THE LAW AND POLICY BEGINNINGS OF ECOSYSTEM SERVICES

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When we bite into a juicy apple and pause to think about where it came from, once we look beyond the store where it was purchased and the orchard where it was grown, we may think of soil and water, but it is unlikely we also consider the natural pollinators that fertilized the apple blossom so the fruit can set. When we drink a cool glass of water from the tap we may think of the local reservoir, but the real source of the water quality lies many miles upstream in the wooded watershed that filters and cleans the water as it flows downhill. When we enjoy a fun holiday at the beach we may think of the warm sun, but not of the carbon sequestration by plants that contributes to climate stability.

Largely taken for granted, healthy ecosystems provide a variety of such critical goods and services. Created by the interactions of living organisms with their environment, it is no exaggeration to state that the suite of "ecosystem services" — purifying air and water, detoxifying and decomposing waste, renewing soil fertility, regulating climate, mitigating droughts and floods, controlling pests, and pollinating vegetation — quite literally underpins human society.[3] One cannot begin to understand flood control, for example, without realizing the impact that widespread wetland destruction has had on the ecosystem service of water retention;[4] nor can one understand water quality without recognizing how development in forested watersheds has degraded the service of water purification.[5]

Over the past decade, there has been an explosion of interest in ecosystem services from scientists, economists, government officials, entrepreneurs, and the media. Yet, the importance of natu-

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3. *See generally* NATURE'S SERVICES: SOCIETAL DEPENDENCE ON NATURAL ECOSYSTEMS 3 (Gretchen Daily ed., 1997) [hereinafter NATURE'S SERVICES].

4. *See, e.g.,* The Trust for Public Land, Building Green Infrastructure: Land Conservation as a Watershed Protection Strategy 13 (2000); Norman Myers, *The World's Forests and Their Ecosystem Services*, *in* Nature's Services, *supra* note 3 at 215—17.

5. *See, e.g.,* THE TRUST FOR PUBLIC LAND, AN OUNCE OF PREVENTION: LAND CONSERVATION AND THE PROTECTION OF CONNECTICUT'S WATER QUALITY 5—8 (1998); Katherine C. Ewel, *Water Quality Improvement by Wetlands*, *in* NATURE'S SERVICES, *Supra* note 3 at 329, 334—36.

ral services to human welfare is neither a novel nor a recent idea. One can trace references to ecosystem services as far back as Plato, and more recently through the writings of George Perkins Marsh, the father of modern-day ecology, and observations of famed environmental writer, Aldo Leopold, among others.[6] So why all the recent excitement over an idea that has been around for millennia?

If we look to fix a date for the birth of ecosystem services as a big "new" idea, it would be 1997 and three influential publications. The first was the book, *Nature's Services.*[7] Its origins were explained by its editor, ecologist Gretchen Daily, in the book's Preface. After dinner one night at an annual meeting of Pew Fellows in Conservation and the Environment, beneath the Arizona stars,

> A small group gathered informally to lament the near total lack of public appreciation of societal dependence upon natural ecosystems. . . . [L]ack of understanding of the character and value of natural ecosystems traces ultimately to a failure of the scientific community to generate, synthesize, and effectively convey the necessary information to the public. A collective strategy to address this problem emerged from the group's discussion, the first phase of which consisted of producing a rigorous, detailed

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6. Plato wrote,

> What now remains of the formerly rich land is like the skeleton of a sick man with all the fat and soft earth having wasted away and only the bare framework remaizning. . . . The soil [used to be] deep, it absorbed and kept the water . . . , and the water that soaked into the hills fed springs and running streams everywhere.

NATURE'S SERVICES, *Supra* note 3, at 5-6 (quoting Plato as quoted in HILLEL, OUT OF THE EARTH: CIVILIZATION AND THE LIFE OF THE SOIL 104 (1991)).

In the 19th century, George Perkins Marsh similarly observed, "Earth, water, the ducts and fluids of vegetation and animal life, the very air we breathe, are peopled by minute organisms which perform most important functions in both the living and inanimate kingdoms of nature." NATURE'S SERVICES, *Supra* note 3 at 12 (quoting GREGORY PERKINS MARSH, MAN AND NATURE 108 (David Lowenthal ed., Harvard Univ. Press 1965) (1864)).

And the great environmental ethicist Aldo Leopold noted,

> The cowman who cleans his range of wolves does not realize he is taking over the wolf's job of trimming the herd to fit the range. He has not learned to think like a mountain. Hence we have dustbowls, and rivers washing the future into the sea . . . . A land ethic changes the role of *Homo sapiens* from conqueror of the land community to plain member and citizen of it.

ALDO LEOPOLD, A SAND COUNTY ALMANAC AND SKETCHES HERE AND THERE 132 (1949).

7. NATURE'S SERVICES, *supra* note 3.

> synthesis of our current understanding of a suite of ecosystem services and a preliminary assessment of their economic value.[8]

The result was a book written by world-class scientists and economists that, for the very first time, presented a well-researched and accessible description of the suite of ecosystem services. *Nature's Services* addressed two basic questions — (1) what services do natural ecosystems provide society, and (2) what is a first approximation of their monetary value? Separate chapters described the range of services and physical benefits provided by climate, biodiversity, soil, pollinators, pest control, the major biomes (oceans, freshwater, forests and grasslands), and case studies where the values of ecosystem services are particularly well-known. Lower-bound estimates of monetary value were determined through replacement costs where possible.

The chapter on soil provides a useful example of the book's findings. More than a clump of dirt, soil is a complex matrix of organic and inorganic constituents transformed by numerous tiny organisms. This living soil provides six ecosystem services: buffering and moderation of the hydrological cycle (so precipitation may be soaked up and metered out rather than rushing off the land in flash floods), physical support for plants, retention and delivery of nutrients to plants, disposal of wastes and dead organic matter, renewal of soil fertility, and regulation of the major element cycles.[9] What are these services worth in the aggregate?

Looking at just one ecosystem service that soil provides, the provision of nitrogen to plants, serves as an example. Nitrogen is supplied to plants through both nitrogen-fixing organisms and recycling of nutrients in the soil. As mentioned above, the authors primarily relied on replacement costs to estimate the value of ecosystem services. If nitrogen were provided by commercial fertilizer rather than natural processes, the lowest cost estimate for crops in the U.S. would be $45 billion, the figure for all land plants $320 billion.[10]

Foundation funds were provided both for writing the book and, equally important, a media campaign accompanying its publication. People took notice. The *New York Times* hailed the book as "the pioneering efforts of some practical ecologists who are eager to make common cause with economists."[11]

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8. *Id.* at xv.
9. *Id.* at 117.
10. *Id.* at 125.
11. Peter Passell, *Economic Science,* N. Y. TIMES, Mar. 27, 1997, at D3.

While a buzz was just forming around *Nature's Services,* the famed scientific journal, *Nature*, published a multi-author article entitled, "The Value of the World's Ecosystem Services and Natural Capital." [12] Examining a range of ecosystem services, the article estimated their global value at between $16-54 trillion per year (the global GNP is $18 trillion).[13] This study generated heated debate within the academic community, with many arguing that the methodology was fundamentally flawed.[14] But it also provided great sound-bite material for the general public — "Nature provides greater wealth than world's economy!"[15]

The third publication was just a short piece by economists Geoff Heal and Graciela Chichilnisky in *Nature*. In two pages, they recounted the story of New York City's strategy of paying landholders and communities in the Catskills watershed in order to ensure clean drinking water. Faced with EPA regulations requiring pre-treatment of drinking water, New York City's water managers found they could ensure clean water more cheaply by paying for landscape management practices in the upper watershed than in building a pre-treatment plant.[16] The moral of the story was simple — investing in natural capital can be a better commercial option than investing in built capital. This example has since become somewhat of a creation myth, certainly the best-known and oft-repeated case for the merits and commercial promise of paying ecosystem services.[17]

To be sure, much had already been published on the operation and value of ecosystem services, and ecosystem service payment schemes were already operating in many parts of the globe,[18] but the concurrent release and media response to these publications both raised the profile of ecosystem services and, more important, began to generate interest among quite diverse audiences — from

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12. Robert Costanza et al., *The Value of the World's Ecosystem Services and Natural Capital*, NATURE, May 15, 1997, at 253.

13. *Id*.

14. *See, e.g.,* David Pearce, *Auditing the Earth: The Value of the World's Ecosystem Services and Natural Capital*, ENVIRONMENT March 1998, at 23-28 (disputing bases for estimate but supporting effort).

15. *See, e.g.,* Tom Horton, *A $54 Trillion Paycheck For Our Ecosystems,* PLAIN DEALER, Aug. 29, 1997.

16. *See* Graciela Chichilnisky & Geoffrey Heal, *Economic Returns from the Biosphere,* NATURE Feb. 12, 1998, at 629.

17. For a debate on the meaning of the Catskills case, see Mark Sagoff, *The Catskills Parable: A Billion-Dollar Misunderstanding,* PERC REPORTS, June 2005, *available at* http://www.perc.org/perc.php?subsection=5&id=547; *see also* James Salzman, *What Paying for Ecosystem Services Means,* Property & Environment Research Center, Letters to the Editor (2005) *available at* http://www.perc.org/perc.php?subsection=5&id=771.

18. See the work of Oliver Houck on wetlands in Louisiana for an example. *See, e.g.,* Oliver A. Houck, *Land Loss in Coastal Louisiana: Causes, Consequences, and Remedies*, 58 TUL. L. REV. 3 (1983).

academics and policy wonks to companies and environmental groups. Each group saw the potential of an ecosystem services approach to further their own interests, whether it was a new stream of income for conservation or a money-making opportunity.

In less than a decade, ecosystem services have gone mainstream, whether as "environmental services," "ecological services," or simply "investing in nature." Virtually anywhere one looks, whether at political initiatives and research projects or market creation and NGO activities, interest in ecosystem services is on the rise around the globe, and still rising. As an instructive snapshot, consider, for example, the following snippets of the most significant developments across a broad range of sectors.

Scholarship

If one focuses on legal scholarship as a proxy, from 1990 through 1996 there were only 17 articles containing the term "ecosystem services." During the following seven years, from 1997-2003, over ten times that number of law review articles referred to ecosystem services. Similar increases in scholarly attention occurred in scientific and economics publishing during this period, as well.[19] The National Academy of Sciences published a major study on the Catskills story[20] and a number of books came out full of case studies on payments for ecosystem services all over the globe.[21] There have also been a number of scientific studies published that directly link agricultural productivity with ecosystem service provision.[22]

Payments for Ecosystem Services

Business opportunities have proven powerful drivers of interest in service provision in many other sectors. With growing interest in the money to be made by investing in service provision, people have begun to realize that many markets for services already exist.

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19. A search on JSTOR found that cites in Economics journals increased 9-fold over the same period, and cites in scientific journals increased five-fold (from 73 cites in 1990-1996 to 372 cites in 1997-2003).

20. NATIONAL ACADEMY OF SCIENCES, WATERSHED MANAGEMENT FOR POTABLE WATER SUPPLY: ASSESSING THE NEW YORK CITY STRATEGY (2000).

21. *See, e.g.,* NATASHA LANDELL-MILLS & INA T. PORRAS, SILVER BULLET OR FOOLS' GOLD: A GLOBAL REVIEW OF MARKETS FOR FOREST ENVIRONMENTAL SERVICES AND THEIR IMPACT ON THE POOR (2002) [hereinafter SILVER BULLET]; SELLING FOREST ENVIRONMENTAL SERVICES 37, 37—62 (Stefano Pagiola et al. eds., 2002).

22. *See, e.g.,* Roland Olschewski et al., *Economic Evaluation of Pollination Services Comparing Coffee Landscapes in Ecuador and Indonesia*, 11 ECOLOGY AND SOCIETY 7 (2006), *available at* http://www.ecologyandsociety.org/vol11/iss1/art7.

Over 280 cases of payments have been documented for *forest* ecosystem services from around the world,[23] not to mention mitigation markets, subsidy schemes, government competitive payments, etc.[24] More enticing, there is great interest in potential new opportunities. It was no coincidence that the influential magazine, *The Economist,* dedicated its April 23, 2005 cover story to ecosystem service markets.[25]

For markets to work, people need to know they exist, and participants need to see, with clarity and ease, who is buying, who is selling, and at what price. There also needs to be a clear understanding of the policy changes that drive these markets, as well as the science that underpins them. Anyone who wants to participate in a market needs basic information — prices, transactions, how the services are measured, packaged and sold, where the buyers and sellers are, etc. To date, this information gap has been a major barrier to ecosystem service market growth. Carbon sequestration has proven an exception to this trend, and an entire cottage industry has developed around this service, for example, with the growth of consultants, markets and newsletters trying both to form and inform the carbon market.[26]

More generally, a website known as the Ecosystem Marketplace has been launched to provide a "one-stop shop" for basic and timely information on emerging markets and payment schemes for ecosystem services around the world.[27] Lloyds of London is known to everyone today as an insurance giant, but it's worth remembering that it started as a popular coffee house where merchants came together to exchange information about shipping news. The Marketplace seeks to provide the same central source of information and networking to buyers and sellers today, facilitating transactions, catalyzing new thinking, and spurring the development of new ecosystem markets.

Environmental Groups

The environmental group, Forest Trends, and its visionary leader, Michael Jenkins, have played a critical role in popularizing

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23. *See* SILVER BULLET, *supra* note 21, at 3.

24. *See, e.g.,* The Ecosystem Marketplace,Library, http://ecosystemmarketplace.com/pages/section_landing.library.php?component_class_name=case_study (last visited August 27, 2007).

25. *See Rescuing Environmentalism (and the Planet)*, THE ECONOMIST, Apr. 23, 2005.

26. *See, e.g.,* Point Carbon, http://www.pointcarbon.com/ (last visited August 27, 2007).

27. See The Katoomba Group's Ecosystem Marketplace, http://ecosystem marketplace.com/, (last visited August 22, 2007).

the model of payments for ecosystem services. Convinced that market mechanisms needed to be harnessed in order to save the world's forests, Forest Trends was an early leader in identifying and documenting examples of payments for ecosystem services as well as developing a business model to generate income streams from service provision. Over a series of international workshops starting in 2000, Forest Trends brought together key individuals from a wide range of sectors — forest product companies, insurers, bankers, grassroots activists, journalists, international civil servants, etc. — from dozens of countries. The goal of this loose network, which came to be known as the Katoomba Group, [28] was both to popularize and serve as the catalyst for ecosystem service payment schemes. The Katoomba Group launched the Ecosystem Marketplace and created regional networks in Latin America and Africa.[29]

Traditional conservation and land trust organizations have also picked up the ecosystem services bug. In a fascinating initiative known as the Natural Capital Project (the brainchild of Gretchen Daily, among others), the Nature Conservancy, the World Wildlife Fund, and Stanford University joined together in a multi-year, multi-million dollar undertaking. Working with study sites in Tanzania, China and central California, the project seeks to develop tools that capture the value of ecosystem services in decision-making, further integrate the consideration of ecosystem services in the policy process, and demonstrate how this can and should be done in practice.[30]

National Governments

The U.S. Environmental Protection Agency created a Science Advisory Board on Valuing the Protection of Ecological Systems and Services in 2003.[31] That same year in Australia, a high-level advisory body, known as The Wentworth Group, called for a new approach to environmental protection that focused on provision of ecosystem services.[32] Perhaps most impressive, the U.S. Forest Service explicitly revised its agency mission to incorporate conser-

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28. In the interests of full disclosure, co-author Jim Salzman is on the Katoomba Group Board.

29. *See* Katoomba: Home, http://www.katoombagroup.org/ (last visited August 27, 2007).

30. *See* Natural Capital Project, http://www.naturalcapitalproject.org (last visited August 22, 2007).

31. Sci. Advisory Bd., Request for Nominations for Experts for a Panel on Valuing the Protection of Ecological Systems and Services, 68 Fed. Reg. 11,082-01 (Mar. 7, 2003).

32. *See* THE WENTWORTH GROUP, BLUEPRINT FOR A LIVING CONTINENT 3, 14 (2002), *available at* http://www.ccsa.asn.au/Blueprint_for_a_Living_Continen.pdf.

vation of ecosystem services.[33] This change of heart is perhaps best exemplified by the statement of the Secretary of Agriculture, Mike Johanns, who declared, "Today, I am announcing that USDA will seek to broaden the use of markets for ecosystem services through voluntary market mechanisms. I see a future where credits for clean water, greenhouse gases, or wetlands can be traded as easily as corn or soybeans."[34] It is a sign of the times when the most important government official for farm policy openly calls for a future premised upon the growth and flourishing of ecosystem service markets.

International Organizations

International governmental organizations have also gotten into the act. For example, the World Bank has undertaken significant research on payment for ecosystem services projects and created a financing mechanism for carbon sequestration projects.[35] The UN Food and Agriculture Program is devoting its influential annual publication in 2007, *The State of Food and Agriculture*, to payments for ecosystem services. Most impressive, though, has been the Millennium Ecosystem Assessment. Launched in 2001, the Assessment was modeled on the Intergovernmental Panel on Climate Change and partnered with secretariats of the Biodiversity, Desertification, Ramsar and Migratory Species conventions. Relying on the contributions of more than 1,360 experts from over 95 countries around the globe, the Assessment published a series of reports that represented the first attempt by the scientific community to assess globally the full range of benefits provided by nature. The Assessment took an explicitly ecosystem services perspective, focusing on:

- Ecosystem services (the benefits people obtain from ecosystems);
- How changes in ecosystem services have affected human well-being;

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33. The lead person behind this development, Associate Chief of the U.S. Forest Service Sally Collins, was the keynote speaker at the symposium. *See, e.g.,* Sally Collins, The Forest Service's Role in Markets For Ecosystem Services (June 8, 2006), (speech available at http://www.fs.fed.us/news/2006/speeches/06/ecosystem-services.shtml).

34. Mike Johanns, Sec'y, U.S. Dep't of Agric., Remarks at the White House Conference on Cooperative Conservation: Innovations In Land and Resource Governance, (Aug. 29, 2005) (transcript available at http://www.usda.gov/wps/portal/!ut/p/_s.7_0_A/7_0_1OB?contentidonly=true&contentid=2005/08/0335.xml).

35. *See* Carbon Finance at the World Bank: Home, http://carbonfinance.org/ (last visited August 27, 2007).

- How ecosystem changes may affect people in future decades; and
- Response options that might be adopted at local, national, or global scales to improve ecosystem management and thereby contribute to human well-being and poverty alleviation.[36]

What's in a Name?

As noted above, the basic idea behind ecosystem services is not new, so why has this term had such traction among such a wide range of groups? One clear strength of the ecosystem service perspective has been to re-frame land management and conservation in familiar financial terms. People are used to thinking in terms of financial capital and human capital. Framing the issue in terms of natural capital makes it easy for people to think of assets (the ecosystem services), streams of revenue (ecosystem goods), outside investment to grow the asset, and creating markets to sell the goods. As in any well-managed portfolio, one also naturally thinks of managing multiple assets, just as one should consider managing land for multiple service provision.

Second, putting a dollar figure on services, however controversial among professional economists, makes it easy for the public to appreciate just how valuable they are. And finally, where people see value they also see markets and, importantly, a way to make money. An ecosystem perspective makes land management and nature conservation potentially lucrative to entrepreneurs and financiers. Equally, from the viewpoint of land trusts and conservation organizations, ecosystem services represent a potential source of revenue to supplement their activities. Put simply, if there's money to be made, people get interested.

In 1998, Jim Salzman supervised a STAR grant funded by EPA to examine the extent to which EPA was currently protecting ecosystem services and, given its statutory authority, how it might strengthen protection of services. Bringing together economists, hydrologists, lawyers and economists, a series of papers were written examining the legal protection of services under NEPA's environmental impact statements,[37] CERCLA and the Oil Pollution Act's provisions for natural resource damages,[38] the Clean Water

36. *See* Millennium Ecosystem Assessment, http://millenniumassessment.org/en/Synthesis.aspx (last visited August 27, 2007).

37. *See* Robert L. Fischman, *The EPA's NEPA Duties and Ecosystem Services,* 20 STAN. ENVTL. L.J. 497 (2001).

38. *See* Janet Herman et al., *Groundwater Ecosystems and the Service of Water Purification,* 20 STAN. ENVTL. L.J. 479 (2001).

Act's requirements of mitigation for dredging and filling wetlands,[39] and local government authority.[40] These papers and others were presented at a multi-stakeholder workshop at Stanford in 2000 and published in a special symposium issue of the *Stanford Environmental Law Journal* in May 2001. This represented the first comprehensive assessment of the legal status of ecosystem services.

As the brief descriptions of recent developments made clear, though, the field has changed greatly since the late 1990s and there are a lot of exciting developments underway. With the partnership of the *Journal of Land Use & Environmental Law,* we thought it important to revisit the state of the field five years after the Stanford workshop. Thus we invited experts across the range of environmental law to Florida State for a two-day workshop assessing the current status of ecosystem services in environmental law. The results are set out in this symposium issue.

As background to the authors, we set out five distinct law and policy challenges to consider:

Scale of Service Provision

- What is the right scale for service management?
- Because ecological and political boundaries rarely overlap, how can the law overcome collective action problems and the challenge of extending authority beyond traditional institutional boundaries?

Market Failures

- Given that many services are public goods, how can the law influence price signals to encourage protection and provision of services?
- How can service scarcity be linked more closely with market mechanisms?
- How can the obstacles to linking discrete buyers and sellers of services be overcome?

Property Rights

- Who owns the positive externalities from service provision?
- What are the limits of nuisance law when the flow of services is impaired?

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39. *See* J.B. Ruhl & R. Juge Gregg, *Integrating Ecosystem Services Into Environmental Law: A Case Study of Wetlands Mitigation Banking,* 20 STAN. ENVTL. L.J. 365 (2001).

40. *See* Geoffrey Heal et al., *Protecting Natural Capital Through Ecosystem Service Districts,* 20 STAN. ENVTL. L.J. 333 (2001).

- To what extent can or should government commodify services?
- Can we find and use effective metrics of service provision?

Instrument Choice

- How should we choose among the range of possible policy approaches to provide services?
    - prescriptive regulation
    - financial sanction
    - property rights
    - payment
    - persuasion
- Given the increasing attention on payments for ecosystem services, what are the perils of payments?

Implementation

- What are the limits of the law?
- When will non-legal approaches be more effective in conserving service provision?
- To what extent does the vision of mission-driven agencies preclude service protection? How can this be changed?

The presentations at the symposium, which then developed into the articles in this special issue, approached the topic of ecosystem services and the law from two perspectives. One set of presentations focused on the law of specific natural resources, and the other set focused on different legal institutions as agents of integration of ecosystem services into law and policy. The resource presentations covered water and watershed resources, agricultural and rangeland resources, and coastal resources, while the institutional presentations addressed land use regulation, common law remedies, public law enforcement regimes, and "second generation" approaches in energy policy.

Contributions to the water and watershed resources topic came from a trio of the nation's most prominent scholars in the field—Jan Neuman, Dan Tarlock, and Robert Abrams. Jan Neuman uses the Tillamook State Forest in Oregon as the lens through which to explore the integration of ecosystem services into "multiple use" public land management regimes. As she explains, multiple use land management is designed to erect a "big tent" under which there is something for everyone to be gained from the public land resource—timber companies, salmon fisheries, weekend hikers, scientists, water users, and the list goes on. But, the tent is only so big; eventually, the state forest agency's mandate to give every

interest its spot under the tent leads to "spending down the principal" in classic tragedy of the commons form. Attention to ecosystem services and the conservation of the natural capital principal of the forest, she posits, is not only consistent with multiple use management, but would alter the calculus to promote sustainable conservation of the principal and ensure a stream of ecosystem service revenues for future generations.

Multiple use in the Tillamook State Forest is a legislative policy decision implemented by a single decision maker—the state forest agency. By contrast, Dan Tarlock explores the problems of multiple use that stem from a watershed landscape owned by innumerable private and public interests—the Klamath River Basin that straddles southern Oregon and northern California. There is no "big tent" for the Klamath, only a vast collection of small tents, each vying for the best position in the campground from which to get what it wants from the bounty of the Klamath resources system. Tarlock traces the history of this once remote, sparsely inhabited land to its present condition of over-consumption of water resources. Over time, the proxy for the single decision maker on public lands came in the form of three imperiled species of fish and the Endangered Species Act. The jolt these three fish gave to public and private resource users from one end of the basin to the other has radically altered the dialogue on the future of the system, making it clear that while there is no return to pre-settlement conditions, there is no hope of continuing the commodity production model in what has become, to put it mildly, a highly stressed ecosystem landscape. Tarlock suggests that the Klamath thus has become the place to conduct "a service provision experiment," though he cautions that, as the prime example of why ecosystem service provision institutions have failed to take hold, the experiment will be no easy undertaking.

Robert Abrams transports us across the nation on the long diagonal from Oregon to Florida. The Apalachicola-Chattahoochee-Flint (ACF) River Basin, which stretches from north of Atlanta across the Florida Panhandle to the Gulf of Mexico, is the scene for a battle between Florida's interest in maintaining a valuable estuary system and Georgia's interest in supplying drinking water to sprawling Atlanta's urban dwellers and irrigation water to south Georgia's farmers. As with the Tillamook and the Klamath, Abrams explains how fragmented and special-interest dominated management of a unitary watershed resource leads to ecosystem stress. In particular, water law and water institutions favor upstream resources users over downstream interests, which constrains the ability of the ecological resources to deliver service

benefits at the downstream end. Abrams suggests that the increased knowledge of ecosystem service values and the manner in which river systems deliver them is likely to provide a counterweight to this upstream-heavy imbalance, with interstate public nuisance doctrine supplying the institutional mechanism for forcing the adjustment.

Turning to rangeland resources, Deb Donahue uses invasive weed species as an indicator of the health of federal public rangelands managed by the Bureau of Land Management (BLM) and U.S Forest Service. Notwithstanding the multiple use mandate for BLM and Forest Service rangelands, Donahue shows that livestock production has been the favored use, and it has led inexorably to invasive weeds and the resulting build-up of hazardous fuels. Yet she argues that BLM and the Forest Service have the authority under the multiple use mandate, if not the duty, to remove livestock from lands to reverse the weed problem and restore ecosystem services that will truly support multiple uses.

The next article, by Robin Kundis Craig, moves the focus off the terrestrial to the marine. Craig explains that ocean and coastal ecosystems provide about two-thirds of the ecosystem services produced by the world's natural capital. Despite their value, however, marine resources have historically been managed at international, federal, state, and local levels where markets traditionally have focused on commercial commodities such as fisheries and on the skyrocketing land values of coastal development, which has led in turn to depletion of the very natural capital that supports those markets. Yet markets learn, and new consumer demands for lifestyle values such as recreation, tourism, "eco-living," and protection from disaster increasingly are aligning market preferences with ecosystem services. Political will, Craig argues, is likely to follow suit.

The final article in the resources series is Dale Goble's discussion of biodiversity, and it serves as a bridge from the resource focus to the institutional focus. Whereas the previous authors found much potential in the concept of ecosystem services as a way of realigning and improving public and private resource management decisions, Goble is less sure of its application in the context of conservation of biological diversity. The question he addresses is rather straightforward: is ecosystem services a viable surrogate for biodiversity conservation, and will sustaining the former conserve the latter? The answer is more complex. For Goble, it depends on why we believe we should conserve biodiversity. The ecosystem services concept frames questions in a distinctly utilitarian context, whereas we might have reasons beyond maximizing social

welfare to conserve biodiversity. And even if we do not, spatial and temporal scales might differ as between what makes good management sense for ecosystem services versus biodiversity conservation. How institutions perceive biodiversity as a resource thus may influence how useful the ecosystem services concept is for its conservation.

Land use regulation opened the symposium focus on institutional design. Craig Anthony (Tony) Arnold turns attention in the first article in this series to the structure of local land use regulation. He argues that the nature of land use regulation as a legal institution implemented primarily at the local level has led to fundamental misconceptions of its capacity to participate in complex public policy problems. Local land use regulation is not, in his view, simply a miniature and lower-tiered version of state and federal policy governance. Rather, local land use regulation is a distinct and dynamic system of governance that is uniquely positioned to address human-environment policy issues from a perspective quite apart from state and federal institutions. From this broad perspective of land use regulation, Arnold uses ecosystem services as a case study for examining how land use regulation can contribute to solutions as well as the limits of that capacity. The land use regulatory system, he concludes, is not primarily an ecosystem protection institution—it has a broad variety of goals to meet in the human-environment policy realm. It is, however, responsive to the increasing importance of ecosystem services and will incorporate natural capital and ecosystem service values into its decision making structure in specific ways.

Next, J.B Ruhl's article examines the "background principles" of natural capital and ecosystem services in the American common law of property. Other scholars have shown that American property law has created systematic disincentives for landowners to retain intact natural capital. Ruhl shows as well that the common law has traditionally provided little relief for landowners who have lost the benefit of ecosystem services when other landowners degrade natural capital. The impetus for change in both respects comes from, of all places, the Supreme Court's regulatory takings jurisprudence, which shields the government from takings claims when regulation merely duplicates land use restrictions embedded in the "background principles" of property law. The Court has acknowledged that these background principles evolve with new knowledge, and Ruhl argues that the ecosystem services concept is just that—new knowledge of how land use that degrades natural capital can injure property interests on other lands. As he shows, courts have begun to pick up on this new knowledge, suggesting a

potential for rapid evolution in the common law.

Shifting to a public law institution focus, Dave Markell explores the role ecosystem service valuation could play in regulatory enforcement decisions. Using this remedial focus, Markell demonstrates how three different enforcement mechanisms—penalties, injunctive relief, and supplemental environmental projects—all could integrate protection of natural capital and ecosystem services as a means of improving enforcement performance. Markell argues that doing so will help deter violations, enhance agency capacity to cease ongoing violations, improve agencies' ability to negotiate enforcement settlements, and ultimately contribute to our knowledge of ecosystem service values. Whereas much of the focus of the previous articles has been the "front end" design of resource management and institutions, Markell demonstrates that attention to the "back end" of the regulatory state holds much promise as well.

Energy policy supplied fodder for the closing set of presentations at the symposium. In his article, David Hodas reminds us of one of the most bountiful and valuable forms of natural capital—energy. In particular, fossil fuels such as coal, petroleum, and natural gas are forms of energy gifted to us by the sun and stored for our use. Yet, Hodas shows that, ironically, almost none of the literature on ecosystem services, including some of the groundbreaking work of the late 1990s as well as more recent treatments, recognizes fossil fuels in this context. Hodas argues that, unless we begin to understand stored energy as an ecosystem service, we cannot reasonably expect to manage our fossil fuel energy resources sustainably. Yet, as he shows, current international and domestic energy law and policy evidences nearly complete ignorance of this feature of fossil fuel energy. The ultimate consequences of this disconnect, he argues, are not just a matter of concern to energy policy, but are of the utmost significance to national security as well.

Dennis Hirsch's article closes this issue by examining the role ecosystem service values could play in market-based instruments such as carbon trading mechanisms. Ecosystem services often behave like public goods—their physical and biological nature makes it difficult for them to be priced in markets. Difficult, that is, without any regulatory help. As Hirsch explores, regulatory markets—markets constructed with the help of regulation when none would have otherwise materialized—have become common in environmental policy and could take advantage of ecosystem service values as a metric. Yet he distinguishes in this respect between regulatory markets that trade one ecosystem service for another,

such as the wetland mitigation banking program, and regulatory markets that trade between technological services and ecosystem services, such as the carbon sequestration trading program. By allowing developed nations to purchase the ecosystem service of carbon sequestration in the form of forest resources, the carbon program allows trades between technology and natural capital. Hirsch argues that the two kinds of regulatory markets demand different analytical frameworks.

Many people not represented in the articles in this issue contributed to the success of the symposium. Martha Noble of the Sustainable Agriculture Coalition provided insights on agricultural policy, and Sally Collins, Associate Chief of the Forest Service, along with Rob Doudrick of that agency explained how ecosystem services are beginning to take hold in public land management policy. Donna Christie of the FSU environmental law faculty organized a fascinating panel on coastal development issues at which Billy Buzzett of the St. Joe Company and Bradley Pickel of the South Walton County Tourist Bureau described the rising consciousness of local and private land managers to ecosystem service values. Mark Seidenfeld of FSU presented comments on the papers by J.B. Ruhl and Dave Markell, and Jacqueline Weaver of the University of Houston Law Center contributed to the panel on energy policy with a rousing exploration of the carbon-based energy economy. Don Elliott of Yale Law School provided closing remarks assessing what the symposium had covered and suggesting next steps for the formulation of ecosystem services law and policy.

Of course, coordinating a gathering of so many people from so many different places was no mean feat. FSU Environmental Law Society members and Journal staff helped with many symposium tasks, and the FSU College of Law provided more than generous financial support. Lastly, but by no means least in terms of gratitude owed, we thank FSU Environmental Program Assistant Meghan McQuellon, who has since moved on to pursue an advanced degree, for her logistical support of both the symposium and the *Journal* issue.

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THINKING INSIDE THE BOX: LOOKING FOR ECOSYSTEM SERVICES WITHIN A FORESTED WATERSHED

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I. INTRODUCTION: ALONG THE RIVER AND THROUGH THE WOODS

Oregon's Tillamook State Forest lies about halfway between the city of Portland and the Pacific Ocean. A visitor heading southwest from Portland drives out of the densely-populated Willamette River Valley, past the suburban campuses of Nike, Intel, and Tektronix, and through rolling fields with signs advertising "u-pick" berries, "u-cut" Christmas trees, and a winery or two. Less than an hour's drive from downtown Portland, the fields give way to the foothills of the Coast Range Mountains, and a short time later, the road enters the Tillamook State Forest. Steep, wooded ravines angle away on either side of the highway, occasionally leveling off to reveal a vista of ridgelines nearly all the way to the coast. The visitor could drive almost another hour before leaving the Tillamook, even without exploring the many side roads heading off into its 550 square miles of forest and meadows.

The main highway through the Tillamook follows the course of the Wilson River for a good part of its length. The Wilson eventually flows into Tillamook Bay on the northern Oregon coast. The Wilson does not have the Tillamook State Forest to itself, however. Other rivers share the territory—the Nehalem, the Kilchis, the Miami, the Trask, and the Tillamook—all rushing down from the coastal mountains to the ocean. The rivers coursing through the state forest divide into two major watersheds, the Tillamook Bay Watershed and the Nehalem Bay Watershed, depending on which of the ocean bays they end up in.[1]

The Tillamook State Forest and its encompassing watersheds are many things to many people. As with other natural resources, that very fact may be its undoing. The Tillamook is *so* many things to *so* many people that the demands on it are becoming unsustainable. Without appreciation of the area as a functioning ecosystem, the Tillamook State Forest's future is certain to be troubled. The tug of war will continue between those who want timber and those who want trees, between those who want steady flows of revenue and those who want steady flows of clean water. Yet, with some recognition of what the Tillamook needs in order to keep producing desired goods and services, along with a bit of moderation in the demands, perhaps the Tillamook could indeed satisfy most of the people most of the time. Although this path is untested, and there is no guarantee of success, the alternative outcome *is* guaranteed: further conflict and degradation of the very

1. The Oregon Water Resources Department groups the two watersheds as the North Coast Basin for purposes of water management. *See* OR. ADMIN. R. 690-500-0010, 690-501 (2007).

resources people want from the forest.

This paper uses the Tillamook State Forest as a case study to explore the potential for applying an ecosystem services model to future management of a forested watershed with numerous interested constituencies. Part II describes the richness of the Tillamook regional ecosystem, its importance far beyond the immediate vicinity, and the many resulting demands on the forest. Part III discusses the current management model, based on multiple uses competing in the political arena for short-term gain, and then considers an alternative model based on managing the Tillamook with the goal of producing a steady stream of ecosystem services over the long-term. Part IV concludes with a call for "re-reforestation" of the Tillamook State Forest and other similar lands by managing for long-term watershed and forest health.

II. THE TILLAMOOK STATE FOREST'S BIG TENT: SOMETHING FOR EVERYONE

A. The State's Forest

The Tillamook State Forest was officially designated in 1973.[2] The dramatic version of the Tillamook's creation story is that of a phoenix rising magically from the ashes. Before being designated a state forest, the area was known simply as The Tillamook Burn.[3] In truth, the state forest's origin was a long and somewhat accidental process, the result of making the best of a bad situation. In the early 1900s, much of the land that is now within the state forest boundary was owned by private timber companies.[4] In 1933, the first of several devastating wildfires swept through the region, dealing a severe blow to the landscape and to the local economy.[5] The fires kept coming with terrible regularity — every six years through 1951 — all together burning 355,000 acres of land and over 13 billion board feet of timber.[6]

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2. For the history of the Tillamook State Forest, *see generally* OR. HISTORICAL SOC'Y, THE OREGON HISTORY PROJECT, THE TILLAMOOK BURN (2006); OREGON LEGISLATIVE COMMITTEE SERVICES, ISSUE BRIEF: TILLAMOOK BURN: HISTORY, REFORESTATION & ECONOMICS (November 2001); OR. DEP'T OF FORESTRY, "TILLAMOOK STORY," *available at* http://egov.oregon.gov/ODF/TSF/tillamook_story.shtml (last viewed December 20, 2006); J. LARRY KEMP, EPITAPH FOR THE GIANTS; THE STORY OF THE TILLAMOOK BURN (1967); HOMER LYON, HISTORICAL SKETCH OF THE GREAT TILLAMOOK FIRE (1940); and OR. STATE DEP'T OF FORESTRY, TILLAMOOK BURN TO TILLAMOOK STATE FOREST (1993).

3. *See generally* OR. DEP'T OF FORESTRY, TILLAMOOK BURN TO TILLAMOOK STATE FOREST, *supra* note 2.

4. *Id.* at 8-9.

5. *Id.* at 5-6.

6. *Id.* at 6, 12-13, 22. The destroyed timber ranged in age from 150 to 400 years old; many trees were up to 300 feet tall and seven feet around. LEGISLATIVE COMMITTEE SERVICES, *supra* note 2, at 1, and ELLIS LUCIA, TILLAMOOK BURN COUNTRY 6 (1983).

The timber companies, already reeling from the Great Depression, staggered and fell, unable to recover from the devastation.[7] The companies could not pay their property taxes, and the surrounding counties eventually foreclosed on thousands and thousands of acres of ravished land.[8] The counties—land rich, but revenue poor—looked to the state for help.[9] Eventually the state and the counties reached an agreement that was designed to bring back the forest and make the counties whole. The counties gave the foreclosed lands to the state; the state created the state forest; the public was enlisted to help replant the burned-over lands; and the state promised to share two-thirds of the future timber revenues with the counties.[10]

Thousands of Oregonians helped in the reforestation effort. Schoolchildren and other volunteers came to the Coast Range by the busload and planted seventy-two million seedlings.[11] As the seedlings grew, so did the kids who planted them, and the Tillamook became the state's forest in more than just name. Many of those who helped replant the forest feel a special attachment to the fruits of their labor. [12] Some of the kids grew up to be loggers, business owners, school teachers, and county commissioners in the small towns sprinkled around and through the forest. Now that the trees are big enough, these residents are ready and waiting to reap the benefits of the harvest.[13] Some of the kids grew up to be fishermen, conservationists, and scientists, and they now look to the Tillamook for fisheries and wildlife habitat rather than for timber harvest.[14] Even newcomers to the state who know nothing about the Tillamook's past have a stake in the forest. The forest provides recreational opportunities accessible to the booming popu-

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7. *See* Sinclair Albert Wilson, *The Tillamook Fire: Staggering Losses in Oregon's Big Forest Fire Estimated*, THE FOUR L LUMBER NEWS, Sept. 15, 1933.

8. OR. DEP'T OF FORESTRY, 2005 OREGON FORESTS REPORT at 14 (OR. FORESTS REP.), *available at* www.oregon.gov/ODF/PUBS/docs/Oregon_Forests_Reports/05OFR.pdf.

9. *See* WILSON, *supra* note 7 (noting that prior to the1933 fire, timber value accounted for 58% of Tillamook County's tax base).

10. OR. FORESTS REP., *supra* note 8. For example, in the 2003-05 biennium, the revenues to Tillamook County from this arrangement totaled approximately $19,266,500, down slightly from $19,463,770 in the previous biennium. *Id.*

11. See TILLAMOOK STORY, *supra* note 2.

12. *See, e.g.* Nick Budrick, *The Coast is Clearcut: the Northwest's Next Eco-War will be Waged in Portland's Backyard* WILLAMETTE WEEK, March 6, 2002, *available at* http://www.wweek.com/popup/print.php?index'2519. ("To replant the charred moonscape left by the fires, Portland school children, a young Leonard [Portland city commissioner, Randy Leonard] among them, were trucked to the Tillamook in school buses for two decades, planting what would become state forest land. It was 40 years ago, but Leonard . . . still vividly recalls those trips . . . . 'I have this sense of ownership— . . . . It's a funny thing when you plant something and it grows.'")

13. *See* Cassandra Profita, *Timber Revenue: It's a Guessing Game* DAILY ASTORIAN, Dec. 6, 2006 (discussing interest of county and local governmental entities in state forest revenue).

14. *See* PORTLAND AUDUBON SOCIETY, FORESTS: TILLAMOOK AND CLATSOP BACKGROUND (noting the forests' importance to open space, clean water, clean air and recreation).

lation of metropolitan Portland, as well as to the whole northwest corner of the state.[15] With both wild and tame areas, the Tillamook has something for everyone—fishing, hunting, hiking, camping, mountain biking, all-terrain vehicle trails, and driftboating.[16]

The Tillamook State Forest, due to its origins, its location, and its resources, has thousands of shareholders. The shareholders all have visions of what "their" Tillamook represents. The stage is set for conflict, and that's only the beginning of the story.

B. The Loggers' Bonanza

The Tillamook State Forest reforestation effort lasted from 1949 into the 1960s.[17] The first trees planted have now passed the half century mark, making them ripe for harvest in the eyes of many.[18] Indeed, the Tillamook's vast swaths of hand-planted, even-age, second growth timber resemble some commercial forests whose goal is to produce easily-harvested clear cuts on fairly short rotations.[19] Timber companies, both large and small, have been banking on the Tillamook trees coming on line for quite some time.[20] Although large timber companies like Weyerhauser, Georgia Pacific, Louisiana Pacific, and other publicly held companies operating in the northwest often own large land holdings, many of these lands were heavily cut over by the 1990s, thus leaving both large and small companies dependent on federal and state public forestlands to keep their mills operating.[21] The timber supply from Oregon's federal forests has taken a nosedive in recent years, in response to changing management directions under federal law, thus creating even more pressure on state lands.[22]

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15. OREGON DEPARTMENT OF FORESTRY, NORTHWEST FOREST MANAGEMENT PLAN 2-64 to 2-67 (2001), *available at* http://egov.oregon.gov/ODF/STATE_FORESTS/nwfmp.shtml (final forest management plan adopted by Board of Forestry in January 2001).

16. OR. FORESTS REP., *supra* note 8, at 14. The funds for maintaining the recreational sites such as trails and campsites come from timber harvest revenue. *Id.*

17. THE TILLAMOOK STORY, *supra* note 2.

18. *See, e.g.,* Testimony of Tim Josi, Tillamook County Commissioner and member of Forest Trust Land Advisory Committee, at the July 28, 2006, Board of Forestry Meeting (urging greater harvest levels, closer to what would be done if forest privately owned).

19. NORTHWEST FOREST MANAGEMENT PLAN, *supra* note 15, at 2-22, 3-5 (about 57% of Northwest state forests are between 35 and 65 years old; 25% are over 65).

20. *See* OR. STATE ARCHIVES, A STATE OF CHANGE: OREGON AFTER WORLD WAR II, *available at* http://arcweb.sos.state.or.us/exhibits/ww2/after/oregon.htm (describing small "gyppo" timber operators and large vertically-integrated timber companies operating in Oregon); *See also* Kathie Durbin, *Tillamook Burn Becoming Bright Spot in Oregon's Timber Picture*, OREGONIAN, Dec. 20, 1990, at A-7 (discussing intensifying interest in expected jump in Tillamook harvest in the next several years, as federal land harvests were reduced and the Tillamook trees came of age).

21. *Id.; see also* U.S. DEP'T OF AGRIC., TIMBER HARVESTING, PROCESSING, AND EMPLOYMENT IN THE NORTHWEST ECONOMIC ADJUSTMENT INITIATIVE REGION: CHANGES AND ECONOMIC ASSISTANCE (1999); F.D.L. CONWAY & G.E. WELLS, OR. STATE UNIV. EXTENSION SERVICE, TIMBER IN OREGON: HISTORY AND PROJECTED TRENDS (1994).

22. Until about ten years ago, federal forestlands in Oregon were the source of most of the state's

C. The Salmon's Nursery

During the past 50 years, the Tillamook State Forest has been growing more than trees. The area has been identified as one of a few "salmon hot spots" in the Cascadia Bioregion where relatively undisturbed rivers offer crucial habitat for fish species that are struggling throughout the Pacific Northwest.[23] The Tillamook and Nehalem Bay watersheds are identified as "major southern strongholds" for Chinook and Chum salmon and steelhead, with combined escapements from these watersheds of nearly 70,000 fish.[24] The Wild Salmon Center and other fish conservation groups have targeted the Tillamook and Nehalem watersheds for creation of watershed sanctuaries and salmon "refugia" to provide anchor habitat for restoration of threatened and endangered salmonid species.[25] The stated goals of the groups who are working to protect these areas include protecting 250,000 acres of public forest land.[26] Some of the threats they are concerned about include road-building and timber cutting, putting them directly at odds with the loggers.[27]

D. The Murrelet's Bedroom

The Tillamook provides habitat for a number of terrestrial at-risk species as well. In spite of the devastating wildfires, some pockets of old growth forest survived in the area, and these pockets provide habitat for marbled murrelets, spotted owls, bald eagles, peregrine falcons and several other creatures that are rare or

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timber harvest. Since the eruption of endangered species controversies and the adoption of the federal Northwest Forest Plan in 1994, federal land timber cutting has declined steeply, and now private forestlands produce the majority of the state's harvest. 2005 OREGON FORESTS REPORT *supra* note 8, at 9. Federal forestland constitutes 59% of Oregon's 30 million forested acres, while industrial private forestland is only 20% and state forestland is only 3% of the total. *Id.* at 22. The pressure is thus concentrated on a much smaller acreage. What happens in Oregon and other Pacific Northwest forests is of more than just local or regional interest. In recent years, Oregon has been the nation's number one producer of lumber and plywood. OREGON STATE UNIVERSITY, *supra* note 20, at 6.

23. The Wild Salmon Center has identified the Tillamook State Forest area and its associated watersheds as one of three North American salmonid strongholds on which to concentrate its conservation efforts. *See* WILD SALMON CENTER, NORTH AMERICA WILD SALMON STRONGHOLDS, http://www.wildsalmoncenter.org/programs/north_america/coast_ranges.php. The Center's priority watersheds for salmonids in the Oregon Coast Range include the Nehalem, Salmonberry, Kilchis, Trask, and Wilson rivers, all within the state forest. WSC identifies the Tillamook Forest as the largest expanse of unprotected, contiguous rainforest in the lower 48 states, containing several endangered and threatened species, including such terrestrial species as the marbled murrelet and the Northern spotted owl. *Id.* The Pacific Northwest temperate rainforests are thus national natural resources, not purely local ones.

24. *Id.*

25. *Id.* The WSC's focus on the Tillamook is part of their comprehensive global program of wild salmon protection, which also includes work around the Pacific Rim in British Columbia and Russia. Once again, the Tillamook's importance extends far beyond its boundaries.

26. *Id.*

27. *Id.*

threatened.[28] The murrelet is particularly interesting in its use of coast range forests. Murrelets are sea birds who fish in the ocean but come inland to nest. The birds fly 30 miles or more inland seeking old growth coniferous forests where they build nests on the low spreading branches of very large, old trees.[29] During the nesting season, they make daily roundtrips to the ocean for food.[30] With logging planned for both the post-fire second growth timber and some of the older pockets,[31] murrelet habitat is also at risk.

E. Portland's Playground

The Tillamook State Forest is only 35 miles west of the Portland metropolitan area, which is home to over a million people and growing rapidly. The state forest contains seven developed campgrounds, 150 miles of "some of the best Off-Highway Vehicle trails in the Pacific Northwest", and miles of hiking, mountain biking, and horseback riding trails.[32] The State Forestry Department's management plan for the forest says that the North Coast region and the area around Portland have the "greatest need in the state for additional recreation facilities."[33] Recreation on these lands is also important to certain sectors of the local economies.[34] Many Portland area voters supported a 2004 statewide ballot initiative drafted by a coalition of conservation groups that sought to put 50% of the Tillamook State Forest into reserves protected from logging.[35] Portland drivers sport bumper stickers proclaiming "Save the Tillamook."[36]

F. The Coastal Communities' Water Supply

The Tillamook and Nehalem Bay watersheds supply municipal

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28. NORTHWEST FOREST MANAGEMENT PLAN, *supra* note 15, at 2-28-2-32 (noting that bald eagles, peregrine falcons, marbled murrelet, and spotted owls are all listed as threatened or endangered under federal and/or state laws, and listing numerous other species of concern).

29. *See generally*, Sustainable Ecosystems Institute, *About the Marbled Murrelet*, http://www.sei.org/murrelet.html; NORTHWEST FOREST MANAGEMENT PLAN, *supra* note 15, at 2-30 and Appendix E-16.

30. *Id.*

31. NORTHWEST FOREST MANAGEMENT PLAN, *supra* note 15, at 2-64.

32. OR. DEP'T OF FORESTRY, TILLAMOOK STATE FOREST: RECREATION, http://egov.oregon.gov/ODF/TSF/Recreation.shtml.

33. NORTHWEST FOREST MANAGEMENT PLAN, *supra* note 15, at 2-64.

34. *Id.*

35. Oregon Ballot Measure 34 (2004), *available at* http://www.sos.state.or.us/elections/nov22004/g04_meas.html. The ballot measure would have allowed timber harvest on only one-half of the Tillamook State Forest lands, requiring the other half to be managed for restoration of native old growth forest. Although the measure failed to pass statewide, voters in Multnomah County (where Portland is located) approved it by a margin of 178,681 to 154,989. http://www.sos.state.or.us/elections/nov22004/abstract/m34.doc.

36. Author's personal observation.

water to tens of thousands of people. The Cities of Tillamook, Wheeler, Nehalem, Vernonia, Manzanita, and many other small communities get their drinking water from rivers, streams, springs, and interconnected groundwater within these watersheds. The City of Wheeler holds a water right to several wells that are tributary to the Nehalem River, Tillamook has a number of water rights to the Tillamook River or its tributaries, and Manzanita, Nehalem and Vernonia have municipal rights from tributaries to the Nehalem.[37] Many individual wells exist in the watersheds as well.[38]

When the rivers leave the forestlands and flatten out on the coastal plains, they provide water for the Tillamook dairy industry. The dairy industry has been an important part of the Tillamook area's economy since the 1800s.[39] Many small farms in the coastal plains supply the Tillamook County Creamery Association (a cooperative), which produces over 78 million pounds of cheese a year for global markets.[40] The Tillamook Cheese Factory near the town of Tillamook attracts nearly a million visitors annually.[41] Indeed, Tillamook County's motto is "the land of cheese, trees, and ocean breeze."[42]

Even when the waters reach the ocean, their work isn't done. The estuaries of Tillamook and Nehalem Bays support shellfish production. In the 1990s, local groups became concerned about the water quality in the bays and estuaries.[43] Contamination from pollutants and sediment had resulted in several closures of the lo-

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37. *See, e.g.*, water rights permits G 12196 (Wheeler), S 30192 (Tillamook), S 41438 (Tillamook), S 45008 (Nehalem), and certificates 33251 (Tillamook), 8480 (Nehalem), 44775 and 82159 (Manzanita), 10099 and 23480 (Vernonia) OREGON DEPARTMENT OF WATER RESOURCES, WATER RIGHTS INFORMATION SYSTEM, *available at* http://apps.wrd.state.or.us/ apps/wr/wrinfo. This is not a complete list of all of these municipalities' water rights, nor does it cover all domestic water suppliers, some of whom do not even hold water rights. *See* GAIL ACHTERMAN, RENEE DAVIS-BORN, IRENE ROLSTON, & LISA GAINES, OREGON COASTAL COMMUNITY WATER SUPPLY ASSESSMENT 18 (Or. State Univ. Institute of Natural Resources, 2005). Non-coastal communities' water supplies are also dependent on the Tillamook State Forest. *See, e.g.*, Laura Gunderson, *Spotted Owls Delay Timber Sale,* OREGONIAN, Sept. 9, 2002, at E-1 (discussing concerns over the potential impact of timber harvest in the Tillamook on sedimentation of the City of Forest Grove's drinking water supply).

38. *See, e.g.*, WATER SUPPLY ASSESSMENT, *supra* note 37, at 18.

39. In 1854, three local farmers built a wooden ship to take their butter to Portland. In 1894, the first cheese processing plant was built, and in 1904, a Tillamook cheese won an award at the St. Louis World's Fair. TILLAMOOK COUNTY CREAMERY ASSOC'N, HISTORY AND TRADITION, http://tillamookcheese.com/OurStory/HistoryAndTradition.aspx. The area dairy farmers formed a cooperative, the Tillamook County Creamery Association, in 1909. As of 2006, the cooperative's member families numbered more than 150. http://www.tillamookcheese.com/OurStory/

40. TILLAMOOK CHAMBER OF COMMERCE, AREA ATTRACTIONS, http://www.tillamookchamber.org/attractions.htm#top.

41. *Id.*

42. TILLAMOOK COUNTY, http://www.co.tillamook.or.us/

43. *See generally* Tillamook Estuaries Partnership (part of the National Estuaries Program), http://www.tbnep.org/.

cal commercial shellfish beds.[44]

The municipal water suppliers, the dairy farmers, and the shellfish harvesters are at the downstream end of the watersheds that encompass the Tillamook State Forest. Their location in the lower river reaches and in the estuary and coastal plains means that they are affected by logging practices and other activities upstream. Erosion, sedimentation, pollution, and flooding threaten their operations. At the same time, these groups can be contributing to the same problems as upstream actors. The shellfish producers and commercial fishermen point fingers at the dairy industry as well as the timber industry for damaging both riverine and estuarine habitat.[45] The municipalities need clean water for domestic supplies, but their diversions can also deplete the area's water resources, especially since they operate in the coastal zone, where the delicate balance between saltwater and freshwater is crucial to watershed health.[46] Individual dairy farmers who divert surface water or pump water from their own wells may also be affected by their own industry's pollutants.[47]

G. The Counties' Battleground

When the state took over the Tillamook Burn reforestation effort in the late 1940s, it also took over ownership of the tax-foreclosed lands from the counties. The arrangement that was created was a trust of sorts, whereby the state would hold the land, manage the timber, and pay two-thirds of the eventual revenue to the counties.[48] The counties thus have an understandable interest in maximizing timber revenue from these lands. In 2005, the state's payments to the three counties that include the Tillamook State Forest exceeded sixty million dollars; in 2006, the amount was about forty-three million dollars.[49] County commissioners keep close tabs on the state foresters, frequently lobbying

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44. *Id.*

45. *See, e.g.*, Letter from Jesse Hayes, President, Hayes Oyster Co., to Pacific Coast Shellfish Growers Association, July 17, 2000 (criticizing dairy industry pollution of estuary). A single dairy cow produces 160 pounds of manure a day. OR. STATE UNIV., OSU DAIRY NEWS June 15, 1998, at 4. *See also* Glenn Spain & Zeke Grader, Pacific Coast Federation of Fisherman's Associations, *Why Forests Matter to Fishermen*, FISHERMEN'S NEWS, October, 1999 (criticizing forestry practices that harm fish and shellfish habitat).

46. WATER SUPPLY ASSESSMENT, *supra* note 37, at 33 (discussing information needs on saltwater intrusion, tidal influence, and other freshwater/saltwater interface issues.)

47. *See, e.g.*, Water Certificates No. 47194 and 58486 (supplying water from a tributary of the Tillamook River for domestic use, stock, dairy facilities and milk parlor clean-up); *see also* WATER SUPPLY ASSESSMENT, *supra* note 37, at 28-29 (discussing water quality challenges for coastal communities).

48. *See* OREGON LEGISLATIVE COMMITTEE SERVICES, ISSUE BRIEF, *supra* note 2.

49. OR. DEP'T OF FORESTRY, 2005 and 2006 OR. FORESTS REP, *supra* note 8.

for increased timber production.[50] This pressure has become particularly insistent in the past few years, as the state's approach to the Tillamook has changed to accommodate several endangered species in the forest and to respond to new demands for protecting many other values besides timber.[51]

H. The Feds' Neighbor

The Tillamook State Forest's immediate neighbor to the south is the federal government. The US Forest Service manages several units of the Siuslaw National Forest adjacent to the state lands, and the Bureau of Land Management manages many scattered sections of "O & C" land — checkerboard parcels of land originally granted to the Oregon and California Railroad and later forfeited back to the federal government.[52] In 1994, in response to the virtual shutdown of federal timber sales in the Pacific Northwest due to litigation under the Endangered Species Act,[53] the federal government adopted the Northwest Forest Plan to govern federal forestlands in the region.[54] Timber cutting on Oregon's federal lands, which had topped out at nearly five billion board feet in 1988, dropped drastically in the years following the plan's adoption.[55]

Many interest groups have put pressure on the state forestlands to increase timber harvesting to make up for the decrease in federal timber sales.[56] Although the largest private timber companies in the Northwest own a great deal of their own timberland, many smaller timber operators rely on the public lands for their timber supply, and even the larger companies were stung by the reduction in federal timber availability because many of their pri-

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50. *See* Profita, *supra* note 13; and Josi, *supra* note 18.

51. *See generally* Associated Oregon Loggers, http://www.oregonloggers.org/index. html (describing the trade association's mission to advocate for contract loggers who harvest timber on state and federal lands).

52. 43 U.S.C. §1181a. *See generally* ELMO RICHARDSON, BLM'S BILLION-DOLLAR CHECKERBOARD: MANAGING THE O & C LANDS (1980).

53. More than a dozen lawsuits and three court injunctions created a virtual management gridlock in Pacific Northwest federal forests in the 1990s. REGIONAL ECOSYSTEM OFFICE, NORTHWEST FOREST PLAN OVERVIEW, http://www.reo.gov/training/historic01.htm

54. Record of Decision, Northwest Forest Plan, April 13, 1994. The NWFP applied to 22.1 million acres of federal forestland managed by the Forest Service and BLM in Washington, Oregon and northern California. The plan designated 10 million acres of those lands as "late successional reserves" (LSRs) or riparian reserves where habitat would be the primary management objective, with timber harvest only allowed when it accelerates habitat development.

55. *See* OREGON FOREST RESOURCES INSTITUTE, OREGON FOREST FACTS: 25-YEAR HARVEST HISTORY, 1977-2001 (OFRI), *available at* http://www.oregonforests.org/factbook/Harvest_History(24).html.

56. *See* Durbin, *supra* note 20 (discussing intensifying interest in expected jump in Tillamook harvest in the next several years, as federal land harvests were reduced); *Cf.* 2005 OR. FORESTS REP., *supra* note 8, at 2-15 (describing "reserve" management strategy on federal lands; contrasting with management of private and state lands).

vate lands had been cut over many years earlier.[57] The State Department of Forestry has adopted a middle ground position, promoting its lands as multi-use lands operating somewhere between the federal "reserve" lands on one hand and the private "wood production" lands on the other hand.[58]

I. The State's Laboratory

In 2001, the State Board of Forestry adopted the Northwest Forest Management Plan to govern the Tillamook State Forest.[59] This management plan incorporated a completely new and different approach to managing the lands. The most unique and controversial component of the plan is "structure-based management".[60] The aim of structure-based management is to transform the Tillamook's even-aged, mostly-single-species tree plantations into structurally diverse forests containing everything from open areas to older forest structure such as that provided by old growth forests.[61] If the variety of species and different layers of structure create an environment similar to naturally diverse forests, this technique could provide a diversity of wildlife habitats, trees that are more resilient to disease, erosion protection, and many other benefits.[62]

The proposed approach of structure-based management involves several significant changes to previous management regimes. Instead of using timber harvest targets as the major planning goal, growing diverse forests becomes the driving goal, and timber harvesting is one tool among many to achieve this goal.[63]

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57. *See* OFRI, *supra* note 55 (noting that private land timber harvest in Oregon peaked at 7.3 billion board feet in 1952, and the federal land harvest took over the lead. But when the federal harvest dropped in the 1990s, the private lands output remained relatively stable at then-existing levels); *see also* Kathie Durbin, *Spotted Owl or Red Herring*? HIGH COUNTRY NEWS, Mar. 20, 2006, at 4 (noting that the Pacific Northwest timber industry's decline from a peak in the 1980s was driven by mill automation, log exports, and overcutting of private lands in the 70s and 80s, as well as by changing federal land management).

58. *See* note 56, *supra*.

59. NORTHWEST FOREST MANAGEMENT PLAN, *supra* note 15. The author was a member of the Board of Forestry at that time (from June 1998 — June 2002) and voted with a unanimous board to adopt the plan. The Board is a gubernatorily-appointed citizen policy board established by statute. OR. REV. STAT. §526.009.

60. *Id.* at 4-5 through 4-8.

61. *Id.* at 4-5 ("SBM is the application of silvicultural tools in a manner that is designed to attain a desired landscape condition. . . .Specifically, it is designed to produce and maintain an array of forest stand structures across the landscape . . . .") and 4-7 (describing the "desired future condition" of "a dynamic mosaic of slowly shifting stand types" including areas of older forest conditions and areas of high timber production).

62. *Id.* at 4-7 - 4-8 (describing the goals of "a broad range of ecosystems and wildlife habitats" to restore and maintain biodiversity and "long-term forest productivity").

63. *Id.* 4-5 — 4-10 (describing how "active management," including thinning, harvest, and other activities, will be used to achieve "a balance of social, economic, and environmental benefits from the forest over time").

The plan proposes much longer harvest rotations than had been previous practice; instead of harvesting trees at 60-80 years of age, the rotation period is increased to over 100 years.[64] Pre-commercial and commercial thinning would take the place of clear-cutting in many areas.[65] The premise of the plan is that by pursuing structure-based management, the Tillamook will be able to grow healthy trees that will provide significant timber value over time, while also providing enhanced fish and wildlife habitat, improving water quality, protecting the watershed for water supply, and accommodating recreational uses.[66]

The structure-based management approach generated controversy in several ways. The affected counties and the timber industry representatives reacted critically to the longer harvest rotations and the reduced timber volume that the Tillamook would produce in the near term; they felt betrayed because they had been expecting considerable timber harvest now that the earliest Tillamook Burn plantings had reached the 60 year mark.[67] Other groups, such as environmentalists and fisheries advocates, are skeptical of structure-based management because it is essentially experimental and includes an active management approach to almost every acre of the state forest.[68] No one knows if in fact older forest structure can be successfully created in 100-year-old stands by thinning and other intensive forestry practices.[69] The state's 2001 proposal to use the Tillamook State Forest as a laboratory for trying out experimental forestry techniques seemed to make no one happy.

The Tillamook State Forest, though only a small portion of one state's land, is a big tent, holding wondrous riches of timber, fisheries, wildlife habitat, water supply, and recreation, of importance far beyond the forest's boundaries. But the tent is crowded with interest groups vying for all those riches. As the groups jostle for control, they run the risk of pulling the tent down around them.

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64. *Id.* at Appendix I-6 (showing average age at harvest of 114 years for the plan's recommended future harvest scenarios).

65. *Id.* at Appendix C-49 to C-62 (describing use of precommercial and commercial thinning and other silvicultural practices to achieve desired stand types).

66. *Id.* at 3-2 — 3-8 (describing the plan's guiding principles).

67. *See, e.g.*, Tom Bennett, *Timber Harvest Levels Fall Short of Plan: Oregon Board of Forestry Re-examines Forest Plan as Counties Face Cuts in Revenue* , DAILY ASTORIAN, Sept. 14, 2006 (describing Tillamook County Commissioner Tim Josi's call for "complete overhaul" of the state forest plan and scaling back of the "structure-based management 'experiment'").

68. *See* Mike Stark, *Will Logging Save the Spotted Owl?* HIGH COUNTRY NEWS, Mar. 12, 2001 (discussing conservationists' criticism of the new forest plan).

69. *Compare* NORTHWEST FOREST MANAGEMENT PLAN, *supra* note 15, at Appendix 11 (noting that unmanaged forests start to display old growth characteristics at 175-250 years in age) with 4-17 (describing "older forest structure" with no reference to age of trees).

III. HOLDING UP THE BIG TENT: THE TILLAMOOK STATE FOREST AND ECOSYSTEM SERVICES

A. Today's Management Model: Spending Down the Principal

The current approach to managing the Tillamook State Forest is similar to the approach to much public lands management. The lands are managed for multiple uses, which often means managing in response to interest group pressures. The power and influence of the various interest groups change from year to year, but the modus operandi is the same no matter which interest is in vogue. Constituencies with the most to gain or lose from particular management decisions pay close attention to what the decision makers are doing and lobby hard to protect and promote their immediate interests.[70] Oregon's former Governor John Kitzhaber described this cycle of conflict succinctly:

> Environmental interests sue the natural resource industries and governmental agencies for failing to meet . . . standards and regulations. They strive to strengthen environmental laws through legislative action. In return, economic interests that are subject to . . . regulation, challenge these regulations in the courts and seek to repeal or weaken them through legislative action. Each side tends to look for opportunities to advance their agenda when the [a]dministration . . . is in their favor, while the other side relies on the courts to form a defensive front against changes that might imperil their interests.[71]

The resulting management choices seem perfectly rational and satisfactory from the perspective of whichever constituency is "winning" at any point in time. The groups who have succeeded in maximizing their short-term gains are happy, while the losers regroup for the next battle, hoping that the next time they'll be victorious and then be able to hold on to their gains for a reasonable period of time.[72]

Stepping back from the immediate perspective of the competing interest groups and taking a broader and longer view, however,

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70. *See generally*, Michael Blumm, *Public Choice Theory and the Public Lands: Why "Multiple Use" Failed*, 18 HARV. ENVTL. L. REV. 405 (1994) (discussing the disproportionate influence on policy making of small and well organized interest groups).

71. John Kitzhaber, M.D., former Governor of Or., Speech to the Ecological Society of America (Aug. 6, 2004) *available at* http://www.lclark.edu/org/kcenter/ecosocamerica.html.

72. *Id.*

exposes this approach as irrational and ultimately self-defeating for those involved. First of all, this approach produces, at best, see-saw management, and, at worst, gridlock.[73] This short-sighted approach is akin to spending down the principal of an endowment instead of limiting spending to the interest income. Pretty soon, there is no more income, and the principal itself is gone. An endowment that might have provided a stream of income for many purposes for years to come has been destroyed.

To expand the endowment analogy to include competing interest groups, think of hostile siblings fighting over their parents' estate, an estate that consists of a large parcel of appreciating real estate and a nicely balanced stock portfolio. If the squabbling kids focus on their disagreements and on maximizing their short-term gain, they may end up forcing partition of the real estate and liquidation of the portfolio in order to get immediate cash flow. The stronger their antipathy, the harder they'll try to get more than their fair share at their siblings' expense, and the less they'll think clearly about how to maximize long-term gain for all of them and their own children. The most rational choice, from the perspective of long-term maximum gain, might well be to hold the assets rather than to distribute them, taking smaller short-term gains in the form of rents, interest, and dividends while allowing the property and the portfolio to increase in value.

But making that choice requires cooperation, as well as agreement on the goal of improving the returns for all of the beneficiaries over a longer time period.[74] Polarized (or cash-strapped) siblings are unlikely to behave so sensibly. Unfortunately, however, once they've liquidated the assets, they may quickly spend their share and soon have nothing to show for their once-valuable inheritance. At least that will spare their own children the same fate, since they won't have anything to fight over, but that's a pretty thin silver lining in an otherwise dark cloud.

Public land management as exemplified by the Tillamook State Forest is currently following the same trajectory. The commercial fishers, the loggers and mill owners, the county commissioners, the environmental groups, the dairy farmers, and all the other interest groups are the squabbling siblings. For the most part, each group insists on a particular product from the Forest, *now*, and fights against others who demand different goods. Meanwhile, the Forest itself is the estate and the endowment.[75] Unless the endow-

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73. *Id.*

74. Of course, if one of the parties has serious immediate financial needs, agreement on a longer-term goal will be even more challenging and some concession to that need may be required.

75. *See generally* THOMAS PRUGH ET AL., NATURAL CAPITAL AND HUMAN ECONOMIC SURVIVAL

ment is managed for robustness and growth, the interest and principal will both diminish and eventually disappear, leaving behind all losers and no winners. "We sue each other, we label each other, we battle it out in the halls of Congress while our rural mills close, our forests burn, and ever more species edge toward the brink of extinction."[76]

Is there a better way? In contrast to the current campaign-cycle forest management model, what would a model look like that "grew" the endowment's principal, thereby guaranteeing a growing stock of natural capital and a steady and increasing flow of future interest income as well? More importantly, how could state forest managers get there from here, given the political world they live in?

B. Tomorrow's Management Model: Preserving and Investing in the Principal

In the financial world, endowment models are fairly well understood. Returning to the analogy of the fighting siblings, for example, suppose that they made out like bandits by selling their inherited real estate and splitting the proceeds. Feeling well-to-do and magnanimous, the family decided to put the rest of the estate's assets into a trust to create an endowed scholarship fund to support annual scholarships. Their goals are to protect the endowment in perpetuity, to prevent the principal from losing value, and ideally to increase the principal value over time, in order to fund more scholarships every year on a growing stream of endowment income. The endowment is seeded with the estate's stock portfolio. The investment adviser is directed to manage the portfolio pursuant to a moderately conservative growth strategy. The investment adviser will then suggest to the trustee and the scholarship award committee a percentage rate of annual spending from the fund to support the yearly scholarship grants. This spending rate number will be calculated based on the historic performance of similar portfolios, as well as on the actual performance of this portfolio over time. The key to determining the rate of allowable spending is choosing an amount that will support an acceptable number of scholarships each year, but will also allow for annual reinvestment of some of the income into the principal, so that the fund's base assets will continue to grow. Assuming that

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44, 102-103 (2d ed. 1999) (discussing the need to keep stocks of natural capital, such as forests, intact in order to maintain sufficient flows of income in the form of goods and services over time; depletion of the natural capital will eventually destroy both the stock and the flow of income).

76. Kitzhaber, *supra* note 71.

the portfolio's value increases at a rate greater than the "spending from endowment" rate chosen, the number and amount of scholarships fundable will steadily increase even without changing the percentage spending rate.

How does this translate into natural resources management? Good question. The earlier discussion about the groups seeking to influence management of the Tillamook suggests that differences complicating smooth translation are more apparent than similarities. First, the endowed scholarship model has only one output, cash. Any disagreement about output will probably focus only on the amount of cash—in this example, the proper number of scholarships to fund. In the Tillamook, the menu of desired outputs is long, varied, and competing. Second, a scholarship endowment fund has three clear decision-making entities: an oversight body serving as the trustee for the endowment, an investment adviser, and a scholarship award body. All three have distinct and clearly-defined roles but, to a significant degree, the same goals. Arguably, all three have fiduciary duties as well. By contrast, in the natural resource management context represented by the Tillamook State Forest, the decision-makers are many and their roles are not so clearly defined. Nor are their fiduciary duties well understood, if such duties exist at all.

Third, in the financial setting, the investment market histories and predictive equations to optimize both income stream and principal growth have been around for decades and are well tested. That is not the case in the natural resource management field. Although relatively short-term predictive equations exist for commodities such as timber, predictive models simply do not exist for jointly optimizing timber harvest, clean water, fish and wildlife habitat, recreation, and other goods and services over a long time horizon.[77]

Does this mean that the idea of "growing the principal" in natural resource management has to be abandoned as hopelessly lost in translation? Not necessarily. The emerging field of ecosystem services provides both a dictionary and possible equations.[78]

Ecosystem services as a discipline focuses attention on the

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77. *See* Robert Costanza and Carle Folke, *Valuing Ecosystem Services with Efficiency, Fairness, and Sustainability As Goals*, *in* NATURE'S SERVICES: SOCIETAL DEPENDENCE ON NATURAL ECOSYSTEMS 64 (Gretchen C. Daily, ed., 1997) (describing the "need to develop truly integrated assessments and models of the quality, quantity, and spatial and temporal dynamics of ecosystem services and the various aspects of their connection to human well-being in the long run"); *see also* James Salzman, *Valuing Ecosystem Services*, 24 ECOLOGY L. Q. 887, 896-898 (1997) (discussing difficulty of valuing ecosystem services).

78. *See* Salzman, *id.* (discussing the potential to borrow methodology for valuing ecosystem services to some degree from financial markets).

valuable goods and services that healthy functioning ecosystems produce for us, essentially free of charge.[79] In contrast, an unhealthy or disrupted ecosystem cannot perform these important services or produce these valuable products, some of which have no cost-effective substitutions.[80] In a forested watershed like the Tillamook State Forest, these goods and services include such things as supplies of fresh water, fisheries, forest products, and carbon dioxide sequestration.[81] The remainder of the paper examines these components as they might be applied in the Tillamook State Forest, and by extension, to similar ecosystems with similar challenges.[82]

C. The Ecosystem Services Model Applied to the Tillamook State Forest

The Tillamook State Forest is an excellent laboratory for applying a new management model based on ecosystem services. First, the boundaries of the state forest are closer to a useful ecosystem boundary than most ownership parcels. Second, the land is in public ownership and its governing law requires management of the lands for the "greatest permanent value" to the state. This language cries out for an appreciation of ecosystem services. Third, the suite of resources that interest groups and the public want from the forest, though numerous and varied, all depend on a healthy, functioning ecosystem for continued production.

1. Inside the Box: The Ecosystem of the Tillamook State Forest

In order to manage the Tillamook State Forest for maximum long-term health and productivity, the forest needs to be understood as an ecosystem in all of its complexity. But as a legal entity

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79. *See generally* Gretchen C. Daily, *Introduction: What Are Ecosystem Services?*, *in* NATURE'S SERVICES, *supra* note 77, at 1-6. The first mention of ecosystem services has been credited to a report titled *The Study of Critical Environmental Problems* that was published by MIT Press in 1970. *See* Harold A. Mooney & Paul R. Ehrlich, *Ecosystem Services: A Fragmentary History*, *in* NATURE'S SERVICES, *id.* at 14. The crossover of ecosystems services into the legal field as a suggested basis for natural resource management has occurred only in about the last decade. *See* Salzman, *supra* note 77, at 898-903.

80. Daily, *supra* note 79, at 5.

81. *Id.* at 3-5. These are only some of the most obvious ecosystem services. Daily lists many more, including: air and water purification; flood and drought mitigation; decomposition and detoxification of wastes; generation and renewal of fertile soil; pollination; pest control; dispersal of seeds and nutrients; maintenance of biodiversity which supports human agriculture, medicine, and industry; protection from the sun's radiation; climate stabilization and moderation of temperatures; support of diverse cultures; and aesthetic beauty and intellectual stimulation.

82. "Site-specific case studies" can help translate abstract ecosystem service values into tangible terms connected to "real people in real socioeconomic settings." Andrew Wilcox & John Harte, *Ecosystem Services in a Modern Economy: Gunnison County, Colorado*, *in* NATURE'S SERVICES, *supra* note 79, at 311.

for management purposes, the Tillamook State Forest is defined by lines drawn on a map without regard for any underlying natural boundaries, processes, or interrelationships. This mismatch is a common problem in natural resource management, where political jurisdictions rarely coincide with natural systems.[83] Fortuitously, however, the boundaries of the Tillamook are reasonably congruent with the outlines of two watersheds—the Tillamook Bay and Nehalem Bay drainage basins. Although the congruence is by no means a perfect overlap, this feature makes viewing and understanding the Tillamook as an ecosystem somewhat easier than doing so with many other natural resource management units. Furthermore, a good deal of information already exists about these forested watersheds. Until recently, however, most studies have emphasized silviculture in aid of maximizing timber growth, and only in the past few decades has the focus shifted to examine other values and products.[84]

The Tillamook State Forest ecosystem is part of the Oregon Coast Range physiographic province, which consists of "low mountains...covered by highly productive, rain-drenched coniferous forests;" in other words, the Tillamook State Forest is a low-elevation temperate coastal rain forest.[85] These coastal forests are among the most productive forest ecosystems *in the world*—even surpassing many tropical forests, thanks to lots of precipitation, long frost-free growing seasons, and moderate temperature swings between mild winters and relatively cool summers.[86] This very productivity and robustness is of course what makes the area of interest to both timber companies and fish and wildlife groups. Furthermore, this world-class ranking of forest productivity means that the area's importance is considerably greater than its size and location would otherwise suggest, and its role in carbon sequestration and climate stabilization cannot be ignored.[87]

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83. *See generally*, Janet Neuman, *Dusting off the Blueprint for a Dryland Democracy: Integrating Water Availability and Watershed Health into Land Use Decisions*, 35 ENVTL. L. REP. 10236 (2005).

84. *See*, Stephen D. Hobbs & Thomas A. Spies, *Introduction, in* FOREST AND STREAM MANAGEMENT IN THE OREGON COAST RANGE 1 (Stephen D. Hobbs, et al. eds., 2002) (discussing the wealth of new interdisciplinary research performed in the Oregon Coast Range since 1987).

85. ATLAS OF OREGON 172-179 (William G. Loy, ed., 2d ed. 2001). The highest points in the Oregon Coast Range are just over 3,000 feet. *Id.* at 252. Annual precipitation averages nearly 200 inches in some parts of the forest. *Id.* at 154. A comprehensive discussion of the Tillamook ecosystem is both beyond the scope of this paper and beyond the scope of my expertise; this section simply sketches out some basic elements to demonstrate the forest's complexity and to illustrate that management decisions cannot focus narrowly on how many trees should be cut or even on how many fish should be grown.

86. *See generally* Thomas A. Spies, et al., *The Ecological Basis of Forest Ecosystem Management in the Oregon Coast Range, in* FOREST AND STREAM MANAGEMENT, *supra* note 84, at 43-45.

87. *See generally* Susan E. Alexander, Stephen H. Schneider, & Kalen Lagerquist, *The Interaction of Climate and Life, in* NATURE'S SERVICES, *supra* note 79, at 71; Norman Myers, *The World's Forests and Their Ecosystem Services, in* NATURE'S SERVICES, *supra* note 79, at 215. (Though primarily discussing tropical, rather than temperate, rainforests, both pieces emphasize the critical role of such forests in

Prior to the intensive logging and devastating fires of the past century, the Tillamook was primarily a mixed conifer forest containing Douglas fir, western hemlock, and Sitka spruce, along with a number of hardwood species, the most widespread of which were alder and maple.[88] Pollen records suggest that this species composition had been relatively stable for as long as 6,000 years.[89] The physical historical record also demonstrates how various species play particular roles in the ecosystem. For instance, deciduous trees are especially important for fixing nitrogen, promoting faster nutrient cycling than conifers alone, stabilizing riparian zones, providing important wildlife habitat, and supporting lichens.[90] The complex and highly productive forest contains hundreds of non-tree plant species and provides habitat for a wealth of fish and wildlife as well, including some sixty-three species of mammals, one hundred forty-seven species of birds, thirty-two reptile and amphibian species, and twenty-eight fish species.[91]

Once the Coast Range became important to the timber industry, and particularly after the fires of the mid-1900s, the mix and distribution of species in the Tillamook began to change. Primarily Douglas fir seedlings were used for the post-fire replanting because of their rapid growth rate and their desirability for lumber.[92] The reforested Tillamook is thus largely made up of even-age Douglas fir, without the historical mix of other conifers and hardwoods. Homogeneous replanted forests are more vulnerable to certain pests and diseases, such as Swiss needle cast, which is taking a drastic toll on the region's Douglas fir stands.[93] The decreased variety in vegetation also diminishes habitat and weakens the food web for both plants and animals, helping to explain why dozens of

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stabilizing local, regional, and even global climate).

88. Spies, *supra* note 86, at 39-41.

89. *Id.* at 39.

90. *Id.* at 39-41.

91. NORTHWEST FOREST MANAGEMENT PLAN, *supra* note 15, at 2-28 and 2-61.

92. *Id.* at 35 (noting that Douglas fir is the foundation of timber management throughout the Coast Range) and 54(intensive forest management tends to shift stand composition to the most valuable timber species, including Douglas fir).

93. *Id.* at 35-36; *see also, generally* Walter G. Thies & Ellen Michaels Goheen, *Major Forest Diseases of the Oregon Coast Range and their Management, in* FOREST AND STREAM MANAGEMENT, *supra* note 84, at 191-212. The vulnerability of the Douglas fir plantings in the Tillamook Burn may have been exacerbated by use of seed stock from outside the Oregon Coast Range. Many of the seedlings came from Washington state and although they were similar to the trees in the Tillamook's pre-fire forests, they were not identical. The Washington seed stock was adapted to the somewhat different environment a few hundred miles north. *See* LUCIA, *supra* note 6, at xxiv and 175 (noting that "in the early years the state forestry scrounged both [seedlings and seed] from any available source" and stating that nearly 2 million trees came from Washington). In keeping with the citizen reforestation effort, Oregon residents were also encouraged to gather pine cones and bring them to the foresters, who would pay them for the cones. Don Hamilton, *Oregon Students Helped Transform the Landscape*, OREGONIAN, Nov. 21, 1996, at WZ 1. (quoting then-Secretary of State Phil Keisling about gathering seed cones for the Tillamook reforestation with his family when he was young and taking them to the weigh station to be paid).

species of animals and plants are officially considered "species of concern".[94] Thus, the picture that emerges of the Tillamook today is of an ecosystem somewhat simplified by human management, but still hugely productive and with a known and recent history of an even higher level of complexity and resilience.

In one of the recent studies of the Oregon Coast Range, a phalanx of scientists synthesized several years of research on wildlife habitat, fisheries habitat, forest health, and a number of other important topics.[95] A reader approaching the compendium on its own terms would likely come away feeling satisfied and informed, as the volume is a veritable encyclopedia of data about the current mosaic of vegetation across the landscape, the fish and wildlife that are found in various locations, the current distribution of major forest diseases, and many other data points. But a reader approaching the volume seeking a more holistic view of the ecosystem's functioning and how the various parts of the system interact may instead come away disappointed. This feeling is not due to any failure on the part of the authors, but results from the fact that in spite of all the valuable information that exists, the systemic knowledge is still quite limited.

For instance, a discussion of the ecological basis of forest ecosystem management includes the following underwhelming conclusions:

> The long-term consequences of these changes in diversity [in stands managed primarily for timber production] to ecosystem outputs are not well understood; consequently, forest management in the Coast Range should be viewed as a large experiment . . . .
> . . .
> [N]atural processes of vegetation development must be better understood if managers can hope to reach a goal of retaining native species and communities . . .
> .
> . . .
> [W]e lack knowledge of many of the details of ecological processes and habitat relationships that are essential to modern forest planning and the ability to predict the consequences of specific actions.[96]

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94. *See generally*, Spies, *supra* note 86; *see also* NORTHWEST FOREST MANAGEMENT PLAN, *supra* note 15, at 2-32 and 2-62 (listing species of concern).

95. FOREST AND STREAM MANAGEMENT, *supra* note 84.

96. Spies, *supra* note 86, at 36, 60-61.

Similar admissions of lack of information appear in chapters on fish and aquatic ecosystems[97] and the ecology of wildlife.[98] In an area as intensively studied as the Oregon Coast Range, the encyclopedic material that does exist hardly seems to make a dent in understanding the big picture. But what if the same teams of interdisciplinary scientists were asked to consider what they already know from a somewhat different perspective? What if they were asked directly to identify the variety of ecosystem services provided by coast range forested watersheds, specifically the Tillamook? I venture to say that--even without any additional research--a very complex picture could be developed. In fact, many of the Tillamook's ecosystem services have already been mentioned earlier, just by describing the various constituencies interested in the forest.[99] Combining those interest group demands with what the Oregon scientists know and incorporating the considerable work done by others in the ecosystem services area would produce something like the following list, though with much more detail and sophistication:

- A wide range of valuable wood products, including everything from high quality Douglas fir lumber, to lower quality woods for paper pulp and veneer, and medicinal products such as taxol from Pacific yew trees;
- Other forest products including such things as moss, mushrooms, shrubbery, boughs, greens, cones, and ferns;
- Water-related goods and services, including, among others, important Pacific salmonid fisheries habitat, freshwater supplies, estuary nutrients, floodwater storage and flood control, water filtration, and erosion control;
- Soil creation and renewal and waste decomposition;
- Carbon sequestration, climate stabilization, radiation protection, and temperature modulation;

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97. Gordon H. Reeves, Kelly M. Barnett, & Stanley V. Gregory, *Fish and Aquatic Ecosystems of the Oregon Coast Range, in* FOREST AND STREAM MANAGEMENT, *supra* note 84, at 83, 85 (noting an emerging, but not yet implemented, recognition that a comprehensive ecosystem approach is necessary for recovery of imperiled fish and that "understanding of the broad-scale behavior of aquatic ecosystems over extended time periods is limited.").

98. John P. Hayes & Joan C. Hagar, *Ecology and Management of Wildlife and Their Habitats in the Oregon Coast Range,* in, FOREST AND STREAM MANAGEMENT, *supra* note 84, at 126-128 (describing the challenges of managing for wildlife habitat at large spatial scales for several reasons, including patchwork ownership, species' unique responses to management activities, and the need to deal with very long time horizons, even centuries).

99. *See* Part II.

- Pollination, seed dispersal, and nutrient transport;
- Maintenance of biodiversity;
- Scientific study; and
- Recreation and esthetics.[100]

This "simple" list demonstrates that the Tillamook State Forest ecosystem is much greater than the sum of its parts. Until a true ecosystem approach is adopted, the forest managers, the interest groups, and the public will all fail to see the forest for the trees . . . or the fish . . . or the off-road-vehicle trails . . . or any other single interest.

2. Managing the Tillamook State Forest for the "Greatest Permanent Value"

The Tillamook State Forest is publicly owned.[101] The forest's boundaries happen to coincide, albeit roughly, with two significant watersheds. The area is recognized as the largest contiguous parcel of temperate rain forest in the lower forty-eight states. What is more, the law governing the Tillamook's management directs the State Forester and the Board of Forestry to manage these lands for the "greatest permanent value" of the lands to the state.[102] This phrase echoes the vocabulary of long-term financial trust management and provides the mandate for treating the Tillamook State Forest as an endowment that must be nurtured to protect its long-term productivity. This law positively begs for an ecosystem services approach.

Although the legislature chose not to define the management directive explicitly in the statute, the lawmakers did include a menu of authorized activities that can be pursued to "secure" the lands' greatest permanent value. "[T]o that end," the State Forester may: sell forest products; reforest the lands, and protect them from fire, disease, and pests; sell rock, sand, gravel, and pumice, and execute mining leases; permit use of the lands for livestock

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100. *See* Daily, *supra* note 79 (summarizing ecosystem services), and NORTHWEST FOREST MANAGEMENT PLAN, *supra* note 15, Chapter 2 (detailing the resources of the Tillamook State Forest).

101. The Tillamook State Forest's public ownership status makes incorporation of an ecosystem services approach to management much easier than for private lands. *See* J.B. Ruhl, *The "Background Principles" of Natural Capital and Ecosystem Services—Did* Lucas *Open Pandora's Box?*, 22 J. LAND USE & ENVTL. L. 527 (2007) (discussing challenge of using common law to address ecosystem services on private lands).

102. OR. REV. STAT. § 530.050 (2005). The "greatest permanent value" language became a part of the state statute in 1941. 1941 Or. Laws, Ch. 236, § 5. No legislative history survives to illuminate the original meaning of the phrase, but since these are three ordinary English words, their plain meaning is not hard to derive. The terms by their nature are flexible and forward-looking and a contemporary determination of what constitutes the greatest permanent value must certainly incorporate expanding understandings of ecology and ecosystems.

grazing, fish and wildlife habitat, protection of water supplies, flood and erosion protection, and recreation; and even use the forestlands to establish a marketable carbon offset program.[103] Without the introductory mandate of managing for greatest permanent value, this list is in many ways just a typical "multiple use" prescription, similar to that for many other public lands. The statute gives no guidance on how to choose or balance among these interests, such as when to favor selling forest products over protecting fish and wildlife habitat, or how to reconcile recreation with protecting water supplies. Without such guidance on priorities or further definition of what is meant by greatest permanent value, the law invites interest groups to lobby for their favorite items from the statutory menu. So far, that is exactly what has happened.

The state forestry managers, unlike bank trust officers, do not work in quiet back offices, communicating periodically with their beneficiaries through routine paper reports. The state forestry department employees work in full public view at all times. The legislature approves the budget that pays their salaries. The governor appoints and the State Senate confirms the volunteer citizen Board members, who in turn appoint the State Forester.[104] The Board represents designated geographic regions throughout the state.[105] Three of the seven board members—but no more than that—may have ties to the timber industry.[106] The Board makes its decisions in public meetings, and the doors of the Department are open at all times to all of the state forests' bosses, beneficiaries, and shareholders. The managers are under the direct and constant scrutiny of politicians, loggers, environmentalists, all-terrain vehicle users, downstream farmers, fishermen, hunters, boaters, and on and on. The only constituencies who cannot put direct personal pressure on the state employees are the fish and the furred and feathered creatures, but they have plenty of human spokespeople to do the job for them.

Therefore, these state land managers often understandably make decisions that are more about appeasing interest groups seeking short-term gains than about long-term permanent value maximization. Adding together a bunch of interest group demands and calling it "the public interest" and even the "greatest value" is sometimes the best agencies can do when their mandates include

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103. OR. REV. STAT. § 530.050(1)-(11) (2005).

104. OR. REV. STAT. §§ 526.009(1), 526.031(1) (2005). The Board members are private citizens who are compensated only for expenses and a small per-diem when attending meetings. OR. REV. STAT. § 526.016(2) (2005); OR. REV. STAT. § 292.495 (2005).

105. OR. REV. STAT. § 526.009(3) (2005).

106. OR. REV. STAT. § 526.009(4) (2005).

something for everyone without any direction on how to make hard choices. The decisions thus reflect rational self preservation, or sometimes just plain weariness, in dealing with conflicting demands from competing constituencies, all of whom have essentially equal claims under the law and who operate on short time horizons.

When the Board of Forestry promulgated administrative rules to further explain the thrust of the greatest permanent value statute in 1998,[107] this was the context in which they operated. The rulemaking process generated tremendous controversy.[108] In the end, the greatest permanent value rules were the product of political compromise.[109] The Board was able to broaden the notion of the public interest in state forestlands somewhat beyond timber to reflect new constituencies and new understandings, and thus the rules reflect an updated view of the "public interest" in publicly owned forests.[110] But insofar as the rules try to be all things to all people by maximizing timber harvest and environmental values at the same time, the rules perpetuate multiple use management and thus stop short of fulfilling the statute's broader fiduciary duty to manage the forest for the greatest permanent value, a duty which does not necessarily allow something for everyone in the short term.

Building on the compromised rule, the Department and Board again attempted to interpret their mandate somewhat creatively when they adopted a management plan for the Tillamook State forest in 2001.[111] The Plan adopted by the Board looks many years into the future, again attempting to maximize multiple returns from the Tillamook's resources. However, it does so by foregoing some immediate benefits, such as near-term timber harvest, and focusing on creating a diverse and healthy forest ecosystem over

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107. OR. ADMIN. R. 629-035-0000 (2007) to 629-035-0110 (2007). The author's term on the Board of Forestry began after the greatest permanent value rules were adopted. *See* NORTHWEST FOREST MANAGEMENT PLAN *supra* note 15.

108. *See, e.g.*, Joan Laatz Jewett, *Subcommittee Delays Position on State Forests' Prime Use*, OREGONIAN, Nov. 5, 1997, at E3. (describing "outpouring of opposition from the public and the governor" to the proposed rules provision that would have formalized timber production as state forests' primary purpose, which led to appointment of a subcommittee of the Board of Forestry to try to reach a compromise).

109. Draft rules published on July 15, 1997, stated timber harvest and producing revenue as primary goals. The final rules as adopted defined greatest permanent value to be "healthy, productive, and sustainable forest ecosystems that over time and across the landscape provide a full range of social, economic, and environmental benefits to the people of Oregon" and placed timber harvest as a goal that needed to be "pursued within a broader management context" but still expressed a goal of actively managing the lands for sustainable timber harvest and revenues). *Compare* Department of Forestry Notice of Proposed Rulemaking Hearing, July 15, 1997, with OR. ADMIN. R. 629-035-0000 *et seq.* (adopted Jan. 7, 1998).

110. *Id*.

111. *See* Part II(I).

several decades using structure-based management, with the hope that a more complex ecosystem will be better able to support timber harvest, fisheries, and numerous other benefits than the closed canopy, even-age, second growth forest that is the Tillamook today.

However, as noted earlier, the new thinking was not greeted with open arms: far from it. The timber industry responded by lobbying the state legislature to directly override the plan and mandate more timber cutting.[112] Their proposed legislation would have required a 40-year harvest schedule.[113] The environmental groups and fisheries advocates also tried to legislate their own preferred plan through the citizen initiative process.[114] The Wild Salmon Center and others sponsored a ballot measure that would have placed half of the acreage in the Tillamook completely off-limits to logging or other active management in order to grow old forest reserves.[115]

This swift reaction to the new management plan demonstrates just how difficult it can be to change an existing management model to incorporate ecosystem services. In spite of a broad and forward-looking statutory mandate and the initial willingness of state forest managers to use this authority creatively, the Tillamook State Forest is still the victim of see-saw management policies. As long as the competing interest groups can keep the focus on short time horizons and single outputs, the state will continue to spend down the principal in order to have enough outputs to keep the various constituents happy in the near term.

However, in spite of the pressures that have kept the state forest managers embattled, the law is on the side of fighting back. The state forest land management law is *qualitatively* different from the usual multi-purpose natural resource management directive because of those three operative words: g*reatest . . . permanent . . . value*. Use of the word *permanent* clearly demands taking a very, very long view. Determining the *greatest value* requires comparative valuation analysis among various competing possible returns, which is different than simply adding up a tally of several desired outputs. The statute does not constrain value to dollars and cents, but contemplates a much more open-ended assessment

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112. *See, e.g.* SENATE BILL 699 (2003). The legislature also tried to force more logging by including budget notes in the Department of Forestry's budget, directing the Department to log at least 250 million board feet a year as a condition of keeping more than 20 full time agency positions. *See* Michelle Cole, *Senate Democrats Pressured to Vote Against Forestry Budget*, OREGONIAN, July 13, 2005, at C1; and Michael Milstein, *Governor Defies Forest Directive*, OREGONIAN, Sept. 9, 2005, at B1. (both discussing legislative budget notes in the 2003-2005 and 2005-2007 biennial sessions and Governor Ted Kulongoski's direction to the Department not to follow the budget notes).

113. *Id.*

114. *See* 2004 BALLOT MEASURE 34, *supra* note 35.

115. *Id.*

of everything from timber to flood control to carbon sequestration.[116] The statute thus gives state officials significant latitude, indeed requires them, to act like trustees of an endowment, managing state forest lands for the long haul, carefully considering the entire list of authorized uses and their relative values in order to determine what management prescriptions would best maximize the long-term gains for the state of Oregon.[117]

But how should state officials compare the value of 10,000 board feet of lumber cut from 60-year-old trees today with 100,000 board feet of lumber cut from 100-year-old trees in 2047? Even assessing just today's cut, how should they factor in and compare the loggers' wages, the counties' trust payments from the state, the foregone wages of the ocean fishermen if the salmon hot spots are damaged by logging, the loss of spotted owl and murrelet habitat, and the indirect impacts on recreation? As soon as forest managers start projecting years into the future, the calculations become even more daunting and less solid, subject to debate about proper discount rates and other predictions.

I know that if I take my checkbook to the lumberyard, I can write a check for fifty dollars and take home a certain number of two-by-fours. But how many murrelet nests would that fifty dollars buy, and who would take my money?[118] If I lived in Wheeler, Oregon, and wanted to assure that the Tillamook watershed would provide clean drinking water for my grandchildren, how much would that cost, and who could I pay for it even if I wanted to? Will there be jobs for my grandchildren to keep them in Wheeler? Will they be loggers, fishing guides, owners of a saltwater taffy shop for tourists, or carbon traders?

Traditional, conventional economic theory does not provide an easy way to value these non-commodity outputs of the forest, what ecological economists have termed "natural capital."[119] Mainstream economists treat land and related natural resources simply as one of many inputs into human economic systems of production and consumption, thus subordinating ecosystems and the natural environment to the human economy.[120] In contrast, the relatively

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116. *See supra* notes 102-103. (the statute lists forest products, flood control, and carbon offsets as three among many authorized purposes for the lands, including both commodity and non-commodity uses).

117. This fiduciary duty is directly supported by the plain statutory language and does not require any creative theories such as an expansive reading of the public trust doctrine. *Cf.* J.B. Ruhl, *Toward a Common Law of Ecosystem Services*, 18 ST. THOMAS L. REV. 1, 6-9 (2005) (noting the public trust doctrine's failure to provide a basis for incorporating ecosystem services into the common law).

118. *Cf.* Salzman, *supra* note 77 (discussing lack of markets for ecosystem services).

119. *See generally* PRUGH, *supra* note 75.

120. *Id.* at 9-21; *see also* Lawrence H. Goulder & Donald Kennedy, *Valuing Ecosystem Services: Philosophical Bases and Empirical Methods*, *in* NATURE'S SERVICES, *supra* note 79, at 24-27 (describing

new field of ecological economics recognizes that all human economic activity is enabled by (and thus essentially subordinate to) the natural environment.[121] Nature provides goods, such as food, water, and other materials (like metals or fossil fuels) that humans use directly or modify to produce other goods.[122] The environment also provides services, including generating oxygen, purifying water, creating soil, and absorbing waste.[123] Looked at this way, it becomes clear that all human economic activity is made possible by the natural environment, and the human economy "nests within the ecosphere," and is thus subordinate to nature, rather than the other way around.[124]

Applying an ecological economics approach to a forested watershed like the Tillamook State Forest requires valuing more than the number of board feet of lumber that can be cut and sold, or even how many dollars fishing visitors might spend in the local communities. Traditional economics assigns all factors of production to one of three categories — land, labor or capital.[125] The ecological approach instead uses a very wide angle economic lens that broadens the traditional "economic trinity"[126] of land, labor, and capital (wealth) to include a more realistic appreciation and valuation of "natural capital."[127] This view specifically recognizes several important insights in addition to the basic truth that the human economy exists within the natural environment rather than the other way around.

First, the category of land and natural resources includes much more than just raw materials for human use. The phrase "raw materials" brings to mind lumber, coal, oil, diamonds—and many other tangible substances that humans take from nature and use for many purposes. A person would not normally think of air or water in the same category of "raw materials", yet humans are completely dependent on nature for these crucial substances as well.[128] Furthermore, manmade capital is not endlessly substitut-

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anthropocentric utilitarian approach to valuing the natural environment only to the extent it confers satisfaction to humans).

121. *Id.*

122. *Id.*

123. Daily, NATURE'S SERVICES, *supra* note 79, at 3-4; PRUGH, *supra* note 75, at 55.

124. PRUGH, *supra* note 75, at 21; Harold A. Mooney & Paul R. Ehrlich, *Ecosystem Services: A Fragmentary History*, *in* NATURE'S SERVICES, *supra* note 79, at 11-17 (arguing that the human economy is a "wholly-owned subsidiary" of natural ecosystems rather than the other way around).

125. *See* PRUGH, *supra* note 75, at 7.

126. *Id.*

127. *Id.* at 51-53 (describing natural capital).

128. Think of an astronaut leaving earth; she needs to take air and water along for the journey since the spatial "ecosystem" does not provide them. *Cf.* Daily, *supra* note 79, at 3 (discussing John Holdren's exercise of deciding what species to take along to live on the moon, assuming that the moon had a human-friendly atmosphere and climate). *See also* Salzman, supra note 77, at 887 (discussing the "Biosphere I" experiment).

able for natural capital, nor are all forms of natural capital renewable, such as minerals and fossil fuels.[129] Although we may be able to substitute synthetics for wood, ethanol for oil and coal, and cubic zirconia for diamonds, we have not yet found a substitute for oxygen or water. Additionally, natural capital consists of both stocks and flows; for instance, the Tillamook or any other forest contains a stock of trees, but it also produces a flow of services, such as carbon sequestration, oxygen generation, erosion control, water capture and filtration, and wildlife habitat maintenance.[130]

If the atmosphere did not protect us from the rays of the sun, we would be hard-pressed to protect ourselves. If plants stopped converting carbon dioxide into oxygen, we would be astronauts without a spaceship. And if microbes and fungi stopped decomposing, we would soon be buried in our own waste. The bottom line is that natural capital is the basis for "life-support" on the planet, and "[a]ll the rest is secondary."[131] Thinking narrowly about how much timber to harvest in a particular state forest seems to be missing the point a bit when placed in the context of these larger concepts.

Land managers, like those who are responsible for determining the greatest permanent value of the resources of the Tillamook State Forest, therefore must incorporate principles of natural capital and ecological economics in two important ways. First, they can use traditional utilitarian and anthropocentric economic analysis to quantify the near-term value of the Tillamook's natural systems and ecosystem services to people, including the downstream communities, the Portland recreationists, and all those who breathe the air in the region. Then, they can expand the analysis beyond the short term and the strictly utilitarian to encompass a longer time horizon and a more biocentric perspective.

Traditional neoclassical economics values resources based on their utility to human beings.[132] However, even the utilitarian economic equation needs considerable expansion to accommodate the value of nature's services in a way that people can relate to. For instance, economists need to join with the coast range scientists discussed earlier to place dollar values on the benefits of the Tillamook for flood control, water purification, soil creation, and fisheries. The benefits to area farmers of the pollination services of bees and butterflies can also be measured in dollars, as can the value of fertile soil. To some degree, all that's required is simply

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129. PRUGH, *supra* note 75, at 49-51.
130. *Id.* at 49.
131. *Id.* at 52.
132. Goulder & Kennedy, *supra* note 120, at 26.

opening our eyes to all that nature provides to us without any conscious realization on our part and without the need for any overt market transaction. Once we acknowledge those goods and services, we can "account" for them in dollars and cents.

Accounting for natural capital and assigning economic values to identified ecosystem services also involves doing a better job of measuring both positive and negative externalities.[133] The timber company who wants to harvest in the Tillamook puts on its balance sheet the cost of the timber price bid, labor, equipment, fuel, supplies, and transportation; the company tallies benefits based on the net profits from selling the raw logs. The company does not need to include in its calculations any negative externalities to downstream fisherman or the down-gradient communities such as erosion, increased runoff, or pollution.[134] Nor do the company employees need to think about the positive externality they themselves may have obtained from the forest's capture and filtration of the water they drink. Recognizing and valuing positive and negative externalities associated with our use of nature and assigning economic value to the services nature provides to us are relatively straightforward components of a new economics that broadly accounts for nature's value to humans. In this way, we simply expand utilitarian cost-benefit analyses to better calculate the full costs and benefits of human activities.[135]

But that's only scratching the surface of ecological economics. Besides properly valuing nature's provision of "production inputs," economic analysis must also acknowledge nonconsumptive use values and even "non-use values."[136] Why is it necessary for economic analysis to stretch this way? Because these values are real, even if they are less tangible than measurable production inputs. As just one example, the Tillamook State Forest and other similar natural areas provide wildlife habitat. Habitat supports birds and many people enjoy bird watching. Although birdwatchers do not have to pay directly for bird watching in the market, their enjoyment of the birds creates both tangible and intangible benefits. Birdwatchers buy gas, food, lodging, birdseed, binoculars, bird books, cameras, film, hats, and clothing in support of their hobby. They do not consume any birds or habitat, but they gain satisfaction from their non-consumptive use of the resource. Ecological

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133. *Id*. at 28-29.

134. *See* Michael Milstein, *Future Uses of State Forests Ride on Fate of Measure 34*, OREGONIAN, Oct. 16th, 2004, A1. (comparing economic values from logging and forest protection: "Wild salmon are grown on state forests, just like trees," said Bob Rees, a Tillamook fishing guide….. "My job depends on wild salmon. It sustains my income.")

135. Goulder & Kennedy, *supra* note 120, at 27-28 .

136. *Id*. at 29.

economists also recognize non-use values, including "existence value" and "option value."[137] A bird lover might never come to the Pacific Northwest to see spotted owls, eagles, falcons, and marbled murrelets, but could still place considerable value on knowing that they exist. Option values also recognize a somewhat abstract worth—the value someone says he or she is willing to pay to preserve some aspect of nature.[138] Existence and option values are difficult to measure, because they essentially reflect opinions without any corresponding expenditures, even indirect ones like the birdwatchers' purchases.[139] But that difficulty does not mean they can be ignored.

At a minimum, determining the greatest permanent value for a forested watershed requires doing the challenging work of broadening traditional economic analysis to include all of these values. Natural capital and ecosystem services need to be included in order to measure the full worth of these lands to the state, the northwest, and beyond. Indeed, at a time when global climate change is our most critical environmental problem, the value of such lands in carbon sequestration may be the greatest value of all.

3. A Sustainable View of the Tillamook State Forest

Assigning economic value to ecosystem goods and services, as described above, can recognize and capture immediate and relatively concrete benefits to humans that we otherwise take for granted and fail to include in economic equations. But these strictly utilitarian and short-term valuation methods will still undervalue natural capital unless they also adequately consider whether current human uses of natural resources and impacts on natural ecosystems can be sustained over time.[140]

The current level of depletion of natural capital and perturbation of ecosystems is not sustainable if projected forward; this is true generally as well as locally in places like the Tillamook State Forest.[141] Because the biosphere is our very life support system, to destroy its integrity, stability, and functionality will ultimately destroy the earth's capacity to support the lives of our grandchildren.[142] Some scholars believe that we may already be close to a

137. *Id.* at 34.
138. *Id*. at 34-35.
139. *Id.*
140. PRUGH, *supra* note 75, at 102. Even though the birdwatchers do not consume the birds, they do, of course, consume other resources in support of their hobby.
141. Id. at 52, 102.
142. Id. at 52.

"critical threshold . . . at which indispensable life-support functions might degrade or even collapse."[143] To avert collapse and pass on to our descendants a world where they can breathe the air, drink the water, and tolerate the sun's rays thus requires more than just broadening anthropocentric, utilitarian cost-benefit analysis to include more costs and more benefits. A much longer time horizon is critical: what level of use of natural capital can be sustained over generations to come?[144] A more biocentric perspective is also crucial: since humans are just part of—and completely dependent on—the biosphere, what level of biotic integrity is required to allow us to continue our existence?[145] These somewhat abstract questions need to be addressed in the specific context of the Tillamook State Forest, and in every other place around the world where resource management decisions are being made.

Answering these questions depends on understanding natural capital as consisting of both stocks and flows. Considering the Tillamook fisheries as an example, a "stock" of habitat creates a flow of fish. Indeed the fish population can also be viewed as a stock at any point in time. With sufficient habitat and a critical mass of minimum population size, a fishery can produce a steady stream of harvestable fish into the future. But if the habitat disappears, or the population drops below the minimum level needed for viable reproduction, the fishery will be depleted beyond repair, to the point of extinction.

The Tillamook as a watershed providing a freshwater drinking water supply to several downstream communities presents another example of natural capital stocks and flows. A healthy, functioning watershed consists of healthy vegetation, soil, and well-developed stream channels and processes. The vegetation and soil capture precipitation, keeping it from running off the surface too quickly, thus preventing flooding. Vegetation also protects the soil from erosion, thus limiting sedimentation and pollution. Adequate ground cover and rich, fertile soil horizons help water percolate slowly into the ground, providing perennial base flows for surface streams and recharging aquifers. Meanwhile, the percolation process also filters the water, helping to remove impurities. The surface water and groundwater can then be accessed for drinking water supplies, often with minimal treatment. In this way, the watershed itself serves a stock of natural capital, producing a flow (pun intended) of freshwater. But if the watershed's health and

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143. Id. at 52 (discussing critical threshold) and 102 (noting that "many observers" think that threshold is already upon us).

144. Id. at 102-105.

145. Id.

natural functions are impaired, thus depleting the stock of natural capital, the flow of valuable drinking water is reduced, and perhaps even eliminated. An overdrawn aquifer may subside and compact to the point that it can never be recharged. A polluted river may be reclaimable at significant cost and effort, but a contaminated aquifer may be a lost cause. A devegetated watershed may also be a lost cause, if it has degraded to the point where the stream channels can no longer carry runoff and the soil can no longer absorb water. Floods, pollution, and water shortages are the result.

Comprehensive analysis and appreciation of the relationship of existing natural capital stocks to future flows of critical ecosystem goods and services are required to insure sustainable flows that will support future generations. Failing to do this means we are "eating the seed corn," imperiling not only the flows but also the stocks of natural capital on which those flows depend for our descendants, indeed imperiling the species' future survival. Although the Tillamook State Forest is certainly not on the verge of collapse as an ecosystem, it is critical that all of the interest groups vying for control of and influence over the forest's outputs begin to appreciate that every single thing they want depends on the continued functioning of that ecosystem. Whether someone wants timber or salmon, water or mushrooms, the prerequisite is the same: a healthy forest, a healthy watershed, and a diverse ecosystem.

IV. CONCLUSION: THE TILLAMOOK STATE FOREST'S RE-REFORESTATION

"Thinking *inside* the box" goes against the grain of the current mantra for creative thinking. But in the case of an ecosystem, thinking inside the box can actually be a good thing. This case study of Oregon's Tillamook State Forest illustrates the value of thinking inside the box when it comes to ecosystem services. Looking at an ecosystem within a watershed boundary helps to focus attention on a system of interrelated parts and processes too often taken for granted. The Tillamook's experience can serve as a model for other land managers seeking a sustainable future for the resources they oversee.

What has your ecosystem done for you lately? Quite a lot, it turns out, but law and policy are only beginning to reflect this reality. The current natural resources management model treats natural resources as spoils for the victor in the political arena. An ecosystem services model would instead view natural resources as

critical goods and services produced by interconnected, working parts of a healthy, functioning ecosystem that needs to be managed like a precious endowment fund. Applying these concepts to the Tillamook State Forest reveals both the difficulty and the importance of shifting natural resource management from a multiple-use, public choice model to an ecosystem services model. Where there are victors, there are also the vanquished. All the interest groups currently vying to impose their vision of the Tillamook on the ground have to continually fight to maintain their position. All victories are temporary, and can be undone by the next legislature, a change in membership on the Board of Forestry, a lawsuit, or a shift in public opinion.

Even though the Tillamook State Forest occupies a relatively small area on the map of the United States, it is an area that produces benefits, such as wood, fish, and even climate modulation, out of proportion to its size and location. If ecosystem services can be incorporated into the management of this state forest, the impacts would be considerable, both as a practical matter and as a matter of showing how it could be done. If ecosystem services cannot be effectively incorporated into the management of the Tillamook, that would not bode well for the future of this field, because the Tillamook's governing law, territory, and resources seem ready made for this approach.

The contests among the interest groups vying for the resources of the Tillamook State Forest threaten to bring down the Tillamook's big tent. To the extent that the constituencies can turn away from the old and begin to embrace the newBnew understandings of the ecosystem, new economics, new time horizons and new duties, the focus may begin to change. Even siblings fighting over their inheritance sometimes can be convinced that it is in their long-term interest to work together to protect the assets of the estate. Perhaps the same could be true for the Tillamook State Forest. In the 1950s, a new vision for the Tillamook galvanized and unified thousands of people to participate in the reforestation effort. The Tillamook State Forest needs to be reforested again, and perhaps the citizens will once again answer the call.

ECOSYSTEM SERVICES IN THE KLAMATH BASIN: BATTLEFIELD CASUALTIES OR THE FUTURE?

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I. THE KLAMATH CONFLICT: FISH AND BIRDS BUT NOT ECOSYSTEM SERVICES

A. The Imposition of a Working Landscape on an Ecosystem

The Upper Klamath Basin in southern Oregon and northern California has long been characterized by its aridity, remoteness from population centers, and short growing season. Today, the entire Klamath Basin is known for the intensity and bitterness of the competing demands for its limited, dependable water supplies. The Upper Basin irrigation community's entrenched water entitlements, enjoyed undisturbed for a century,[1] are being challenged by Indian tribes, government and non-governmental entities acting to enforce the Endangered Species Act (ESA),[2] and Lower Basin fishing communities.[3]

Over a century of intensive upstream irrigation diversions and dams has produced a highly stressed ecosystem from headwaters to the Pacific Ocean. Before white settlement, the Upper Basin was one of the West's great functioning wetland ecosystems, a vast network of interconnected shallow lakes and marshes.[4] The Klamath ecosystem sustained both wildlife and Indians.[5] The marshlands of the Upper Basin supported large local and migratory bird populations as well as populations of two large (up to two feet long), long-lived (surviving up to thirty or forty years) fish called qapdo and c'wam.[6] These fish were venerated by the Klamath Indians, for whom they provided a major food source.[7] The ecosystem survived relatively intact until the end of the nineteenth century; however, as was the case in many of areas of the world, a productive ecosystem was shrunk in size and in function to permit irrigated agriculture.

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1. *See* RICHARD A. SLAUGHTER, JOINT INSTITUTE FOR THE STUDY OF THE ATMOSPHERE AND OCEAN, WATER ALLOCATION UNDER STRESS: INSTITUTIONAL COMPARISON OR SNAKE AND KLAMATH RIVER 19 (2004) (the Snake River basin has a long history of adaptation to change compared to Klamath, which had no history of adaptation prior to 2001).

2. Endangered Species Act of 1973, 16 U.S.C. §§ 1531-1543 (2006).

3. The Klamath is actually two basins, an upper and lower. The Upper Basin lies on the fringe of the Great Basin. The Lower Basin encompasses a large part of far northwestern California and runs to the Pacific through a rugged mountainous terrain. Indian tribes and commercial and recreational fishermen have long prized the river for its salmon runs. *See* Holly Doremus & A. Dan Tarlock, *Fish, Farms, and the Clash of Cultures in the Klamath Basin*, 30 ECOLOGY L.Q. 279, 289-92 (2003) [hereinafter *Fish, Farms, and the Clash*].

4. *See id*. at 291.

5. *See* TUPPER ANSEL BLAKE ET AL., BALANCING WATER: RESTORING THE KLAMATH BASIN 35-37 (Univ. Cal. Press 2000) (discussing the Klamath area before white settlement) [hereinafter BALANCING WATER].

6. *Id*. at 136.

7. Reed D. Benson, *Giving Suckers (And Salmon) An Even Break: Klamath Basin Water and the Endangered Species Act*, 15 TUL. ENVTL. L.J. 197, 202 (2002).

The Upper Basin was one of the last areas of the Pacific Northwest investigated by trappers[8] and opened to white settlement.[9] Its remote location initially allowed it to survive the first waves of western settlement and "progress." The rugged mountains of the Lower Basin ensured that downstream settlement would be very modest, except at the mouth of the Klamath on the Pacific Ocean. In Oregon, small-scale irrigation began in the late nineteenth century and accelerated after the passage of the Reclamation Act of 1902.[10] The Klamath was chosen as one the first federal irrigation projects.[11] President Theodore Roosevelt overruled the engineers in the newly created Reclamation Service who argued that federal funds should be targeted to the areas with the best potential for irrigation and instead opted for a policy of the geographical distribution of projects.[12] President Roosevelt opted for distribution of reclamation throughout the West to help his chances for reelection in 1904.[13] Hardy pioneers, including many Czech immigrants fleeing the decaying Austro-Hungarian Empire, eventually put some 400,000 acres under irrigation, about half supplied by the federal Klamath Project.[14] The Upper Basin's geographic history lives in place names like Tule Lake, although the vast majority of the region's wetlands were long ago drained and converted to agriculture.[15]

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8. Peter Skene Odgen led the first trapper party into the area between 1826-1827. *See* JEFF LALANDE, FIRST OVER THE SISKYOUS: PETER SKENE OGDEN'S 1826-1827 JOURNEY THROUGH THE OREGON-CALIFORNIA BORDER (1987).

9. *Fish, Farms, and the Clash*, *supra* note 3, at 288.

10. Reclamation Act of 1902, 43 U.S.C. § 372 (1902). For a detailed description and history of the Klamath Project, see ERIC E. STENE, BUREAU OF RECLAMATION HISTORY PROGRAM, THE KLAMATH PROJECT (1994), *available at* http://www.usbr.gov/dataweb/html/klamathh.html.

11. U.S. FISH AND WILDLIFE SERVICE, BIOLOGICAL/CONFERENCE OPINION REGARDING THE EFFECTS OF OPERATION OF THE U.S. BUREAU OF RECLAMATION'S PROPOSED 10-YEAR OPERATION PLAN FOR THE KLAMATH PROJECT AND ITS EFFECT ON THE ENDANGERED LOST RIVER SUCKER (*DELISTES LUXATUS*), ENDANGERED SHORTNOSE SUCKER (*CHAMISTES BREVIROSTRIS*), THREATENED BALD EAGLE (*HALIAEETUS LEUCOCEPHALUS*) AND PROPOSED CRITICAL HABITAT FOR THE LOST RIVER AND SHORTNOSE SUCKERS 3 (2002) [hereinafter FWS 2002 BIOP], *available at* http://www.usbr.gov/mp/kbao/docs/Final_Biological_Assessment_02-25-02.pdf.

12. DONALD J. PISANI, TO RECLAIM A DIVIDED WEST: WATER, LAW, AND PUBLIC POLICY 1848-1902 312 (1992).

13. *Id.* The Clean Water Act similarly distributed sewage treatment grants, distributing the grants among the states regardless of the severity of pollution. 33 U.S.C. §§ 1251-1387 (2006). Likewise, the Department of Homeland Security now showers high tech security around the country in areas of both high and low risk.

14. STENE, *supra* note 10.

15. Before white settlement, there were about 185,000 acres of wetlands in the basin; today only 36,000 remain. ERNIE NIEMI, ET AL., ECONORTHWEST, COPING WITH COMPETITION FOR WATER: IRRIGATION, ECONOMIC GROWTH, AND THE ECOSYSTEM IN THE UPPER KLAMATH BASIN, 19 (2001) [hereinafter COPING WITH COMPETITION], *available at* http://www.salmonandeconomy.org/pdf/KlamathWater.pdf.

B. Ecosystem Restoration Proxies Emerge

As the Upper Basin was being drained, there were no strong competing uses or opposing interests to "speak" for the ecosystem. Nonetheless, for most of the past century, irrigation and the ecosystem were still able to coexist. For example, the Lost River and shortnose suckers, as they are now known, once inhabited all the major lakes of the Upper Basin and their tributaries,[16] supporting multiple canneries.[17] These fish remained the target of a recreational as well as a tribal fishery until catches sharply declined in the 1980s.[18] The decline continued even as the modern environmental movement laid the foundation for the appreciation of the importance of maintaining ecosystem functions including endangered species conservation. More recently, we have come to recognize that ecosystems provide many valuable human services.[19]

It has proved very difficult to translate this appreciation into effective ecosystem conservation. In contrast to pollution and toxic substances control, it has been much harder to conserve ecosystems and to maintain the services that they provide. Ecology's insights came long after strong land and water legal entitlements or political expectations evolved to support the maintenance of the status quo, regardless of the environmental damage that it causes. Thus, ecosystem services, as we now define them, are either provided by proxies or by new institutions, which are generally costly because their provision must be overlaid by over-established exploitation regimes. In the West, the two existing proxies for ecosystem conservation and service provision to challenge the status are wildlife refuges and Indian tribes who seek to maintain historic fisheries. Both were in place during the heyday of the Reclamation Era, but neither was powerful enough to resist the rise of irrigation.

Before World War I, wildlife refuges were established in the Upper Basin, but wildlife conservation was consistently subordinated to irrigation.[20] A proud local Indian tribe had inhabited the area for over 14,000 years, but just as the Italians rejected the cold northern Reformation devoid of pageantry and artistic splendor, the Klamaths had no interest in the alien, white idea of irriga-

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16. FWS 2002 BIOP, *supra* note 11, at 21.

17. *See id.* at 35.

18. Endangered and Threatened Wildlife and Plants, 53 Fed. Reg. 27130, 27131 (July 18, 1998).

19. See *infra* Part II.A. for a discussion of the conceptual foundations of ecosystem service provision and the difference between conservation of ecosystem function and service provision.

20. *See* Benson, *supra* note 7, at 205-06.

tion.[21] The Klamath Indians were first put on a reservation and then driven to the brink of extinction. During the tragedy of the Eisenhower administration's embrace of the idea of ultimate Indian assimilation into "white society" through reservation termination, the Klamath reservation was wiped off the map.[22] For most of the twentieth century, the white irrigators were able to assume that the basin's limited supplies of water would be almost exclusively dedicated to irrigation in perpetuity regardless of the environmental and social costs. However, the changes in resource use triggered by the environmental and Indian rights finally reached the Basin by the 1980s, long after other areas of the west had begun to adjust to this paradigm shift.

C. Environmental Change Comes to the Klamath

The vehicles that brought environmentalism to the Basin and continue to sustain it are the ESA and the Indian sovereignty movement.[23] The Klamaths were eventually restored to tribal status,[24] and the remnant Tribe supported the listing of the two stressed suckers under the ESA.[25] During the 1990s, the United States Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) began to issue Biological Opinions suggesting that the basin's main storage space, Klamath Lake, should be maintained at high summer levels to support the two federally listed fish.[26] Small percentage cutbacks and wet years avoided an outright conflict between the ESA and irrigation until the drought summer of 2001.[27] To comply with the ESA, the United States Bureau of Reclamation, which administers the Reclamation Act of 1902,[28] ordered the cutoff of ninety percent of normal deliveries to the Klamath Project.[29] The Bureau took this drastic unprece-

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21. *Fish, Farms, and the Clash*, *supra* note 3, at 296.

22. The story is briefly told in CHARLES WILKINSON, BLOOD STRUGGLE: THE RISE OF MODERN INDIAN NATIONS 120-121 (2005). *See also* THEODORE STERN, THE KLAMATH TRIBE: A PEOPLE AND THEIR RESERVATION (Monograph 41 of the American Ethnological Society 1965)

23. *Id*. at 324-27.

24. Benson, *supra* note 7, at 203.

25. Endangered and Threatened Wildlife and Plants: Determination of Endangered Status for the Shortnose Sucker and Lost River Sucker, 53 Fed. Reg. 27130, 27131 (July 18, 1988).

26. Benson, *supra* note 7, at 218.

27. Between October 2000 and August 2001, the Basin received fifty-four percent of its normal rainfall—6.93 compared to 13.05 inches. Michael Milstein, *Clearing Up Water Issues in the Klamath Basin*, THE PORTLAND OREGONIAN, Aug. 29, 2001.

28. 32 STAT. 388 (1902) (presently codified in scattered sections of 43 U.S.C.).

29. U.S. BUREAU OF RECLAMATION, KLAMATH PROJECT 2001 OPERATIONS PLAN (Apr. 6, 2001).

dented action in response to biological opinions issued by FWS and NMFS which concluded that normal summer irrigation releases would threaten the survival of the Lost River shortnose suckers, bald eagles in Upper Klamath Lake, the project's principal reservoir, and downstream Coho Salmon.[30] The potential of the ESA to limit state water rights and federal contract entitlements in the Upper Basin had long been anticipated,[31] especially in the Klamath basin, but the 2001 summer irrigation season cutoff was the first time that the Bureau had actually closed the headgates to protect a listed species. [32] Things got worse. The summer of 2002 produced a large downstream salmon kill, and downstream, commercial, and recreational fishermen as well as several Tribes have brought additional political and legal pressure to the Upper Basin.[33]

Fallout was immediate and dramatic. In 2001, protests and a brief outbreak of violence followed.[34] The Klamath became a Westwide—and even national—symbol of the clash between the virtuous, commodity-producing rural West and the economically irrational, illegitimate ESA supported only by "eco-radicals."[35] In the end, neither a new Sagebrush rebellion was triggered nor has the ecosystem been stabilized.[36] Since the summer of 2001, cutoffs have been avoided due to a combination of factors, including having wet years, a National Academy of Sciences study asserting there was insufficient evidence to conclude the chosen lake levels were necessary to protect the species in the stressed ecosystem,[37] and a revised Biological Opinion by the farmer friendly, environmentally hostile Bush II administration which spread ESA com-

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30. The literature on the Klamath crisis in 2001is already substantial. See Benson, *supra* note 7, for a history of the legal events that led to the 2001 shut down. Post 2001 events are analyzed in *Fish, Farms, and the Clash*, *supra* note 3; Marcilynn Burke, *Klamath Farmers and Cappuccino Cowboys: The Rhetoric of the Endangered Species Act and Why it (Still) Matters*, 14 DUKE ENVTL. LAW & POL'Y F. 441 (2004); Holly Doremus & A. Dan Tarlock, *Science, Judgment, and Controversy in Natural Resources Regulation*, 26 PUB. LAND & RESOURCES L. REV. 1 (2005) [hereinafter *Science, Judgment, and Controversy*].

31. *See* OREGON WATER RESOURCES DEPARTMENT, RESOLVING THE KLAMATH (1999), *available at* http://www1.wrd.state.or.us/pdfs/klamath_summary99.pdf.

32. The Bureau cut water deliveries in 1992 and 1994, but did not cut off all water deliveries. *Id.* at 28.

33. *See infra* notes 34-40 and accompanying text.

34. *Fish, Farms, and the Clash*, *supra* note 3, at 321-23.

35. *See id.*

36. *See id.*

37. NATIONAL RESEARCH COUNCIL, ENDANGERED AND THREATENED FISHES IN THE KLAMATH RIVER BASIN: CAUSES OF DECLINE AND STRATEGIES FOR RECOVERY (2003) [hereinafter ENDANGERED AND THREATENED FISHES]. In June 2007, the Washington Post reported that Vice President Richard Cheney initiated the NRC request, overruling the objections of the former's lobbyist that independent NRC panels were "a roll of the dice." Jo Becker & Barton Gellman, *Leaving No Tracks*, THE WASHINGTON POST, Wednesday, June 27, 2007, at A01.

pliance duties over ten years.[38] A wide range of public and private stakeholders have unsuccessfully tried to find a more permanent solution to balance irrigation and ecosystem conservation, but the underlying degradation is continuing and the "problem-shed" continues to expand.[39] Lower salmon fisheries have been severely stressed by upstream water use and fishing communities have been put at risk.[40]

D. A Possible Role for Ecosystem Services

Since 2001, two resource use paradigms and the landscape visions that they support have competed for dominance in the Klamath. The first is the continuation of the West as a commodity production region. The second is a new West of urban archipelagoes, large biodiversity reserves, eco-tourism and "rationalized," sustainable agriculture. The first vision views the Klamath as an irrigation district that must, at best, accommodate the "accident" that it is also the habitat of several endangered species and the spawning grounds for Coho Salmon, with the minimum disruption of the status quo. The alternative vision is less clear because it could range from an unrealistic pre-white settlement baseline to a more realistic managed landscape that supports a wide range of ecosystem services and limited agriculture focused on high-value specialty crops.

These visions lie behind the strategies that all sides follow to advance their interests. For environmentalists and salmon fisherman, the rigid enforcement of the ESA is the best way to force the necessary changes in the basin. To irrigators, resistance to the ESA and takings suits are the way to maintain the status quo. Neither have moved the basin to a more sustainable landscape. Therefore, the Klamath Basin would seem to be a good place to experiment with ecosystem services provisions, including provider payments, as a way to reduce resource conflicts and reshape the landscape.

This has not happened to date, although it could happen because ecosystems are hard to kill physically[41] and economic

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38. U.S. DEPT. OF INTERIOR, BUREAU OF RECLAMATION, FINAL BIOLOGICAL ASSESSMENT: THE EFFECTS OF PROPOSED ACTIONS RELATED TO KLAMATH PROJECT OPERATION (APRIL 1, 2002 - MARCH 31, 2012) ON FEDERALLY-LISTED THREATENED AND ENDANGERED SPECIES 1 (Feb. 25, 2002) [hereinafter BR FINAL 2002 BIOLOGICAL ASSESSMENT].

39. *See Fish, Farms, and the Clash*, *supra* note 3, at 324-35.

40. *Id.* at 326.

41. The best example of a revived ecosystem is Mono Lake in California. The ecosystem was in danger of collapse from transbasin water diversions. Good scientific research, litigation, and public monies have led to the increased tributary inflows which appear to have stabilized the ecosystem. Jane Kay, *Mono Lake Restoration: Water's Arising,* S.F.

stresses are a force for change in the Basin. The Klamath is not yet the United States' Aral Sea. Upper Klamath Lake remains the largest section of the wetlands in that region.[42] The lake is very shallow, much like a marsh, averaging only between eight feet deep when full and three feet deep during dry years.[43] In surface area, it is the largest lake in Oregon[44] and is reportedly the largest freshwater lake in the West.[45] Other large lakes and marshes remaining in the Upper Basin include Lower Klamath, Tule, and Clear Lakes.[46] It is the law that makes ecosystems hard to restore. Upper Basin irrigators have been able to capture the right to use most of the flow of the Klamath, and they are naturally reluctant to surrender these water rights or consider alternative landscape visions regardless of the environmental and social costs imposed on discrete downstream residents and society generally.[47]

The case for a service provision experiment is strengthened by the growing realization by all parties that it is unlikely that the status quo can be maintained in the long run. Neither the status quo nor a return to pre-white settlement conditions are ecologically, economically, and socially realistic. The Upper and Lower Basins are dynamic eco- and social systems under stress from the effects of Project and off-Project irrigation and market forces.[48] The ecosystem stresses include high background concentrations of phosphorus and farming practices that use fertilizers, pesticides, and manure from livestock operations that washes into the rivers and lakes and causes eutrophication.[49] Upper Klamath Lake is nutrient-rich, and its impaired water quality puts the endangered fish at increased risk.[50] The operation of Link River Dam for hydropower generation also contributes to the stresses.[51] Ecological

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CHRON., July 29, 2006 at A1. *See generally* Craig A. Arnold, *Working Out an Environmental Ethics: Anniversary Lessons from Mono Lake*, 2004 WYO. L. REV. 1 (2004).

42. *Fish, Farms, and the Clash*, *supra* note 3, at 291.

43. *Id*.

44. Harry Carlson et al., *Upper Klamath Basin Soil Resources*, in WATER ALLOCATION IN THE KLAMATH BASIN RECLAMATION PROJECT, 2001: AN ASSESSMENT OF NATURAL RESOURCE, ECONOMIC, SOCIAL, AND INSTITUTIONAL ISSUES 153 (Ore. St. Univ. 2001), *available at* http://extension.oregonstate.edu/catalog/html/sr/sr1037/soil.pdf.

45. BALANCING WATER, *supra* note 5 at 26.

46. *Fish, Farms, and the Clash*, *supra* note 3, at 291.

47. *Fish, Farms, and the Clash*, *supra* note 3, at 340.

48. The Bureau takes the position that "the Project should not be responsible for effects of all of the water development and land management activities throughout the Basin" on endangered species. BR FINAL 2002 BIOLOGICAL ASSESSMENT, *supra* note 38, at 2.

49. ENDANGERED AND THREATENED FISHES, *supra* note 37, at 102-22 (tracing out the anthropocentric and non-anthropocentric causes of lake pollution).

50. *Id*. at 122.

51. Despite its ownership of Link River Dam, the Bureau contends that it lacks the authority to require PacifiCorp to install fish screens or take other measures to limit entrainment at the Dam. FWS 2002 BIOP, *supra* note 11 at 11.

stresses are compounded by economic ones. For example, the present owner of the utility that serves the project, PacifiCorp, has announced it will not renew an earlier sweetheart deal between its predecessor and the irrigators which provided cheap power rates.[52] Farmers, especially potato growers, find it hard to compete with other states and global markets.[53] Finally, the specter of decreased winter snowpacks and decreased summer flows caused by global climate change hangs over the entire region.[54]

The Klamath is an ongoing story, and any analysis and conclusions must be discounted because the appropriate time horizon to pass judgment is long. A Yurok fisherman summed it up when he said of the possibility of a healthier river, "I may not see it, my dad may not see it, . . . Hopefully it will help out my son further down the road."[55] This Article examines the case for ecosystem service provision as a way to address the basin's environmental problems and explains why most of the incentives that exist in the Basin favor winner-take-all litigation and regulation as opposed to alternative strategies built around ecosystem service provision. The Article focuses on three service provision problems: (1) the geographic scale of the ecosystem, (2) the pros and cons of using ESA litigation as a catalyst to force change, and (3) the problems posed by the existence of entrenched entitlements. It concludes that the Klamath requires both voluntary and mandatory land and water use practices which restore and conserve some measure of the traditional ecosystem services[56] that watersheds long provided before they were degraded through intensive development and commodity production. However, to date, the Klamath story only explains why ecosystem service provision institutions do not emerge while partial, patchy regulatory ecosystem conservation experiments do.

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52. PACIFIC POWER, KEEPING YOU INFORMED: UPDATE ON PACIFIC POWER RATE INCREASE REQUEST (May 9, 2006), *available at* http://www.pacificpower.net/File/File65387.pdf. The decisions were upheld by the California and Oregon public utilities commissions. Proposed Decision, California PUC Docket No. 105-11-022, November 13, 2006, and Oregon Public Utility Commission Docket No. UE-170, Order No. 06-172, April 12, 2006.

53. In 2000, potato farmers elected not to plant because they could not compete with Idaho growers and world markets. Wendell Wood, *We Should Stop Blaming Species for Problems and Seek Real Solutions*, KLAMATH FALLS HERALD AND NEWS, Apr. 23, 2001. The Director of the Oregon Department of Agriculture expressed similar fears about the state's agricultural sectors that refuse to adapt to increased national and international competition. Kathy Coba, *The First Year in Review, Address at the Eastern Oregon Forum* (Feb. 11, 2004), *available at* http://egov.oregon.gov/ODA/do_speech_040211.shtml.

54. John M. Melack et al., *Effects of Climate Change on Inland Waters of the Pacific Coastal Mountains and Western Great Basin of North America*, 11 HYDROLOGICAL PROCESSES 971, 973 (1997).

55. John Driscoll, *Klamath Confluence*, EUREKA TIMES-STANDARD, May 22, 2006, *available at* http://www.klamathforestalliance.org/Newsarticles/newsarticle20060522.html.

56. *See* James Salzman, *Creating Markets for Ecosystem Services*, 80 N.Y.U. L. REV. 870 (2005).

Those trying to design more successful service provision experiments will have to work harder at overcoming the barriers found in the Klamath and many other basins.

II. ECOSYSTEM SERVICE PROVISION: THE WAY OF THE FUTURE?

A. The Ecosystem Service Idea

The scientific construct of the ecosystem is ecology's most important contribution to environmental protection, but it has proved difficult to implement the teachings of ecology in part because ecology continually evolves. The original idea that natural systems should be walled off to the maximum extent possible from human intrusion to conserve their inherent stability has given way to a more complicated understanding of ecosystems as dynamic systems responding to stresses and changing over time. Modern ecology now views ecosystems as dynamic, complex systems continually adapting to change and stress.[57] Ecosystems are neither stable nor chaotic, but continue to evolve at different rates over different spacial scales. The rate of change is not continuous, and systems can display equilibria states for long periods of time but then collapse, and cascading change can occur.[58]

This vision has sparked a debate about whether society should actively and adaptively manage ecosystems for their functions or services or some combination of both. Ecosystem function and services are related but are analytically different. Ecosystem function refers to the various physical processes that ecosystems perform. Ecosystem services refers to those functions that provide concrete, monitizeable benefits to human welfare.[59] However, in practice, the line between function and service is hazy, especially since we tend to address the issue of ecosystem conservation through imperfect proxies that do not make a clear function-service distinction.

The focus on the role that ecosystems play in providing useful

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57. *See* C.F. Hollings & Lance H. Gunderson, *In Quest of a Theory of Adaptive Change, in* PANARCHY: UNDERSTANDING TRANSFORMATIONS IN HUMAN AND NATURAL SYSTEMS 1-23 (Lance H. Gunderson & C.S. Holling eds., 2002) (discussing a series of ecosystem changes).

58. C.F. Hollings et el., *Sustainability and Panarachies*, *in* PANARCHY: UNDERSTANDING TRANSFORMATIONS IN HUMAN AND NATURAL SYSTEMS 72-77 (2002).

59. The Millennium Ecosystem Assessment, for example, posits four categories of services: (1) the provision of food and water, (2) the regulation or prevention of adverse impacts such as disease, (3) support for other production activities, and (4) cultural services such as recreation. MILLENNIUM ECOSYSTEM ASSESSMENT, LIVING BEYOND OUR MEANS: NATURAL ASSETS AND HUMAN WELL-BEING 7 (2005) [hereinafter LIVING BEYOND OUR MEANS], *available at* http://www.millenniumassessment.org/documents/document.429.aspx.pdf.

services to humans reflects two powerful recent trends. First, the emphasis on lost ecosystem services reflects the rise of biodiversity as an organizing concept for a variety of uncoordinated resource management objectives.[60] Biodiversity conservation requires that ecosystems be viewed as a functioning unit rather than a discrete collection of species. Put differently, all species and the natural processes that support them are potentially equally important.[61] Second, the ultra-utilitarian rationale for ecosystem and biodiversity protection reflects the capture of much of the environmental policy discourse by science and welfare economics.[62]

This said, the question becomes: Does ecosystem service provision offer positive advantages in areas such as the Klamath compared to the current litigation-regulation strategies that are being followed?[63] Much energy has been devoted to the development of environmental ethics, but the strongest case for environmental protection remains the ability to show that protection can be justified by hard numbers.[64] Science-based, utilitarian solutions have the potential to appeal to a wide variety of interests. They are less polarizing than appeals to higher spiritual and aesthetic values. Despite heroic efforts to create a workable system of environmental ethics that encompasses non-humans, environmental protection remains relentlessly anthropocentric. It is also harder to argue against a policy with dollar values attached. Finally, because ecosystem service provision is either tied to a market or to government subsidies, it can be a fair and equitable way of reallocating resources. The problem has been to apply these diverse rationales from concept to the working landscape.

The ultimate issue in the Klamath is whether it is possible to move to an alternative, sustainable landscape with a mix of agriculture and the enhanced maintenance and restoration[65] of impor-

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60. *See* DAVID TAKACS, THE IDEA OF BIODIVERSITY: PHILOSOPHIES OF PARADISE (Johns Hopkins Univ. Press 1996), for an informative history of the construction of the term. A recent United Nations report links biodiversity conservation and ecosystem services. LIVING BEYOND OUR MEANS, *supra* note 59, at 12.

61. For a masterful analysis of the unanswered scientific questions that the construct raises, see Fred Bosselman, *A Dozen Biodiversity Puzzles*, 12 N.Y.U. ENVTL. L. J. 364 (2004)

62. For the best example of this capture, *see* LIVING BEYOND OUR MEANS, *supra* note 59.

63. There are, of course, risks to this approach. *See* Dale Goble, *What* are *Slugs Good for? Ecosystem Services and the Conservation of Biodiversity*, 22 J. LAND USE & ENVTL. L. 415 (2007), (cautioning against shifting the focus from the scientific, non-utilitarian ethical concern with ecosystem function to the relentlessly utilitarian focus on ecosystem service provision).

64. *See Science, Judgment, and Controversy, supra* note 30. The counter position is well-articulated by Professor Mark Sagoff, *Price, Principle, and the Environment* 135-144 (2004)

65. The need to focus on restoration strategies is forcefully argued in Debra Donahue *Federal Rangeland Policy: Perverting Law and Jeopardizing Ecosystem Services*, 22 J. LAND

tant ecosystem functions and services. One solution is a mix of induced and mandated conservation practices combined with the "post-modern" concept of ecosystem service markets. Federal and state requirements dealing with pollution control and resource conservation could work together toward that goal supplemented by NGO participation. However, there has been little consideration of the quantification and commodification of ecosystem services as a long term solution in the Klamath. There are many sincere and hopeful peacemakers at work, but the focus remains on maintaining the traditional white irrigation culture to the maximum extent possible.

B. From Theory to Action: Some Hard Questions

The Klamath illustrates three of the central meta problems with efforts to shift traditional resource exploitation-environmental protection debates to ecosystem services conservation options. First, the resource exploitation legacy of the nineteenth and twentieth centuries stack the deck in favor of the preservation of the status quo.[66] Second, the use of a single powerful law such as the ESA to change the status quo can, perversely, shift the focus from ecosystem function and service conservation to adoption of only minimal mitigation measures to save a species from extinction or to push the problem forward a few years. Third, the Klamath is, in effect, a heritage area. The benefits of ecosystem service generation are national, if not global. However, the public and private service providers are disconnected from the beneficiaries.

To overcome these barriers, three hard problems which often arise when one tries to develop a landscape strategy for an area that restores a level of lost ecosystem services must be addressed.[67]

USE & ENVTL. L. 301 (2007).

66. The reasons include the existence of entrenched property rights and cultural attitudes that discourage interest in new, cooperative management schemes, especially where endangered species are present. *See* Christopher S. Elmendorf, *Ideas, Incentives, Gifts, and Governance: Toward Conservation Stewardship of Private Land, in Cultural and Psychological Perspective*, 2003 U. ILL. L. REV. 423 (2003).

67. This Article does not address the question of the optimal institutional mix to provide ecosystem services. Since Secretary Bruce Babbitt's tenure as Secretary of the Interior, there has been a movement to solve ecosystem problems by ad hoc public-private stakeholder processes. Professors Jody Freeman and Daniel A. Farber call this development modular regulation. Jody Freeman & Daniel A. Farber, *Modular Environmental Regulation*, 54 DUKE L.J. 795 (2005). For a more skeptical but ultimately hopeful view see Peter M. Lavigne, *The Movement for American Ecosystem Restoration and Interactive Environmental Decisionmaking: Quagmire, Diversion, or Our Last, Best Hope?*, 17 TUL. ENVTL. L.J. 1 (2003).

(1) What is the geographic extent of the ecosystem and how does its scope and scale impact the incentives and disincentives to provide ecosystem services? The Klamath's two basins create a great disparity between those who enjoy ecosystem benefits and those with the power to degrade them.

(2) Do environmental and resource management laws help or hinder efforts to make ecosystem provision an integral part of a landscape conservation plan? For example, the ESA has been hailed as having the power to induce long term changes in public and private behavior. The Klamath experience, however, suggests that the focus on listed species widens the disconnect between the ESA and existing state water law entitlements. Because the reallocation of water is vital to ecosystem service provision, the limited ability of the Act to change long-established water allocation patterns is troubling.

(3) Is a "Coasian" solution always possible or must there be a reassignment of property rights? The widespread assumption in the ecosystem service literature is that equity and efficiency counsel "bribing" existing entitlement holders to provide the necessary services.[68] In the Klamath Basin, the law of prior appropriation and federal reclamation stack the deck in favor of irrigators and against either existing ecosystem service providers or the emergence of new ones,[69] thus effectively shifting the cost of water conservation to federal tax payers. Put differently, there is a potential moral hazard problem. The law rewards, rather than penalizes, resource use patterns with high social costs.

III. GEOGRAPHICAL SCALE MATTERS

A. The Physical Features of the Klamath Basin

Before the service provision issues can be addressed, the "prob-

68. *See infra* note 110 and accompanying text for a discussion of this issue.
69. *Fish, Farms, and the Clash, supra* note 3, at 339-40.

lemshed" must be delineated. The geographic scale of the ecosystem influences the barriers and incentives to service provision. For aquatic ecosystem problems, the river basin is the presumptive geographic area. However, the practice of good geography may only exacerbate the problem. The presumption holds in the Klamath, although the Basin is actually two equally sized subbasins each with a different geography, culture, and economy. Nature flipped the usual pattern; the Upper Basin is relatively flat and dry and the Lower steep and wet. The Klamath watershed covers a vast, sparsely populated, remote region in south central Oregon and extreme northern California.[70] This area is much poorer than the urban and exurban areas of these two prime examples of successful post-industrial states.[71] The river originates in Upper Klamath Lake, a broad, shallow lake fed by snow melt from the Cascade Mountains of Oregon, and flows through the Trinity Alps of California, where the Scott, Trinity, and Salmon Rivers join it, before it reaches the Pacific Ocean at the Redwood National Park.[72]

The Upper Basin, often referred to simply as the Klamath Basin, is the site of the conflicts of 2001.[73] It spans across the California-Oregon border[74] and has long been dedicated to irrigated agriculture—primarily potatoes, specialty crops and hay.[75] It includes high peaks in the Cascade Mountains that receive more than forty inches of precipitation annually.[76] But, "its dominant feature is a flat, agricultural valley lying just west of the ridge that marks the beginning of the forbiddingly arid Great Basin."[77] Only about eleven inches of rain fall in the valley each year, making it nearly a desert, and water demand exceeds supply about seven out of every ten years.[78] Agriculture is made even more challenging by the area's high elevation and short growing season. Because of the severe climatic conditions, none of the lands in the region fall in the U.S. Department of Agriculture's highest productivity class (Class I).[79]

The Lower Klamath Basin, lying entirely in California, is

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70. *Id.* at 289.
71. *Fish, Farms, and the Clash*, *supra* note 3, at 295.
72. *Id.* at 289.
73. *Id.*at 291.
74. *Id.*
75. *Id.* at 299.
76. *Id.* at 291.
77. *Fish, Farms, and the Clash*, *supra* note 3, at 291.
78. Agriculture is the only important consumptive use of water in the Basin, accounting for more than 95 percent of the consumptive use. *See* BR FINAL 2002 BIOLOGICAL ASSESSMENT, *supra* note 38, at 25.
79. Carlson, *supra* note 44, at 156.

dominated by timber-covered slopes and mountainous wilderness areas.[80] The Lower Klamath River and its tributaries were once teeming with Coho and Chinook Salmon,[81] allowing the Indians along the river to harvest a million pounds annually.[82] Wild Chinook are considered superior to farm-raised salmon because of its taste and heart-healthy oils. Like many headwaters areas, the Upper Basin was able to put the waters to beneficial use before other claims emerged, thereby exporting some of the external costs of this allocation downstream. Salmon runs are threatened by the lack of water and other non-anthropocentric factors.[83]

Commercial harvest began in the early 1800s and continued until the mid-1990s, when the severely declining Coho fisheries were essentially closed.[84] Coho populations fell from a range of 50,000 to 125,000 in the 1940s to 6,000 fish in 1996.[85] Recreational harvest of Coho Salmon in the Klamath River and its tributaries continued until the Coho were listed under the federal ESA in 1997. A small tribal Coho harvest, affecting about seventy naturally spawning fish per year, remains.[86] Salmon conditions have deteriorated since 2001. There was a major die off in 2002,[87] and in 2006 the anticipation of low Klamath fall Chinook runs resulted in sharp reduction in the allowable catch of the Pacific Coast salmon fishery in Oregon and California.[88]

B. The Geography of Interests

The ability of upstream irrigators to shift costs downstream

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80. *Fish, Farms, and the Clash, supra* note 3, at 289.

81. *Id.* The Klamath Basin was "the third most important salmon producing river system in the nation, producing an estimated 660,000 to 1,100,000 million [sic] adult fish annually." *Water Management and Endangered Species Issues in the Klamath Basin: Oversight Field Hearing Before the H. Comm. On Resources*, 107th Cong. 123 (2001) (statement of William F. "Zeke" Grader, Jr., Executive Director, Pacific Coast Federation of Fishermen's Associations).

82. BALANCING WATER, *supra* note 5, at 35.

83. ENDANGERED AND THREATENED FISHES, *supra* note 37, at 102-22.

84. Threatened Status for Southern Oregon / Northern California Coast Evolutionarily Significant Unit (ESU) of Coho Salmon, 62 Fed. Reg. 24588, 24593-94 (May 6, 1997). NMFS regulations allow incidental take of Coho in Chinook-directed fisheries off California consistent with Pacific Fishery Management Council regulations. *See* 50 C.F.R. § 223.204. Coho are not to be retained, but are impacted by "hook and release." NAT'L MARINE FISHERIES SVC., BIOLOGICAL OPINION: KLAMATH PROJECT OPERATIONS 29 (May 31, 2002) [hereinafter NMFS 2002 BIOP] *available at* http://swr.nmfs.noaa.gov/psd/Klamath/KpopBO2002finalMay31.pdf.

85. Mary Christina Wood, *Restoring the Abundant Trust: Tribal Litigation in Pacific Northwest Salmon Recovery*, 36 ELR NEWS & ANALYSIS 10163, 10164 (2006).

86. NMFS 2002 BIOP, *supra* note 84, at 29.

87. *Fish, Farms, and the Clash*, *supra* note 3, at 335.

88. Fisheries Off West Coast States; West Coast Salmon Fisheries; 2006 Management Measure and a Temporary Rule, 71 Fed. Reg. 26254-66 (May 4, 2006).

illustrates the problem with moving toward an ecosystem services provision remedy when the most immediate beneficiaries of ecosystem services are located far from the origin of the service. Upper Basin irrigators have no incentive to provide the services unless compelled by the ESA, and downstream fishing communities have no incentive to share the cost of service provision. Shallow upper Klamath Lake is the irrigator carry-over storage reservoir, but there is little reserve water to release in a drought. Therefore, at least in the eyes of the lower basin, the geography of the Klamath creates two classes of parties: "tort feasors" and "victims."[89] The "tort feasors" are the Klamath irrigators, who have shifted the external costs of irrigation downstream, and the "victims" are downstream tribes as well as commercial and recreational salmon fisherman, since lowered flows impair salmon runs. This perception creates an incentive for "victims" to rely on litigation-regulatory solutions: full enforcement of the ESA, which in effect shifts the provision burdens back to the upstream irrigators who try to shift it to the federal tax payers.[90] Either irrigation deliveries must be cut or a federally financed water bank must provide the necessary water.[91] The next section addresses the potential of the ESA to overcome these barriers.

IV. THE PROS AND CONS OF UNLEASHING THE ESA PIT BULL

A. The Catalyst Theory of the ESA

Three decades ago, Professor George Coggins described the

89. I am not asserting that upper stream irrigators are necessarily liable under common law tort doctrines such as nuisance. These issues are fully addressed in J.B. Ruhl, *The "Background Principles" of Natural Capital and Ecosystem Services — Did* Lucas *Open Pandora's Box?*, 22 J. LAND USE & EVNTL. L. 527 (2007). I am borrowing the analysis developed by Judge Guido Calabresi, illustrating that the fault system makes liability decisions on an "all-or-nothing basis" and makes it difficult to allocate costs efficiency. GUIDO CALABRESI, THE COSTS OF ACCIDENTS: A LEGAL AND ECONOMIC ANALYSIS 239-43 (Yale Univ. Press 1970).

90. Both irrigators and fisherman have received emergency relief. The Oregon Natural Resources Council put the 2001 disaster relief for the irrigators at $48,625,000.00. JAMES MCCARTHY, OREGON NATURAL RESOURCES COUNCIL, CRISIS PROFITEERING: INEQUITIES AND EXCESSES OF KLAMATH PROJECT BAILOUT (2001), *available at* http://www.klamathbasin.info/CrisisProfiteering.pdf. After the virtual closure of the 2006 Pacific fishing season, fishermen demanded $81 million, but Congress only authorized the release of $2 million from a NOAA emergency fund. David Whitney, *House OKs $2 Million in Disaster Aid for Salmon Fleet*, SACRAMENTO BEE, June 29, 2006, at A3.

91. Starting in 2002, the Bureau of Reclamation created a water bank in the Upper Basin to met downstream flow obligations. Sufficient water was provided but the Bureau cannot quantify the actual impacts. UNITED STATES GOVERNMENT ACCOUNTABILITY OFFICE (GAO), KLAMATH RIVER BASIN: RECLAMATION MET ITS WATER BANK OBLIGATIONS, BUT INFORMATION PROVIDED TO WATER BANK STAKEHOLDERS COULD BE IMPROVED (March 2005) [hereinafter GAO].

ESA as "one of the few nearly absolute standards governing management of the American natural legacy."[92] Among environmental statutes, the ESA is relatively unique because it contains substantive as well as procedural mandates. In practice, the ESA is much less draconian than its friends and opponents portray it. The two agencies that administer the ESA have turned it into a more user-friendly development permit program. In the majority of cases the focus is on mitigation and the use of habitat conservation plans to allow the killing of a percentage of listed species. Nonetheless, proponents of species protection and ecosystem conservation support the use of aggressive ESA litigation as a catalyst to trigger more comprehensive long range solutions. One strategy is to trigger the Section 7 consultation process in the hopes that stringent enforcement (or the threat of it) will produce a better result for the species and its habitat ecosystem.[93] Federal agencies who propose actions that may place listed species at risk must consult with either the FWS or the NMFS. These agencies issue a Biological Opinion (BiOp), which determines whether the action poses a risk to a listed species and outlines the necessary avoidance measures. An unfavorable BiOp, such as the 2001 Klamath BiOp, triggers the duty to ensure that the action "is not likely to jeopardize the continued existence" of the species.[94]

There are two ecosystem service justifications for ESA catalyst or "rule of law" litigation, that the use of litigation to create a crisis that will produce a long run solution for the ecosystem.[95] First, it can target the optimal or most efficient service provider. Second, if you adopt the "tort feasor"-"victim" approach, the ESA can trigger solutions that are fair, that go beyond the narrow mandates of the statute, and that are systemwide. The Klamath Project irrigators may be the cheapest cost avoiders because they can cut back production in water during short years and take other adaptive measures.[96] Neither salmon nor Indian fishermen have the same range

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92. George Cameron Coggins & Irma S. Russell, *Beyond Shooting Snail Darters in Pork Barrels: Endangered Species and Land Use in America*, 70 GEO. L.J. 1433,1435 (1982).

93. 16 U.S.C. § 1536(b).

94. 16 U.S.C. § 1536(a)(2).

95. The environmental movement began in large part as a legal guerilla movement and non-governmental organizations pursued the strategy of asking courts to construct strict statutes that imposed substantive and procedural duties that could be characterized as environmental. *See generally* A. Dan Tarlock, *The Future of "Rule of Law" Litigation*, 19 PACE ENVTL. L. REV. 575 (2002).

96. In the United States, we still view natural disasters such as drought as beyond the control of the victims and thus worthy of government relief. Australia has started, with some backsliding in the severe drought that began in this century, on a different course. Australian drought policy is premised on the assumption that drought is an expected occurrence in the world's driest climate and thus farmers should take proactive steps to anticipate it and to mitigate the risks. *See* BEYOND DROUGHT: PEOPLE, POLICY AND PERSPECTIVES

of avoidance options. Putting the service provision cost on irrigators can also be characterized as an example of the "polluter pays" principle at work. For years, the irrigators were able to shift the external costs of their water use to others, so it is only fair that they now internalize a portion of these costs.

The fear of strict enforcement has triggered some very creative solutions, such as multi-species habitat conservation plans in which the burdens of species conservation are widely shared between public and private providers.[97] However, in the Klamath, the ESA has frustrated efforts to develop a basin-wide solution in the Upper Basin by focusing on only one class of tort feasors—the federal irrigators. Without a federal nexus, all irrigation operations can only be addressed through section 9, which prohibits any person from "taking" a listed species.[98] Enforcement would require FWS or NMFS to prove that the actions of a specific entity (an individual farmer or irrigation district) caused the take of a listed fish—a showing that can be difficult to make. In contrast, the use of the Section 7 procedure makes it much easier to look to Project irrigators than to non-Project irrigators to bear the costs of protecting the endangered fish. However, it is easy to see why Project irrigators (and the agency that serves them—the Bureau) would feel unfairly targeted by any increased burdens in light of a century of undisturbed access to water. The result in the Klamath has been BiOps that leave protection of the listed species in doubt because of reluctance to impose inequitable burdens on Project irrigators.

In short, the catalyst theory does not appear to have yet worked in the Klamath despite many good faith efforts to make it happen. Writing after the drought summer of 2001, Professor Holly Doremus and I concluded:

> The Klamath experience . . . confirms the disconnect

(2003).

97. The habitat conservation plan process remains controversial and there are many problems with it. My point is only that fear of ESA enforcement provided the incentive for ecosystem conservation experiments that go far beyond the requirements of the ESA. *Compare* Lindell Marsh, *Conservation Planning Under the Endangered Species Act: A New Paradigm for Conserving Biodiversity*, 8 TUL. ENVTL. L.J. 97 (1994), *and* Marc Ebbin, *Is the Southern California Approach to Conservation Succeeding?*, 24 ECOLOGY L.Q. 695 (1997), *and* Jody Freeman, *The Private Role in Public Governance,* 75 N.Y.U. L. REV. 543 (2000), *and* A. Dan Tarlock, THE DYNAMIC URBAN LANDSCAPE IN THE ENDANGERED SPECIES ACT AT 30 127 (2006), *with* Shi-Ling Hsu, *The Potential and Pitfalls of Habitat Conservation Planning Under the Endangered Species Act*, 29 ENVTL. L. REP. 10592 (1999), *and* Karen Sheldon, *Habitat Conservation Planning: Addressing the Achilles Heel of the Endangered Species Act*, 6 N.Y.U. ENVTL. L.J. 279 (1998).

98. A taking includes habitat modification, Babbitt v. Sweet Home Chapter of Communities for a Great Oregon, 515 U.S. 687 (1995), including water withdrawals. United States v. Glenn-Colusa Irrigation Dist., 788 F. Supp. 1126, 1133 (E.D. Cal. 1992).

> between the ESA and state water law, and the Act's limited ability to change long-established water allocation patterns. The NMFS 2002 Biological Opinion makes a commendable stab at broadening the vision of responsibility for improving the Klamath's ecological condition by calling for initiation of a state/federal process to identify non-project water that could contribute to flows needed by the coho. But that effort, which does not go nearly as far as is needed, seems doomed to failure unless the state chooses to cooperate. The Bureau, the target of NMFS' requirement, has no authority to demand state, or even other federal agency, participation in any such process, much less to demand any particular substantive outcome.
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> To date the Klamath experience suggests that, at best, the ESA is an uneven, weak catalyst. In Oregon, resistance to those changes continues. In the spring of 2002, a coalition of environmental groups submitted a petition asking the Oregon Water Resources Commission to place a moratorium on new appropriations on the Klamath and Lost Rivers. Given the recent water conflicts in the basin, the ongoing adjudication, and the fact that no new flow appropriations have been granted since 1997, that seemed a relatively mild request. The Commission, however, with the support of the agricultural community, rejected the petition.[99]

B. Counter-Culture Reactions

Subsequent events have largely tended to confirm our analysis and to reveal a number of specific problems with catalyst litigation. Four developments stand out. The first is a hardening of the position by those who want to maintain the status quo and a consequent unwillingness to compromise. The second, which is a symptom of the first, is the use of a counter catalyst. The third is that the focus on legal and regulatory solutions create disincentives to seek alternative, longer-lasting solutions to the problem. The final development is the ease with which strict enforcement of the ESA can be avoided. This problem is discussed in Section V of this Article. This Section focuses on the second and third prob-

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99. *Fish, Farms, and the Clash*, *supra* note 3, at 348-49 (citations omitted).

lems.

Rule of law litigation is a game that anyone can play, and the Klamath irrigators, emboldened by a Supreme Court decision that allowed them to challenge Biological Opinions[100] and the 2002-2003 National Research Council Reports, tried to land a knock-out punch. To wipe out the successful ESA cases which held that the existence of vested state water rights was not a defense to compliance with the ESA, the irrigators tried to ride the current property rights wave and brought a Court of Claims Fifth Amendment takings suit for more than a billion dollars.[101] However, this move did not succeed. The court found that the federal government had appropriated all of the non-appropriated waters in the basin for the Project and that the individual farmers only had contract rights, rather than property rights. It refused to follow an earlier case[102] that had found a physical taking.[103] Specifically, the court noted that many Reclamation contracts, including those in the Klamath, absolved the government of liability for "water shortages—hydrologic, regulatory, or hybrid—that may occur within the system."[104] It also suggested that even if the contracts did not specifically provide for delivery interruptions, the ESA could be characterized as a sovereign act which overrode the Bureau's Reclamation Act duties. The court remanded for proceedings on contract claims, but the court again ruled against the irrigators.[105]

The third reason recognizes that the regulatory system offers such powerful advantages to both sides and thus crowds out the search for alternative solutions. In a recent paper, a group of researchers studied the failure of a voluntary watershed planning process, cemented by compliance social norms rather than legal duties, to emerge on the an Illinois river. Building on the foundation work of Elinor Ostrom, which challenges the assumption that private commons management is always tragic,[106] they concluded that the enforcement or threat of enforcement of stringent resource

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100. Bennett v. Spear, 520 U.S. 154, 176 (1997). In holding that the ESA citizen suit provisions applied to opponents of species conservation, Justice Scalia unilaterally rewrote the legislative history of the ESA with his incredible statement that the primary purpose of the Act was "to avoid needless economic dislocation produced by agency officials zealously but unintelligently pursuing their environmental objectives." *Id.* at 176-77.

101. Klamath Irrigation Dist. v. U.S. Pac. Coast Fed'n of Fishermen's Ass'ns, 67 F.Cl. 504 (2005).

102. Tulare Lake Basin Water Storage Dist. v. United States, 49 Fed.Cl. 313, 317 (2001).

103. *Klamath Irrigation Dist.*, 67 Fed. Cl. at 537.

104. *Id.* at 535 (quoting Brian Gray, *The Property Right in Water*, 9 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 1, 26 (2002)).

105. *Klamath Irrigation Dist. v. United States*, 75 Fed. Cl. 677 (2007)

106. *See generally* ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION (1990).

management laws can crowd out other regimes by transferring power to progressively higher levels:

> Underneath and alongside . . . formal governing bodies, numerous formal and informal institutions of "civil society," ranging from state-chartered corporations and organizations to customary associations and social orderings have more-or-less formalized rules governing their behaviors. In a locality such as the Cache, where many individuals live within widely ramifying sets of kin and other long-standing, multi-generational relations, these informal governing rules often override formal laws. The overlapping jurisdictions of formal and informal institutions create a governing terrain in which "custom" can be as significant as formal procedures.[107]

It may nonetheless be premature to write off the catalyst theory. Despite the Bush Administration's efforts to defang the ESA, it retains vigor. Downstream fishermen have been able to use the ESA to successfully challenge the Bush Administration's efforts to push forward all serious compliance with Biological Opinions that require water cutoffs.[108] In 2006, a federal district court held that the Bureau of Reclamation had to release water, at the expense of the project, to support threatened Coho in the Lower Basin.[109]

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107. Adams, Jane et al., *Watershed Planning: Pseudo-democracy and its Alternatives — The Case of the Cache River Watershed, Illinois*, 22 AGRIC. AND HUMAN VALUES 327, 332 (2005).

108. *See infra* notes 168-81 and accompanying text.

109. Pac. Coast Fed'n of Fishermen's Ass'ns v. U.S. Bureau of Reclamation, 2006 WL 798920 (N.D. Cal. 2006). The Ninth Circuit had previously held that the Bureau's release plan (or non-plan) was arbitrary. Pac. Coast Fed'n of Fishermen's Ass'ns v. U.S. Bureau of Reclamation, 426 F.3d 1082 (9th Cir. 2005). The Bureau practically guaranteed the result by adopting a Biological Opinion in 2002 which phased in downstream protection over ten years and delayed the provision of the full amount of water necessary to protect the Coho until year nine. BR FINAL 2002 BIOLOGICAL ASSESSMENT, *supra* note 39. The court easily found that the BiOp failed to analyze adequately the impact of the effect of the delay on the Coho in years one through eight. *Pac. Coast Fed'n of Fishermen's Ass'ns*, 426 F.3d at 1090. In short, it carried its own "death wound" by adopting policies that it could not support with credible science. The injunction was upheld in *Pac. Coast Fed'n of Fishermen's Ass'ns v. U.S. Bureau of Reclamation*, 226 Fed. Appx. 715 (9th Cir. 2007). The years of litigation that led to this decision are set out in Wood, *supra* note 53.

V. COASE IN THE KLAMATH OR PROPERTY RIGHTS ASSIGNMENTS ALSO MATTER

A. The Necessity for Property Rights

Ecosystem services require the creation of new property rights. The Klamath is an ecosystem in which long-established property rights, primarily water rights, reenforce resistance to fundamental change. This Section addresses the question of how existing property rights can facilitate or hinder the necessary changes in the system. In theory, the existence of entrenched property rights is no stranger to efficient change. Ronald Coase received the Nobel Prize in economics for his article *The Problem of Social Cost.*[110] Coase's theorem posits that, absent transaction costs, parties will bargain toward an efficient allocation of resources regardless of the initial allocation of property rights. Critics have long pointed out that a world of zero or minimal transaction costs seldom exists and that the initial assignment of rights can strongly influence the reallocation options. This section argues that when private providers are involved, the level of service provision, if any, is a partial function of the property entitlement claimed by the presumptive provider. The more entrenched the initial entitlement, the more pressure there will be for both forced reallocations and bribes. [111] Proponents of a Coasian solution must take full account of the loss of power and self-esteem that all change, forced or compensated, brings. The situation for public providers is different; public ownership often carries with it the discretion, but seldom the duty, to dedicate land and water to ecosystem provision. Thus, the result is often the same: the under-provision of ecosystem services because of the power of entrenched private entitlements and expectations that public resources will be dedicated to commodity production.

A necessary condition for the provision of ecosystem services is the existence of a defined, consistent provider. Proponents of service provision would prefer that a beneficiary also be identified and that the two be linked through markets. However, providers can provide services as a bi-product of other activities either because they are forced to or because they are bribed to so. Thus, the class of beneficiaries can be an identifiable group or society at large. Once the provider is identified, the question turns to the relationship between property rights and ecosystem service provision. The

110. Ronald Coase, *The Problem of Social Cost,* 3 J.L. & ECON. 1 (1960).

111. I use "bribe" in the classic economics sense: a person changes his or her behavior in response to a legal payment of money.

root of the problem is that the relationship is often negative because private entitlements are difficult to modify even when money may be available to do so.

B. Property Rights in the Klamath: Entrenched Entitlements Resist Change

Western national resources law has a fundamental bias toward resource exploitation, and the legislative process has generally operated, at least until recently, to reinforce the expectation that there will be few limits on exploitation. Western water law is a prime example, as it is a product of the legacy of late Roman legal thought. The modern notion of property remains rooted in the Roman notion of exclusive dominion subject only to the duty not to cause a nuisance. For example, this view lies behind the Supreme Court's dismissal of the argument that the purchaser of highly regulated wetland property assumes the risk of a development denial with the quip that "[T]he State may not put so potent a Hobbesian stick into the Lockean bundle."[112] Locke himself might be surprised that his labor theory has now incorporated the Roman right of *ius abutendi*, the right to destroy property. Both the common law and the police power temper this discretion, but this legacy has made it much harder to limit activities that degrade ecosystems as opposed to the limitation of air, soil, and water as waste disposal sinks.

The combination of legal entitlements backed by the political process is at work in the Klamath to maintain the status quo. The irrigators, supported by the Bureau of Reclamation, claim the right to apply water without regard to the environmental costs. They rely on the doctrine of prior appropriation, which is a practical, intuitive response to the seasonable unreliability of western water supplies. Miners developed the custom of allocating rights by priority rather than trying to use the vague equal sharing rules of the common law of riparian rights. Courts sanctioned this custom as an acceptable risk distribution scheme for the arid west,[113] but the

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112. Palazzolo v. Rhode Island, 533 U.S. 606, 627 (2001). Professor J.B. Ruhl partially disagrees with this analysis and argues that the common law has the potential to adapt over a long period of time to recognize a duty of ecosystem provision. J.B. RUHL, STEVEN E. KRAFT & CHRISTOPHER L. LANT, THE LAW AND POLICY OF ECOSYSTEM SERVICES, 266-271 (2007). *See* Palazzollo v. Rhode Island, 2005 WL 1645974 (R.I. Super. 2006), the Supreme Court's decision on remand, which held that the state could deny the permit because draining and filling would be a nuisance.

113. For example, at a time when the public use doctrine limited the exercise of the power of eminent domain to property which would be used by the public, the Supreme Court upheld a Utah statute allowing appropriators to condemn ditch right of ways across private lands because of "some peculiar condition of the soil or climate, or other peculiarity of the

rhetoric of Western water law has obscured the high level of risks inherent in prior appropriation and instead has stressed the illusory firmness of water rights. The Reclamation Era was premised on the expectation that federal government would eliminate most risk or recurring periods of drought and highly variable rainfall patterns by carry-over storage. Dams and reservoirs reduced but did not eliminate risk. Because risk is inherent in water entitlements, there should be no inherent legal barriers to management solutions that equitably reassign the risks of water shortages to accommodate all relevant uses and stakeholders in a basin and enhance the provision of ecosystem services.[114] The federal reclamation program's construction of carry-over storage reservoirs to back-stop water rights—not the law—is the main reason that water rights are relatively firm regardless of the water year. Thus, it has proved very difficult to add new risks to Western water rights.

C. Ecosystem Service Property Rights

There are three counter strategies to the drag of existing entitlements: (1) environmental group property rights, (2) forced reallocation through the ESA, and (3) bribes.

1. Public and Group Environmental Property Rights

Two federal property rights exist in the Klamath that could potentially be dedicated to ecosystem provision and offset the effects of irrigation. Both the Upper Basin's wildlife refuges and the Klamath Tribe can claim water rights that can be dedicated to service provision, but the potential of these rights to provide consistent long term, ecosystem services is limited. Due to the fact that western settlement preceded effective federal control over the pub-

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state . . . ." Clark v. Nash, 198 U.S. 361, 368 (1905).

114. The California Supreme Court has recently sanctioned a new risk-based law of flood control liability. Bunch v. Coachella Valley Water District, 63 Cal. Rptr. 2d 89 (1997), holds that a public entity which diverts water from a natural watercourse that has historically flooded adjacent lands and constructs flood control works that fail in a major rain event is only liable if it acted unreasonably in designing, constructing and operating the project.

> [T]he only way to determine whether a damaged private landowner has . . . been forced to contribute a compensable "disproportionate" share of the public undertaking is to determine whether the system, as designed, constructed, and operated and maintained, exposed him to an "unreasonable" risk of harm, either individually or in relation to other landowners.

Id. at 100-01.

lic domain, states gained the power to allocate water in the west and have long claimed that this historical accident excludes federal control. There is no constitutional basis for this claim; it rests entirely on Congressional forbearance and this has been eroded over time.[115]

Three twentieth century historical moments have restored a measure of federal power under the Commerce and Property powers: the conservation movement, tribal sovereignty, and the environmental movement. First, the conservation era first produced a special class of federal water rights for Indian tribes and public land withdrawals. These are mixed riparian and appropriative rights. A federal reserved right has a priority date, but unlike an appropriative right, it need not be put to beneficial use to be perfected. Like a riparian right, it can be claimed at any time and can encompass ecosystem conservation, at least for the maintenance or revival of historic fisheries. But federal claims remain limited in scope and quantity and are seldom robust enough to support the desired range of ecosystem services.

Until the 1963 decision in *Arizona v. California*,[116] Westerners assumed that only Indians had federal water rights. In the epic litigation to divide the Lower Colorado River, the Supreme Court held that the federal government can claim non-Indian federal reserved rights to fulfill the purposes of a public land withdrawal.[117] *Arizona v. California* and a subsequent case initially took an expansive view of reserved rights.[118] They could be implied to fulfill the purpose of a reservation. However, this view did not survive. In *United States v. New Mexico*,[119] the Supreme Court limited implied public land rights to the minimum amount necessary to fulfill the primary (not secondary) purposes of the reservation and made it extremely difficult for the public land agencies to obtain a fraction of the water they need to manage public lands consistent with the expanded ecosystem conservation mandates of Congress. The Forest Service claimed instream flows for a wilderness area, but the majority reasoned that the 1897 Organic Act limited the purpose of national forests to "securing favorable conditions of water flows" for downstream irrigators and cities and "furnish[ing] a

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115. California Oregon Power v. Beaver Portland Cement Co., 295 U.S. 142, 163-64 (1935) (three Congressional Acts severed western waters from the public lands and made them "subject to the plenary control of the designated states").

116. 373 U.S. 546 (1963).

117. *Id.* at 597-98.

118. Cappaert v. United States, 426 U.S. 128 (1976).

119. 438 U.S. 696 (1978). The definitive history of the litigation is discussed in G. Emlen Hall, *The Forest Service and Western Water Rights: An Intimate Portrait of United States v. New Mexico*, 45 NAT. RESOURCES. J. 979 (2006).

continuous supply of timber."[120] The court subsequently held that both Indian and Non-Indian federal reserved water rights could be adjudicated in the state court General Adjudications, but the states had to apply federal standards. The net result is that *New Mexico* has made it difficult but not impossible for the federal government to assert non-Indian reserved water rights for public lands withdrawals. For example, after the case, the Forest Service tried to assert reserved rights for sediment transport. A Federal District Court agreed that stream integrity was a favorable condition, but held that the flows were not necessary to support this hydrologic function. The federal government has filed many public land claims as well as instream flow claims under state law. In Colorado and Idaho, the Forest Service encountered a Catch 22: state instream flow rights can only be held by a state agency.[121] In addition, Idaho has developed a substantial anti-federal reserved rights jurisprudence for wildlife refuges based on the court's "reading" of history.[122] The federal government has fared better in Oregon, but it has not been able to reverse the years of the subordination of the refuges to irrigation.

a. Klamath Wildlife Refuge Rights

The refuges are wetlands depending on water to survive and can claim federal water rights, but water law has long split water from land and limited the ability of the federal government to claim water rights for public lands. For years the refuges' water flow was under the control of irrigators; the refuges got return flows and any water not needed for irrigation. For example, water has been delivered to the Klamath National Wildlife Refuge, but it has always been the lowest delivery priority so it often receives only polluted agricultural waste water.

Wildlife refuges are a category of public land withdrawal which falls between the limited use mandates that characterize (or once

120. *United States v. New Mexico*, 438 U.S. at 714.

121. *In re* Matter of the Amended Applications of the United States for Reserved Rights in the Platte River, Case No. W-8439-76 (Feb. 12, 1993). *See* Teresa Rice, *Colorado Water Court Denies Reserved Rights Claims for Channel Maintenance*, 4 RIVERS 146 (1993) (no longer published).

122. *See*, *e.g.*, United States v. Idaho, 23 P.3d 117, 128-29 (Idaho 2001) (finding it "inconceivable" that President Franklin D. Roosevelt would give preference to waterfowl over irrigation when he created a wildlife refuge in the Snake River island in 1937, in the midst of the dust bowl); Potlatch v. United States, 12 P.3d 1260, 1268 (Idaho 2000) (reserved rights do not attach to wilderness areas; Wilderness Act does not protect watersheds because Senator Frank Church, D-Idaho, would have never voted for the Act because recognition of such rights would cripple economic growth in Idaho). Wyoming has a similar tradition. *See, e.g.*, *In re* General Adjudication of All Rights to Use Water in the Big Horn River System (Big Horn III), 835 P.2d 273 (Wyo. 1992).

did) the national park system and the expansive, open-ended multiple use management mandates of withdrawals such as forests and grazing lands.[123] They grew in an uncoordinated fashion by the creation of individual areas. Refuges management has steadily evolved toward ecosystem conservation, but it took decades for this view to crystallize and, thus, multiple use philosophy has dominated thinking about refuges until recently. A comprehensive organic act was not passed until 1997. Under the National Wildlife Refuge System Improvement Act, the primary mission of the system is now to conserve and to restore wildlife habitats.[124] However, multiple-use is embedded in wildlife refuge law, especially in the Klamath, and specific uses control over the more ecosystem conservation mandate.

The Klamath Project sits squarely in the Pacific Flyway, the major migratory route for birds in western North America, and refuges were created shortly after the Project was authorized. The progressive conservation era had already reached the Klamath Basin by the time the Project was constructed. President Theodore Roosevelt is credited with creating the first refuge in 1903 when he set aside Pelican Island in Florida to preserve a breeding ground for native birds.[125] Shortly thereafter, two wildlife refuges were created in Tule and Lower Klamath Lakes.[126] The Tule Lake refuge has the distinction of being the first refuge to be superimposed on "a watershed being revamped by the Reclamation Service."[127] President Taft later established the Clear Lake National Wildlife Refuge in 1911.[128] The refuge lands were within the project boundaries. However, Reclamation Service botanists concluded that the two could co-exist, and as a result ecosystem function and services have been consistently subordinated to irrigation.[129]

The Klamath refuges were not initially recognized as valuable ecosystem fragments. They had to struggle to survive and to perform their wildlife conservation function, although refuges should have been easy to maintain. The soils in the lower Klamath were too alkaline for crops, but the pressures of settlement prevailed. In 1915, President Wilson reduced the size of the Lower Klamath

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123. *See generally* Robert L. Fischman, *The National Wildlife Refuge System and the Hallmarks of Modern Organic Legislation,* 29 ECOLOGY L.Q. 457 (2002); Robert L. Fischman, *The Significance of National Wildlife Refuges in the Development of United States Conservation Policy*, 21 J. LAND USE & ENVTL. L. 1 (2005)

124. 16 U.S.C. § 668dd(a)(2).

125. BALANCING WATER, *supra* note 5, at 76.

126. *Id*. at 79.

127. *Id*. at 77.

128. *Id.*

129. *Id.*

Lake Refuge from 80,000 to 53,600 acres.[130] A Lower Klamath drainage basin district was organized, and the lake was drained and reduced to a 365-acre pond.[131] Homesteading began in the Tule Lake area in 1916 and did not end until 1949, one of the last gaps in the great project of public land disposition.[132] In 1946, during the last gasp of the nineteenth century homestead experiment, farmers in Tule Lake were threatened by the annual migration of waterfowl along the Pacific Flyway, and the Fish and Wildlife Service stepped in to practice what we might now call adaptive management. Pressured to take action, the FWS tried a number of methods to help the farmers clear their fields of waterfowl. Using military surplus equipment such as smoke grenades, searchlights, and small airplanes, the FWS herded the birds back into the refuges. The service also issued permits that allowed local farmers and their Mexican laborers to scare birds from the fields with shotguns and flares. The combined efforts of these groups contained the birds on the refuge until farmers completed their harvest. For the most part, the birds remained there until hunters came to kill them after the beginning of hunting season in October or until they flew south to their wintering grounds in California's Central Valley and Mexico.[133]

The environmental consequences of the draining of the lake were clear. The area turned into a "desert waste of dry peat and alkali."[134] The peat periodically burned. Restoration began in 1941, when excess water from Tule Lake was diverted back into Lower Klamath and the birds returned.[135] Farmers learned to leach the soils; thus, like many refuges, they receive nutrient-rich return flows instead of clean water.[136] In 1964, Senator Thomas Kuchel of California succeeded in passing legislation for the refuges.[137] Waterfowl management was declared the major purpose of the refuge but "with full consideration to optimum agricultural use."[138] The federal government was authorized to lease lands in the Upper and Lower Klamath refuges and the Tule Lake refuge for crops.[139] This multiple use not only benefits farmers in refuges, but over time, one of the rationales for crop raising is that migra-

130. BALANCING WATER, *supra* note 5, at 78.
131. *Id.*
132. *Id.* at 81, 85.
133. Robert M. Wilson, Directing the Flow: Migratory Waterfowl, Scale, and Mobility in Western America, 7 Environmental History 247 (2002).
134. BALANCING WATER, *supra* note 5, at 79.
135. *Id.*
136. *Id.*
137. *Id.* at 86.
138. 16 U.S.C. § 695l (1964).
139. *Id.*

tory birds will feast in this area and fewer will fly on to the Central Valley and eat higher valued crops. In fact, about seventy-five percent of the leased lands in the refuge are for grain crops on which the birds feed. Legislation passed in 1964 allows leasing, but it does not protect farmers from the market. Farm sales decreased in the Refuge from some $30 million in the 1980s to around $20 million in the 1990s.[140] An Environmental Assessment disclosed substantial adverse impacts to the refuge's ecosystem.[141] However, there has been no systematic assessment of the value of its ecosystem services, although they can reasonably be expected to increase substantially in the future as the area becomes more of a "life style" destination. A 2002 Fish and Wildlife Study found that visitor expenditures were around $2 million dollars and generated $797,600 in employment income[142] at the same time that the Final Environmental Assessment for the continued leasing program reported lease revenues of only $1,884,026 in 1996, the last year surveyed.[143] These ecosystem service values are expected to increase in the future. Nonetheless, the FWS has implemented a pilot "walking wetlands" program in the refuge.[144] Lands are alternatively drained, put into potato production, and then flooded.

The federal government has begun to claim reserved rights for the refuges, but it is difficult to obtain sufficient quantities of water to adequately support the ecosystem to which they attached.[145] The problems start with the uncertainty about all water rights in the basin. Despite over 100 years of project operation, the Klamath Basin remains unadjudicated, although a state adjudication has been ongoing since 1975.[146] Thus, the irrigators enjoy a vast advantage because their existing uses are *de facto*, but not necessarily *de jure*, measures of their actual water rights, even though they may in fact be entitled to less water than claimed.[147] In the Klamath adjudication, the U.S. Forest Service filed 212 claims, the Bureau of Land Management filed fifty-two, and the

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140. FISH AND WILDLIFE SERV., U.S. DEP'T OF THE INTERIOR, FINDING OF NO SIGNIFICANT ACTION, IMPLEMENTATION OF AGRICULTURAL PROGRAM ON TULE LAKE NATIONAL WILDLIFE REFUGE 3.5.3 (2002), *available at* http://www.fws.gov/klamathbasinrefuges/Final Environmental/AgProgramEa.pdf [hereinafter ENVIRONMENTAL ASSESSMENT].

141. *Id.* at 4.1.1.

142. U.S. FISH AND WILDLIFE SERVICE, BANKING ON NATURE 2002: THE ECONOMIC BENEFITS TO LOCAL COMMUNITIES OF NATIONAL WILDLIFE REFUGE VISITATION 35 (2003), *available at* http://www.fws.gov/southeast/grants/BankingOnNature2002_101403.pdf.

143. ENVIRONMENTAL ASSESSMENT, *supra* note 141, at 3.5.2.

144. Natural Resources Conservation Service, United States Department of Agriculture, Klamath Basin Conservation Partnership Accomplishments (2007), *available at* http://www.nrcs.usda.gov/feature/klamath/images/BrochureProgressReport2007.pdf.

145. *See Fish, Farms, and the Clash, supra* note 3, at 303-05.

146. *Id.* at 302.

147. *Id.*

Fish and Wildlife Service filed twenty-two claims for the four different refuges.

The federal government has focused more on Indian claims than on refuge claims in the Klamath adjudication[148] and has made major concessions to the irrigators. Nonetheless, Oregon still contests the scope of the claimed rights. For example, the United States agreed to take a 1985 priority date for the Klamath Marsh National Wildlife Refuge in Oregon, although the priority date would ordinarily be 1960, the date of the creation of the refuge. Oregon has agreed that the primary purpose of the refuge is migratory bird conservation and thus even under *New Mexico*, the United States is entitled to the minimum amount of water necessary to prevent the frustration of this objective. But the state has taken a harder line on the rights claimed in the Upper Klamath Wildlife Refuge with a 1928 priority date. President Hoover's original Executive Order described the purpose of the refuge as a "breeding ground for birds and wild animals,"[149] but Congress described the purpose as "to preserve intact the necessary existing habitat for migratory waterfowl in this vital area of the Pacific flyway."[150] Following the letter of *New Mexico*, Oregon claims that any water rights can only be used to manage waterfowl.[151] These narrow readings, if upheld, limit the ecosystem service potential of the reserved right.

b. Indian Water Rights

Indian tribes can potentially claim federal water rights to large amounts of water including ecosystem service claims, although the latter have often been limited and must be adjudicated in state proceedings.[152] Unfortunately, the Klamaths are unlikely to match the success of other tribes with a large potential irrigable reservation.[153] Historically, the main purpose of federal Indian water rights has been to give Indians parity with white irrigators to speed Indian assimilation. The primary standard for the right is the practicable irrigable acreage (PIA) of the reservation.[154] The Court came close to replacing the standard with one much more

148. *E.g.*, Adair v. United States, 723 F.2d 1394, *cert. denied*, 467 U.S. 1252 (1983).

149. Exec. Order No. 4851 (1928).

150. 16 U.S.C.A. § 695k (2006).

151. Memorandum from Walter Perry, Assistant Attorney General, Natural Resources Section to Richard Bailey, Adjudicator, Water Resources Department, September 19, 1999.

152. *Colorado River Water Conservation Dist. v. United States*, 424 U.S. 800 (1976).

153. BONNIE G. COLBY, JOHN E. THORSON & SARAH BRITTON, NEGOTIATING TRIBAL WATER RIGHTS: FULFILLING PROMISES IN THE ARID WEST (2005).

154. Arizona v. California, 373 U.S. 546, 600-01 (1963).

favorable to Indians,[155] but PIA remains the law. So far courts have agreed that PIA does not require a positive benefit-cost analysis and that tribes are not limited to farming methods in use at the time that the reservation was created.[156]

PIA does the Klamath Tribe and the ecosystem no good. Nonetheless, the Klamath have successfully used the *Winters*[157] doctrine to increase their bargaining power within the basin and to bolster the ecosystem, although no Indian water right is actually devoted to ecosystem services. The Tribe first had to establish its right to water even though its historic reservation had been terminated by Congress in the last gasp of assimilation during the 1950s. In the end, *Winters* rights were attached to the remnant Tribe and to the lands severed from the reservation during the first wave of assimilation, the allotment era. *United States v. Adair* held that the Klamath Termination Act expressly preserved pre-existing water rights, including an instream flow right necessary to effectuate the hunting and fishing rights reserved to the Klamath Tribe by the 1864 treaty creating the reservation.[158] That water right, the court ruled, dated to time immemorial, not merely to the 1864 treaty. With respect to allotted lands, the court held that Indian successors to the lands had a right to a portion of the tribal reserved right.[159] Non-Indian successors enjoyed a slightly less secure right.[160] Non-Indians acquire an 1864 priority to water sufficient to irrigate both the acreage under irrigation at the time of transfer and any additional acreage that may be reasonably irrigated.[161]

United States v. Adair was a significant and lasting tactical victory for the Klamath Tribe, but the Court of Appeals did not quantify the tribe's reserved rights and left many questions unanswered. The instream flow right only gives the Tribes the right to enjoin depletions of the river when they threaten to interfere with protected hunting and fishing rights.[162] In 2001, the United States

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155. *In re* General Adjudication of All Rights to Use Water in the Big Horn River system, 753 P.2d 76 (Wyo. 1988), *aff'd by an equally divided Court sub nom*. Wyoming v. United States, 492 U.S. 406 (1989).

156. Arizona v. California, 460 U.S. 695 (1983). The Supreme Court subsequently held that non-Indian reserved rights were limited to the "principle purpose" of a land withdrawal. *New Mexico*, 438 U.S. 696, 716. This standard potentially applies to Indian water rights, but the Supreme Court has not limited Indian water rights as it has non-Indian federal reserved rights.

157. *Winters v. United States*, 207 U.S. 564 (1906).

158. 723 F.2d 1394, 1411-17.

159. *Id*. at 1415-17.

160. *Id*. at 1417.

161. *Id.* The right of non-Indian allottees had been previously recognized in Colville Confederated Tribes v. Walton, 647 F.2d 42 (9th Cir. 1981).

162. *See Adair*, 723 F.2d at 1411.

and the Tribes asked the federal district court to reopen the *Adair* decree to clarify the standard for determining the Tribe's right after the Oregon Water Resources Department formally interpreted *Adair* to limit Indian use to a moderate living capped by the low level of hunting, fishing, and gathering activity in 1979. The district court subsequently expanded *Adair* to hold that the Tribe's treaty water entitles it to sufficient water levels to support the necessary productive aquatic habitat which it defined as the habitat currently used, not that used in 1864.[163] This crabbed interpretation of the Tribe's treaty entitlement was rejected by the federal district court. Instead, the Tribe has the right to whatever water is necessary to achieve a supported habitat.[164]

The current bottom line is that the existence of water rights gives the Tribe important political and legal leverage, but has not fundamentally changed the status quo. The Tribe's potential rights are counter-balanced by the ability of the irrigators to continue to divert water by water rights which have not yet been determined to be valid. Despite the Klamath Tribe's victories between 1983 and 2005, the Tribe is still waiting for a quantified water right, while the Project and non-Project irrigators use much of the basin's water to grow crops. The Tribe's right is essentially negative. As the Ninth Circuit said in *Adair*, "the entitlement consists of the right to prevent other appropriators from depleting the streams [sic] waters below a protected level in any area where the non-consumptive right applies."[165] Both the irrigators and the Indians will have to navigate their future in the context of a doctrine that is both stable and evolving, but which remains biased in favor of the status quo.

2. Are Coasian Bribes Possible in the Klamath?

Much of the writing on the provision of ecosystem services assumes that existing property rights are a barrier to service provision, and thus existing right holders should be "bribed" though compensation to dedicate their property to ecosystem services. There are two distinct primary rationales for taking property rights as they lie. The first is instrumental. The arguments based on this rationale range from the straight-forward "real politick" argument that it is usually faster and cheaper to pay for the rights than to contest them to more nuanced arguments that compensa-

163. United States v. Adair, 187 F. Supp. 2d 1273, 1278-79 (D. Or. 2002) *vacated sub nom.* United States v. Braren, 338 F.3d 971 (9th Cir. 2003).

164. *Adair*, 187 F. Supp. 2d 1273.

165. *Adair*, 723 F.2d at 1411.

tion is necessary to overcome cultural biases against ecosystem service provision.[166] The second rationale is an ethical justification. Property rights are a guarantee against sudden majoritarian changes in policy, regardless of the merits of the new policy.[167] Thus, clearly established rights must be respected. The two principal counter arguments are that the property right claimed may be less established and free of risks of change than the holders assume and that payment creates a moral hazard problem. A moral hazard is a law or social policy that encourages inefficient action because there will be no penalty for taking it. [168]

The Klamath farmers derive much of their political power from their water entitlements, water rights perfected by hard work under the doctrine of prior appropriation and protected in a variety of waters by Oregon as well as federal law. Irrigators have every incentive to hold their water rights until the harsh discipline of the market takes effect and the federal government withdraws from its historic role of buffering western farmers from this discipline. The Klamath water right holders are also encouraged to continue behavior with high potential private and social costs because they know that they will be compensated for any losses that they incur or that the government will bail them out, as it has, with emergency relief. The control of water in the Klamath is the key to the basin's destiny. Water entitlements are both a source and a manifestation of political power. The Klamath experience to date suggests that the case for sole reliance of a Coasian solution, which is indifferent to the assignment of property rights, should be carefully examined. In addition to cultural resistance to the cold logic of efficiency, the existence of firmly entrenched rights will push authorities to adopt a solution that carries with it a high risk of "sub-optimization" if not failure. For example, after the summer of 2001, the Bureau of Reclamation created a faux water bank in the Klamath.[169] It is a faux bank because it is not a permanent pool of water with deposits and withdrawals, but rather a series of ad hoc payments to irrigators to either retire land or drill wells.[170] A 2005 GAO report concluded that Reclamation gas met its flow targets, but the actual reduction of water use was difficult to quantify

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166. Elmendorf, *supra* note 65.

167. *See, e.g.*, Jesse J. Richardson, Jr., *Downzoning, Fairness and Farmland Protection*, 19 J. LAND USE & ENVTL. L. 59 (2003). For a reply see Mark W. Cordes, *Fairness and Farmland Preservation: A Response to Professor Richardson*, 20 J. LAND USE & ENVTL. L. 371, 372 (2005).

168. For an excellent analysis of these issues, see James Salzman, *Creating Markets for Ecosystem Services*, 80 N.Y.U. L. Rev. 870 (2005).

169. *Fish, Farms, and the Clash*, *supra* note 3, at 327-28.

170. *Id.*

because Reclamation lacks "effective flow measurement equipment and monitoring data for the Klamath Project."[171] The net result was the Bureau accelerated groundwater depletion and did not provide enough water for downstream Coho Salmon support.[172] Finally, the rush to a Coasian solution also creates no incentive to explore the extent to which the claimed existing entitlements are immune to readjustment. Water rights are as much about risk as they are about stability. The focus should be on the actual expectations that lie behind a use[173] so that alternative ways of satisfying those expectations can be accommodated.

3. The ESA

As previously mentioned, the environmental movement reached the Klamath primarily through the ESA. The Act has the potential to reallocate water rights, although any reallocation is likely to be seasonable. Courts have consistently held that the existence of a vested state water right is no defense to compliance with the Act.[174] Two courts of claims have split on the issue of whether withheld deliveries constitute a taking.[175] The earlier discussion of the ESA suggested that the Act is less of a catalyst than many hope because the Act is vulnerable to reinterpretation in ways that make it difficult, but not impossible, to challenge in court. In brief, after the 2001 summer and the interim National Research Council report, which rejected the Fish and Wildlife Service's conclusion on Upper Klamath Lake levels and questioned its conclusions about the need for downstream Coho salmon flows, the Bureau issued a new BiOp.[176] The 2002 BiOp designated a relatively wet period, 1990-1999, as the baseline, and the Bureau developed a ten-year operating plan for the project. Upper Klamath Lake levels would be maintained at levels no lower than the average end-of-end elevations over a ten-year period and daily average Klamath River flows would be no lower than ten year averages

171. GAO, *supra* note 91, at 25.

172. *Id*. at 25-28.

173. This analysis echoes and recasts the Progressive Era concern that the monopolization of water rights would prevent the more widespread distribution of access to water to the detriment of society's interest in the conservation of resources. For example, the great treatise writer Samuel Wiel, in *Water Rights in the Western States*, floated the idea that unreasonable assertions of priority would not be recognized. SAMUEL WIEL, WATER RIGHTS IN THE WESTERN STATES 329-40 (3d ed. 1911),

174. *Fish, Farms, and the Clash*, supra note 3, at 310-11.

175. Tulare Lake Basin Water Storage Dist. v. United States, 49 Fed. Cl. 313 (U.S. Ct. Fed. Claims 2001) (finding there was a taking); Klamath Irrigation Dist. v. United States, 67 Fed. Cl. 504 (U.S. Ct. Fed. Claims 2005) (finding there was not a taking).

176. BR FINAL 2002 BIOLOGICAL ASSESSMENT, *supra* note 38.

plus a 10,000 acre foot April pulse for downstream smolt migration.[177]

The story of how the Bush II Bureau of Reclamation and Department of Interior quickly tilted the balance from fish to farmers is both a tale of the legitimate use of the political process and the legacy of the environmental movement to limit the use of old-fashioned influence politics to undermine statutes. A 2002 report by the National Research Council took the Bureau off the hook for Upper Klamath lake levels and cast doubt on the benefit of minimum flows for the Coho, but not for downstream flows.[178] However, instead, of trying to implement its call for a broad menu of ecosystem restoration measures, the Bureau tried to protect the irrigators from all risks in its "creative" 2002 BiOp.[179] The ten-year plan was a deft way to push the problem as far into the future as possible by transferring the risks from upstream to downstream species in contravention to the mandates of the ESA. Under pressure, the National Marine Fisheries Service ultimately acceded to the 2002 BiOp, but with serious reservations.[180] NMFS was concerned primarily with the fact that because the Bureau had pushed the dates for full compliance with the target levels and flows to the end of the ten-year period,[181] "the mean flows for each water year type will decline toward the minimums that occurred during the reference period,"[182] which "is expected to increase the risk of extinction to Klamath Basin Coho Salmon"[183] and the many scientific uncertainties in the assumptions behind the opinion. Not surprisingly, courts found that the plan did not adequately protect the Coho and invalidated most of it.[184] To date, the downstream fisherman have not benefited from the decision; as previously mentioned, the 2006 Coho season was virtually eliminated because of low runs.

This is a familiar problem when courts apply the ESA to existing entitlements. A similar story occurred on the Missouri River. In 2002 the National Research Council issued a report calling for the development of a new flow regime on the river to protect endangered species and biodiversity generally.[185] NGOs won a major

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177. *Id.*

178. NATIONAL RESEARCH COUNCIL, THE MISSOURI RIVER ECOSYSTEM: EXPLORING PROSPECTS FOR RECOVERY (2002) (I was a member of the NRC committee that produced the report).

179. BR FINAL 2002 BIOLOGICAL ASSESSMENT, *supra* note 38.

180. NMFS 2002 BIOP, *supra* note 85.

181. *Id.* at 63.

182. *Id.* at 36.

183. *Id.* at 49.

184. See *infra* note 108.

185. NMFS 2002 BIOP, *supra* note 85 at 52-45.

decision compelling the United States Army Corps of Engineers to release more water in the spring and less in the summer to benefit a listed fish,[186] but the Department of Interior replaced the original team which issued the Biological Opinion which provided the support for the modified flow regime. A new opinion appeared, recommending against the original spring-summer release plan, and a federal district court upheld it.[187] The Missouri ecosystem is still at risk.

VI. CONCLUSION

The Klamath is a classic illustration of market underproduction to public goods.[188] Instead of long term solutions, those that emerge tend toward the negative state of affairs described by a leading Italian anti-Fascist diplomat in characterizing his objective in negotiating a post-World War I treaty between Italy and the newly created Yugoslavia: "that the causes of discontent should be equally divided between the two nations."[189] This may be the best that one can hope for among nation states, but ecosystem and biodiversity conservation require a more affirmative response if this laudable objective is to be realized.

The modification of the unsustainable status quo in the Klamath with institutions that recognize the value of the Basin's ecosystem services and encourage their production, by payments or legal duties, remains an unfulfilled aspiration in the Klamath. There are, however, some hopeful signs. The relicensing of Iron Gate dam has created a forum. The existence of entrenched property rights combined with a Bureau of Reclamation committed to supporting them to the maximum extent possible with the ESA creates powerful incentives not to seek a permanent solution built around ecosystem service provision. Litigation to compel stringent regulation or to prevent it remains the preferred mode of problem solving. Let us hope that in the twenty-first century, the real happy endings are not just in sports.

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186. South Dakota v. Ubbelohde, 330 F.3d 1014 (8th Cir. 2003).

187. *In re* Operation of the Missouri River Sys. Litig., 363 F. Supp. 1145 (D. Minn. 2004). *See* Sandra Zellmer, *A New Corps of Discovery for the Missouri River Management*, 83 NEB. L. REV. 305 (2004).

188. *See* MANCUR OLSON, THE LOGIC OF COLLECTIVE ACTION (Harvard Univ. Press 1971)(1965).

189. COUNT CARLO SFORZA, ITALY AND THE ITALIANS 86 (1949).

BROADENING NARROW PERSPECTIVES AND NUISANCE LAW: PROTECTING ECOSYSTEM SERVICES IN THE ACF BASIN

ROBERT HASKELL ABRAMS[1]

I. INTRODUCTION

The political stalemate among the neighboring states of Georgia, Alabama, and Florida over the cooperative management of the Apalachicola-Chattahoochee-Flint (ACF) River Basin has been chronicled in numerous articles in the past.[2] Along with the

1. Professor of Law. Florida A & M University College of Law. The author would like to thank several friends and colleagues for their helpful comments on drafts and for ideas that have found their way into this article. They are Pam Bush, Noah Hall, Zyg Plater, and J. B. Ruhl. The author also wishes to thank Nicolette Tsambis, FAMU College of Law, Class of 2008, for her research assistance and the Florida A & M University College of Law for the research grant that supported this work.

2. *See, e.g.*, Charles DuMars & David Seeley, *The Failure of the Apalachicola-Chattahoochee-Flint River Basin and Alabama-Coosa-Tallapoosa River Basin Compacts and a Guide to the Successful Establishment of Interstate Water Compacts*, 21 GA. ST. U. L. REV. 373 (2004); Carl Erhardt, *The Battle over "The Hooch:" The Federal-Interstate Water Com-*

neighboring Alabama-Coosa-Tallapoosa (ACT) River Basin, the ACF Basin was the subject of an interstate compact[3] in which the three states solemnly covenanted to agree to try to agree,[4] yet failed.[5] With efforts at negotiation effectively ended, the struggle over the uses of the ACF Basin has resumed unabated on the water[6] and in the courts.[7]

A river basin is a resource shared by many users. In Twenty-First century America, the ACF Basin can hardly be imagined to be an unregulated commons.[8] Nevertheless, many aspects of Garrett Hardin's famous description of "The Tragedy of the Commons"[9] apply. Existing regulatory controls do not consider basin-wide best interests. Rather, existing regulatory controls only con-

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pact and the Resolution of Rights in the Chattahoochee River, 11 STAN. ENVTL. L.J. 200 (1992); Douglas L. Grant, *Interstate Allocation of Rivers Before the United States Supreme Court: The Apalachicola-Chattahoochee-Flint River System,* 21 GA. ST. U. L. REV. 401 (2004); George William Sherk, *The Management of Interstate Water Conflicts in the Twenty-First Century: Is it time to call Uncle?* 12 N.Y.U. ENVTL. L. J. 764 (2005); Benjamin L. Snowden , *Bargaining In The Shadow Of Uncertainty: Understanding The Failure of the ACF And ACT Compacts*, 13 N.Y.U. ENVTL. L.J. 134 (2005); C. Hansell Watt, IV, *Who Gets the Hooch? Georgia, Florida, and Alabama Battle for Water from the Apalachicola-Chattahoochee-Flint River Basin*, 55 MERCER. L. REV 1453 (2004).

3. U.S. CONST. art. 1, § 10, cl. 3; Josh Clemons, *Interstate Water Disputes: A Road Map for States*, 12 SE. ENVTL. L.J. 115, 129-31, 137-39 (2004).

4. ACF Compact, Pub. L. No. 105-104, 111 Stat. 2219 (1997); ACT Compact, Pub. L. No. 105-105, 111 Stat. 2233 (1997).

5. In September 2003, Florida broke the ACF compact with Georgia and Alabama; in August 2004, Alabama halted negotiations for the ACT compact. J.B. Ruhl, *Water Wars, Eastern Style: Divvying Up the Apalachicola-Chattahoochee-Flint River Basin*, 131 J. CONTEMP. WATER RES. & EDUC. 47, 50 (2005).

6. *See, e.g.*, Press Release, Gov. Sonny Perdue, Moratorium on Water Permits for Flint River Basin to be Lifted (Mar. 11, 2006), *available at* http://www.gov.state.ga.us /press/2006/press1087.shtml (last visited June 13, 2006). *See also* Robert Abrams, *Georgia DNR Issues The Flint River Basin Regional Water Development and Conservation Plan: Moratorium on Farm Water Use Permits Lifted*, 1 E. WATER L. & POL'Y REP. 174 (2006).

7. Robert Abrams, *Eleventh Circuit Refuses to Enjoin U.S. Army Corps of Engineers from Taking Steps to Finalize Lake Lanier Water Supply Contracts*, 1 E. WATER L. & POL'Y REP. 22 (2006). *See also*, Alabama v. Corps of Eng'rs, 424 F.3d 1117 (11th Cir. 2005). Both the article and the Eleventh Circuit decision include a reasonable synopsis of the tri-partite litigation over the operation of the Chattahoochee River dams by the Corps of Engineers (Corps). The three strands of litigation were all brought in different federal jurisdictions. This Eleventh Circuit decision was brought by Alabama (joined later by Florida) against the Corps in Alabama federal court. A suit by Georgia was brought against the Corps in the Georgia federal court, and a suit by power producers was brought against the Corps in the District of Columbia federal court. On July 25, 2006, the United States District Court for the Northern District of Alabama denied a motion by Florida for an order requiring the Corps to maintain releases from the lowest dam in the system at 6,300 cfs until the date scheduled for release of the Fish and Wildlife Service biological opinion finding there had not been a "take" of an endangered species. Alabama v. Corps of Eng'rs, 441 F. Supp. 2d. 1123, 1124 (N.D. Ala. 2006).

8. A sampling of the laws affecting the basin includes the following: Federal Water Power Act of 1920, 16 U.S.C. § 791(a)-828(c) (2000); Fort Gains Project, Pub. L. No. 85-363, 72 Stat. 73 (1958); Rivers and Harbors Act of 1946, Pub. L. No. 79-525, 60 Stat. 634 (1946); Water Supply Acts, 43 U.S.C.A § 390 (2000).

9. Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243 (1968).

sider much narrower decisional criteria. Individuals and economic entities that use the ACF resourceplex, like Hardin's cow herds, remain encouraged to seek to maximize their beneficial use of the resource.[10] In a fragmented and incomplete regulatory regime, the naked self-help appropriation of the benefits that typify users of Hardin's unregulated commons is replaced by the effort to win those same benefit-internalizing and cost-externalizing outcomes in the regulatory forum. Therein lies the need for cumulative and cooperative interstate management.

At the Ecosystem Services Symposium, this point was well made by the presentations of both Professor Neuman and Professor Tarlock: fragmented or special interest-dominated management of a unitary resource will not achieve good long term results. In Professor Neuman's chronicle of Oregon's Tillamook State Forest, the political pressure of well-organized and self-interested constituencies undermines the power of a management agency having sufficient breadth of authority to sustainably protect ecosystem services.[11] Equally, in Professor Tarlock's description of the Klamath River Basin, the Bureau of Reclamation, an agency with its own mission-driven agenda and local constituency, cannot reliably manage a resource in a way that protects ecosystem services for the longer term,[12] particularly in the face of extreme interest group pressure and political opportunism on the part of the Bush administration.[13]

This Article will canvas parallel ground in relation to the ACF Basin. In addition, this Article will consider the usual mantra about why the legal deck appears to be stacked against the bottom of the basin where the principal benefits of the water are derived from the ecological systems that are supported by a more natural flow regime.[14] After that, however, the Article will explain how

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10. This simplistic behavioral assumption underpins a great deal of welfare economics. *See generally* ROBERT COOTER & THOMAS ULEN, LAW AND ECONOMICS 3 (3d ed. 2000). Those assumptions are not a perfect reflection of human motivation and behavior, but they are a sufficiently accurate generalization to have predictive and descriptive utility.

11. *See* Janet Neuman, *Thinking Inside the Box: Looking for Ecosystem Services Within a Forested Watershed*, 22 J. LAND USE & ENVTL. L. 173 (2007).

12. *See* A. Dan Tarlock, *Ecosystem Services in the Klamath basin: Battlefield Casualties or the Future?*, 22 J. LAND USE & ENVTL. L. 209 (2007).

13. *See, e.g.*, Tom Hamburger, *Water Saga Illuminates Rove's Methods; Bush Strategist Works Agencies in Bid to Make Policy Decisions Jibe with Political Goals*, WALL ST. J., July 30, 2003, at A4.

14. The upstream/downstream dichotomy is frequently going to dictate the power of a state to unilaterally impose its decisions on a neighbor. States abutting lakes or rivers also may find the actions of their neighbor incompatible with their desired use of the waterbody. *See* discussion of interstate lake pollution *infra* Part III.B. Upstream effects are relatively rare, but the movement of fish in an interstate stream might give the upstream state a claim. *See infra* Part III.B. Also, in the west, where priority of use plays so prominent a role in the fabric of water allocation law, an upstream state could be the later developing

the greatly expanded understanding of ecosystem services that has come about in recent decades can be a counterweight to insular decisionmaking. The legal vehicle for that transformation is interstate public nuisance and the core principles of state sovereignty that it enables. Neither of two late twentieth century developments, preemption by comprehensive federal water pollution control legislation nor a change in equitable apportionment doctrine, are sufficient to contradict that conclusion.

II. DECISIONS REGARDING THE ACF BASIN

As a highly simplified matter, the ACF Basin has three distinct parts. In the north and west, the features of greatest consequence are the Chattahoochee River and the two major United States Army Corps of Engineers (Corps) dams on its mainstem that control the river's flow. The upstream Burford Dam, that forms Lake Lanier in proximity to the metropolitan Atlanta area, is a flashpoint for efforts to influence how the Corps manages both the lake levels and the timing of its releases. The parties most ardently contending for the Corps' favor are Atlanta and nearby municipalities, hydroelectric power providers, and users in Alabama and Florida far downstream who rely on ecosystem services and related benefits that the river has historically been available to provide. The Corps' operations at dams lower on the Chattahoochee River have more recently become a focus of debate.

The second distinct part of the ACF system is its east and central feature, the Flint River, that flows southward through central Georgia and then turns west to join the Chattahoochee River and form the Apalachicola River at the border with Florida and Alabama. This rural central Georgia region is dominated by irrigated agriculture that depends on direct withdrawals from the Flint River and, increasingly, on pumping hydrologically connected groundwater. The irrigation increases agricultural yields. Historically, the Flint River is responsible for somewhat more than forty percent of the basin's summer flow. In this part of the basin, the regulator is the Georgia Department of Natural Resources Environmental Protection Division (EPD) which is charged with permitting responsibilities for withdrawals of water.[15] The contestants seeking EPD's favor in this context are the mid-Georgia farmers and the environment, both the riparian environment in the Flint Basin and downstream, as the Apalachicola flows through

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state and face a claim that the water is already committed to downstream use. *See* discussion of the Vermejo River cases *infra* Part III.C and note 97.

15. *See* discussion *infra* Part II.C and notes 47-48.

Florida to sustain the river's delta and the estuarine environment of Apalachicola Bay in the Gulf of Mexico.

The third distinct part of the system is the Apalachicola system. That river meanders through the ecologically rich Florida panhandle and then provides critical freshwater flows into the Apalachicola bay. This is a sparsely populated region rich in scenic beauty. Economically, this region derives its benefits directly from the ecosystem services—literally harvesting some of them by oystering, but also by taking advantage of the beauty to promote tourism and recreational water use.

With three so distinct features, and with a geopolitical posture spanning three states having differing relationships to the resourceplex, the decision of how the ACF Basin should be used is a source of conflict. There have been serious efforts by the three states to manage the basin as a whole by interstate compact. Both preceding that effort and in its wake are actions by the Corps on the Chattahoochee and the EPD on the Flint that are determining the uses made of the basin's waters.

A. *Interstate Compacts as a Mechanism for Comprehensive Basin Management*

In the ACF basin, the comprehensive management story is no better than in most basins; some might contend it is worse. Early in the 1990s, the ACF dispute became heated when the Corps indicated it would try to make permanent a decade old temporary practice of providing excess water to Atlanta area water agencies to increase municipal supply.[16] Alabama and, shortly thereafter, Florida, made legal objections.[17] Georgia intervened on the side of the Corps and the case promptly moved from court to the negotiating table.[18] The negotiations were protracted, lasting more than a decade. The negotiations were carried out in good faith, as evidenced by the unusual step that the parties took. They entered into an interstate compact, the purpose of which was to work out an agreed allocation of the basin's waters.[19] Eventually, the states failed to agree as hoped and the allocation issue returned to the courts.[20]

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16. This history is recounted in Georgia v. U.S. Army Corps of Eng'rs, 302 F.3d 1242, 1246-49 (11th Cir. 2002).

17. The history of this branch of the litigation is best set out in Alabama v. U.S. Army Corps of Eng'rs, 424 F.3d 1117, 1121-23 (11th Cir. 2005).

18. Memorandum of agreement between Alabama, Florida, Georgia, and United States Army, Jan. 3, 1992.

19. ACF Compact, Pub. L. No. 105-104, art. I, 111 Stat. 2219 (1997).

20. The Compact was terminated on September 1, 2003. At that time, the sovereign

In the ACF Basin, the chance for a holistic view of the basin as the foundation for management died with the failed ACF Compact (Compact). In fact, as is the case in most shared basins over which there is a significant degree of interstate competition for the water, the chances for holistic management were slight even before the Compact failed. As the desired endpoint of the effort was quantified allocation in the ACF, the chances for comprehensive management had been diminished by the Compact itself, which simply referred to its intent as follows: "to develop an allocation formula for equitably apportioning the surface waters of the ACF Basin among the states while protecting the water quality, ecology and biodiversity of the ACF . . . ."[21] Had a water allocation of the kind the Compact contemplated been achieved, a simple division of the available water, the Compact would not have managed the basin's water in a comprehensive or holistic fashion.[22] Florida understood that mere allocation was inadequate from its perspective. David Struhs, Secretary of the Florida Department of Environmental Protection, was quoted as saying, "Florida was unable to accept only minimum flows, plus whatever else the upstream states were not able to consume or store. This would place too great a risk on one of the most naturally productive rivers and bays in the United States."[23]

Simple water allocation, almost invariably, is the enemy of well-coordinated basin management. Allocation quantifies rights and obligations in each of the party states. States treat their allocation as an insular umbrella of entitlement under which a state's water users operate in relative isolation from concerns relating to the sustenance of the larger resource.[24] As long as delivery obligations are the defining element of the compact, the upstream state has no economic self-interest or legal obligation to maximize the benefits downstream. Rather, a fairly predictable scenario would be for an upstream state to regulate its use to provide water toward its downstream delivery obligation in low demand seasons (typically October through May)[25] and restrict the water released

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protagonists returned to the court trying to legally constrain the Corps' choices.

21. ACF Compact, art. VII, 111 Stat. at 2222-23.

22. *Cf.* DuMars & Seeley, *supra* note 2, at 374-75 (describing the variety of delivery obligation clauses present in interstate compacts).

23. *Florida to take Georgia, Alabama to court over water rights*, U.S. WATER NEWS ONLINE, Sept. 2003, http://www.uswaternews.com/archives/arcrights/3floto9.html.

24. Robert H. Abrams, *Secure Water Rights in Interstate Waters*, *in* WATER LAW: TRENDS, POLICIES, AND PRACTICE, 330, 331-334 (Kathleen Marion Carr & James D. Crammond, eds. 1995); Robert Haskell Abrams, *Interstate Water Allocation: A Contemporary Primer for Eastern States*, 25 U. ARK. LITTLE ROCK L. REV. 155, 169-70 (2002).

25. In the Flint River portion of the ACF Basin, the irrigation season is April through September. *See* discussion *infra* Part II.C and note 47.

to flow downstream in high demand seasons. In many cases, as in the ACF, the high demand season is the summer growing season is also the hydrologic low flow season. In that scenario, the upstream state maximizes its benefits by reducing flow by the greatest amount when the river's hydrograph is already at a low flow stage.[26] This is rational management under an annual delivery obligation, but poor management of the resourceplex.

Two compacts have departed significantly from a simple delivery obligation allocation model: the Delaware River Compact[27] and the Susquehanna River Compact.[28] These two compacts give the compact commission broad regulatory powers that allow for basin management and coordination of activities in the signatory states to best serve the larger interests of the basin. In the Delaware River Compact, the managerial power is coordinated with the central allocational principles that, in a very general way, balance New York City's water supply interests against the remaining basin uses. Nevertheless, the power of the Delaware River Basin Commission (DRBC) has provided numerous opportunities for basinwide benefit maximizing projects and policies.[29]

An example of the DRBC at its best was its response after a record drought in the 1960s eclipsed the drought of 1929-33.[30] This earlier drought had served as the previous basis for the maximum diversions and minimum releases from New York City's Delaware Basin reservoirs that were established by a Supreme Court decree in 1954.[31] Through the 1960s drought and subsequent dry periods, the Commission provided a forum for the basin states and New York City to negotiate a series of ad hoc reductions to the out-of-basin diversions accorded New York City and to the minimum flows it was required to maintain in the main stem Delaware River at Montague, New Jersey.[32]

In the late 1970s, the Commission convened the Decree Parties, including the four basin states and New York City, for intensive good faith negotiations to improve interstate water management in the basin, particularly during drought. Over a period of three years, the parties reached a set of consensus recommenda-

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26. See the ACF Basin Flow Appendix for a figure that depicts the Flint River annual hydrograph, http://waterdata.usgs.gov.

27. Delaware River Basin Compact, Pub. L. No. 87-328, 75 Stat. 688 (1961).

28. Susquehanna River Basin Compact, Pub. L. No. 91-575, 84 Stat. 1509 (1970).

29. The details enumerated in the examples of DRBC functioning that follow were provided to the author by Pamela M. Bush who currently serves as Secretary and Assistant General Counsel of the Delaware River Basin Commission [hereinafter *Pamela M. Bush Testimony*].

30. *Id.*

31. *See* New Jersey v. New York, 347 U.S. 995, 995-1002 (1954).

32. *Pamela M. Bush Testimony*, *supra*, note 29.

tions, including a set of drought operating curves, which, with the benefit of incremental tweaks in later years, called for stepped down diversions by both New York and New Jersey and proportional reductions in the Montague flow target during conditions defined as "drought watch," "drought warning" and "drought." With the consent of the Decree parties, these curves were adopted as regulations by the DRBC in 1982. Since then, objective indicators trigger certain reductions automatically, enhancing the dependability of Delaware Basin water supplies by conserving water in the City's drinking water reservoirs while simultaneously protecting downstream uses. Other good faith recommendations enacted as DRBC regulations allow the Commission to draw on private power company reservoirs and state and federal multipurpose reservoirs to augment Delaware River flows in order to repel salt and protect water supply intakes in the Delaware Estuary and Bay, while also allowing New York City to maintain adequate water levels in its reservoirs.

The Commission is not rooted in place; instead, it adapts its management to changing understandings of the basin's cumulative best interest. For example, the Commission acknowledged and responded to a steadily increasing demand by the public for instream flows to protect ecological and recreational uses by adaptively managing the water resources. Flows were increased to meet the needs of aquatic life and the demands of anglers, boaters, and other recreational users that are now deemed a vital management objective, although such needs were not contemplated by the Supreme Court when it apportioned the waters of the Delaware River fifty years ago.[33]

In this endeavor, the DRBC has reached out to embrace new partners. For example, a key advisory subcommittee on Ecological Flows, created in 2003 to advise DRBC's Regulated Flow Advisory Committee, is chaired by a Nature Conservancy staffer. Similarly, the Delaware River Foundation, a group comprised of fishing guides and others whose livelihoods depend upon the cold water fishery created by New York City's reservoir releases, is a key partner in defining the shortcomings of past release regimes and in proposing alternatives. Through the Commission's advisory committees and other collaborations, DRBC is building a common base of knowledge and consensus in the Basin community on such vital topics as the need for additional storage. A study is underway for expanding two of the New York City reservoirs, while a sophisticated flow model is shared by participants to test different

33. *See* New Jersey v. New York, 347 U.S. 995 (1954).

release scenarios for operating the existing reservoirs. The study results will provide the basis for instituting improved release regimes in the future. This process exemplifies the ability of an institution like the DRBC to continually assimilate new information and participants, to coordinate the activities of these participants, and to generate multiple alternative solutions to water resource problems.

Taking a step back and comparing the DRBC to the more typical allocation compact commission, it is evident that the DRBC atypically approaches its basin without allocation as its mantra. Part of its success in this regard is attitudinal—the Commission has always operated as a regional manager, not a commission made up of state players representing their individual interests under a fixed allocation. No doubt there are functional management imperatives, such as maintaining an adequate supply of water for New York City. Nevertheless, the DRBC has been able to honor those real-world water supply imperatives, the Commission while also establishing multi-state basinwide benefits as its goal. No one successfully championed this sort of basin management structure for the ACF.

B. "Management" by Mission-Driven Agencies

Throughout the compact process in the ACF basin, the Corps continued to manage the Chattahoochie basin according to its own plans for operations with little fanfare. Perhaps the parties believed that the compact process would effectively supplant the Corps' role in water allocation by making it subordinate to the compact agreement.[34] Whatever may have transpired in the wake of a successful compact allocation, with the failure of the ACF Compact, the Corps was again front and center.

The Corps, in addition to controlling the operation of the largest dams in the system, also controls the award of many of the sys-

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34. The ACF Compact in Article X(c) addressed the relationship to other laws and the Corps' dam operations. The Compact, due to congressional ratification, enjoys the status of federal legislation. It states that the Corps and other federal agencies, "to the maximum extent practicable, shall exercise their discretion in carrying out their responsibilities, powers, and authorities over water resources in the ACF Basin and water resource facilities in the ACF Basin in a manner consistent with and that effectuates the allocation formula developed pursuant to this Compact." What that language did not do is change the mandates of the federal laws that govern Corps operations in the basin. In practical effect, the language of that provision removed most of the Corps' discretion to allocate excess water, but did not change its obligations in managing for statutory purposes of power generation and flood control, for example. The Compact would not have taken fights about Corps' decisionmaking out of the equation, but it would have limited the contests among the states in that regard. ACF Compact, Pub. L. No. 105-105, 111 Stat. 2233, 2239-40 (1997).

tem's water benefits among the competing resourceplex users. The Corps' operation of its dams not only affects the upstream-downstream distribution of benefits, but also mediates competing claims to upstream benefits. Cities want the Corps' dams operated to ensure them of secure and increased water supply as a primary goal and of summer flat-water lake-based recreation as a secondary goal. That management regime is, to a considerable degree, in conflict with the interests of hydropower producers whose generation opportunities are directly impacted by the withdrawal of water for municipal use from the system that bypasses the outlet dams. Power producers are also affected by the timing of releases from the Corps' dams and by the holding of water as a hedge against drought. In a somewhat oversimplified view, that conflict has three prongs: diversion, storage, and timing. The power producers on the Chattahoochee River desire to have all of the water in reservoirs released through the dams. They want substantial releases in the summer, which is their period of peak demand, and at other times the power producers want reliable releases so that they can plan their mix of power sources efficiently. The cities want some of the water diverted from the reservoirs for municipal use. For those diversions the return flow, if any,[35] would be released below the dam. The cities, consistent with prudent flood control, also want Lake Lanier kept as full as possible. This gives them a hedge against future droughts and, concurrently, maximizes recreational opportunities for the inhabitants of the metropolitan region.

The Corps' decision regarding municipal diversions, timing, and releases, flows downstream to the ACF Basin's other users. The resultant operating regime, to whatever degree it favors the cities, is likely to be suboptimal for other users whether it is the hydropower suppliers, the irrigators in the middle of the basin, or those who benefit from summer freshwater fisheries. Still other users, such as the oystering community in Apalachicola Bay, who require the river to retain its natural flow patterns, are likely to suffer losses when the Corps operations do not mimic natural

35. In a national trend, more and more sewage effluent is being reused for landscape and golf course irrigation rather than being returned to the rivers. There are a number of benefits to this practice. On the quantity/supply side, (1) the treated effluent is substituted for additional withdrawals of groundwater or surface water and (2) the water is being substituted for more expensive potable water deliveries. On the quality side, even though treated, the sewage effluent is, in most cases, of lower quality than the receiving body quality, especially in regard to nutrients. This is a significant problem in many riverine environments. *See, e.g.*, Ariz. Pub. Serv. Co. v. Long, 773 P.2d 988 (Ariz. 1989). *See also, e.g.*, G. Oliver Melgar, *Sewage Effluent Happens: But Who Has the Right to Its Beneficial Use?*, 24 J. LAND RESOURCES & ENVTL. L. 587 (2004); Robert Abrams, *Northeast Florida Increases Residential Irrigation with Treated Sewage Effluent*, 1 E. WATER L. & POL'Y REP. 167 (2006).

flows. If, however, the Corps operated the dams on a pass-through basis, mimicking the natural hydrograph (other than to prevent major flooding), the cities and power producers would be harmed. In that way, the Corps is a de facto river basin manager.[36] The Corps, acting pursuant to its legal authority, decides who gets to use the water at what time and thereby imposes external costs on the loser of the allocation contest.

The Corps enjoys several layers of authority when it operates the dams under its control. The first layer is dam-specific, that is, every dam has legislation that authorizes it and specifies the purposes for which the dam is to be operated, or the program of which the dam is a part, which in turn will have program purposes that attach to the dam by reference. For example, on the Chattahoochee, Buford Dam that forms Lake Lanier was authorized by the Rivers and Harbors Act of 1945.[37] That legislation effectively designated flood control and hydroelectric generation as the sole purposes for the dam.[38] The legislative history and the report of Lt. Gen. R. A. Wheeler, Chief of Engineers that described the rationale for the dam, indicated that downstream navigation in the Apalachicola River and municipal water supply for Atlanta were adjunct benefits of the dam, but "Congress gave no priority to the use of Lake Lanier's waters for such purposes," nor were any of the costs of the project allocated to either of those purposes.[39] That mandate was supplemented by more general authority granted to the Corps by the Water Supply Act of 1958[40] and, possibly, the Flood Control Act of 1962.[41] The Water Supply Act expressly allows the Corps to reallocate water under its control to municipal supply. However, congressional authorization is required if the

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36. The Corps has painful experiences of being cast in that role. *See* Sandra B. Zellmer, *A New Corps of Discovery for Missouri River Management*, 83 NEB. L. REV. 305 (2004); *see also* JOSEPH SAX, ET AL., LEGAL CONTROL OF WATER RESOURCES 87-97 (4th ed. 2006) [hereinafter SAX, LEGAL CONTROL].

37. Act of July 24, 1946, ch. 595, 60 Stat. 634.

38. *See* George William Sherk, *The Corps' Conundrum: Reconciling Conflicting Statutory Requirements in the ACF River Basin*, PROCEEDINGS OF 2005 GA. WATER RESOURCES CONF.,U. GA. 1 (Apr. 25-27, 2005), *available at* http://www.uga.edu/water/GWRC/Papers/SherkJ%20Corps%20Conundrum.pdf [hereinafter Sherk, *Conundrum*].

39. *Id*. at 2.

40. 43 U.S.C. § 390b (2000).

41. Pub. L. No. 87-874, § 203, 76 Stat. 1173, 1182 (1962). The Flood Control Act of 1962 served as authorization for the West Point Dam which sits downstream of the Buford Dam and has no direct application to Buford Dam. The shared flood control purpose can, accordingly, be served by coordinated management of the two dams. The ambiguity here is that the portion of the 1962 legislation authorizing the West Point Dam also gives a high priority to fish, wildlife, and recreational use of West Point Lake. Jerry Sherk argues that this later-in-time authority favoring fish, wildlife, and recreation values downstream limits the Corps' discretion in managing Buford Dam to favor other purposes. Sherk, *Conundrum*, *supra* note 38, at 3.

reallocation "[W]ould seriously affect the purposes for which the project was authorized . . . [or] involve major structural or operational changes"[42]

With the Corps operating pursuant to that framework, the efforts to manipulate the water outcomes by "winning" with the Corps come into clearer view. Atlanta, needing increased municipal supply, obtained it first by receiving temporary allocations which the Corps did not believe met the threshold for requiring congressional approval as a reallocation due to their temporary, albeit recurrent, nature. When Atlanta municipalities wanted to further increase the amount and make the source secure, it triggered the 1989 determination of the Corps that it was time to seek congressional authorization to reallocate storage space in Lake Lanier for municipal and industrial water supply. This would allow the Corps to enter into the proposed water storage contracts with local water supply providers. That choice by the Corps provoked the two losers in the process, the hydropower producers and the downstream states, to take action (litigation) to try to force a different outcome than the one that the Corps had selected as its plan for the Basin's waters.

What matters here is not the wisdom of the Corps' decision. Rather, the importance rests with what factors the Corps was legally required to consider, legally permitted to consider, and what factors it was legally required to ignore. Arguing for the narrow view, the Corps has its mission prescribed for it by Congress and can manage the resource only for the explicit statutory purposes relating to Buford Dam, flood control, and hydropower. That management does not consider the downstream effects. Even under the Water Supply Act, the calculus is whether there is water surplus to the authorized purposes of the dam in question that can be allocated to municipal supply. Again, that decision takes no account of downstream effects.[43] It is possible to argue somewhat

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42. 43 U.S.C. § 390b(d) (2000).

43. Colonel Bob Keyser, one of the Corps key players in the ACF management, espoused a broad view of the Corps' sense of its role and authority. He stated at the Appalachicola-Chattahoochee-Flint River Basin Stakeholder's Meeting, held December 5, 2002 in Columbus, GA, on ACF issues facing the Corps:

> I'm sure you all have heard before the seven purposes to the ACF system, seven authorized purposes: navigation, hydropower, fish and wildlife, flood control, recreation, water supply, water quality…And I daresay that everybody in this room has got a claim to the water in the ACF system for one of those purposes…My job is to balance all those seven purposes and the needs of everybody that's in this room, realizing a lot of those are competing interests a lot of times.

Transcript of the Appalachicola-Chattahoochee-Flint River Basin Stakeholder's Meeting,

formally that the National Environmental Policy Act of 1969 (NEPA) mandates the Corps to evaluate downstream environmental effects in the decisional process leading up to seeking legislative authorization for reallocation to municipal supply.[44] That is part of the literal command of NEPA, but that law has been authoritatively interpreted to have no substantive impact.[45] The ecosystem services in the bottom of the basin, even if studied by the Corps, are not meaningful contenders for water allocation when the Corps manages the Buford Dam and effectively determines the largest component of the flow regime on the Chattahoochee River.[46]

C. Management by Single-State Authority

The Corps is not alone as a de facto resourceplex manager in the ACF Basin. The Georgia Environmental Protection Division of the Georgia Department of Natural Resources (EPD) is given primary control in the administration of Georgia's waters including both surface water[47] and groundwater.[48] EPD permits are required for water withdrawals for industrial, municipal, or agricultural use that have the capacity to exceed 100,000 gallons per day.[49] Thus, EPD has the power to control irrigation and other uses of Flint River water and hydrologically connected groundwater from the Floridan Aquifer.

The mutually reinforcing combination of drought and increased irrigation activities by Flint River Basin farmers thrust EPD squarely into the middle of Flint River management. A severe drought that began in 1998 prompted all existing water with-

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11-12 (Dec. 5, 2002), *available at* http://www.sam.usace.army.mil/briefings/ACT-ACF/ACFMtg12-05-02Transcript.pdf.

44. National Environmental Policy Act of 1969, Pub. L. No. 91-190, 83 Stat. 852 (codified as amended at 42 U.S.C. §§ 4321-4361 (2000)). Proposals for legislation are agency actions that require an Environmental Impact Statement. 42 U.S.C. § 4332(C) (2000). Subsection (v) of that provision further makes clear the timing of the EIS is such that it "shall accompany the proposal through the existing agency review processes." *Id.*

45. Somewhat unhelpfully in this setting, NEPA insists that the Corps consider alternatives that can ameliorate adverse environmental effects, but section 105 of NEPA, 42 U.S.C. § 4335 (2000), makes NEPA's policies and goals "supplementary to those set forth in existing authorizations" has not been construed in a substantive manner that would grant the Corps authority to allocate water to environmental purposes.

46. The one exception to this statement is the requirements imposed on the Corps by section 7 of the Endangered Species Act. 16 U.S.C. §§ 1531-1544 (2000). A recent effort to control Corps' action on that basis has, thus far, failed. *See* Alabama v. Corps of Eng'rs, No. CV-90-BE-01331-E, 2006 WL 2106991 (N.D. Ala. July 25, 2006). *See* discussion *infra* Part II.C.

47. Georgia Water Quality Control Act, GA. CODE ANN. § 12-5-20 to -53 (2006).

48. Ground-water Use Act of 1972, GA. CODE ANN. § 12-5-90 to -107 (2006).

49. GA. CODE ANN. § 12-5-31(a)(1)(A) (2006) (surface water); § 12-5-96 (a)(1) (2006) (groundwater).

drawal permit holders to begin using maximum amounts and generated a veritable flood of new groundwater irrigation permit applications. Most of the groundwater being sought in the new permits was to be pumped from areas of the Floridan Aquifer that produce large amounts of tributary groundwater that constitute the base flow of the Flint River. Even before most of the permit applications were considered, already permitted withdrawals of ground and surface water began to dry up segments of the Flint River, particularly in the southern reaches of the basin. Already existing models and studies that had been conducted up to that time predicted "a severe impact on the Flint River and some of its tributaries under conditions of drought and increased irrigation withdrawals from the Floridan aquifer."[50] As a response, the Director of EPD, on October 23, 1999, invoked statutory authority to develop the Flint River Basin Regional Water Development and Conservation Plan (Flint Plan),[51] to study the basin and set operating parameters for EPD in its permitting activities.

Announcing the Flint Plan had a paradoxical short-term effect as it significantly increased irrigation withdrawals because of the permit rush it engendered.[52] In basins subject to such a plan, permits issued for twenty-five years or more, which include farm use permits, can only be issued in accordance with the plan. The announcement that there would be a Flint River Basin Plan sparked an immediate spike in permit applications of would-be-irrigators hoping to get a permit that would not be subject to whatever restrictions the Flint Plan called on EPD to impose. Approximately 1,500 such applications were received between October 23 and the end of November, 1999, and were acted upon under the old standards for permits during the following year.[53] EPD thereafter responded to the continuing application rush with a moratorium, indicating it would process no new permit applications received after December 1, 1999 until after the entire study of the basin and a plan for its acceptable management could be completed.[54]

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50. GA. DEP'T OF NATURAL RES. ENVTL PROT. DIV., FLINT RIVER BASIN REGIONAL WATER DEVELOPMENT CONSERVATION PLAN 37 (2006), http://www.gadnr.org/frbp/Assets/Documents/Plan22.pdf [hereinafter FLINT PLAN].

51. *See* GA. CODE ANN. § 12-5-31(h) (2006) (surface water); GA. CODE ANN. § 12-5-96(e) (2006) (groundwater).

52. The Flint Plan does not give a figure for how much water was involved only the number of such permits which represents at least a seven percent increase in the number of permitted withdrawals.

53. EPD believed that many of those applications were duplicates; they eventually acted upon 900 such applications during the next year. FLINT PLAN *supra* note 50, at 39-41.

54. FLINT PLAN *supra* note 50, at 39. Since the moratorium, 1,134 permits have been "backlogged" representing requests to irrigate an additional 95,000 acres. *Id.* at 30, 41.

Basinwide on the Flint there is some mix of uses, but the real subject of the Flint Plan is irrigation and that concern dominates over all others. Municipal and industrial (M&I) uses are few. In the less stressed northern part of the basin "permitted [M&I] use is substantially less than agricultural water use."[55] In the critical southern part of the basin, "[T]otal M&I withdrawals represent less than 3% of agricultural irrigation withdrawals . . . [and] their cumulative impact on stream-aquifer flux and the regional groundwater budget is negligible."[56]

The Flint Plan is a good effort in some regards. It is replete with carefully developed data. As reports of this kind go, the EPD Flint Plan is more transparent than most.[57] It acknowledges that it is trying to find a decision matrix that allows the maximum economic development consistent with acceptable levels of adverse ecological impacts.[58] As it considers setting the maximum allowable withdrawals, the Flint Plan indicates cognizance of legal restraints imposed by (1) the federal Endangered Species Act,[59] (2) the federal Clean Water Act,[60] (3) property rights of riparians as recognized by Georgia's regulated riparianism regime, and (4) property rights related to Georgia's groundwater law.[61]

The Flint Plan, however, is not a balanced document. It sets as its regulatory goal the maximization of agricultural productivity from irrigation use of water consistent with maintaining the minimum amount of water in the river necessary to avoid illegal breaches of ecological protection responsibilities.[62] The Flint Plan is candid. For example, the Flint Plan anticipates that its regulatory choices regarding past and future permitting in the most stressed regions of the Flint Basin will over-allocate the available water in low flow years with an adverse effect on the mussel populations and the Gulf striped bass population.[63] Even so, rather

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55. *Id.* at 95.

56. *Id.* at 96.

57. The Flint Plan describes its methodologies carefully and, when methodological tradeoffs (e.g., expected cost of better data versus expected value of better data) are made, the Flint Plan notes them and what assumptions, if any, are used to address issues that the added data may have disclosed.

58. FLINT PLAN *supra* note 50, at 41-42. Perhaps hinting at how the balance might be tilted, Section 1.3, entitled "Conservation, development, and ecologic sustainability" begins that "An important aspect of this Plan is to consider the economic impact of any actions that would affect agricultural irrigation. Agriculture in Georgia is a $9.9 billion industry, and $1.9 billion of that is derived from agriculture in southwest Georgia..." *Id.* at 41.

59. 16 U.S.C. §§ 1531-1544 (2000).

60. Federal Water Pollution Control Act, 33 U.S.C. §§ 1251-1387 (2000).

61. FLINT PLAN *supra* note 50, at 42-44.

62. *Id.* at 52.

63. *See id.* at 51-52 acknowledging (but not reducing) "the amount of water *currently* withdrawn for agricultural irrigation in drought years increases both the magnitude and duration of low flows in streams of the FRB, thus further harming endangered species and

than limit additional permits, the Plan opts to rely on the Flint River Drought Protection Act,[64] under which the state must purchase forbearance from permit holding agricultural users to maintain critical stream flow.[65] Apart from being a bit of a fiscal albatross, the Flint River Drought Protection Act is unfunded and thus requires explicit legislative action to appropriate the money. Moreover, there is a chance that the statute will be inoperative in any year in which the severity of the drought is not foreseen before March 1, the date that marks the beginning of the spring planting season.[66] On the positive side, permits issued after the Plan is in place will require farmers to use conservation measures during periods of water shortage, but most of the water will already be allocated under pre-Plan permits that, together, already over-allocate water in times of shortage.[67]

Given the state of affairs in the basin in low flow years, the Flint Plan treatment of the Endangered Species Act appears inadequate. There are four fresh water mussels and one species of gulf sturgeon found in southwest Georgia that are listed by the United States Fish & Wildlife Service (FWS) as endangered.[68] When it estimates costs of its alternatives, the Flint Plan describes very considerable impacts of the combination of drought and low flow that it will permit. Freshwater mussel populations in six separate stream stretches will suffer fifty to one-hundred percent die-offs.[69] The Flint Plan is clearly not the sort of approach that the FWS had in mind. The portion of the FWS website relating to

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potentially limiting the amount of water available for all users." *See also*, *infra* text accompanying note 74 (discussing striped bass fishery).

64. GA. CODE ANN. § 12-5-540 (2006).

65. In two past low flow years the state paid roughly $10 million to prevent permitted irrigation in the lower Flint Basin. These payments to the farmers combine with the fact that the irrigation is, in part, driven by crop subsidies. *See* discussion *infra* Part II.C.

66. This was the case in 2006 when a failure to appreciate the onset of drought led to passage of the March 1st date by which the Flint River Drought Protection Act could be triggered. In relation to the watering bans, put in statewide in response to the drought, Nap Caldwell, a senior EPD water planning and policy advisor, was paraphrased as having said, "Although the Flint River drainage basin uses the lion's share of water in the state, it's too late to trigger additional restrictions on farmers there this year." S. Heather Duncan, *State Restricts Outdoor Water Use: Drought Level One Means No Watering From 10a.m.-4p.m.*, MACON TELEGRAPH, June 22, 2006, *available at* http://www.macon/com/mld/macon/news/local/14872944.htm.

67. As a mixed metaphor, this is tantamount to closing the barn door after the river is dry.

68. *See* ACT ACF Water Issues, Georgia Ecological Service, http://www.fws.gov/athens/rivers/ACT_ACF.html (last visited June 10, 2006) [hereinafter ACT ACF].

69. FLINT PLAN *supra* note 50, at 70. Fifteen to fifty percent die offs are expected at another five locations. The Plan does not identify which species are involved. Thus, it is not certain on the face of the Flint Plan that listed species are the ones affected, but it is likely that the most stressed existing populations (i.e., the listed species) will be further affected by increased dewatering of the river.

listed species in the region, under the heading of "Solutions," states as follows:

> In order to protect the biodiversity of the [ACF and ACT] basins, the water allocation formulas should:
>
> - Minimize departures from natural flow regimes.
> - Allocate water for recognized near-term uses.
> - Include federal reservoir operations guidelines in the formulas.
> - Maintain and improve water quality.
> - Monitor water use allocations, reservoir operations guidelines, and their effects on resources.[70]

The Flint Plan is not on the same page.

For a rather telling comparison of the gravity with which ESA issues are approached by various actors in control of the ACF's waters, the Corps is aware that its dam operations can affect spawning of the gulf sturgeon. In Spring 2006, a year that was already behind on rainfall and in which Corps' reservoir levels heading into summer were low, the Corps operated its dams on a largely pass-through basis to ensure adequate water downstream to facilitate sturgeon spawning.[71] That action prevented the reservoirs from being as full as possible heading into summer. Georgia Governor Sonny Perdue commented, "I don't think Congress or the public intended increasing the sturgeon population by seven in the Apalachicola Bay should trump the drinking water needs of an entire metro population."[72]

Returning to the Flint Plan, its elaborate economic analysis is more justificatory than objective. When it measures benefits and costs it takes a wholly intrastate view. As a political and mission-related matter, it is understandable that EPD is most concerned about the effects of its plan on Georgia and its citizenry. Neverthe-

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70. ACT ACF *supra*, note 68.

71. *See* Robert Abrams, *The Long Hot Summer Starts Early: Low Water, Endangered Species, and Congressional Posturing Usher in the Season on the Chattahoochie River*, 1 E. WATER L. & POL'Y REP. 196 (2006).

72. The Governor apparently was referring to the fact that as few as seven sturgeons were observed in the breeding areas. *See* Stacy Shelton, *Anxiety Over Lake Lanier and Beyond - High and Dry?*, ATLANTA J.-CONST., June 8, 2006, at A1, *available at* http://infoweb.newsbank.com/iw-search/we/InfoWeb (search "anxiety over lake Lanier" in "2006"; then follow the only hyperlink under results) (last visited Aug. 8, 2007). For data on the levels in the reservoirs, *see* Jerome Thompson, *Downstream Doings,* ATLANTA J.-CONST., June 8, 2006, A1.

less, ignoring downstream costs of low flows and downstream benefits of higher flows is not a proper way to conduct benefit-cost analysis.

As a further point of imbalance, the cost accounting was not conducted in the same way as the benefit accounting. Benefits were monetized and, as seen below, inflated by questionable assumptions; costs are described only in narrative terms with no effort to quantify their impact either in economic or resource values. The concept of ecosystem services plainly is not in evidence.

The Flint Plan notes that quite significant mussel die-offs have occurred in some stream stretches and are directly attributable to pumping at pre-moratorium irrigation levels.[73] It then goes on to note that further mussel die-offs will ensue, but makes no estimate of their magnitude. It does not state whether the mussel species affected are those that are listed as endangered by the FWS, nor does it make an effort to quantify the loss in economic terms. The positive effect of the mussels on water quality is not mentioned or even compared to the cost of typical M&I filtration to accomplish the same result. The gulf striped bass discussion is only a little better. A reader of the report can infer that the striped bass population in the lower Flint is already stressed at current withdrawal levels as evidenced by the fact that the population is sustained at recreationally valuable levels in the region by stocking. The report then explains that additional aquifer withdrawal permits will deprive the bass of thermal refuges in the vicinity of surrounding "blue-holes" of aquifer discharge that provide cooler water temperatures without which the bass "stop feeding and die."[74] Yet, besides the mention of these effects and some lesser effects on bass fishery, the Flint Plan does not quantify the loss in economic or ecologic terms.

In contrast to leaving the ecological harms in vague narrative terms, the Flint Plan appears to calculate with great care the monetary benefits associated with irrigation in the southern part

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73. *See, e.g.*, FLINT PLAN, *supra* note 50, at 71. The Flint Plan states:

> On the main stem of Ichawaynochawy Creek where it flows into Subarea 4, mussel populations experienced large declines (a drop of between 50% and 100%, depending on species; Golladay, et al, 2004). There is probably little ground-water contribution to the stream at this location, but under normal circumstances there is substantial tributary flow above this point, as well as significant of [sic] surface-water withdrawals. Even under drought conditions, flows at this point would have been substantially higher [without irrigation], almost certainly precluding a large mussel die-off.

Id.

74. *Id*. at 73.

of the basin. Due to its transparency, however, the series of simplifying assumptions greatly limits the usefulness of the resultant monetized figure. For example, the model chosen was simplified to the point where there were only two variables: (1) the baseline number of irrigated acres and (2) the management strategy—a forty, thirty, or twenty percent reduction in irrigation and an increase of about fifteen percent represented by granting all of the backlogged permits.[75] The model chosen calculated everything as a function of the end price received for the crops sold. The model used multiplier effects to increase the benefits to reflect the non-farm aspects of the farming activity. Crop mix was made a constant, looking only at the three most common crops, peanuts, cotton, and corn, and yields with and without irrigation obtained from data collected from a single USDA research farm located in the region. The price data was for a single year. All of the crops enjoyed federal price stabilization that artificially raised their value but simultaneously implied that those crops were already grown in excess of desirable levels. In the end, EPD used the subsidies to increase the value of the water in irrigation (and applied a multiplier effect to that figure) to support the added irrigation that increased the yields of crops that were already being grown in excess. After all of that effort, the benefits were modest, at best. For the two sub-basins most likely to be the subject of increased irrigation, application of the model (increased by subsidies and multipliers) predicted a $56 million difference between the most moderate reduction plan (twenty percent) and a plan granting all backlogged permit applications. This failed to consider the unquantified ecologic consequences[76] and the rather easy to predict tens of millions of dollars that the state will pay to buy forbearance of use from the over-issued permits to prevent ecologic disasters (if it acted in time).[77] In a $9 billion plus Georgia farm economy, the benefits of the Flint Plan were less than peanuts.

Realistically, however, EPD cannot be expected to be a Platonic Guardian in these circumstances. It is a state agency that is responsible to its constituents. It is an executive branch agency with policies that are designed to promote the interests of the State of Georgia. The desire of the farmers to irrigate is within its narrow economic calculus and, spurred on by the subsidies, perfectly rational. Politically, EPD's great solicitude for permitting irrigation use is understandable. Downstream ecosystem services are not

75. *Id*. at 152-59.

76. *Id*. at 157.

77. The cost of payments at lower pre-Plan, pre-Moratorium permitting levels exceeded $10 million.

within EPD's purview.

Nevertheless, it is hard to ignore the externalized downstream effects of EPD's actions. Irrigation is a highly consumptive use of water and the timing of the permitted irrigation withdrawals comes at the low ebb in the river's hydrograph[78] when the Flint provides forty percent of the summer discharge of the ACF Basin.[79] That confluence of factors makes it almost certain that the amount of irrigation allowed in the Flint Basin will have a significant ecosystem services impact further downstream. Even if all of the claimed benefits of the Flint Plan were real,[80] adding the value of downstream ecosystem services to the Georgia harms that were not quantified, a more objective decisionmaker would select a different course than that chosen by EPD.

III. STACKING THE DECK AGAINST THE ACF LOWER BASIN NON-DEVELOPMENTAL USES

In the ACF Basin, the stressors are mounting and the decisional posture of the Corps and the EPD are hauntingly similar to other cases in which mission and geopolitical polarity preclude a holistic view of the system. This is not surprising. The physical deck is stacked against lower users and the estuary. The traditional legal deck is stacked against the passive user. The federal regulatory deck is stacked against the broader forms of use. The political deck is stacked against power-sharing by insular state and local agencies. Those either at the bottom of the basin, or those who developed more slowly or more naturally than the other users of the resource, have fared badly.

A. The Physical Deck

If water law was simply a rule of capture, the bottom of the basin would get whatever the top allows it to receive. Whether through dams that store the water, diversions that turn the water into other basins, consumptive uses that deplete the water, or ef-

78. See data collected in Appendix A.

79. *Id.*

80. The data in the Flint Plan suggests that Georgia will pay a high ecological price in the interest of maximizing irrigation. This can be seen in the Flint Plan data that makes projections of shortfalls. These projections are measured in terms of (1) the percentage of years with flows below the targeted minimum and (2) frequency of flows below historic 7Q10. The "in-state" effect can be found by comparing those projections for the two most stressed Flint River sub-basins in Georgia (Ichawaynochaway Creek and Spring Creek) and those same projections for a gauging station at the very bottom of the Flint River basin (Bainbridge) just before the water flows into Florida. FLINT PLAN, *supra* note 50, at 228-33. Inadequate flow remains a problem at Bainbridge.

fluent discharges that foul the water, the upper state would be the master of what the lower state received. Add to that possibility the Western adage, "Water runs uphill to money," and it should be clear that the upper state's vision of what is in its developmental best interest could often leave little of value for the downstream state. Thus, as a starting point, the physical hand dealt to the bottom of the basin is pretty much whatever the top of the basin doles out as it uses water instrumentally to pursue its desires to improve the quality of life for its residents.

B. The Early 20th Century Legal Deck

The physical control of the upstream states is subject to legal restraint. Historically, in the United States there were two different, rather stark, periods of legal approach to water allocation disputes. One was an initial, more idealistic period as the nation entered the twentieth- century, and the other was a more utilitarian approach that was espoused by the Supreme Court in the last half of that century. The former offered a considerable solicitude for downstream interests, but under late twentieth-century legal doctrine the source and extent of legal recognition of downstream and less development-oriented interests was less than reassuring.

In a common pool resource like the ACF, as already described, an actor with the physical ability to simply appropriate the benefits of the resource can be expected to do so. To capture all of the benefits seems palpably unfair, but to capture some of the benefits seems to be perfectly just. Thus, in regard to a shared river basin, some capture of the benefit by those positioned to do so is an appropriate undertaking, *to a degree*. Justice Holmes put it best in the upstream-downstream contest over the Delaware River between New York on one side and New Jersey and the other downstream states on the other:

> A river is more than an amenity, it is a treasure. It offers a necessity of life that must be rationed among those who have power over it. New York has the physical power to cut off all the water within its jurisdiction. But clearly the exercise of such a power to the destruction of the interest of lower States could not be tolerated. And on the other hand equally little could New Jersey be permitted to require New York to give up its power altogether in order that the river

> might come down to it undiminished.[81]

Therefore, *to a degree*, Georgia, the upstream state in the ACF basin, cannot be required to give up its power altogether in order that the river might come down undiminished. In light of the complex demands for basin water posed by millions of people in a technologically sophisticated world, it is simply not productive to discuss total restoration of natural flow. In sharing the resource equitably, the easiest kinds of comparisons to draw upon are comparisons of similar uses. The best examples of these arise in the western states under the prior appropriation doctrine because of the convergence of both the law and the manner in which water use historically proceeds. Water rights under prior appropriation have four elements: (1) diversion of (2) unappropriated water from (3) a natural stream and (4) application to a beneficial use. In the East, there may be times when laws and uses upstream and downstream are both similar, as when the principal functions of a waterway are municipal supply and navigation. More often the uses are not commensurate and similar. The water needs of river estuaries tend not to be the same as the needs upstream. Upstream states and their municipalities may value power generation, flat water recreation behind dams, navigation, municipal source water, and sewage disposal. Downstream states may not make the same uses because of tidal effects or a different topography. When the upstream and downstream uses diverge, comparison and equitable balancing are more difficult. However, what Justice Holmes makes abundantly clear is that the interests of the downstream state are on par with those of the upstream state. The difficulty of comparison and balancing the full spectrum of a state's interests, including flow regime and ecosystem services, does not make their virtual destruction a legally permissible choice.

Despite the idea of rivers as treasures and similar platitudes, flow protection for its own sake has not fared well in the history of water law. With the possible exception of the English doctrine of natural flow riparianism that held sway in England for perhaps 250 years, the world's history of water management and law in relation to water management supports the concept that water is not a mere natural amenity but is, instead, used by humankind as an instrumentality of human effort to improve human welfare.[82]

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81. New Jersey v. New York, 283 U.S. 336, 342 (1931).

82. Even this token adherence to flow for its own sake may be overstated. Professor Morton Horowitz' now famous article and book have explained that aspect of English law as being tolerable in that period because it supported all the uses that were being made of the water under the topographic, economic, and social conditions prevailing in England in that

American water law is distinctly instrumental in the same regard—inexorably, the law has been molded to fit the needs of society to use the water beneficially.[83] Ecosystem services accounting puts flow and non-developmental uses of water back into the balance as a substantial (non de minimis) state interest, a point that tends to be eclipsed by some of the Court's later interstate water decisions.

C. The Late 20th Century Legal Deck

The technological capacity to impound, divert, and befoul water courses has reached levels that were barely imaginable, and surely unattainable, at this nation's founding. That may help explain why water was largely unaddressed by the Constitution. The scant bits of legal governance given to water basins by the Constitution exist by extrusion from the interstate Commerce Clause[84], the Necessary and Proper Clause[85], the Property Clause[86], and the Tenth Amendment.[87] The principal method of adjusting state interests when states sue one another,[88] absent a negotiated agreement, is the doctrine of equitable apportionment supported by the grant of original jurisdiction to the United States Supreme Court.[89]

The major question in equitable apportionments,[90] of course, is the one implicitly posed by Justice Holmes: to what extent are upstream states, having the physical power to control what happens

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period. *See* Morton Horwitz, *The Transformation in the Concept of Property in American Law, 1780-1860*, 40 U. CHI. L. REV. 248 (1973); *see also* SAX, LEGAL CONTROL, *supra* note 36, at 39-47.

83. *See* Robert Abrams, *Charting the Course of Riparianism: An Instrumentalist Theory of Change*, 35 WAYNE L. REV. 1381 (1989).

84. U.S. CONST. art. 1, § 8, cl. 3.

85. U.S. CONST. art. 1 § 8, cl. 18.

86. U.S. CONST. art. 1 § 8, cl. 8.

87. U.S. CONST. amend. X.

88. There are, in fact, four methods of interstate water allocation: interstate compact, congressional apportionment, equitable apportionment by the Supreme Court, and private litigation regarding rights to waters of an interstate stream. *See, e.g.*, Robert Abrams, *Interstate Water Allocation: A Contemporary Primer for Eastern States*, 25 U. ARK. LITTLE ROCK L. REV. 155 (2002). For the ACF Basin, the agreement needed for compact allocation is absent. Congressional apportionment is rare. SAX, LEGAL CONTROL, *supra* note 36, at 835-36. Recently, Congress has shown a willingness to use that device when there is interstate agreement where there are major federal interests (usually tribal concerns) that require funding or protection. *Id*. at 836-37 Private litigation does not address the full extent of upstream or downstream claims. *Id*. at 874-78.

89. U.S. CONST. art. III, § 2, cl. 2.

90. Professor Tarlock has compiled an excellent summary of equitable apportionment jurisprudence. *See* A. Dan Tarlock, *The Law of Equitable Apportionment Revisited, Updated, and Restated*, 56 U. COLO. L. REV. 381 (1985) [hereinafter A. Dan Tarlock, *Equitable Apportionment*].

downstream, constrained by legal doctrine in their chosen use and managerial imperatives of the water?[91] This is a question not susceptible to a succinct answer. Originally, the United States Supreme Court gave an answer to that question that held great promise for downstream or later developing states unlike the conventional modern doctrine announced in *Colorado v. New Mexico*.[92]

The first equitable apportionment case was *Kansas v. Colorado*.[93] It stressed the sovereign equality of the states, helping to build the tradition upon which Justice Holmes relied in *New Jersey v. New York*.[94] Justice Brewer speaking for the Court in *Kansas v. Colorado* stated:

> One cardinal rule, underlying all the relations of the states to each other, is that of equality of right. Each state stands on the same level with all the rest. It can impose its own legislation on no one of the others, and is bound to yield its own views to none. . . . We must consider the effect of what has been done upon the conditions in the respective states, and so adjust the dispute upon the basis of equality of rights as to secure as far as possible to Colorado the benefits of irrigation without depriving Kansas of the like beneficial effects of a flowing stream.[95]

While intervening decisions, in the main, kept faith with the "cardinal rule of equality of right," the Court's apparent desire to give more predictability to equitable apportionment led to a pair of opinions apportioning the Vermejo River between Colorado and New Mexico that, in effect, defined a series of elements of a cause of action and announced burdens and standards of proof that must be met by states seeking to obtain a decree from the court.[96] The most salient facts for present purposes are that New Mexico claimed that her water users had already put the entire flow of the river to beneficial use. Colorado, the upstream state, had approved plans to allow a headwater diversion of Vermejo River water into another basin in Colorado, the Purgatoire, that was grossly overappropriated and in need of additional supplies.[97] The

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91. *See* New Jersey v. New York, 283 U.S. 336, 342 (1931).

92. 459 U.S. 176 (1982), *aff'd*, 467 U.S. 310 (1984) (discussed *infra* note 97-98 and accompanying text).

93. Kansas v. Colorado, 206 U.S. 46 (1907).

94. 283 U.S. 336 (1931).

95. Kansas, 206 U.S. at 97, 100.

96. *See Colorado v. New Mexico,* 459 U.S. 176 (1982), *aff'd*, 467 U.S. 310 (1984).

97. For additional facts and a far more complete description of the case and the hold-

most salient part of the holding, for present purposes, is that Colorado got no water whatsoever.

For less developed regions, this result may be an ominous portent. Looking on the gloomy side of the case, I previously concluded that states like Florida in the ACF who use water more passively for its in situ benefits faced a changed and inhospitable doctrine:

> Despite the citation to proof standards required in previous cases, the Court's distillation of prior cases, which had been far more open-ended in their approach, into a set of discrete, sequential inquiries each having an allocated burden of proof was novel. That specification transformed what previously had been a search for fairness guided by broad principles of the equality of sovereign states into a less robust inquiry. It changed the case from one of seeking to do equity under all of the circumstances and pursuing the great equitable maxim that "equality is equity" to something more akin to an action at law where an unfair outcome is tolerated as the price of having predictable legal outcomes that assist citizens in planning their activities and investments.[98]

While I am not ready to recant my dim view of Vermejo River decisions, I am hopeful that their scope of application can be limited to cases in which the states come to the Court making parallel claims as to type of use and local law governing the allocation of water. In the Vermejo case, both Colorado and New Mexico were prior appropriation jurisdictions where the desire was to be allocated water that, in turn, would be reallocated to support traditional western states beneficial uses. It is not the same as in the ACF, where Georgia, that claims to be the state making the economic use of the water, is actually the newcomer that is interfering with established economic practices in the Basin. For example, Georgia's increased irrigation in the Flint Basin is interfering with established oystering in the Apalachicola Bay where the flow is relied on to provide ecosystem services that support the harvesting of oysters. Under the Vermejo River cases, that may be enough to win a decree. Additionally, as argued more fully below, there are reasons to see Florida's claims of harm to its interest in ACF re-

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ings *see* A. Dan Tarlock, *Equitable Apportionment, supra* note 91, at 404-09.

98. Robert Abrams, *Interstate Water Allocation: A Contemporary Primer For Eastern States*, 25 U. ARK. LITTLE ROCK L. REV. 155, 166 (2002).

sourceplex as sharing common ground not only with the older United States Supreme Court equitable apportionment cases, but also with the central precept of the Court's substantive interstate nuisance decisions.[99]

As a possible counterpoint to the Vermejo River decisions, there is one unusual equitable apportionment case in which the Court apportioned the fish resource that was supported by an interstate river, an action that can easily be viewed as apportioning a specific ecosystem service.[100] In that case the Court ruled that it could apportion the right to salmon runs in the Columbia-Snake system between the competing states. The Court stated, "[a] dispute over the water flowing through the Columbia-Snake River system would be resolved by the equitable apportionment doctrine; we see no reason to accord different treatment to a controversy over a similar natural resource of that system."[101] Professor Ruhl, after noting that language continues:

> Like fish flowing through the river system, ecosystem services do as well, delivering true economic value in many different ways and locations. Injury to those economically valuable resources ought, therefore, to count in the "substantial injury" analysis.
>
> Likewise, once those ecosystem services are recognized for both their ecologic and economic values, the Court should focus its equitable apportionment doctrine on the apportionment of resources associated with those services, which in this case is the natural flow regime of the ACF River. In other words, it is not enough to protect a minimum base flow for Florida, as Georgia has emphasized; rather, the real medium of apportionment should be the flow regime itself.
>
> The suggestions that the Court should take injury to ecosystem services into account for purposes of its substantial injury test, and should focus on ecosystem services in the apportionment phase of the case as well, are novel propositions, but they are the logical, incremental extensions of the Court's analysis in *Idaho v. Oregon*. The salmon and trout involved in that case were the resource of interest for Idaho - they moved within the river system and

99. *See* discussion *infra* notes 128-37 and accompanying text.
100. Idaho *ex rel* Evans v. Oregon, 462 U.S. 1017 (1983).
101. *Id.* at 1024.

> were, for all practical purposes, what made the water valuable to the state.
>
> Ecosystem services, like the salmon, are economically valuable resources that flow within the water system of the ACF and any other river. Moreover, with each year we understand more about the nature and value of ecosystem services-to leave them out of the interstate water apportionment analysis would simply be to ignore the ecological and economic realities of river systems such as the ACF.[102]

Between a narrowed reading of the Vermejo River decisions and the possibilities suggested by the salmon apportionment, it is possible to hope that the modern equitable apportionment card in the deck, though not a certain protector of ecosystem services, is not a certain ace in Georgia's hand in the ACF dispute.

D. The Federal Regulatory Deck

The federal government does not have a national water policy.[103] Congress left establishment of water policy to the traditional police power authority of the states. Congress seldom intervenes without state agreement into water allocation decisions.[104] What Congress has done, however, is to use its interstate commerce and other express powers in ways that affect water allocation as evidenced by the way in which the national government has gone about achieving national objectives unrelated to water allocation.

A familiar example, in play in the ACF Basin, is the power of Congress to authorize the Corps to build dams on navigable rivers and operate those facilities for navigation and flood control purposes. The federal authority that traces to the interstate commerce power is unquestioned. The Corps, in turn, operates the dams to achieve those purposes with attendant impacts on the basin flow regime. As seen in the ACF, this is de facto water management. If the use that a state favors is the use that the Corps is managing to achieve, the state is in luck. If the use that the state

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102. J. B. Ruhl, *Equitable Apportionment of Ecosystem Services: New Water Law For A New Water Age*, 19 J. LAND USE & ENVTL. L. 47, 53-54 (2003).

103. Janet C. Neuman, *Federal Water Policy: An Idea Whose Time Will (Finally) Come*, 20 VA. ENVTL. L.J. 107 (2001).

104. *See, e.g.*, SAX, LEGAL CONTROL, *supra* note 36, at 802-08. The lone counter-example is the Colorado River, in which the Court held in *Arizona v. California*, 373 U.S. 546 (1963), that Congress had apportioned the river in the Boulder Canyon Project Act, which was deemed to allocate the water on a basis that had been resisted by Arizona.

is seeking to achieve is at odds with the Corps' operating plan, the state is out of luck. The fate of the upper basin states on the Missouri is the most recent and most visible case in point. There, efforts to force the Corps to revise the Master Manual to support the burgeoning recreational tourism industry has been trumped by the Corps, whose actions within the jurisdiction enjoy the mantle of federal supremacy.[105] There is no reason to expect the Corps to take actions that materially advance Florida's desire to maintain and improve ecosystem services in the ACF, unless it happens as a felicitous by-product of the Corps pursuing its narrower statutory missions.[106]

E. The Political Deck

The political deck is stacked against power-sharing. Recalling the Flint Plan, what possible motivation can be conjured up for the EPD to do anything other than maximize benefits to Georgia? So long as the only significant costs of greater upstream consumption are felt exclusively out-of-state and farther downstream, there is no counterweight to serving constituent self-interest. Floridians do not vote for Governor Perdue of Georgia, or the legislature that passed the Georgia Water Code, or the judges who review EPD's actions. If anything, the we-they (Georgia-Florida) distribution of benefits and costs makes the result a political no-brainer for Georgia politicians, bureaucrats, and popularly elected local judges. The opposite course of action is politically risky, if not suicidal.[107]

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105. *See In re* Operation of the Mo. River Sys. Litig., 421 F.3d 618 (8th Cir. 2005). Environmental groups won an early skirmish on the issue, *see* Am. Rivers v. U.S. Army Corps of Eng'rs, 271 F. Supp. 2d 230 (D.D.C. 2003).

106. The Corps and other federal agencies such as the Federal Energy Regulatory Commission (FERC) are, at times, more like pawns whose regulatory power is being used as a small handle by persons seeking to block or obtain a certain result. One high profile example is the decades long efforts of North Carolina to defeat an eighty-two mgd diversion from the Roanoke River at Lake Gaston, just above the North Carolina border, that was going to be shipped via pipeline to Virginia Beach, Virginia. In that instance, North Carolina tried to prevent needed federal agency approvals of rights of way and similar agency decisions having almost nothing to do with water allocation as a means of defeating the project. *See, e.g.*, SAX, LEGAL CONTROL, *supra* note 36, at 87-97.

107. That word has been used in relation to interstate water controversies by none less than Justice Holmes to stand for nearly the opposite proposition than that being suggested here. *Bean v. Morris*, 221 U.S. 485 (1911), involved a private interstate water use dispute between upstream Montana junior appropriators whose rights were created pursuant to Montana law and a downstream senior appropriator whose right was created under Wyoming law. The case had been litigated originally in Montana federal court because the Wyoming senior could not get Wyoming personal jurisdiction over defendants. This was prior to the overturning of *Pennoyer v. Neff*, 95 U.S. 714 (1877) and jurisdiction was still unavailable. That plaintiff eschewed going to Montana state court, likely fearing local bias in favor of the home state Montana junior appropriators. Earlier litigation over the same stream stretch seems to demonstrate that the Montana juniors were aware of the Wyoming

A recent water story from Idaho highlights the power of water as a political hot button for voters.[108] As part of the ongoing Snake River Basin General Adjudication, the Idaho Supreme Court ruled on claims asserted by the United States seeking federal reserved water rights. Recognizing such rights, in effect, would reduce the amount of water available for appropriation by Idaho's water users. One such claim was for a reservation of all unappropriated water of Snake River tributaries flowing into three federal wilderness areas in Idaho. Initially, in a three-to-two decision, the Idaho Supreme Court upheld the lower court's ruling awarding such rights as necessary to fulfill the wilderness purposes.[109] Public uproar at the decision led the court to grant a rehearing. While the rehearing was underway, the author of the suspended majority opinion, Justice Silak, was soundly defeated in her bid for reelection by an opponent who had made the granting of reserved rights an issue. Catching the political drift, on reconsideration, one of the other justices, who had been in the original majority and who was about to face reelection, switched sides so that a new majority position emerged and denied the federal claim.[110] Quite unsurprisingly, the politically wary Idaho Supreme Court also found no federal reserved water rights for the benefit of the Deer Flats and Minidoka Wildlife Refuges.[111] In that later case the reserved rights would have guaranteed minimum instream flows necessary to maintain the separation of islands that provided migratory bird habitat safe from terrestrial predators.

The moral to be drawn from the Idaho story for interstate basins is little different than in its original context. It really does not matter that the "outsider" in the Idaho case was the federal government. The political pressure to serve the interests of in-state water users, whose rights are dependent on their state having as large an entitlement as possible, is extraordinary. Out-of-state water users in competition with in-state users should not expect

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seniors and built their elaborate diversion works anyway. In a rather odd blend of pragmatism and idealism, Justice Holmes ruled that Montana would give comity and recognize the right of a Wyoming senior's right to take the water. He found to do otherwise would be "suicidal" because the upstream and downstream positions of the two states were reversed on some of the region's other interstate streams. *See* Bean v. Morris, 221 U.S. 485 (1911).

108. *See generally*, Michael C. Blumm, *Reversing the Winters Doctrine?: Denying Reserved Water Rights for Idaho Wilderness and its Implications*, 73 U. COLO. L. REV. 173 (2002).

109. *In re* SRBA, Case No. 39576--Wilderness Reserved Claims, 1999 WL 778325 (Idaho, Oct. 1, 1999) (opinion withdrawn).

110. Potlach Corp. v. United States, 12 P.3d 1260 (Idaho 2000). Justice Silak was still a lame duck member of the court for the rehearing opinion–she dissented from the reversal of position. Newly elevated Chief Justice Trout changed sides to vote with the new majority.

111. United States v. Idaho, 23 P.3d 117 (Idaho 2001).

much from politically accountable decisionmakers across the border.

IV. CREATING A "LAW OF THE RIVER" FOR THE ACF[112] THAT VALUES ECOSYSTEM SERVICES

The phrase, "The Law of the River," as a water law term, is used to describe the unique and intricately complex mix of federal and state law and administrative actions that govern the Colorado River. More and more, however, other rivers and basins are beginning to develop their own complex of governance mechanisms. Plainly that is the case with the Columbia, the Delaware, the Rio Grande, the Platte, the Missouri, the Sacramento-San Joaquin, and the Everglades. While these are rivers and basins of high visibility, a pattern is clearly in place. Despite the variability and site-specific nature of each basin's "law," each basin has a complex matrix of governmental actions taken by various authorities that create a de facto form of conflict resolution and basin governance. Each case is unique as to what actors and authorities are most prominent, but competing demands for the use of water are forcing the creation of mechanisms that allocate the use of basin water resources.

In virtually any of those basins, it might be appealing to borrow the Delaware model as an example of a strong basin commission that manages the entire resource with a basinwide perspective. However, this has yet to happen in any other basin, and it is not likely to happen in the ACF. The unusual power held and exercised by the DRBC grew out of a major crisis—a simultaneous credible threat to the water supply of both New York City and Philadelphia—that created an extraordinary political exigency and allowed the political leaders to grant managerial power to the compact agency. Those conditions will probably never be replicated in the ACF. Likewise, traditional allocation law, established by the late twentieth century equitable apportionment jurisprudence, if not altered, entrenches the current pattern of ACF water use and its attendant effects. Thus, those unhappy with the direction in which management of the ACF is heading, and there should

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112. Professor Ruhl has suggested that the ACF has no law of the river. *See* Ruhl, *supra* note 103, at 49. Professor Ruhl equates the concept of having a "Law of the River" with a long and articulated legal history that combines to control the river. *See id.* at 49-50. The idea being offered here has a much lower threshold, a discernible set of institutional controls, possibly including formal adjudications, from which a mostly consistent pattern of water allocation and use can be predicted. In the years since 2003, under this standard, the ACF has had a "Law of the River." Putting aside the difference in use of the terms, Professor Ruhl and I fully agree that the status quo that is in place needs to change. *Id.* at 56-57.

be many, need to find ways in which to influence or re-channel the course that the Corps and EPD are in the process of establishing as the law of the basin. The status quo holds the prospect of a gradual ecological impoverishment of the Apalachicola Bay estuary, and sets a precedent that appears capable of repetition in any basin where the estuary is not a major population center or regional economic engine.

One of the main objectives of this symposium is to win recognition for, and a place in, resource decision making for the non-traditional concept of ecosystem services. In the ACF basin, proper accounting of ecosystem services would raise doubts about the large scale benefit-cost premises upon which the EPD's Flint Plan relies for justification. Even so, a better accounting of ecosystem services does not give the Corps, the EPD, or Georgia elected officials any greater political reason to value out-of-mission or out-of-state benefits. It is still necessary to find a mechanism that places ecosystem services into the mix in a way that can affect outcomes enough to force stakeholders benefiting from the current "law of the ACF" to be willing to negotiate and compromise.

A. Common Law Nuisance on the Larger Interstate Stage

Professor Ruhl has suggested that the tort of nuisance might be employed to advantage in cases where damage to ecosystem services can be quantified and made part of the nuisance inquiry.[113] He initially explains the view that nuisance can be helpful, but that nuisance does not appear to be capable of protecting ecosystem services sufficiently.[114] He states: "[T]here is wide agreement that private nuisance actions alone are grossly inadequate for resolving the more typical pollution problems faced by modern industrialized societies."[115] Replace "pollution" in that sentence with "ecosystem management" and one has the lack of capacity argument in a nutshell."[116]

Later in the article, however, he sounds more hopeful:

> It is my belief that the common law is equipped to

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113. *See* J. B. Ruhl, *Ecosystem Services and the Common Law of "The Fragile Land System*," 20 NAT. RESOURCES & ENV'T. 3, 4-5 (Fall 2005). [hereinafter Ruhl, *Fragile Land System*].

114. *Id.*; *See also* John Sprankling, *The Anti-Wilderness Bias in American Property Law*, 63 U. CHI. L. REV. 519 (1996) (arguing that the common law has developed with an ingrained anti-environmental bias).

115. Ruhl, *Fragile Land System supra* note 114, at 5 (citing ROBERT PERCIVAL, ET AL., ENVIRONMENTAL REGULATION 72 (4th ed. 2003) (citation omitted).

116. *Id.*

> answer that question and others like it. The fact that it has not until now attempted to do so does not mean that it cannot, or will not have the opportunity, or simply is against all notion of it. The only missing ingredient until now has been the storehouse of knowledge ecologists and economists are building about the value of ecosystem services. This is precisely the kind of new knowledge Justice Scalia confirmed in [*Lucas*] [that] can transform the common law and "make what was previously permissible no longer so."[117]

Against this backdrop, it is worth re-examining the doctrine of nuisance, particularly how that doctrine fits into the interstate ecosystem services setting. First, consider the basics. Most fundamentally, the gravamen of the nuisance cause of action, "unreasonable interference with the quiet enjoyment of land," scrutinizes the degree of interference suffered by the victim.[118] Importantly, for assessing liability of the defendant, the word "unreasonable" modifies the word "interference." Nuisance, therefore, initially focuses attention solely on the harm suffered, not the qualitative nature of the defendant's conduct.[119] Most typically, nuisances are intentional torts in which the defendant is held responsible for the natural consequences of an intended act.[120] Here, too, there is very little concern with the qualitative nature of defendant's conduct or with the defendant's state of mind. The intent requirement is that the defendant intended to act in a particular way and that the harm was foreseeable, not that the defendant intended harm to the plaintiff.[121] The law then tracks reality and the knowledge of the community to include liability for the natural and probable consequences of an intended act. As the knowledge of cause and effect improves, which has been an inexorable process, the scope of liability in nuisance expands. As knowledge of how ecosystems provide ecosystem services improves, persons whose actions have as a natural and probable consequence the significant impairment

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117. *Id*. at 69, *quoted in* Lucas v. South Carolina Coastal Council, 505 U.S. 1003, 1031 (1992); *see also* Michael Blumm & Lucas Ritchie, *Lucas's Unlikely Legacy: The Rise of Background Principles as Categorical Takings Defenses*, 29 HARV. ENVTL. L. REV. 321 (2005).

118. W. PAGE KEETON, ET AL., PROSSER AND KEETON ON THE LAW OF TORTS § 86 at 616 (5th ed. 1984).

119. ZYGMUNT J. B. PLATER, ET AL., ENVIRONMENTAL LAW AND POLICY: NATURE, LAW, & SOCIETY 106-07 (3rd. ed. 2004).

120. BLACK'S LAW DICTIONARY 470-71 (2d pocket ed. 1996).

121. *Id.*

("unreasonable interference") of ecosystem services will be liable under the nuisance doctrine.

Already, the physical mechanisms by which the ecosystem is harmed and the value of ecosystem services are far better established than they were a generation (or two) ago at the beginning of the Earth Day era.[122] Those mechanisms and values are far better understood than they were before the Symposium of Ecosystem Services held at Stanford University in 2001. For these reasons, nuisance holds promise for protecting ecosystem services, but to be effective, nuisance law must be clear of apparent limitations traceable to two additional modern era jurisprudential developments. In the common law arena, the famous 1970 decision, *Boomer v. Atlantic Cement Company*,[123] had a profound effect on tort law remedial doctrine in the environmental context, making the balancing of the equities more prominent and effectively eliminating private standing to insert broad public health considerations into the private nuisance lawsuit. In the public law arena, massive federal legislative efforts, including the enactment of the Clean Water Act,[124] resulted in preemption of interstate common law nuisance remedies for pollution introduced by point source dischargers[125] and choice of law limitations on private nuisance suits seeking remedies for interstate water pollution.[126]

B. Balancing the Equities

Boomer was a case of conceded liability in which the only issue was remedy.[127] In a suit by a few neighbors, a major new cement plant was allowed to continue its polluting activities without change. The court found the plant was a nuisance, a ruling that was not contested by the defendant on appeal. In the remedial phase of the case, when the court balanced the equities, the interference with quiet enjoyment suffered by plaintiffs was vastly outweighed by the loss to defendants of closing a new state-of-the-art $45 million cement plant that provided hundreds of local jobs and a major infusion of local tax revenue.[128] Because it was a state of

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122. Earth Day was first celebrated on April 22, 1970. *See e.g.*, Gaylord Nelson, *How the First Earth Day Came About*, ENVIROLINK, http://earthday.envirolink.org/history.html.

123. 257 N.E.2d 870 (N.Y. 1970).

124. Federal Water Pollution Control Act (Clean Water Act), 33 U.S.C. §§ 1251-1387 (2000).

125. City of Milwaukee v. Illinois, 451 U.S. 304 (1981); *see also*, Robert Percival, *The Clean Water Act and the Demise of the Federal Common Law of Interstate Nuisance*, 55 ALA. L. REV. 717, 767-68 (2004).

126. Int'l. Paper Co. v. Ouellette, 479 U.S. 481 (1987).

127. Boomer, 257 N.E.2d at 871.

128. For a less generous view of the *Boomer* case, *see* ZYGMUNT PLATER, ET AL., *supra*

the art plant, and because the majority felt Atlantic Cement was incapable of innovating its way out of the problem alone,[129] the majority felt it was faced with an "all or nothing" choice: the only effective way to end the continuing nuisance was to totally close the plant, a step the majority felt was inequitable. The remedy allowed in *Boomer*, permanent damages, was imperfect in salient regards,[130] but application of the balancing of the equities doctrine was, and remains, a well-established part of the remedial calculus when injunctive relief is sought. Applying that doctrine in the ecosystem services context can be profoundly unsatisfying. Economically important nuisances that substantially impair (unreasonably interfere with) ecosystem services will win the balance of the equities test, and leave the harm caused to the ecosystem services unabated.

That is far too bleak a view, however. First, it assumes that the balance of equities will favor the ecosystem impairing activity and that the degree of needed abatement is an "all or nothing" proposition. Not all balances will be as one-sided as *Boomer* appears to be. One thing that the ecosystem services concept brings to the table is an enhanced recognition of the harms caused and the values affected when those services are disrupted. Seasonal dewatering of a stream segment is no longer thought of as a mere interference with the amenity values of a few riparians or an interference with the operations of a few canoe liveries and bait shops. The mussel die-off costs a great deal in lost filtration and water quality. The loss of flow not only kills fish trapped without water, but it also impairs spawning and depresses the fish populations into the future. Further, the flow reductions that occur at what already is the low ebb in the hydrograph weaken the flow through the estuary, allowing increased salinity concentrations to come further upstream and interfere with oyster habitat and reproduction.[131] Because scientists now understand the mechanism by

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note 120, at 111-14, 173-74.

129. In fact, electrostatic precipitator technology was available but not in use at the plant. The plaintiffs in litigating the case apparently were unaware of that fact. In any event, the record in the case found the plant was "state of the art" and that there was not an existing technological improvement that would reduce the emissions. Boomer, 257 N.E.2d at 873. For that reason, the "state of the art" assertion had especial importance because it made the case appear to the majority to be one in which its only effective injunctive option was to close the plant. *Id*.

130. The refusal of all relief other than permanent damages has the same effect as private condemnation of an easement for disposal of dust and vibration for a non-public purpose without statutory authorization delegating the power of eminent domain to a private entity. That aspect of the case might be viewed more critically after the public dismay with the result in *Kelo v. City of New London*, 545 U.S. 469 (2005).

131. WASHINGTON STATE AQUATIC HABITAT GUIDELINES PROGRAM, INTEGRATED STREAMBANK PROTECTION GUIDELINES, APPENDIX F, FLUVIAL GEOMORPHOLOGY (2002),

which those harms accrue, and because economists can compute the values those ecosystem services provide, two aspects of the nuisance calculus are affected. Defendants intend what is foreseeable, and when the remedy stage comes, there is more to tip the scale towards an injunction that protects the flows. The ramifications of this sort of invocation of ecosystem services can be far-reaching. Balance, for example, the value of water stored behind dams in spring at the expense of the usual scouring flows. Assume that those waters have a calculable value for flat water recreation and hydropower generation. A better understanding of ecosystem service mechanisms identifies the fact that dam operators now know impounding spring high flows, particularly over several seasons, and this reduces channel scouring and sediment transport.[132] Correspondingly, the failure of channel maintenance exacerbates flooding during high rainfall events, which, in a built-up region, causes vast and readily calculated damages that can be taken into account in the balance of equities.[133]

It may be a while in coming—or it may not—but a better understanding of ecosystem services will lead to more weighty interests being placed in the balance of equities on the side of protecting natural systems via nuisance-based injunctions. In the Flint River Basin, for example, the preservation of subsidy-induced cropping decisions, even though it has some local economic benefit, does not clearly outweigh the destruction of the oystering economy in Apalachicola Bay or the lost water quality benefits of the filtration services provided by the mussels. Moreover, because the remedy is being sought in equity, it need not be a black and white decision. A decree could have triggers linked to flow regime after which the balance shifts from allowing irrigation to ensuring flows and back again as the circumstances allow. The experience in the Delaware Basin teaches that this is feasible and growing easier as increasing computing power, better data sets, and better monitoring put more

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available at http://wdfw.wa.gov/hab/ahg/ispg_app_f_fluvialgeo.pdf#search='fluvial%20geomorphology.

132. The technical name for this branch of science is fluvial geomorphology. *Id.*

133. Lest anyone doubt the significance of the cost of increased flood damages, consider first the trend in the amount of flood damage. The National Weather Service for the most recent three year period (2001-03 in the public data set) estimated the annual average flood damage at $3 billion. The long term trend is that damages (in 1995 constant dollars) from floods are rising and rising. *See* Flood Damage in the United States: National Data Set, http://www.flooddamagedata.org/national.html (last visited Aug. 7, 2007). Consider also the way the insurance industry, which is very interested in minimizing their responsibility to reimburse such losses, handles the matter with flood zone coverage exclusions that leave property owners to seek their solace in the largess of the federally subsidized flood insurance program. *See generally* Oliver A. Houck, *Rising Water: The National Flood Insurance Program and Louisiana*, 60 TUL. L. REV. 61, 66 (1985).

accurate modeling in reach.

Second, even if the balance of equities favors continuation of the ecosystem impairing activity, if the impact on the ecosystem services is substantial,[134] a damage award will be made. Obviously, damages alone do not stop the impairment of ecosystem services, but they are far from worthless. Damages provide a deterrent to similar conduct by others. Damages increase the attractiveness of investing in ameliorative actions that would reduce the damage. Damages provide a fund that can support remedial activities including, but not limited to, habitat improvement, stocking, mussel reintroduction, and land retirement. Thus, recognizing the routine availability of at least a damage remedy, via nuisance actions for harms to ecosystem services, internalizes those costs, prompts an interest in avoiding the cost that was not present before, and funds restoration.[135] The deterrent value of the damage remedy in ecosystem services cases increases as a function of the certainty of liability and value of the harm to ecosystem services. The exponential growth in contemporary understanding of ecosystem services increases both the certainty of liability in nuisance, the values at stake (by either shifting the balance of the equities or increasing the deterrent value of damages), and the lengths to which project proponents will go to avoid impairment of ecosystem services in the first instance.[136]

C. States as Interstate Nuisance Complainants

A further consideration in relation to the balancing of equities doctrine is the distinction between private nuisance actions and public nuisance actions. The latter have an intuitively greater claim on the court's conscience because, usually, they are brought in the name of the government by the public servant responsible for protecting the public health and safety.[137] Even more dramatically, case law displays a remarkable contrast between private

134. This statement is meant to embrace the maxim, "de minimis non curat lex." The law does not concern itself with trifles.

135. There are salient limitations to the effectiveness of *private* nuisance in a setting such as the Flint River where (1) the harm to ecosystem services is being caused by the collective effect of many individual actions and where (2) the suitors claiming damages to their lands due to impaired ecosystem services each suffer hard to quantify losses.

136. The hardest issues here are likely to be issues of aggregation–aggregate damage and aggregate causation. Those issues recede in the interstate public nuisance context of most concern in this article. Defendant class actions may be a method for considering collective causation if the activity involved is not subject to control by a unitary regulator.

137. Recall here that in *Boomer* the private plaintiffs were not allowed to raise public interests in their part of the balance of equities, whereas the contributions of defendant's cement plant to the local economy and tax base were prominently mentioned. Boomer, 257 N.E.2d at 873-75. The public official is allowed to put more things onto the scale.

nuisance actions and interstate public nuisances pursued by the injured state on a *parens patriae* theory. Interstate public nuisance actions brought by an injured state are, rather plainly, highly apposite precedents for cases in which the harm claimed is impairment of ecosystem services.[138]

The classic example of the distinction between private nuisance and interstate public nuisance is seen in the early twentieth century copper smelting cases along the Tennessee-Georgia border.[139] The same sulfur-laden[140] and acid-laden fumes that destroyed crops and timber and covered plaintiffs' lands with sickening and noxious odors were at issue in two roughly contemporaneous cases. The first was an intrastate private nuisance action by a small number of Tennessee neighbors of the smelters.[141] The second, and far more famous, was brought by the State of Georgia for injuries to lands lying within its borders. In the intrastate private nuisance case, *Madison v. Ducktown Sulphur, Copper & Iron, Company*,[142] "[T]he defendants admitted that they were liable in actions at law in damages for whatever injuries had been inflicted, but denied the right of the complainants to an injunction."[143] The court, however, pointed out findings below that, despite expenditures in excess of $200,000 by one of the defendants, defendants could not:

> [G]et rid of the smoke and noxious vapors. . . . [and therefore] if the injunctive relief sought be granted, the defendants will be compelled to stop operations, and their property will become practically worthless, the immense business conducted by them will cease,

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138. A. Dan Tarlock , *Equitable Apportionment, supra* note 91, at 388-92 suggests there are important reasons emanating from Eleventh Amendment state immunity that make this distinction very important and restrict the availability of some forms of relief to true *parens patriae* suits.

139. There is at least a small degree of irony in the ACF situation should Georgia find itself aligned with the defendants in an interstate nuisance case when it was the principal plaintiff in the most famous precedent favoring states as plaintiffs. The symmetry of the doctrine, that a state can be either a plaintiff or a defendant, is noted as part of its inherent fairness and appropriateness in the context of inter-sovereign disputes.

140. As a matter of arcane trivia that becomes readily accessible with the advent of the world wide web, the "correct" spelling of the chemical substance was changed in the United States from "sulphur" to "sulfur" in chemical reference works in the early 19th century. *See* World Wide Words: Sulphur http://www.worldwidewords.org/topicalwords/tw-sul1.htm (last visited Aug. 7, 2007). In England, that change was resisted for more than a century thereafter, until 1990, when the IUPAC adopted the spelling "sulfur" followed by the Royal Society of Chemistry Nomenclature Committee in 1992. *See* Sulfur – Wikipedia, the free encyclopedia, http://en.wikipedia.org/wiki/Sulfur#Spelling (last visited Aug. 7, 2007).

141. Ducktown Sulphur, Copper & Iron Co. v. Barnes, 60 S.W. 593 (Tenn. 1900).

142. 83 S.W. 658 (Tenn. 1904).

143. *Id*. at 661.

> and they will be compelled to withdraw from the state. It is a necessary deduction from the foregoing that a great and increasing industry in the state will be destroyed, and all the valuable copper properties of the state become worthless."[144]

After reciting a variety of facts detailing the number of jobs, the gross payrolls, and the local tax revenues associated with the copper smelters, the Tennessee Supreme Court addressed the true issue before it:[145] whether or not to grant an injunction. The court used the balancing of the equities doctrine that provides for equitable discretion to do what is more just under the circumstances. In this case, equitable balance meant to deny an injunction and preserve the millions of dollars invested along with the jobs of whole counties full of inhabitants.[146] Damages would have to suffice as the remedy for the considerable inconvenience and lost property value of the plaintiffs.[147]

At roughly the same time, the State of Georgia, which was proximate to the same two smelting firms, Ducktown Sulphur and Tennessee Copper Company, filed an original bill in equity in the Supreme Court of the United States to enjoin those Tennessee defendants from discharging their noxious gasses over a five county area in Georgia.[148] The bill charged destruction of crops, orchards, and forests, as well as other damage, and further alleged that a vain request for relief had been made to the State of Tennessee.[149] A former State Supreme Court Justice, Oliver Wendell Holmes delivered the opinion of the Court.[150] The opinion's premises and approach could hardly have been more different:

> The case has been argued largely as if it were one between two private parties; but it is not. The very elements that would be relied upon in a suit between fellow-citizens as a ground for equitable relief are wanting here. The state owns very little of the territory alleged to be affected, and the damage to it capable of estimate in money, possibly, at least, is small. This is a suit by a state for an injury to it in

144. *Id*. at 660.

145. The court had eliminated one claimant's equitable rights by application of the doctrine of laches. *Id*. at 662-63.

146. *Id.* at 667.

147. *Id*.

148. *See* Georgia v. Tennessee Copper Co., 206 U.S. 230, 236 (1907).

149. *Id.*

150. *Id.*

> its capacity of quasi-sovereign. In that capacity the state has an interest independent of and behind the titles of its citizens, in all the earth and air within its domain. It has the last word as to whether its mountains shall be stripped of their forests and its inhabitants shall breathe pure air. It might have to pay individuals before it could utter that word, but with it remains the final power. The alleged damage to the state as a private owner is merely a make-weight, and we may lay on one side the dispute as to whether the destruction of forests has led to the gullying of its roads.[151]

From that starting point, Justice Holmes reiterated the understanding of interstate nuisance actions he had announced for the Court in *Missouri v. Illinois*.[152] The passage bears unusual importance to interstate resource allocation disputes:

> The caution with which demands of this sort, on the part of a state, for relief from injuries analogous to torts, must be examined, is dwelt upon in *Missouri v. Illinois*. But it is plain that some such demands must be recognized, if the grounds alleged are proved. When the states by their union made the forcible abatement of outside nuisances impossible to each, they did not thereby agree to submit to whatever might be done. They did not renounce the possibility of making reasonable demands on the ground of their still remaining quasi-sovereign interests; and the alternative to force is a suit in this court.
>
> Some peculiarities necessarily mark a suit of this kind. If the state has a case at all, it is somewhat more certainly entitled to specific relief than a private party might be. It is not lightly to be required to give up quasi-sovereign rights for pay; and, apart from the difficulty of valuing such rights in money, if that be its choice it may insist that an infraction of them shall be stopped. The states, by entering the Union, did not sink to the position of private owners, subject to one system of private law. This court has

151. *Id*. at 237.

152. 180 U.S. 208 (1901) (recognizing cause of action); *bill dismissed without prejudice*, 200 U.S. 496 (1906) (denying relief principally due to lack of proven injury).

> not quite the same freedom to balance the harm that will be done by an injunction against that of which the plaintiff complains, that it would have in deciding between two subjects of a single political power. Without excluding the considerations that equity always takes into account, we cannot give the weight that was given them in argument to a comparison between the damage threatened to the plaintiff and the calamity of a possible stop to the defendants' business, the question of health, the character of the forests as a first or second growth, the commercial possibility or impossibility of reducing the fumes to sulphuric acid, the special adaptation of the business to the place.
>
> It is a fair and reasonable demand on the part of a sovereign that the air over its territory should not be polluted on a great scale by sulphurous acid gas, that the forests on its mountains, be they better or worse, and whatever domestic destruction they have suffered, should not be further destroyed or threatened by the act of persons beyond its control, that the crops and orchards on its hills should not be endangered from the same source. If any such demand is to be enforced this must be notwithstanding the hesitation that we might feel if the suit were between private parties, and the doubt whether, for the injuries which they might be suffering to their property, they should not be left to an action at law.[153]

The Court approached the remedial phase by inviting Georgia to submit a proposed decree at the beginning of the following term, while allowing reasonable time for defendants to complete improvements that might eliminate the injury.[154] Instead, Georgia consented to a longer period for the attempted control measures and agreed to a stipulated course of conduct to be followed by the two defendants. The key elements were major reductions in sulfur emissions (fifty percent or more), limitations on plant expansion,

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153. Tennessee Copper Co., 206 U.S. at 237-38 (citations to Missouri v. Illinois omitted). The first Mr. Justice Harlan, in an opinion not joined by any other members of the Court, concurred in the result finding that Georgia as a party had produced ample evidence to justify equitable relief and expressly disavowed joining in creating a special rule of equity applicable to states as sovereigns. *Id.* at 239-40.

154. *Id*. at 239.

monitoring daily and weekly emission limits rather than annual averages, and a compensation fund for payment of damages suffered by Georgia and its inhabitants. Tennessee Copper conformed to the stipulation to Georgia's satisfaction, but Ducktown Sulphur did not. Thus, Georgia returned to the Supreme Court to seek an injunction. In its ruling favoring Georgia, the majority rejected the arguments of Ducktown Sulphur that its extensive pollution control activities had so changed the conditions that Georgia was no longer entitled to a decree.[155] The decree the Court ordered was quite similar in its principal terms to the stipulation that Georgia claimed was not adhered to by Ducktown.[156] Standing back from the details, the net result in this major interstate pollution case was an injunction issued in favor of the State of Georgia upon a showing of substantial harm but without a traditional balancing of the equities. The result was not total abatement of Ducktown's activities; it was abatement to a level that Georgia effectively had indicated was acceptable by its prior stipulation. Similarly, based on the ability of Tennessee Copper to meet the terms of the stipulation, the abatement required attaining a performance level that allowed the continued (profitable) operation of the smelting industry in that locale.

Due to the stipulated agreement and decree in its image, the *Ducktown* decree loses its "all or nothing" adversarial character. That does not diminish its precedential value. The Holmes view, set out at length above, in which recognition of state sovereignty modifies the traditional rules of equity jurisprudence, is still in force. What has occurred is sufficient abatement that the now altered operation of the smelters is not invading Georgia's rights as she asserted them.

Chicago's sewage figures prominently in the law of interstate nuisance. The original *Missouri v. Illinois* litigation arose in relation to Chicago's initial efforts to send its sewage southward through the Illinois River system into the Mississippi River which forms Missouri's eastern border. That case provided the backdrop for the stentorian pronouncements of Justice Holmes, equating that pollution to a *causus belli,*[157] which became the legal bedrock on which the *Ducktown* opinion rests. That same analysis of the

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155. The dissent of Justice Hughes, joined by Chief Justice White and Justice Holmes is a bit enigmatic, but seems to have differed on whether Ducktown's efforts had made a sufficient improvement. The dissenting opinion in its entirety reads: "I do not think that the evidence justifies the decree limiting production as stated." Georgia v. Tennessee Copper Co., 237 U.S. 474, 478 (1915).

156. *Id*. The Court subsequently revisited its decree and made minor changes in its terms. *See* Georgia v. Tennessee Copper Co., 240 U.S. 650 (1916).

157. Missouri v. Illinois, 200 U.S. 496, 520-21 (1906).

sovereign's right to be free of harm to its sovereign interests, not the previously described equitable apportionment doctrine, was at the forefront in the interstate litigation initiated by the Great Lakes states challenging Illinois' use of Great Lakes water to "flush" that sewage southward.[158]

The Chicago Diversion interstate litigation[159] has far more in common with the interstate nuisance cases than it does with late twentieth century equitable apportionment cases. Most simply, in *Wisconsin* and *Michigan v. Illinois*, [160] the other Great Lakes states sought an injunction against Illinois in their quasi-sovereign capacities against activities taking place in Illinois that caused substantial interference with enjoyment of lands and waters in their states. In that case, the complainant states alleged that the Chicago Diversion, as it was being operated at the time, was causing a drop in water levels on Lake Michigan and the downstream lakes of approximately six inches. That reduction in flow and channel depth, in turn, resulted in substantial lost carriage capacity, lost hydropower generation, and some adverse shoreline lakefront effects. The Court, relying on extensive quantified findings compiled by Special Master (and former Justice) Charles Evans Hughes, confirmed that the magnitude and extent of those "great losses" of the complainant states "are made apparent by these figures."[161] After concluding that only a bit less than one-half of the water being diverted was authorized by the Secretary of the Army pursuant to proper exercise of congressionally delegated authority, the Court referred the case to the Special Master for "the restoration of just rights to the complainants" in a manner "as speedy as practicable."[162] The Court called for abatement, not balancing.

The Master subsequently recommended, and the Court approved, a decree[163] that put Illinois on an eight-year schedule and reduced the diversion by almost eighty percent. Importantly, a

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158. *See* Wisconsin v. Illinois, 449 U.S. 48 (1980); Wisconsin v. Illinois, 388 U.S. 426 (1967); Wisconsin v. Illinois, 289 U.S. 395 (1933); Wisconsin v. Illinois, 281 U.S. 696 (1930); Wisconsin v. Illinois, 281 U.S. 179 (1930); Wisconsin v. Illinois, 278 U.S. 367 (1929). Ironically, by the time of the later litigation, Missouri, joined by the other downstream Mississippi River states, intervened on the side of Illinois because they now were enjoying river navigation benefits supported in part by the diverted Great Lakes water.

159. There also is Chicago Diversion litigation commenced by the United States on behalf of the Corps of Engineers to compel the corporate entity operating the waterworks and to abide permit limitations imposed on diversion pursuant to Corps authority granted by the Rivers and Harbors Act of 1899. *See* Sanitary Dist. of Chicago v. United States, 266 U.S. 405 (1925).

160. *See* 289 U.S. 395 (1933); Wisconsin v. Illinois, 281 U.S. 696 (1930); Wisconsin v. Illinois, 281 U.S. 179 (1930); Wisconsin v. Illinois, 278 U.S. 367 (1929).

161. Wisconsin v. Illinois, 278 U.S. 367, 409 (1929).

162. *Id.* at 421.

163. Wisconsin v. Illinois, 281 U.S. 179 (1930).

reduction to that level of diversion corresponded to a level where earlier findings of the Special Master indicated the harms to the complainant states would be slight. Thus, there would be no need for further abatement because at that level of diversion, the complainant states already would no longer be suffering legally cognizable injury. Importantly for public health, the Court affirmed the Master's recommendation that the effluent from the treatment plants that Chicago was required to construct under the decree would be channeled south out of the basin.[164] The Court also allowed a small incremental withdrawal for domestic use.[165]

There are three important ways in which the Chicago Diversion litigation indicates that its jurisprudence is more firmly part of the interstate tort line than the equitable apportionment line. First, the Court does not treat Illinois as having any interest in allocating or using the water in ways that might impose adverse consequences on its neighbors. The Court did not ask the Special Master to recommend an apportionment of the water; it asked him to recommend a decree that would abate the injury. Second, the key finding is like that in a nuisance case, and also like that of a potential ACF ecosystem services case. The linchpin of placing liability on Illinois turns solely on the degree of injury to the complainant states which was found to be "great" and "apparent."[166] That same concern for substantial injury limits the scope of the required abatement. Third, there is no balancing of the equities. The public health importance of Illinois' use of the water to send the huge volumes of sewage away from Lake Michigan and out of the otherwise stagnant waters of the Chicago River was obvious. Again, like *Ducktown*, the Court had an available outcome that was not an all or nothing result. The federally permitted level of diversion, supported by the Corps' power over navigation, and the new reduced level of diversion at which Chicago was expected to operate the system, were sufficient to solve the public health problem without unacceptable harm to the complainant states.

The Chicago Diversion litigation bears only a superficial resemblance to the Court's equitable apportionment jurisprudence: it involves water diversion and an interstate resource. Professor Hall has commented about the Chicago Diversion litigation:

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164. The Court's opinion openly questioned the wisdom of the Great Lakes states in seeking to have the effluent discharge returned to Lake Michigan ("we are somewhat surprised that the complainants should desire the effluent returned," *id.* at 200), and showed more common sense than the complainants by rejecting that request.

165. *Id.* at 200.

166. Wisconsin v. Illinois, 278 U.S. at 409.

> It is notable that the Supreme Court's opinions in the Chicago diversion dispute make only minor references to the Court's previous (primarily western) equitable apportionment cases. The Court's equitable apportionment doctrine began to evolve in the prior cases *Kansas v. Colorado* and *Wyoming v. Colorado*, yet the only references to these decisions were in a string citation regarding the Supreme Court's jurisdiction and a comment regarding the possibility that Congress could take action on the matter. Further, there is no discussion of the various water use doctrines in the relevant states. Nor does the Court establish any rule of law for allocating the waters of the Great Lakes among the states of region. These elements are typically central to the Supreme Court's handling of western equitable apportionment cases.
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> The Supreme Court's lack of reliance on its previous equitable apportionment cases may have been intentional. Perhaps the Court recognized that Great Lakes water management was less an issue of apportionment of water rights and more an issue of defining the bounds of the states' shared reasonable use duties.[167]

Given the nature of the underlying riparian rights, water law systems of all states involved in the controversy further that hypothesis. There is a marked similarity between the nature of common law riparianism and the law of nuisance. The Restatement (Second) of Torts states the principal precept of common law riparianism as a liability rule: "A riparian proprietor is subject to liability for making an unreasonable use of the water of a watercourse or lake that causes harm to another riparian proprietor's reasonable use of water or his land."[168] In salient regards, this is a nuisance standard and it appears to correspond to the approach of the Court in *Wisconsin v. Illinois*.

Distancing the Chicago Diversion case from equitable apportionment accentuates one aspect of how the case may be used as a precedent in ecosystem services cases. Simultaneously, there are elements present in that case that are shared with equitable apportionment cases that further, rather than diminish, the claims of

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167. Noah D. Hall, *Toward a New Horizontal Federalism: Interstate Water Management in the Great Lakes Region*, 77 U. COLO. L. REV. 405, 421-22 (2006) (footnotes omitted).

168. RESTATEMENT (SECOND) OF TORTS § 850 (1979).

state's harmed by impairment of ecosystem services. As with the quasi-sovereign[169] interest of the states in nuisance cases, the equal dignity of each of the states as quasi-sovereigns in equitable apportionment cases has important consequences for escaping the harsh outcomes that might seem to flow from the late twentieth century equitable apportionment approach taken in Vermejo River apportionment litigation. The precept of state sovereignty over shared basin resources announced in the first equitable apportionment case bears repeating:

> One cardinal rule, underlying all the relations of the States to each other, is that of equality of right. Each State stands on the same level with all the rest. It can impose its own legislation on no one of the others, and is bound to yield its own views to none.[170]

That attitude is repeated in other apportionment cases. For example, in *New Jersey v. New York*,[171] one of the first steps that led to the framing of the Delaware River Compact was the Court's decision to put New York on notice that New York City could not command the river to the detriment of the co-riparian states. Even more on point is the Columbia-Snake anadromous fish apportionment case[172] where the Court made it clear that the sovereign claim of each state to its resource base was sufficient to require sister states to respect that interest. There is much in the equitable apportionment cases that complements the interstate resource impairment cases and strengthens the hand of Florida when its ecosystem services claim is the basis of its objections to Georgia activities. To an extent, the full import of the Vermejo River equitable apportionment litigation must be understood as applicable only to a narrow range of western states' equitable apportionment cases where the interstate conflict is aptly governed by principles of prior appropriation law.

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169. Justice Holmes used the term "quasi-sovereign" to refer to the surrender of sovereignty of the states by which they renounced their ability to go to war with one another and accepted the forms of interstate dispute resolution set forth in the United States Constitution, most notably, via suit in the Court's original jurisdiction.

170. Kansas v. Colorado, 206 U.S. 46, 97 (1907).

171. 347 U.S. 995 (1954).

172. *See* Idaho *ex rel* Evans v. Oregon, 462 U.S. 1017 (1983).

D. Preemption[173] and Non-Preemption of Interstate Nuisance Remedies

The favored position of interstate nuisance, indeed its availability in the interstate stream context, can be called into question by the decisions announced by the United States Supreme Court in *Illinois v. City of Milwaukee* [174] and *Int'l. Paper Co. v. Ouellette*.[175] Those decisions are sometimes read as preempting interstate federal common law water pollution nuisance through the operation of the Clean Water Act. That conclusion, while accurate in a confined range of application, is not readily extended to cases of interstate impairment of ecosystem services.

Illinois v. City of Milwaukee reached the high court as the culmination of effort on the part of William Scott, the Illinois Attorney General, to bring a high profile and exceedingly popular lawsuit against the City of Milwaukee. The suit sought to protect the Illinois' Lake Michigan shores from beach closures and other impairments caused by the release of untreated and inadequately treated sewage by Milwaukee's rather antiquated combined sanitary and storm sewer system. The system's two outfalls into Lake Michigan were located less than thirty miles from the Wisconsin-Illinois state line, roughly ninety miles north of Chicago. The severity of the problem was made worse by the fact that Milwaukee had inadequate capacity in its combined system for sewage and runoff, so extensive raw sewage overflow events were triggered by even moderate rainfall events several times each year.

Initially, Illinois sought to invoke the original jurisdiction of the United States Supreme Court, as had Georgia in the *Ducktown* litigation. Instead of being allowed to proceed in that forum, the Court met the petition with its first opinion in the case.[176] The Court acknowledged that the case was within the limits of its original jurisdiction,[177] but found that jurisdiction was not obligatory and should be reserved for appropriately important cases, a determination that could be influenced by the availability of an

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173. The term preemption is usually reserved for preemption of state law or regulation by federal enactments. The legal phenomenon at work here is one of federal statutory interpretation, by which the presence of remedies for interstate water pollution in the Clean Water Act, a "comprehensive" statute, may be held to limit the scope of otherwise available common law remedies. *See infra* notes 190-92 and accompanying text.

174. 451 U.S. 304 (1981).

175. 479 U.S. 481 (1987).

176. *See* Illinois v. City of Milwaukee, 406 U.S. 91 (1972).

177. Article III, Section 2, Clause 2 of the United States Constitution provides that, "In all Cases . . . in which a State shall be a Party, the Supreme Court shall have original Jurisdiction." *See id*. at 93, 99.

alternative competent forum.[178] The Court went on to explain that the case was within the grant of federal question jurisdiction because it stated a claim arising under federal common law of interstate nuisance.[179] In dicta, the Court's opinion in *Illinois v. City of Milwaukee* suggested that water pollution control legislation might displace the common law if it comprehensively regulated the subject.[180] The opinion did not specifically mention the Federal Water Pollution Control Act Amendments of 1972[181] that were then being debated by Congress, but once that extensive legislation was enacted, it was certain that Milwaukee would seek dismissal on the preemption ground.[182]

Subsequently, Illinois filed the case in the United States District Court for the Northern District of Illinois located in downtown Chicago. The court found that the raw and inadequately treated sewage discharged by Milwaukee that befouled the Lake Michigan beaches and waters in Illinois was a nuisance and significantly impaired Illinois' rights. In the Seventh Circuit's opinion on this issue, the rule was stated very plainly: "The elements of a claim based on the federal common law of nuisance are simply that the defendant is carrying on an activity that is causing an injury or significant threat of injury to some cognizable interest of the complainant."[183] *Georgia v. Tennessee Copper* was cited as authority.[184] The District Court, affirmed by the United States Circuit Court of Appeals for the Seventh Circuit, ordered specific relief that would result in adequate treatment of all sewage and would require Milwaukee to build its capacity "to permit full treatment of

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178. *Id.* at 93. "The question of what is appropriate concerns, of course, the seriousness and dignity of the claim; yet beyond that it necessarily involves the availability of another forum where there is jurisdiction over the named parties, where the issues tendered may be litigated, and where appropriate relief may be had." *Id.* at 93; *see also* Washington v. General Motors Corp., 406 U.S. 109 (1972) (decided the same day, the Court declined to assert original jurisdiction over a claim by states against automakers that simultaneously was within the subject matter jurisdiction of the lower federal courts).

179. Illinois v. City of Milwaukee, 406 U.S. at 98. The bulk of the opinion is devoted to describing the origin of the federal common law in this area, with reliance on the principles already described herein. Two of the most prominent cases are, of course, *Missouri v. Illinois* and *Ducktown*.

180. *Id.* at 93.

181. 33 U.S.C. §§ 1251-1376 (2000).

182. *See* Illinois v. City of Milwaukee, 366 F. Supp. 298 (N.D. Ill. 1973) (rejecting Milwaukee's argument). This was an interlocutory ruling and could only be appealed after a final judgment, which it was. *See* Illinois v. City of Milwaukee, 599 F.2d 151 (7th Cir. 1979) (rejecting broad preemption argument, preempting and reversing effluent limitations for treated sewage that were different than those set by CWA). *See* City of Milwaukee v. Illinois, 451 U.S. 304 (1981) (accepting somewhat broader preemption argument) discussed *infra* notes 185-86.

183. *See* Illinois v. City of Milwaukee, 599 F.2d 151, 166 (7th Cir. 1979) (citing Georgia v. Tennessee Copper, 206 U.S. 230, 237-38 (1907)).

184. *Id.*

water from any storm up to the largest storm on record for the Milwaukee area."[185]

That abatement order was vigorously resisted by the City of Milwaukee and numerous amici involved with municipal sewage treatment concerns because of its economic impact. For example, Milwaukee's brief stated:

> The decision in this case will determine whether your petitioners, the City of Milwaukee, the Sewerage Commission of the City of Milwaukee, and the Metropolitan Sewerage Commission of the County of Milwaukee (cumulatively, "Milwaukee"), must spend, and if so when they must spend, literally hundreds of millions of dollars over and above what is required under pollution discharge permits issued pursuant to the new federal statutes. The Court's decision will affect the expenditure of tens of billions of dollars by municipalities across the nation.[186]

A contemporaneous EPA document had estimated the nationwide cost of improving combined sewage overflow treatment capacity at more than $21 billion for limiting raw sewage bypass discharge events to a level of two unrelated events per facility each year.[187] The standard of preventing a bypass under the worst recorded conditions, by comparison, was not even considered by the EPA.[188]

With the case in that posture, the Supreme Court reviewed the preemption rulings below. In effect there were two, because the Seventh Circuit had reversed the imposition by the District Court of specific effluent limitations for *treated* sewage that were different than those prescribed for the facility under its NPDES permit. Combined Sewer Overflows (CSOs), in contrast, were not the subject of specific numerical effluent limitations and the Seventh Circuit had felt free to uphold the stringent abatement ruling. CSO's however, were addressed in other ways by the CWA and by the EPA, the agency empowered to implement the CWA. Justice Rehnquist reached out to create a broad principle of displacement

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185. City of Milwaukee v. Illinois, 451 U.S. at 312.

186. Brief of Petitioners-Appellants at 6-7, City of Milwaukee v. Illinois, 451 U.S. 304 (1981) (No. 79-408). The cost assertions of petitioners were well founded. *See also* REPORT BY THE COMPTROLLER GENERAL OF THE UNITED STATES: LARGE CONSTRUCTION PROJECTS TO CORRECT COMBINED SEWER OVERFLOWS ARE TOO COSTLY, CED-80-40, 22 (Dec. 28, 1979).

187. *See* EPA, 1978 NEEDS SURVEY: COST METHODOLOGY FOR CONTROL OF COMBINED SEWER OVERFLOWS AND STORMWATER DISCHARGE, Rpt. No. 430/9-79-003 (Feb. 10, 1979) (pursuant to Sec. 516(b) of FWPCA, the EPA must submit a national needs report to Congress not later than February 10th of each odd numbered year).

188. *Id.*

of federal common law:

> We conclude that, at least so far as concerns the claims of respondents, Congress has not left the formulation of appropriate federal standards to the courts through application of often vague and indeterminate nuisance concepts and maxims of equity jurisprudence, but rather has occupied the field through the establishment of a comprehensive regulatory program supervised by an expert administrative agency.[189]

The majority found the CWA comprehensive in its regulation of dischargers required to have NPDES permits. More subtly, it also found that as for those dischargers, the displacement of federal common law of interstate water pollution nuisance applied to aspects of their discharges that were not the subject of numerical effluent limitations, or CSOs. The majority said:

> The overflows do not present a different case. They are *point source discharges* and, under the Act, are prohibited unless subject to a duly issued permit. As with the discharge of treated sewage, the overflows, through the permit procedure of the Act, are *referred to expert administrative agencies for control*. All three of the permits issued to petitioners explicitly address the problem of overflows.[190]

The opinion thereafter recited the ways in which CSOs were addressed explicitly in the permits and held that the ways in which they were addressed comported with duly promulgated EPA regulations.[191]

A few years later, in the case of interstate pollution of Lake Champlain, the Court further confined common law actions seeking to redress interstate water pollution nuisances.[192] In that instance, International Paper Company was located on the New York side of the lake and was discharging into the lake pursuant

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189. City of Milwaukee v. Illinois, 451 U.S. at 317. He also made clear that "displacement" of federal common law by federal statute can be found upon a lesser finding of congressional intent than preemption of state law because of the strong police power interest of the states and the historic federalism based recognition of concurrent regulation whenever Congress or its laws do not make the preemption express or plainly implied. *Id.* at 320.

190. *Id.* at 320 (emphasis added).

191. *Id.* at 321-22.

192. *See* Int'l. Paper Co. v. Ouellette, 479 U.S. 481 (1987).

to conditions contained in an NPDES permit.[193] Vermont plaintiffs sued in state law private nuisance for the unreasonable interference to their property caused by the defendant's pollution of the lake.[194] To begin with, the Court clearly recognized that state law nuisance actions survived the passage of the Clean Water Act and were not preempted by it.[195] This was clearly intended by Congress, as evidenced by the inclusion of section 510 of the Clean Water Act that states:

> Except as expressly provided . . . nothing in this chapter shall (1) preclude or deny the right of any State or political subdivision thereof or interstate agency to adopt or enforce (A) any standard or limitation respecting discharges of pollutants, or (B) any requirement respecting control or abatement of pollution; except that if an effluent limitation, or other limitation, effluent standard, prohibition, pretreatment standard, or standard of performance is in effect under this chapter, such State or political subdivision or interstate agency may not adopt or enforce any . . . less stringent . . . effluent limitation, or other limitation, effluent standard, prohibition, pretreatment standard, or standard of performance . . .; or (2) be construed as impairing or in any manner affecting any right or jurisdiction of the States with respect to the waters . . . of such States.[196]

What the Court did do to limit the plaintiffs, however, was limit the choice of law that could be applied to the case. The Court held that only New York state nuisance law, the law of the situs of the factory and the law of the state that had issued the permit could be applied.[197] The rationale was that the regulated party should have all of its responsibilities ascertainable with certainty by the reference to the law of the sovereign in whose territory it was operating.[198]

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193. *Id.* at 481.
194. *Id.*
195. *Id.* at 498-99.
196. 33 U.S.C. § 1370.
197. Int'l Paper Co., 479 U.S. at 497.
198. This is a very odd result in at least two respects. First, over the years the Court has exercised very little federal control of choice of law. *See e.g.* Allstate Ins. Co. v. Hague, 449 U.S. 302 (1981). Second, the limit of choice of law was not a position argued by any of the parties or amici. Importantly for present purposes, the most interesting position taken in the briefs was that of the United States, which suggested that holding a valid NPDES permit and operating within the limits prescribed in the permit, should, in the remedy

City of Milwaukee v. Illinois (*Milwaukee II*) and *Ouellette* do not vitiate the force of public interstate nuisance in the ecosystem services context.[199] Both cases arise in the confined context of NPDES regulated discharges. The effluents directly causing the harm to the complainants were explicitly regulated by permits issued to defendants as part of an unusually comprehensive and tightly integrated statute for the regulation of those discharges and the injuries to water quality that result. Despite suggestively broad language in *Milwaukee II*, in the end, Justice Rehnquist's opinion was founded on direct regulation of the CSOs, not evisceration of a common law remedy for aspects of interstate damage that were not part of the CWA's direct regulatory web.

The case for the continued vitality of interstate nuisance actions by states to protect their quasi-sovereign interest in ecosystem services should not be seen as impaired by *Milwaukee II* or *Ouellette*. Most, if not all impairments of ecosystem services are not the direct result of a comprehensively regulated activity that is regulated to prevent that type of harm. For that reason, *Milwaukee II* is simply inapplicable. Reading it so broadly to find wholesale displacement of interstate nuisance lawsuits contradicts Justice Rehnquist's own language in the case in which he stresses the multifaceted direct regulation of the specific offending activity by the CWA. Moreover, in situations like the ACF, where there is not effective comprehensive federal regulation of the resource, it would be quite surprising to invoke overbroad language of Justice Rehnquist to eviscerate that quasi-sovereign state interest[200] and leave a complainant state with no remedy whatsoever for undue substantial harm.

It is important to recognize that Illinois, despite being denied the degree of abatement of Milwaukee's discharges that it sought

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phase, be a complete defense to an injunction. *See* Brief for the United States et al. as Amicus Curiae Supporting Affirmance, Int'l. Paper Co. v. Ouellette, 479 U.S. 481 (1987) (No. 85-1223). The Court, even though it went well beyond the positions of the parties to decide the case, declined to go in this direction, thereby rejecting preemption of the abatement remedy in the presence of permit compliance. *Id.*

199. *Ouellette* is not even a public nuisance action and does not involve a remedy similar to that sought by Georgia in *Ducktown* or by the Great Lakes states in the Chicago Diversion litigation. Moreover, *Ouellette* does not cut off common law remedies, including possible abatement. Plaintiffs will be able to obtain a fair application of source state nuisance law. Allowing the case to proceed in the courts of the victim state (Vermont) was a reasonable assurance that New York nuisance law would be honestly applied as required by full faith and credit, and the equities fairly balanced without the fear of a local New York judge protecting the local polluting entity against loss or abatement if warranted.

200. It would be even more surprising to find Justice Rehnquist as the intentional architect of a doctrine that allowed speculative characterizations of federal legislation to debase a long-recognized core element of state sovereignty. *Cf.* David L. Shapiro, *Mr. Justice Rehnquist: A Preliminary View*, 90 HARV. L. REV. 293 (1976).

in the common law action, still obtained a remedy that substantially improved water quality and reduced impairment caused by Milwaukee to a reasonable level. The CWA, which was not in place when Illinois originally sued, provided an effective remedy, albeit a less demanding one, than the District Court was willing to grant in the nuisance litigation. Milwaukee improved the adequacy of its sewage treatment and vastly reduced the frequency of CSO bypasses. In that regard, the outcome in *Illinois v. Milwaukee* has a great deal in common with the levels of abatement won by Georgia in the *Ducktown* case and the Great Lakes states in the Chicago Diversion litigation. None of the offending activities were totally abated. In practical terms, all of the challenged uses were vital, and the "victim" state, so long as its interest was adequately protected, could no more have expected total cessation of the activity, than could New Jersey expect that New York would not be allowed to have some of the water from the Delaware. State sovereignty is reciprocal. In every case, however, the unacceptable degree of harm was reduced to an acceptable level. Somewhat abstractly, it is possible to describe the difference in the three remedial situations as relating to the source from which the Court obtained the standard it employed to define acceptable interference with the sovereign interest of the complainant state. In *Ducktown*, the Court borrowed a level of pollution to which Georgia had agreed to submit. In the Chicago Diversion litigation, the level of insubstantial injury was determined by findings of the Special Master. In *Illinois v. Milwaukee*, the level of control that renders the impairment not an infringement of Illinois' sovereign interest is the level established by the federal expert agency considering the composite interests of all states as potential dischargers and as potential victims of the discharges. *Milwaukee II* is most assuredly not a death knell for suits by complainant states seeking protection against extraterritorial activities that cause substantial impairment of ecosystem services. There will be no preemption of Florida's claims as they relate to either the Chattahoochee (Corps dam operations) or the Flint (EPD permitted dewatering) in the ACF basin. No one is comprehensively managing the resource under a statute that is intended to address the harms suffered downstream.[201]

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201. It is important to recognize that there are some avenues of interstate protection that Florida may seek to invoke apart from interstate nuisance. For example one of the CWA "rights" of the downstream state is the ability to set water quality standards and have them protected from upstream interference. *See* Arkansas v. Oklahoma, 503 U.S. 91 (1992). If the Apalachicola is a water quality impaired stream, for example, setting a heat TMDL that is exceeded due to upstream irrigation-induced increases in the temperature of Flint River source water might protect downstream state ecosystem services. *See* S.D. Warren

V. CONCLUSIONS

The more extensive the resourceplex, the more likely it is that the stream of benefits flowing from it cannot simultaneously be maximized for all potential users. Thinking about the ACF basin in the most general terms, it is axiomatic that some short term localized benefits are obtained at the cost of longer term productivity, whether locally or in other parts of the basin. It is axiomatic that some consumptive uses of water or effluent assimilation uses of water degrade downstream in situ uses. It is axiomatic that demands for upstream summer storage compete with downstream summer irrigation. As surely as water flows downstream under the pull of gravity, user conflicts flow down the river system with the water, whether in excessive or inadequate amounts, and whether of greater or lesser quality.

In virtually all basins, laissez faire governance of river systems, if it ever existed, long ago succumbed to the regulatory commands of federal and state agencies pursuing legitimate, but fragmented water policies. Only in the rarest of cases does a decisionmaker have sufficient authority to mange the entire resourceplex, and even more rarely is that power free from debilitating political fractionalization.[202] In the river basin world, the one or two exceptions[203] are hard to replicate. Sovereigns must willingly surrender sovereignty. Usually, one sovereign will have to do so in a setting where it is also giving up a "winning hand" under the existing governance regime. Such acts are seldom taken in the absence of an otherwise insuperable crisis.[204]

What grows up, as conflicts mature, are efforts by interested parties to influence how the water of the basin is allocated and used. Too often, as in the ACF, those at the bottom of the basin or in its less developed areas, find their ecosystem services being degraded through developmental activities occurring elsewhere in the basin. The law, up until now, has encouraged this pattern. Better knowledge of ecosystem services can be a key factor in arresting the pattern and reversing the trend. Identifying the value of ecosystem services and raising the level of visibility of the activities that encroach upon them greatly increases the chances that those values will be protected.

Co. v. Maine Bd. of Envtl. Prot., 126 S.Ct 1843 (2006); PUD No. 1 of Jefferson County v. Wash. Dep't of Ecology, 511 U.S. 700 (1994).

202. *See generally* Janet Neuman, *supra* note 11.

203. *See supra* notes 29-32 and accompanying text for discussion of DRBC.

204. For a different governance model that seeks to retain state sovereignty by managing to a collectively agreed standard *see* Hall, *supra* note 168.

The process of reshuffling the legal deck begins with the embrace of principles of state sovereignty and resource integrity. These principles were first announced by the Court a century ago. They have never been repudiated, but they were not prominent in the Court's most recent western states equitable apportionment decision. The centurion character of those precedents and the relative lack of intervening cases combine to raise the normative question of whether it remains appropriate to apply them in modern ecosystem services context. To the extent that those early cases were grounded on the nature of state sovereignty in the American federal system, the equation is unchanged. Justice Holmes made it abundantly clear what interest was represented and why the Court must honor it.[205]

The interstate context holds the most promise for change because the traditional American federalism value of correlative state sovereignty has been and can again be channeled into the adjudication process. There is much in the Court's interstate water jurisprudence that has always been aligned with this concept of state sovereignty in regard to resources, especially water resources. All states are on an equal legal footing in regard to water resources.[206] Each is free to choose its own water law. Each state, likewise, comes before the Supreme Court as a co-equal sovereign, whose interests are entitled to the same respect as those of her sister states.[207] More emphatically, the Court's interstate nuisance jurisprudence lends itself to protecting a state's interest in ecosystem services against substantial impairment. Georgia maximizes its benefits in the ACF Basin by holding water in upstream reservoirs on the Chattahoochee and consuming water from the Flint and hydrologically linked groundwater for irrigation. Georgia, however, does not have the right to impose a western style appropriation of resource values on Florida, which benefits from the ACF resourceplex in a different, but still substantial manner. For the ACF Basin, it is important that the time for reestablishing the traditional principles of interstate resource sharing be now, before the estuary pays an irreversible price for upstream development spurred by Corps of Engineers tunnel vision, unwise subsidies, and parochial state agency policies. The states have correlative rights to the use of water and the ecosystem services of the resourceplex. Georgia may opt for differing levels of use than Florida or Ala-

205. *See* New Jersey v. New York, 283 U.S. 336, 342 (1931).

206. "States admitted to the Union after the original thirteen succeed to the same rights as the original states." A. DAN TARLOCK, LAW OF WATER RIGHTS AND RESOURCES § 8.8 (Susan Mauceri ed., Thomson/West) (2006).

207. *See, e.g.*, Kansas v. Colorado, 206 U.S. 46 (1907).

bama, but Georgia cannot unilaterally impose the substantial adverse consequences of its water use choices on its "quasi-sovereign" neighbors. The ACF Basin, eventually, will have its own law, and it is reasonable to hope that public nuisance concepts will allow recognition of ecosystem services values to play a role in determining how the water is used.

Appendix A

ACF BASIN FLOWS

Data set	RIVER													
	RIVER	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1976-2005	Chattahoochee	13,100	16,800	19,700	14,100	9,980	8,170	8,910	7,690	6,730	6,480	8,270	11,200	131,130
1938-2005	Flint - Newton	8,510	10,700	12,800	10,600	6,230	4,800	5,230	4,060	3,190	3,310	3,650	5,640	78,720
	Flint-N % of inflow	39%	39%	39%	43%	38%	37%	37%	35%	32%	34%	31%	33%	38%
	Flint-B % of inflow	50%	48%	48%	57%	50%	49%	45%	48%	43%	44%	39%	43%	48%
	above Woodruff -N	21,610	27,500	32,500	24,700	16,210	12,970	14,140	11,750	9,920	9,790	11,920	16,840	209,850
	above Woodruff -B	23,909	29,883	35,417	28,219	18,033	14,530	15,279	13,326	11,010	10,808	12,868	18,447	231,729
1928-2005	Apalachicola-head	27,200	33,300	40,600	34,100	21,700	16,600	17,300	15,100	12,300	12,400	13,400	20,100	264,100
1977-2005	Apalachicola-estuary	28,800	39,000	45,100	36,500	24,000	19,900	22,400	19,500	16,400	14,900	16,100	23,300	305,900
	Flint River Data Adjustment to use Bainbridge													
	Bainbridge 2001										2098	1897	2989	
	Bainbridge 2002	3355	4934	6175	5757	3314	2066	2241	1839	2091	3707	6643	6011	
	Bainbridge 2003	6825	8449	17980	13000	14550	12920	10790	10460	5660	4326	4506	5134	
	Bainbridge 2004	5136	11500	7371	4429	4454	4616	4646	3534	12390	8107	7015	8336	
	Bainbridge 2005	7419	9742	13330	28610	9127	12530	20480	10930	5852				
	4 yr total	22735	34625	44856	52796	31445	32132	38157	26763	25993	18238	20061	22470	
	Newton 2001										1539	1504	2472	
	Newton 2002	2996	4249	5345	4581	2747	1434	1744	1311	1490	3172	5242	4770	
	Newton 2003	5065	7048	14080	9039	11810	9869	8557	7595	3811	3026	3290	3997	
	Newton 2004	4219	9165	5325	3248	3358	3477	3270	2704	10370	6212	5890	6248	
	Newton 2005	5619	7856	11780	22770	6412	9471	17760	7669	3703				
	4 yr total	17899	28318	36530	39638	24327	24251	31331	19279	19374	13949	15926	17487	
	Bainbridge %	127%	122%	123%	133%	129%	132%	122%	139%	134%	131%	126%	128%	129%

Source: http://waterdata.usgs.gov

Site #	Site
02343801	Chattahoochee near Columbia AL
02353000	Flint at Newton GA
02356000	Flint at Bainbridge GA
02358000	Apalachicola at Chattahoochee FL
02359170	Apalachicola at Sumatra FL

FEDERAL RANGELAND POLICY: PERVERTING LAW AND JEOPARDIZING ECOSYSTEM SERVICES

DEBRA L. DONAHUE*

I. INTRODUCTION

In 2000 the federal Bureau of Land Management (BLM) warned that a "large part of the Great Basin lies on the brink of ecological collapse ."[1] The BLM attributed the "downward spiral of ecological conditions" on 75 million acres of public lands in the Great Basin to invasive plant species (primarily cheatgrass) and fire,[2] and it related fire and vegetative conditions to livestock grazing.[3] About the same time that BLM issued this dire warning, the first issue of a new journal devoted to biological invasions was released. In it, two prominent scientists warned that "positive feed-

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1. BUREAU OF LAND MANAGEMENT, THE GREAT BASIN: HEALING THE LAND 1, 35 (2000) [hereinafter HEALING THE LAND]. *See also* Great Basin Restoration Initiative, Executive Summary ("The Great Basin is facing a crisis. A century ago, it consisted of a network of dynamic ecosystems that supported diverse species of plants and animals. Today . . . [it] has arrived at the threshold of a critical, and potentially permanent, change."), http://www.fire.blm.gov/articles/exec.htm (last visited June 21, 2007). The Great Basin, also known as the Intermountain Region, "includes most of Nevada, the western half of Utah, lower third of Idaho, the southeast corner of Oregon and a narrow strip of eastern California." HEALING THE LAND, *supra* at 9.

2. HEALING THE LAND, *supra* note 1, at Letter to Reader (statement of Acting BLM Director, Tom Fry).

3. *Id.* at 12 (noting that "changes in wildland fire" and grazing are "related," that early livestock grazing led to the decrease of native perennial grasses and invasion of cheatgrass, and that removal of biological soil crusts by livestock facilitated the invasion of exotic plants).

backs among [the] increasing number of exotic [plant and animal] species can facilitate additional invasions and lead to an invasional 'meltdown.'"[4] A study published in *Science* in 2006 provides compelling support for this hypothesis.[5] Based on their review of dozens of published studies, the researchers observed that "[n]ative herbivores strongly suppressed, whereas exotic herbivores strongly enhanced, the relative abundance of exotic plants."[6] They concluded that "anthropogenic alteration of herbivore communities has facilitated exotic plant invasions."[7] "These findings" they urged, "have considerable implications for ecosystem conservation, suggesting that *eradication of exotic herbivores and restoration of native generalist herbivores* could mitigate exotic plant invasions . . . ."[8]

Invasive plants are problematic West-wide.[9] Weeds significantly compromise the potential of rangelands[10] for producing ecosystem goods and services: They "threaten soil productivity, water quality and quantity, native plant communities, wildlife habitat, wilderness values, recreational opportunities, and livestock forage, and are detrimental to the agriculture and commerce of the U.S.

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4. Daniel Simberloff & Betsy Von Holle, *Positive Interactions of Nonindigenous Species: Invasional Meltdown?*, 1 BIOL. INVASIONS 21 (1999).

5. John D. Parker et al., *Opposing Effects of Native and Exotic Herbivores on Plant Invasions*, 311 SCI. 1459 (2006).

6. *Id.* at 1459 (citation omitted). The investigators "tested the effects of herbivores on exotic plant invasions using meta-analysis to examine 63 published studies that experimentally excluded herbivores and monitored the success of more than 100 exotic plant species." *Id.* (noting that studies were drawn from a broad range of biomes and vertebrate and invertebrate herbivores, both native and exotic). "[E]xotic herbivores increased the relative abundance of exotic plants by 65%" and "promoted exotic plant dominance and richness." *Id.* at 1459-60. "Native vertebrate herbivores had a three- to fivefold larger [negative] impact on exotic plant survival than did native invertebrate herbivores." *Id.* at 1460 (citation omitted).

7. *See id.* at 1460.

8. *Id.* (emphasis added) (footnote omitted).

9. *See, e.g.,* HEALING THE LAND, *supra* note 1, at 24 ("Montana, Wyoming, Colorado and California all have serious invasive species problems."); DAVID S. DOBKIN & JOEL D. SAUDER, SHRUBSTEPPE LANDSCAPES IN JEOPARDY: DISTRIBUTIONS, ABUNDANCES, AND THE UNCERTAIN FUTURE OF BIRDS AND SMALL MAMMALS IN THE INTERMOUNTAIN WEST 3, 6, 8 (2004) (describing sagebrush ecosystems as on the brink of "collapse"); Steven T. Knick et al., *Teetering on the Edge or Too Late? Conservation and Research Issues for Avifauna of Sagebrush Habitats,* 105 CONDOR 611 (2003).

10. "Rangeland" refers to both an ecosystem type and a land use. *See* Norman L. Christensen et al., *The Report of the Ecological Society of America Committee on the Scientific Basis for Ecosystem Management*, 6 ECOL. APPL'NS 665, 671, (Box 3) (1996). "Rangelands" are defined broadly by the Society for Range Management (SRM) as lands "characterized by native plant communities, which are often associated with grazing, and are managed by ecological, rather than agronomic methods." Society for Range Management, *Policy Statement: Rangeland and Range Resources*, http://www.rangelands.org/about_pos_rangeresources.shtml (last visited June 21, 2007); *see also* COMMITTEE ON RANGELAND CLASSIFICATION, NATIONAL RESEARCH COUNCIL, RANGELAND HEALTH: NEW METHODS TO CLASSIFY, INVENTORY, AND MONITOR RANGELANDS 19 (1994) [hereinafter RANGELAND HEALTH] ("Grazing lands . . . include rangelands, forests, and pastures.").

and to public health."[11] Despite efforts to combat them, "[i]nvasive vegetation and noxious weeds are the dominant vegetation on an estimated 35 million acres of public lands,"[12] spreading at an estimated rate of 4,600 acres per day.[13] According to the BLM, weeds and the resulting "build-up of hazardous fuels" pose "one of the greatest challenges in ecosystem management."[14]

Federal range management, however, seems divorced from these realities. Despite identifying the causal factors and admitting that "[w]hat we've done before . . . has not reversed this trend,"[15] the BLM pursues business as usual.[16] Its range management has changed little, and its proposals for restoring ranges[17] largely ignore the causes of current conditions.[18] Indeed, both

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11. BUREAU OF LAND MANAGEMENT, DEP'T OF INTERIOR, VEGETATION TREATMENTS USING HERBICIDES ON BUREAU OF LAND MANAGEMENT LANDS IN 17 WESTERN STATES, DRAFT PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT, at ES-1 (2005) [hereinafter VEGETATION TREATMENTS PEIS]. Healthy rangelands provide a wealth of goods and services. *See generally* RANGELAND HEALTH, *supra* note 10, at 4-5 (defining rangeland "health"); *id.* at 1, 18, 19 (including among rangeland ecosystem services "wildlife habitat, water, minerals, energy, recreational opportunities, some wood products, and plant and animal genes," as well as scenic beauty, solitude and open space, wilderness, sources of spiritual and cultural enrichment, and opportunities for scientific research); *cf.* Jan G. Laitos & Thomas A. Carr, *The Transformation on Public Lands*, 26 ECOL. L.Q. 140, 235 (1999) ("The total value of ecosystem services amounts to $71.7 billion from the national forest system, [and] $222.3 billion from BLM lands.").

12. VEGETATION TREATMENTS PEIS, *supra* note 11, at ES-1; *cf. id.* at 3-26 ("BLM estimates that nearly 36 million acres of public lands were infested with weeds in 2000, and that invasive plants and noxious weeds are spreading at a rate of about 2,300 acres per day." (citation omitted)).

13. AMERICAN LANDS ALLIANCE, THE SAGEBRUSH SEA 3, 12 (2001) (citing A.J. BELSKY & J.L. GELBARD, LIVESTOCK GRAZING AND WEED INVASIONS IN THE ARID WEST (2000); Use of Weed-free Forage on Public Lands in Nevada, 65 Fed. Reg. 54,544 (Sept. 8, 2000)).

14. *See* VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-207; *cf.* JARED DIAMOND, COLLAPSE: HOW SOCIETIES CHOOSE TO FAIL OR SUCCEED 437 (2005) ("Among the most recalcitrant problems today are those posed by introduced pest species [including weeds] . . . ."); *see also id.* at 55-56.

15. HEALING THE LAND, *supra* note 1, at Letter to Reader. By "what we've done before" the agency was referring to "a combination of treatments primarily designed to stabilize soils after a wildland fire." *Id.* It seemed oblivious of the wider implications of the statement—that seventy years of BLM management has not checked the deterioration of arid and semiarid rangelands.

16. *See infra* Part II.A.-B.

17. *See* VEGETATION TREATMENTS PEIS, *supra* note 11; BUREAU OF LAND MANAGEMENT, DEP'T OF INTERIOR, VEGETATIVE TREATMENTS ON BUREAU OF LAND MANAGEMENT LANDS IN 17 WESTERN STATES, DRAFT PROGRAMMATIC ENVIRONMENTAL REPORT (2005) [hereinafter VEGETATION TREATMENTS PER] (describing the BLM's proposed heavy reliance on herbicides, mechanical treatments, and fire to combat invasive weeds). *See also* HEALING THE LAND, *supra* note 1; *infra* Part II.

18. National forest management is subject to similar criticisms. *See, e.g.*, USDA-FOREST SERVICE, CHANGE ON THE RANGE: NEW PERSPECTIVES FOR RANGELAND RESEARCH IN THE 90S (1992) (reporting that more than forty-seven percent of riparian areas in national forest grazing allotments were "not meeting management objectives"); CURTIS H. FLATHER ET AL., SPECIES ENDANGERMENT PATTERNS IN THE UNITED STATES, U.S. Forest Service Gen. Tech. Rep. RM-241, at 22-23 (1994) (deeming livestock grazing the primary cause of species endangerment in arid regions of the West).

the BLM and the U.S. Forest Service (USFS) continue to manage rangelands in ways that ensure the weed problem will persist and probably worsen. The immediate causes are management policies that unduly favor certain land uses, particularly livestock production.[19] Underlying these policies are skewed interpretations of the agencies' legal obligations and authority.[20] Thus, although the BLM has declared that "[r]estoration work must begin now,"[21] neither agency is using the potentially most powerful tool at its disposal—removal of livestock.[22]

Using the BLM's management of invasive weeds, specifically cheatgrass, as a case study, this article argues that the BLM and USFS possess both the authority and a duty to manage public rangelands so as to ensure the sustainable generation of ecosystem goods and services. The discussion centers on the worsening weeds problem because it is arguably the single greatest threat to rangeland ecosystem service provision.[23] All surface-disturbing activities tend to promote the spread of weeds.[24] The paper focuses on livestock grazing because it is the predominant western land use,[25] a (if not *the*) major cause of the weeds problem,[26] and a

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19. Indeed, it is widely recognized that the impacts of livestock grazing on arid and semiarid lands can be (and in some cases already have been) irreversible. *See infra* discussion of thresholds at notes 31-39. *See also* COMPTROLLER GENERAL, GENERAL ACCOUNTING OFFICE, PUBLIC RANGELAND IMPROVEMENT—A SLOW, COSTLY PROCESS IN NEED OF ALTERNATE FUNDING, GAO/RCED-83-23 at 11 (1982) ("[I]t is widely accepted that past overgrazing permanently damaged our Nation's public rangelands and that they cannot be restored to their pregrazing state."); RANGELAND HEALTH, *supra* note 10, at 37-46, 90-91; DAVID SHERIDAN, DESERTIFICATION OF THE UNITED STATES 120–23 (1981) (noting overgrazing's contribution to desertification in vast areas of the West); DEBRA L. DONAHUE, THE WESTERN RANGE REVISITED: REMOVING LIVESTOCK FROM PUBLIC LANDS TO CONSERVE NATIVE BIODIVERSITY 64–66, 114–20 (1999) (describing changes in the physical landscape of rangelands).

20. *See infra* notes 61-71 and accompanying text; *infra* Part III.

21. HEALING THE LAND, *supra* note 1, at 6; *id.* at 2 ("Healing of the Great Basin needs to begin now. Tomorrow may be too late.").

22. *See infra* notes 112-20 and accompanying text; *see also* DONAHUE, *supra* note 19, at 287-88.

23. *See supra* text accompanying note 14.

24. According to the BLM:

> [I]nvasive plants are spread primarily by vehicles, humans, wild horses, livestock, wind, water, and wildlife. Initially, invasive weeds may get established in disturbed sites such as trailheads, along roads and trails, firebreaks, landing pads, oil and gas development sites, wildlife and/or livestock concentration areas, and campgrounds, but may also invade relatively undisturbed sites.

VEGETATION TREATMENTS PEIS, *supra* note 11, at 3-26.

25. *See generally* Thomas L. Fleischner, *Ecological Costs of Livestock Grazing in Western North America*, 8 CONS. BIO. 629 (1994); *id.* at 629 (reporting that "[l]ivestock grazing is the most widespread land management practice in western North America" occurring on seventy percent of the area); GEORGE CAMERON COGGINS ET AL., FEDERAL PUBLIC LAND AND RESOURCES LAW 777 (5th ed. 2002) (describing livestock production as the most widespread commercial use of federal lands). At least 160 million acres of BLM lands and about

principal driver in the declining productivity of arid and semiarid rangelands.[27] Part II of this article provides a brief summary and critique of the BLM's strategy for weed control and argues that removing livestock from certain lands will be essential to the success of any invasive species control effort.[28] Part III examines the laws governing BLM and USFS rangeland management and urges that a proper construction of the agencies' legislative authority supports a weed control program based on the removal of livestock. The article concludes that the potentially drastic consequences of maintaining the status quo on public rangelands outweigh the costs to ranchers and the social risks of acting in the face of scientific uncertainty. As the BLM and a growing number of commentators have warned, we *must act now*. If we fail to change the way we use rangelands, both the lands and the human communities that depend on them[29] will become increasingly impoverished.[30]

II. CASE STUDY: INVASIVE WEEDS

A. A Summary and Critique of BLM Weed Control Proposals

Weed invasions on arid and semiarid western rangelands are accompanied by a progressive deterioration of ecological function.

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100 million acres of national forests are open to grazing. *See generally* VEGETATION TREATMENTS PEIS, *supra* note 11, at 3-1; VEGETATION TREATMENTS PER, *supra* note 17, at 4-120; *Public Land Ranching by the Numbers*, *in* WELFARE RANCHING: THE SUBSIDIZED DESTRUCTION OF THE AMERICAN WEST 5 (George Wuerthner & Mollie Matteson eds., 2002) [hereinafter WELFARE RANCHING].

26. *See supra* notes 5-8, 24, *infra* notes 34-39, 56 and accompanying text.

27. *See generally* DONAHUE, *supra* note 19, chs. 1, 3 & 5 (recounting the ongoing ecological impacts of public-land livestock production and explaining the significance of aridity); *see also* Fleischner, *supra* note 25; R.D. Ohmart & B.W. Anderson, *Riparian Habitat*, *in* INVENTORY AND MONITORING WILDLIFE HABITAT 169–99 (B.S. Cooperrider ed., 1986) ("[L]ivestock grazing may be the major factor negatively affecting wildlife in the 11 western states."); VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-211 (reporting "a general downward trend in habitat value from historical conditions for nearly all habitat types evaluated" in the Interior Columbia Basin, and attributing the habitat modification to "grazing by domestic livestock and wild horses and burros, timber management, fire suppression, and invasion by weeds and other unwanted vegetation"). *See also infra* notes 34, 256.

28. *See infra* Part II.

29. *See* AMERICAN LANDS ALLIANCE, *supra* note 13, at 3 (noting that the interior West is "the fastest growing region of the country" and "[a] number of the fastest growing counties . . . are in the Sagebrush Sea" (citing BLM, ELEVEN WESTERN STATES ARE AMONG THE FIFTEEN FASTEST GROWING IN THE U.S. (2000))).

30. "Impoverishment" is used increasingly to describe the consequences of species loss and degradation of ecosystems. *See, e.g.*, H E. Dregne, *Desertification of Arid Lands*, *in* PHYSICS OF DESERTIFICATION (F. El-Baz & M. H. A. Hassan eds., 1986), *available at* http://www.ciesin.columbia.edu/docs/002-193/002-193.html; James A. Young et al., *Alien Plants in the Great Basin*, 25 J. RANGE MGMT. 194, 194 (1972); Daniel Quammen, *Planet of Weeds*, HARPER'S, Oct. 1998, at 57, 67.

This process, which can culminate in ecological "collapse,"[31] demonstrates ecological threshold principles.[32] Drivers include loss of species and genetic diversity, "overharvesting, climate change, invasive species, and nutrient loading."[33] In the Intermountain West, the chief driver of ecosystem change has been prolonged and excessive disturbance by livestock grazing,[34] which has altered plant structure, species composition, and soil conditions[35] and led to altered fire cycles.[36] When threshold conditions are exceeded, a new vegetative community develops and reestablishment of predisturbance conditions can become unfeasible.[37] Ecosystem function and, hence, services can be impacted profoundly and irreversibly.[38] It is just such a transition—from native shrub-

31. *See* HEALING THE LAND, *supra* note 1; *see generally* BUREAU OF LAND MANAGEMENT, OUT OF ASHES, AN OPPORTUNITY 14 (1999) [hereinafter OUT OF ASHES].

32. Thresholds are "typical feature[s] of the relationship between human pressure on the environment and ecosystem function." ECONOMICS FOR THE ENVIRONMENT CONSULTANCY (EFTEC), THE ECONOMIC, SOCIAL AND ECOLOGICAL VALUE OF ECOSYSTEM SERVICES: A LITERATURE REVIEW 8 (Jan. 2005) [hereinafter EFTEC]. They mark "boundar[ies] in space and time between two ecological states." RANGELAND HEALTH, *supra* note 10, at 37. Regarding thresholds on arid and semiarid landscapes, *see* M.H. Friedel, *Range Condition Assessment and the Concept of Thresholds: A Viewpoint*, 44 J. RANGE MGMT. 422, 424-26 (1991); W.A. Laycock, *Stable States and Thresholds of Range Condition on North American Rangelands: A Viewpoint*, 44 J. RANGE MGMT. 427–28 (1991); *see generally* RANGELAND HEALTH, *supra* note 10, at 36–39 (discussing thresholds between ecological states and types of rangeland change).

33. *See* MILLENNIUM ECOSYSTEM ASSESSMENT, ECOSYSTEMS AND HUMAN WELL-BEING: SYNTHESIS 12 (Island Press 2005) [hereinafter MILLENNIUM ASSESSMENT]. Significantly, livestock grazing plays a role in each of these factors.

34. Overgrazing is a chief cause of rangeland desertification not only in the West but worldwide. *See* Dregne, *supra* note 30; SHERIDAN, *supra* note 19, at 121 (identifying overgrazing as the "most potent desertification force, in terms of total acreage affected," of 225 million acres of the U.S.); *see also* MILLENNIUM ASSESSMENT, *supra* note 33, at 47 ("Expansion of livestock production around the world has often led to overgrazing and dryland degradation, rangeland fragmentation, loss of wildlife habitat, dust formation, bush encroachment, deforestation, nutrient overload through disposal of manure, and greenhouse gas emissions." (citation omitted)). *Cf. infra* text accompanying note 318 (quoting PRIA).

35. *See* RANGELAND HEALTH, *supra* note 10, at 91.

36. The spread of cheatgrass, in particular, is responsible for drastically shortened fire cycles in the Intermountain West. *See infra* note 95 and accompanying text.

37. *See* RANGELAND HEALTH, *supra* note 10, at 37-38 ("Threshold changes . . . are not reversible on a practical time scale without human intervention. In some cases, human intervention may not be sufficient to reverse these changes, for example, severe soil erosion." (citation omitted)); DONAHUE, *supra* note 19, at 145–51, 158–60, 179; *cf.* Thomas J. Valone et al., *Timescale of Perennial Grass Recovery in Desertified Arid Grasslands Following Livestock Removal*, 17 CONS. BIO. 995, 999 (2002) (observing "dramatic increase in perennial grass cover" following *thirty-nine* years of rest from grazing, and suggesting that on some sites, perhaps due to soils, "loss of perennial grass cover from historic grasslands may not be irreversible"). Unfortunately, "we currently lack sufficient understanding of ecosystem dynamics to identify thresholds *a priori*, and consequently it is difficult to implement informed policy." EFTEC, *supra* note 32, at 8.

38. "Ecosystem function depends on its structure, diversity, and integrity." Christensen et al., *supra* note 10, at 671. Experimental studies generally "show that ecosystem functioning is decreased as the number of species in a community decreases." Shahid Naeem et al., *Biodiversity and Ecosystem Functioning: Maintaining Natural Life Support Processes*,

perennial grass communities to a cheatgrass-dominated landscape—that caused the BLM to warn of the "downward spiral" and incipient collapse of much of the Great Basin.[39]

BLM management policies, however, do not heed what science teaches about thresholds. Pending BLM proposals to "treat" vegetation on millions of acres infested with exotic weeds would do nothing to halt existing land uses that lead to weed infestations,[40] while further disturbing degraded landscapes with chemicals, fire, and mechanized equipment.[41] These proposals are set forth in two programmatic documents, which the BLM refers to as the Vegetation Treatments EIS (or PEIS) and Vegetation Treatments Environmental Report (or PER).[42] The proposals involve massive, costly manipulations of rangeland conditions,[43] while assuming the continuation of the single most potent agent of environmental degradation, livestock grazing.[44]

It is impossible here to summarize the PEIS and PER (which comprise hundreds of pages). In brief, the agency intends to treat *annually* approximately 2.2 million acres using mechanical methods, 2.1 million acres using fire, 932,000 acres using herbicides, 545,000 acres using biological control (e.g., pathogens or livestock), and 270,000 acres manually (e.g., hand-pulling weeds).[45] The documents manifest a clear preference for active treatment rather than passive restoration techniques,[46] although the agency stops short of proposing to reestablish native vegetation on all treated

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ISSUES IN ECOL., Fall 1999, at 1, 8. *See also infra* notes 95-96 and accompanying text*; infra* text accompanying note 104.

39. *See supra* text accompanying notes 1-2.

40. *See* VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-3 ("This PEIS assumes that . . . future land uses would be similar to those that currently occur on public lands.").

41. *See infra* text accompanying note 45.

42. *See supra* note 17. The "P" in each abbreviation stands for "programmatic." The PEIS sets forth an "ecological risk assessment methodology" to guide use of eighteen herbicides, including four never before used on public rangelands. *See* Vegetation Treatments EIS and Environmental Report, http://www.blm.gov/nhp/spotlight/VegEIS (last visited June 22, 2007). The PER describes the "environmental impacts of using non-herbicide vegetation treatment methods." *Id.*; *see also* VEGETATION TREATMENTS PER, *supra* note 17, at ES-1.

43. The total area treated by all treatments would increase from the current two million to six million acres annually. VEGETATION TREATMENTS PER, *supra* note 17, at ES-1 to -2 (noting that the increase is in response "to Presidential and Congressional mandates to reduce the risk of wildfire by reducing the occurrence of hazardous fuels, . . . restoring fire-adapted ecosystems, and repairing lands damaged by fire" (citing the National Fire Plan and the Healthy Forests Restoration Act of 2003)).

44. *See infra* notes 61-70, 110 and accompanying text.

45. *See* VEGETATION TREATMENTS PER, *supra* note 17, at ES-2, 4-33, 4-111, 4-125 to -126.

46. "Passive treatments involve suspension of activities that cause loss of ecological integrity," in other words, reduction or removal of livestock grazing, ORV use, and other surface-disturbing activities. *See* VEGETATION TREATMENTS PEIS, *supra* note 11, at 2-12 (tbl. 2-5). *See also infra* notes 56-63 and accompanying text.

areas.[47] The BLM claims that the "proposed actions would reduce the risk of catastrophic wildfires," "restor[e] fire-damaged lands," and "improve ecosystem health by controlling weeds . . . and managing vegetation to benefit fish and wildlife habitat, improve riparian and wetlands areas, and improve water quality in priority watersheds."[48] Scant support is offered for these claims.

The documents not only fail to deal frankly with the substantial role of livestock in impairing ecosystem function,[49] but they also imply that a significant objective of the treatments is to improve livestock forage conditions.[50] According to the PEIS, the BLM's management "focus" is on "restoring ecosystem processes *and* maintaining livestock populations in balance with the health of rangelands."[51] This "focus" reflects a flawed understanding of "ecosystem health."[52] The agency's assumption that there is some level at which livestock numbers can be maintained "in balance with the health of rangelands" takes for granted that livestock production is sustainable on *any* landscape.[53] But ecology and evolutionary constraints;[54] physical limits, such as topography; and

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47. *See infra* notes 80-85 and accompanying text.

48. VEGETATION TREATMENTS PER, *supra* note 17, at 4-33; *see also id.* at ES-1 (adding that "actions would be taken to . . . manage vegetation in a manner that provides for long-term economic sustainability of local communities").

49. For instance, the executive summary of BLM's Vegetation Treatments PEIS lacks any mention of livestock as a cause or contributor to the ecological conditions of concern. Similarly, livestock grazing is mentioned only once in the discussion of soil erosion in Chapter 3 ("Affected Environment"). *See* VEGETATION TREATMENTS PEIS, *supra* note 11, at 3-10 ("Biological soil crusts . . . are easily disturbed by grazing . . . .").

50. *See, e.g.*, VEGETATION TREATMENTS PER, *supra* note 17, at 4-95 ("All treatments that successfully reduce the cover of noxious weeds on rangelands would benefit livestock by increasing the number of acres suitable for grazing and the quality of forage."); VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-215 (noting that "[w]here feasible, the BLM will incorporate the use of livestock as part of the overall weed management program," and that the program "should benefit the livestock industry"); *id.* at 4-216 ("Over the long term, . . . resources should improve and enable public lands to support populations of livestock at or above current levels.").

51. VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-215 (emphasis added); *cf.* VEGETATION TREATMENTS PER, *supra* note 17, at 4-93 ("The purpose of vegetation management is to restore native ecosystems that have the capacity to provide a steady source of forage for livestock while meeting the needs of native animals and other uses and resource values."). Conversely, only "15% of [all] treatments would be specifically designed to benefit wildlife habitat." *Id*. at 4-73.

52. *See, e.g.,* RANGELAND HEALTH, *supra* note 10, at 5 ("Rangeland health should be a minimum ecological standard, independent of the rangeland's use and how it is managed."). As explored further below, the statement in the text also reflects a misunderstanding of the law. *See generally infra* Part III.

53. *Cf.* VEGETATION TREATMENTS PEIS, *supra* note 11, at 3-1 (suggesting that the only BLM lands that are *not* available for livestock grazing—19 of 262 million acres—"consist of barren mountains, mountaintops, glaciers, sand dunes, and playas").

54. *See, e.g.,* Richard N. Mack & John N. Thompson, *Evolution in Steppe with Few Large, Hooved Mammals*, 119 AM. NATURALIST 757, 758-61, 763-64 (1982) (attributing the more serious impacts of livestock grazing in the Intermountain West, compared to the Great Plains, to differences in vegetation, large herbivores, and evolutionary history); JAYNE BEL-

economics[55] belie this assumption.

The closest the BLM comes to acknowledging a remedy other than what it proposes—massive spraying, chaining, mowing, burning, and biocontrol measures—is in the following concession, buried in the middle of one of the tomes:

> Prevention and early detection are the least costly and most effective weed control methods. Weeds colonize highly disturbed ground and invade plant communities that have been degraded, but are also capable of invading intact communities. Passive treatments, such as *removing the cause* of the disturbance (*e.g.*, *livestock*, OHVs) *may be more effective long term than active treatments* and would be evaluated for their merit before implementing active treatments.[56]

Throughout the rest of the documents, however, the BLM ignores or dilutes this advice.

The panoply of potential adverse environmental impacts attending the proposed treatments—many of which cannot be predicted much less avoided if the proposals are implemented[57]—should lead readers to question why the agency gives such short shrift to passive remedies, i.e., removing the causes of rangeland

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NAP ET AL., BIOLOGICAL SOIL CRUSTS: ECOLOGY AND MANAGEMENT, Tech. Ref. No. 1730-2, at 41 (USDI-BLM & USGS 2001); DONAHUE, *supra* note 19, at 133-39. *See also supra* note 27 and accompanying text.

55. *See*, *e.g.,* VEGETATION TREATMENTS PER, *supra* note 17, at 2-12 ("Caution should be used whenever grazing or any other vegetation control is prescribed near riparian areas [or] in steep topography . . . ."); *see also* A.J. Belsky et al., *Survey of Livestock Influences on Stream and Riparian Ecosystems in the Western United States*, 54 J. SOIL & WATER CONS. 419 (1999) (reviewing the literature); NATIONAL RESEARCH COUNCIL COMMITTEE ON RIPARIAN AREA FUNCTIONS AND STRATEGIES FOR MANAGEMENT, RIPARIAN AREAS: FUNCTIONS AND STRATEGIES FOR MANAGEMENT 171-73, 386-87 (2002) [hereinafter NRC, RIPARIAN AREAS] (noting the tendency of cattle to concentrate in riparian areas, especially in the arid and semiarid West, and that steep uplands may exacerbate the problem); R. Lal, *Soil Erosion and Carbon Dynamics on Grazing Land*, *in* THE POTENTIAL OF U.S. GRAZING LANDS TO SEQUESTER AND MITIGATE THE GREENHOUSE EFFECT 231, 234-35 (R.F. Follett et al., eds. 2001) ("A significant percentage of semiarid rangelands has steep slopes, often >25%. Soil erosion increases exponentially with increase in slope gradient."); DONAHUE, *supra* note 19, at 133-42. Regarding the economics of public-land ranching, *see infra* notes 122, 156, 289 and accompanying text.

56. VEGETATION TREATMENTS PER, *supra* note 17, at 4-32 (emphasis added); *see also id.* at 2-16 ("Prevention and early detection is the cheapest and most effective weed control method."). "OHVs" refers to off-highway vehicles. *Id.* at 1-5. "Active treatments" refers to the weed control methods on which the BLM relies in these documents, i.e., use of prescribed fire, herbicides, mechanical control, and biological controls. *Id.* at 2-5. Regarding passive restoration, see *infra* discussion at notes 58-63.

57. *See generally* VEGETATION TREATMENTS PEIS, *supra* note 11, at ch. 4 (in particular pp. 4-235 to -239, summarizing unavoidable adverse effects).

degradation.[58] The BLM considered a "passive treatment" alternative (Alternative E), but only at the insistence of several conservation organizations, which actually developed and submitted a plan describing this option.[59] The agency's analysis and rejection of this alternative evidence its bias against reducing livestock grazing[60] and its serious misunderstanding of the laws that govern BLM land management.[61]

As described by BLM:

> [Alternative E] would place greater emphasis on passive restoration, by prohibiting or restricting activities such as livestock grazing, OHV [off-highway vehicle] use, logging, or oil and gas development in areas where these activities have promoted a less desirable vegetation community or increased erosion. *Since these activities are allowed under FLPMA, however, restrictions on their use would only be considered to the extent they are consistent with BLM vegetation and land use management practices* (e.g., excluding grazing animals from recently reseeded areas).[62]

The agency also states that "OHV use and livestock grazing *could*

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58. *See supra* note 46; *infra* note 63 and accompanying text.

59. *See* VEGETATION TREATMENTS PEIS, *supra* note 11, at 2-12 (tbl. 2-5), 2-13 (describing Alternative E, which "was developed based on an alternative proposal . . . submitted by the American Lands Alliance"). The full text of this proposal, *Restore Native Ecosystems Alternative*, is set forth in Appendix G of the PEIS. *See* VEGETATION TREATMENTS PEIS, *supra* note 11, at app. G.

60. *See, e.g.*, VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-216 ("By reducing the number of livestock entering degraded areas, improvement in ecosystem health can be expected. Thus, the number of livestock able to graze on public lands could be less under [Alternative E] than under the other alternatives." (citation omitted)); *Id.* at 4-133 (noting that EPA in 1981 recommended against registration of certain herbicides that BLM proposes to use because of their persistence in the environment and the difficulty of detecting them at low concentrations, but explaining that "in this assessment, none of [these] herbicides resulted in risk to livestock").

61. For instance, the BLM considered but rejected an alternative that would "[e]xclude logging, grazing, OHV use, and energy/mineral development on public lands," reasoning: "FLPMA *requires* that BLM manage public lands for multiple uses including those listed." VEGETATION TREATMENTS PEIS, *supra* note 11, at 2-14 (emphasis added). The agency conceded, however, that "[f]ield offices . . . can limit these activities, consistent with its [sic] land use plan where it benefits vegetation management and land health and complies with the FLPMA." *Id*. *See also infra* Part III.

62. VEGETATION TREATMENTS PEIS, *supra* note 11, at 2-13 to -14 (emphasis added); *see also id.* at 2-14 (asserting that "FLPMA requires that BLM manage public lands for multiple uses," including "logging, grazing, OHV use, and energy/mineral development"). The BLM concedes that "[f]ield offices . . . can limit these activities, consistent with its [sic] plan where it . . . complies with the FLPMA." *Id.*

only be restricted to levels consistent with adopted BLM LUPs [land use plans]," even though these activities are "known to impact soils and lead to invasive species establishment."[63]

These statements not only reflect a seriously jaundiced view of what the Federal Land Policy and Management Act (FLPMA)[64] allows and requires,[65] they turn administrative decisionmaking on its head: The agency suggests that land management *practices* dictate interpretation of the *law*. It is the law, of course, that governs (or *should* govern) public land management decisions.

The BLM's strained view of its governing legislation appears frequently throughout the Vegetation Treatments documents. For instance, the BLM asserts that it has made progress toward some of its water quality and watershed improvement goals, but that it is "challenged by the *need to meet multiple land use objectives*, such as allowing oil and gas development that may conflict with restoration objectives."[66] It argues that, "under the principles of multiple use and sustained yield in accordance with the intent of Congress [in FLPMA]," "vegetation must be managed to protect and enhance the health of the land *while providing a source of food, timber, and fiber* for domestic needs.[67] The agency concedes that "passive restoration would be *considered* first when developing restoration management plans," but adds that it "would be used [only] to the extent possible within the constraints of FLPMA."[68]

The BLM rationalizes what it seems to perceive as conflicting legal mandates:

> Passive restoration is often an important first step in improving watershed health because the anthropogenic activities that are causing degradation or preventing recovery are reduced or eliminated. Livestock grazing and OHV use are often cited as factors that cause loss of wetland and riparian habi-

63. *See id.* at 4-21 (emphasis added).

64. 43 U.S.C. §§ 1701-1784 (2000).

65. As I argue in Part III, the agency ignores or misconstrues FLPMA's multiple-use and sustained-yield principles, several planning directives, and the mandate that the agency "prevent unnecessary or undue degradation." 43 U.S.C. § 1732(b).

66. VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-202 (citing OMB 2005) (emphasis added). The agency's claim to "progress" is inconsistent with its admission in an earlier report. *See* DEP'T OF INTERIOR, RANGELAND REFORM '94 DRAFT ENVIRONMENTAL IMPACT STATEMENT 45 (1994) [hereinafter RANGELAND REFORM '94] (reporting that riparian areas on BLM-managed lands were in their *worst condition* in history and that conditions on dry uplands had *not improved* under fifty years of BLM range management).

67. VEGETATION TREATMENTS PER, *supra* note 17, at ES-2 (emphasis added). I address and refute this argument in Part III.

68. VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-209 (emphasis added).

> tat function and watershed degradation; by prohibiting livestock from entering wetland and riparian areas, and placing limits on OHV activity, improvement in watershed function can be expected. *However*, the BLM would *have to balance* watershed protection with the multiple use requirements under FLPMA.[69]

"[*T*]*herefore*," the agency explains, "the BLM modifies the timing and duration of grazing to reduce potential impacts rather than implements total exclusion [of livestock] whenever possible."[70]

As discussed in more detail in Part III, these and similar statements misinterpret or misapply the multiple-use and sustained-yield mandates in FLPMA, while ignoring many other provisions of law, including FLPMA's over-arching non-degradation mandate.[71] In addition to being flawed as a matter of law, the policy of adjusting the "the timing and duration of grazing" rather than removing livestock is not based on sound science.[72]

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69. *Id.* at 4-203 (emphasis added) (citation omitted). The BLM's intimation that "watershed protection" must be compromised to meet FLPMA's requirements is outrageous. "Watershed" is one of the objects of "multiple use" itemized in the FLPMA definition, *see infra* note 165, but "watershed" and watershed *protection* are not equivalent. Further, the PER and PEIS frequently acknowledge that ongoing land uses "are causing degradation" (*see* quotation in the text), but the BLM fails to consider the legal significance of this fact. *See infra* Part III.B.

70. VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-205 (emphasis added); *cf.* VEGETATION TREATMENTS PER, *supra* note 17, at ES-2 ("Actions to prevent or minimize the need for vegetation control *could* include protecting intact systems . . . [or] reducing the effect of ongoing activities (e.g., improving grazing management practices." (emphasis added)).

71. The BLM comes closer to getting it right in the following passage:

> [V]egetation must be managed to protect and enhance the health of the land while providing a source of food, timber, and fiber for domestic needs. Land-disturbing activities must be conducted in a manner that minimizes ecosystem fragmentation and degradation, and lands should be rehabilitated when necessary to safeguard the long-term diversity and integrity of the land.

VEGETATION TREATMENTS PER, *supra* note 17, at ES-2. Despite this lip service to the law, the BLM has *not* managed its lands to "minimize" degradation, nor do its weed control proposals serve this ambitious objective.

72. The assumption that watershed and riparian restoration can be achieved simply by modifying the timing and duration of grazing has been refuted by both the BLM itself and an NRC Committee. *See* RANGELAND REFORM '94, *supra* note 66, at 45 (asserting that "[w]atershed and water quality conditions would *improve to their maximum potential*" if livestock were *removed* from public lands); NRC, RIPARIAN AREAS, *supra* note 55, at 232 (concluding that complete removal of livestock is necessary to restore riparian areas damaged by grazing). While altering the timing and duration of grazing can alleviate some effects (e.g., improve the ability of native plants to produce seed or reduce compaction of wet soils), many impacts of livestock (e.g., trampling, erosion, overuse of riparian areas and

The BLM also dismisses the passive treatment alternative based on perceived practical considerations, for example, because passive measures alone would be insufficient to restore certain lands[73] or because "recovery of vegetation" would "take longer" using only passive measures.[74] The agency intimates that if passive measures alone would not suffice, they should be disdained in favor of "more aggressive treatments."[75] Rejecting "passive treatments" simply because they would be inadequate, on their own, to restore degraded rangelands cannot be defended based on law, logic, or practical land management. The fallacy of this reasoning is that it justifies combating a problem with "aggressive" measures, while simultaneously *continuing the significant cause(s)* of the problem.[76] This is analogous to a doctor treating obesity with "fat pills" or liposuction, while encouraging the patient to continue her high-fat, high-calorie diet. In fact, "natural recovery," even if slower, "may be the most practical approach."[77] Passive restoration not only promotes improved conditions in the long term, it poses fewer negative short-term consequences.[78] Passive restoration thus ought to be the *primary* weed control tool. In the end, the BLM offers that "passive restoration would be *considered* when developing restoration management plans," but it drastically and unnecessarily limits this assurance by adding: "to the extent possible within the constraints of FLPMA."[79] We will return to this issue in Part III.

The BLM's endorsement of affirmative revegetation is similarly

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wetlands, water pollution, damage to biological soil crusts, reduction of cover for small mammals and birds, etc.) are simply unavoidable. *See generally* Fleischner, *supra* note 25; DONAHUE, *supra* note 19.

73. For instance, the BLM concedes that "[p]assive treatments, where the underlying cause of the invasive species problem is identified and eliminated or moderated . . . *would help*." VEGETATION TREATMENTS PER, *supra* note 17, at 4-93 (emphasis added).

74. *See* VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-207; *see also id.* at 4-214.

75. *See* VEGETATION TREATMENTS PER, *supra* note 17, at 4-93.

76. In fact, the plan is to use *multiple* treatments to combat weeds. *See, e.g.*, VEGETATION TREATMENTS PER, *supra* note 17, at 2-13 ("Biological treatments are most effective when followed with other treatments."); *id.* at 4-133 (describing "Brown-and-burn Operations," in which vegetation is "treated with herbicides several weeks before beginning a prescribed burn"). In other words, the agency is proposing to use *multiple active* treatments, each of which will have adverse, unintended, and in some cases unpredictable environmental consequences, while continuing the disturbances that give rise to weed problems.

77. *See* Stephen B. Monsen, *Restoration or Rehabilitation through Management or Artificial Treatments* [hereinafter Monsen, *Restoration*], *in* RESTORING WESTERN RANGES AND WILDLANDS, Rocky Mtn. Res. Stn. Gen. Tech. Rep. RMRS-GTR-136, at 1, 25, 27 (Stephen B. Monsen et al. compilers, Sept. 2004) [hereinafter RESTORING WESTERN RANGES]. By "natural recovery," Monsen means passive restoration.

78. *See supra* text accompanying note 57.

79. VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-209 (emphasis added); *see also id.* at 4-203, -205, and -209 (stating that "passive restoration would be . . . used to the extent possible within the constraints of FLPMA").

lukewarm.[80] Most authorities consider reintroduction of native species by seeding or planting essential to restoration or rehabilitation efforts in many circumstances, including where the target weed is cheatgrass.[81] But the BLM makes no promise that seeding or planting will occur in those cases where it is necessary or desirable,[82] nor does it explain why it would waste resources on treatment *sans* revegetation if the treatment would consequently fail.[83] Only once does the BLM indicate that it would revegetate herbicide-treated cheatgrass ranges.[84] Elsewhere, the agency equivocates.[85] More ominously, the agency insinuates that it will actually manage some lands *for* cheatgrass, one of the most invasive

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80. *See, e.g.*, *id.* at 4-45 ("Some treatments are very successful at removing weeds over the short term, but are not successful at promoting the establishment of native species in their place. In such cases, seeding of native plant species would be *beneficial*." (emphasis added)); VEGETATION TREATMENTS PER, *supra* note 17, at 4-95 (same); *id.* at 4-32 ("Reseeding or replanting *may be* required to revegetate sites in which the soil has been disturbed or vegetation has been removed, and where there is insufficient vegetation or seed stores to naturally revegetate the site." (emphasis added)); *id.* at 2-16 (same).

81. *See, e.g.*, *Restore Native Ecosystems Alternative*, *in* VEGETATION TREATMENTS PEIS, *supra* note 11, at app. G ("[S]olely killing weeds cannot restore ecosystems that are vulnerable to invasion by aggressive exotic species."); Monsen, *Restoration*, *supra* note 77, at 25, 26-27 (noting that disturbed, overgrazed rangelands have often lost important native forbs and grasses, which will not regenerate naturally); Richard Stevens, *Basic Considerations for Range and Wildland Revegetation and Restoration*, *in* RESTORING WESTERN RANGES, *supra* note 77, at 19, 22 ("Restoration of native plant communities usually requires the reintroduction of a variety of species to provide community structure and function."); Richard Stevens & Stephen B. Monsen, *Guidelines for Restoration and Rehabilitation of Principal Plant Communities*, *in* RESTORING WESTERN RANGES, *supra* note 77, at 199 [hereinafter Stevens & Monsen, *Guidelines*]; *see also id.* at 256 ("Cheatgrass sites must be planted with perennials to reduce the reestablishment of the annual grass. If perennials are not established the first season after treatment, cheatgrass will regain dominance.").

82. *See, e.g.*, VEGETATION TREATMENTS PEIS, *supra* note 11, at 2-15 ("Disturbed areas *may be* reseeded or planted with desirable vegetation when the native plant community cannot recover and occupy the site sufficiently" (emphasis added)); *id.* at ES-2 (observing that the "overriding goal is to restore desirable vegetation on lands only when it is necessary").

83. Similarly, the BLM indicates that herbicide treatments in hot deserts "usually must be followed by revegetation," but it warns that revegetation "may be unsuccessful due to low and erratic precipitation," and it points out the risks to wildlife of removing the sparse vegetation cover in these areas. VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-109. Again, the BLM seems to suggest that its weed treatment proposals could waste resources on rehabilitation projects that are doomed to fail or which may only worsen ecological conditions on these sites. *See also infra* note 114.

84. *See infra* text accompanying note 88.

85. The agency's standard operating procedures (SOP), for instance, suggest that revegetation may be the exception rather than the rule. One SOP provides: "Revegetate sites with native species if there is no reasonable expectation of natural regeneration." But this SOP applies *only* to "Wilderness and Other Special Areas." *See* VEGETATION TREATMENTS PEIS, *supra* note 11, at 2-19 (tbl. 2-6). Similarly, the agency states that revegetating with native vegetation "has been incorporated into the proposed action *to the extent practical*." *Id.* at 2-14 (emphasis added). It is not clear whether "to the extent practical" applies to revegetation generally or only to the use of native species. But either interpretation is cause for concern. As discussed above, see *supra* notes 81-83 and accompanying text, seeding should not be considered optional in areas where native plants are significantly reduced or absent.

plants known, because the species is difficult to eradicate and because it provides useful forage for livestock.[86] The BLM's pro-livestock bias becomes most evident in its plans for dealing (or not) with cheatgrass.

B. The Specific Case of Cheatgrass

The PER and PEIS are ambiguous regarding the BLM's plans for cheatgrass (downy brome) control and management.[87] On the one hand, the BLM states: "Herbicides would be used on rangelands dominated by annual grasses, such as downy brome . . . , followed by revegetation with perennial grasses and forbs."[88] On the other hand, the agency declares: "Downy brome is unique among non-native weeds in that it is managed both *for and against*."[89] Despite the propensity of cheatgrass for devastating ecosystems,[90] the BLM observes that its abundance "has caused some livestock producers to rely on it as a source of early spring forage."[91] In fact: "Because of its widespread dominance, downy brome has become *the most important forage grass in the western U.S.*"[92] "The disadvantage for livestock producers," the BLM observes matter-of-factly, "is the narrow window of grazing opportunity and the wide variation of total forage production from year to year."[93]

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86. *See infra* notes 89-93, 100-10 and accompanying text.

87. Cheatgrass is the most frequently used of several common names for *Bromus tectorum*, but the BLM refers to it consistently throughout the PEIS and PER as downy brome.

88. VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-61. The extent of the cheatgrass-infested area proposed for treatment cannot be determined from the documents. The agency indicates that it plans to apply herbicides to approximately 650,000 acres (70 percent of 932,000 acres) annually in the Temperate Desert Ecoregion where, it says, nearly all of the cheatgrass is found and where cheatgrass is the chief problem. If cheatgrass will be a target of all those treatments, this would equate to treating only six to seven percent of the cheatgrass-infested area (10-11 million acres) per year. *See generally* VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-206, 4-126, 4-64, 3-26 to -27. If the BLM follows its own advice about the need for *multiple* treatments of the same areas to achieve effective annual weed control, *see supra* note 76, the aggregate area treated for cheatgrass will not necessarily increase each year.

89. *See* VEGETATION TREATMENTS PER, *supra* note 17, at 4-93 (emphasis added). The agency also states: "Grazing can be *managed to provide* nearly uniform grassland cover . . . ." *Id.* at 4-88 (emphasis added). The BLM offers no clue as to whether or where grazing might be used for this purpose, but few BLM lands are grasslands where "nearly uniform grassland cover" would be desirable. On the other hand, grazing can lead to "nearly uniform" stands of cheatgrass, a highly *undesirable* situation.

90. *See infra* notes 95-96 and accompanying text.

91. *See* VEGETATION TREATMENTS PER, *supra* note 17, at 4-93.

92. VEGETATION TREATMENTS PEIS, *supra* note 11, at 3-65 to -66 (emphasis added); *cf. id.* at 3-28 (tbl. 3-5) (reporting nearly 25 million acres infested with four species of *Bromus* in 2000).

93. VEGETATION TREATMENTS PER, *supra* note 17, at 4-93; *see id.* at 3-66 (reporting that cheatgrass is "highly unreliable as a forage base for both cattle and wildlife because it can exhibit 'tenfold differences (300-3,500 lbs/acre) from year to year' in productivity, de-

These statements signal a perilous development in BLM range management. Cheatgrass is perhaps the most intractable and potentially devastating ecological problem facing public-land managers in the Intermountain West.[94] The plant's chief threats to ecosystems are its ability to "increase the frequency and intensity of wildfire and destroy the structure of the native plant communities, particularly sagebrush habitats."[95] Ultimately, diverse, shrub-grass communities are replaced by cheatgrass monocultures, with

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pending on precipitation," offering no source for the internal quotation); Mike Pellant, *Cheatgrass: Invasion, Occurrence, Biological/Competitive Features and Control Measures*, *in* RESTORATION AND MANAGEMENT OF SAGEBRUSH/GRASS COMMUNITIES (2002) [hereinafter Pellant, SAGEBRUSH WORKSHOP], *available at* http://www.rangenet.org/trader/2002_Elko_Sagebrush_Conf.pdf (same); Mike Pellant, *Cheatgrass: The Invader that Won the West* 6 (1996) [hereinafter Pellant, *Invader*], *available at* http://www.icbemp.gov/science/ pellant.pdf (noting that cheatgrass is palatable to cattle only before it cures and dries, or if it is later moistened by rain or snow). Pellant now leads the BLM's Great Basin Research Initiative. *See Rangeland Ecologist Selected for Great Basin Restoration Position* (Jan. 2003), http://www.fire.blm.gov/gbri/news_pellant.html (last visited June 22, 2007).

94. *See* VEGETATION TREATMENTS PER, *supra* note 17, at 4-93 ("Downy brome [cheatgrass] and other related annual brome species are the most significant non-native species affecting rangelands in the West due to the sheer number of acres they cover and their site tenacity."); Monsen, *Restoration*, *supra* note 77, at 31 ("Cheatgrass is the most severe weed problem encountered on a wide spectrum of plant types within the Intermountain Region."). Cheatgrass infestations first occurred on livestock-degraded ranges in the late 1800s. *See* Pellant, *Invader*, *supra* note 93, at 1; Mack & Thompson, *supra* note 54, at 761. Having continued to spread on both disturbed and relatively undisturbed areas, see VEGETATION TREATMENTS PER, *supra* note 17, at 4-32, cheatgrass is now found over a huge area. *See* VEGETATION TREATMENTS PEIS, *supra* note 11, at 3-65 (estimating "that downy brome infests over 56 million acres in the 17 western states and the infestation is growing at 14% per year" (citing Duncan 2005)); Stevens & Monsen, *Guidelines*, *supra* note 81, at 253-54 ("Cheatgrass now dominates former brush and tree types in . . . big sagebrush, juniper-pinyon, blackbrush, shadscale saltbush, and mountain brush," and it has "recently invaded southern desert shrub regions.").

95. *See* VEGETATION TREATMENTS PEIS, *supra* note 11, at 3-65 to -66; Steven G. Whisenant, *Changing Fire Frequencies on Idaho's Snake River Plains: Ecological and Management Implications, in* PROCEEDINGS--SYMPOSIUM ON CHEATGRASS INVASION, SHRUB DIE-OFF, AND OTHER ASPECTS OF SHRUB BIOLOGY AND MANAGEMENT (E. Durant McArthur et al. eds., Apr. 5-7, 1989), U.S. Forest Service, Intermtn. Res. Sta. Gen. Tech. Rep. INT-276, at 4-10 (1990); Pellant, *Invader*, *supra* note 93, at 3; William L. Baker, *Fire and Restoration of Sagebrush Ecosystems,* 34 WILDLIFE SOC'Y BULL. 177, 183 (2006); Pellant, *Invader*, *supra* note 93; J.W. CONNELLY et al., CONSERVATION ASSESSMENT OF GREATER SAGE-GROUSE AND SAGEBRUSH HABITATS, *Synthesis* 7-22 (2004), *available at* http://www.blm.gov/ca/pdfs/bishop_pdfs/sagegrouse/ConAssessGSG_Connelly_etal_2004.pdf (noting that conversion to cheatgrass "changes the temporal availability of water and may impact [soil] nutrients as well"); *id.* at 7-14 ("Frequent fires [in cheatgrass stands] may also remove protective plant and litter cover, increasing flooding and susceptibility of soil to wind and water erosion."). *See also* David M. Richardson, et al., *Naturalization and Invasion of Alien Plants: Concepts and Definitions,* 6 DIVERSITY & DISTRIBUTIONS 93, 98 (tbl. 1) (2000) (placing cheatgrass within the category of "transformers," specifically, "fire promoters," a "subset of invasive plants which change the character, condition, form or nature of ecosystems over a substantial area"). Cheatgrass invasion of shrub steppe communities drastically alters ecosystem functions by reducing species richness and eliminating functional groups. VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-106 (reporting declining populations of many native wildlife species due to replacement of native shrubs by cheatgrass and other exotic annual grasses).

drastically reduced potential for generating ecosystem goods and services.[96] Cheatgrass cannot be eradicated or even significantly reduced as long as the exogenous disturbance persists and unless native perennial species can be reestablished.[97] In other words, it will not be possible to control cheatgrass or other invasive weeds in the arid and semiarid shrub-steppes and deserts of the West so long as livestock grazing continues in these areas.[98] Furthermore, it may not be possible to prevent the subsequent invasion of cheatgrass-infested landscapes by even more undesirable and intractable weeds.[99]

The BLM's bald statements—that livestock producers "rely on" cheatgrass, that cheatgrass is "the most important forage grass in the western U.S.," that "*the* disadvantage" of cheatgrass for producers is forage production variability, and that it manages "for" cheatgrass[100]—are genuinely alarming.[101] Managing "for" cheat-

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96. Runoff and erosion increase, water quality decreases, wildlife habitat dwindles, fire-fighting costs sky-rocket, the scenery is blighted, and recreation use wanes. *See, e.g.,* VEGETATION TREATMENTS PEIS, *supra* note 11, at 3-65 to -66, 4-152, 4-212; CONNELLY ET AL., *supra* note 95, at 7-14, 7-21 to -22; Stevens & Monsen, *Guidelines*, *supra* note 81, at 233.

97. *See supra* note 81 and accompanying text.

98. *See infra* note 119 and accompanying text. According to The Nature Conservancy (TNC), where grazing does continue, "[l]asting control of cheatgrass will require a combination of chemical control, physical control, vegetative suppression, and proper livestock management." TNC, *Element Stewardship Abstract for* Bromus tectorum *L.* 4 (1998-99) [hereinafter TNC, *Bromus tectorum*], *available at* http://tncweeds.ucdavis.edu/esadocs/documnts/bromtec.pdf (referring to this as a "cumulative stress" method).

99. The replacement of cheatgrass by another Eurasian annual grass, medusahead wildrye, illustrates yet another threshold operating in some semiarid rangelands. *See* Stevens & Monsen, *Guidelines*, *supra* note 81, at 254; M. Hironaka, *Medusahead: Natural Successor to the Cheatgrass Type in the Northern Great Basin*, *in* PROCEEDINGS—ECOLOGY AND MANAGEMENT OF ANNUAL RANGELANDS, PROCS.—ECOLOGY AND MANAGEMENT OF ANNUAL RANGELANDS, USFS Intermtn. Res. Sta. Gen. Tech. Rep. INT-GTR-313, at 89 (Stephen B. Monsen & Stanley G. Kitchen eds., Sept. 1994); James A. Young & Charlie D. Clements, *Weed Problems on Great Basin Rangelands*, in SAGEBRUSH WORKSHOP, *supra* note 93.

100. *See supra* text accompanying notes 89, 91-92.

101. Also troubling is the BLM's co-sponsorship of research "to evaluate intensive cattle grazing as a method for reducing the fire hazard of cheatgrass." *See* Project Details–Great Basin CESU, http://www.ag.unr.edu/gbcesu/Project_Details.aspx?ProjectID=81 (last visited June 22, 2007). Numerous researchers, however, believe that "grazing is *not* a recommended method of control for cheatgrass." TNC, *Bromus tectorum*, *supra* note 98 at 17 (emphasis added); *see also* L.M. Roselle et al., *Effects of Grazing after Fire in Sagebrush Steppe Communities*, PROCS. SOC'Y FOR RANGE MGMT., 58th Ann. Mtg., Feb. 2-11, 2005 (reporting "[n]o differences in density" of cheatgrass six grazing treatments); BELSKY & GELBARD, *supra* note 13, at 20 ("Evidence to support the long-term effectiveness [of grazing] . . . is scant . . . ."); *id.* at 21 ("Such grazing is counterproductive since cattle grazing . . . also weakens native perennial grasses and disturbs wet soils."). Cattle grazing can reduce cheatgrass seed production and stand density, but this will not eliminate the stand. *See* Stephen B. Monsen, *Controlling Plant Competition*, *in* RESTORING WESTERN RANGES, *supra* note 77, at 59 [hereinafter Monsen, *Controlling Plant Competition*]. *Any* cheatgrass production will contribute to the potential for ranges to burn because the plants consume available soil moisture, crowd out other plants, and dry out early. Pellant, *Invader, supra* note 93, at 1, 3; U.S. Geological Survey, An Assessment of Exotic Plant Species of Rocky Mountain National

grass is antithetical to sustainable range management.[102] Cheatgrass is "a fire hazard in wet years, produce[s] little forage in dry years, and prevent[s] reestablishment of native species."[103] The presence of cattle on cheatgrass ranges, like cheatgrass itself, impairs ecosystem function in many ways.[104] Cheatgrass is not even sustainable as a livestock forage crop![105] Managing "for" an invasive weed to provide a few weeks of highly subsidized forage for cattle owned by 18,000 permittees,[106] when whole ecosystems are on the "brink of collapse" largely *because* of this plant, is unconscionable.[107]

While the PER and PEIS do not explain where or how the BLM manages "for" cheatgrass, *in effect* the agency manages for cheatgrass (1) on all rangelands where it does not reestablish native plants after applying herbicides, and (2) on all lands infested or susceptible to invasion by cheatgrass,[108] where livestock grazing continues or is resumed following herbicidal treatment.[109] These categories describe virtually *all* BLM rangelands.[110]

The highest priority for managing public lands should be to

Park: *Bromus tectorum L.* [hereinafter USGS, *Assessment*], http://www.npwrc.usgs.gov/resource/plants/explant/bromtect.htm (last visited June 22, 2007).

102. Significantly, there is no scientific basis for the view—urged by livestock producers and recited by the BLM—that "removal of livestock would actually accelerate conversion to cheatgrass because of increased fuel accumulations and more frequent wildfires." *See* Pellant, *Invader, supra* note 93, at 9 (calling the view "speculation").

103. Stevens & Monsen, *Guidelines*, *supra* note 81, at 254 (referring to cheatgrass, red brome, and medusahead wildrye).

104. *See supra* notes 34-36, 95-96, and accompanying text.

105. *See supra* note 99 and accompanying text; *infra* text accompanying note 333.

106. About 18,000 of the approximately 23,000 federal grazing permits hold permits for BLM lands. *See* COGGINS, WILKINSON & LESHY, *supra* note 25, at 777; DONAHUE, *supra* note 19, at 252-53.

107. Botanist Stephen Monsen put the tradeoffs this way: "'It's not about one month [of grazing use] in the spring. We're talking about [destroying] a year-round forage base. It's habitat, nesting habitat, concealment.'" Lisa Jones, *He's Worried about Weeds,* HIGH COUNTRY NEWS, May 22, 2000 (quoting Monsen), *available at* http://www.hcn.org/servlets/hcn.Article?article_id=5812. *See also supra* note 95.

108. Few if any rangelands lack cheatgrass or a reservoir of cheatgrass seed. *See, e.g.,* DENNIS KNIGHT, MOUNTAINS AND PLAINS: THE ECOLOGY OF WYOMING LANDSCAPES 104-05 (1994) ("Weed-free soil samples can still be found in remote locations at some distance from disturbances . . . but it seems probable that such areas will become more rare."). *See also* Pellant, *Invader, supra* note 93, at 2 (noting that cheatgrass seeds remain viable in soil for up to five years); USGS, *Assessment*, *supra* note 101. Cheatgrass also can invade relatively intact rangelands. *See supra* text accompanying note 56; *infra* notes 113, 120.

109. *See generally supra* notes 50-51 and accompanying text; *infra* note 110.

110. Apart from temporary grazing closures of some treated areas, *see* VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-231; VEGETATION TREATMENTS PER, *supra* note 17, at 2-19, BLM range management apparently will be business as usual for livestock operators. *See also supra* notes 50-51. Indeed, the BLM predicts only slight declines in future grazing use of public lands. VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-231 ("Livestock grazing activity in the Interior Columbia Basin on lands administered by the BLM and Forest Service is projected to decline about 1% annually to ensure protection of rangeland habitats and TES species.").

protect relatively intact native rangelands and to prevent expansion of cheatgrass and other noxious weeds.[111] The best—perhaps the only—way to prevent weed expansion is to "ensure [that] perennial herbaceous plants are managed to dominate the site."[112]

There is mounting evidence and opinion that stopping the onslaught of invasive weeds will require major changes in livestock grazing management. First, there is broad consensus that the best way to minimize invasion by weeds, including cheatgrass, is to maintain the cover and richness of native perennial species,[113] and the best way to maintain native perennials is to "minimize abuse" or disturbance.[114] Livestock are the chief agents of disturbance on western ranges.[115] Furthermore, cattle preferentially graze native grasses, [116] maintenance of which (as just noted) is the best way to keep weeds in check. Similar considerations apply to sites already infested with weeds, at least where some native perennial species remain. In the latter situations, removing livestock from arid and semi-arid shrublands may "prevent further degradation, control weed invasion, and effectively restore diverse communities."[117] On sagebrush sites where "there is some perennial understory in place, removal of grazing may be the most effective and economical means of restoring sites."[118] Conversely, "[n]atural recovery usually *cannot* occur unless grazing is *completely discontinued*."[119]

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111. *See* Stevens, *Basic Considerations*, *supra* note 81, at 20 (fig. 1) ("[M]aintenance of diverse communities must be a key priority for land management throughout the West. Intact communities should not be altered or disrupted.").

112. Cheatgrass, http://extension.usu.edu/rangeplants/Grasses/cheatgrass.htm (last visited June 22, 2007); *see also infra* note 113.

113. *See, e.g.*, Jay E. Anderson & Richard S. Inouye, *Landscape-Scale Changes in Plant Species Abundance and Biodiversity of a Sagebrush Steppe over 45 Years,* 71 ECOL. MONOGRAPHS 531, 552-53 (2001) (reporting that the "bulk of the evidence available suggests" that cheatgrass poses less threat "where native plant populations in sagebrush steppe are thriving"). *See also supra* text accompanying note 56.

114. *See* Monsen, *Restoration*, *supra* note 77, at 29 (noting further: "Many semiarid ranges . . . need improvement, but changes can often be more easily attained through proper long-term management than through artificial revegetation."). Salt desert shrub communities are especially "difficult to restore" by artificial means; thus, "preventing weed invasion" in these sites is "essential." *See* Stevens & Monsen, *Guidelines*, *supra* note 81, at 245 (fig. 31).

115. *See supra* note 34 and accompanying text.

116. *See* VEGETATION TREATMENTS PER, *supra* note 17, at 4-96; *id.* at 2-12 ("Many weed species are less palatable than desired vegetation, so the animals may overgraze desired vegetation rather than the weeds."). Most BLM permits authorize cattle use. VEGETATION TREATMENTS PEIS, *supra* note 11, at 3-41.

117. Stevens & Monsen, *Guidelines, supra* note 81 at 233. *See also* Anderson & Inouye, *supra* note 113, at 547-49 (reporting a change from dense sagebrush canopy and depleted herbaceous understory [but little or no cheatgrass] to an open sagebrush stand with "productive . . . perennial understory" in twenty-five years after removal of livestock); *infra* text accompanying note 119.

118. *See* Stevens & Monsen, *Guidelines*, *supra* note 81, at 233.

119. *Id.* (emphasis added). *Cf. supra* text at note 9. The most compelling scientific arguments for removing livestock relate to thresholds. *See supra* notes 31-39 and accompa-

The conclusion is inescapable: The best way to alleviate *or* avoid weed problems is to exclude livestock.[120] Such a precautionary approach would be eminently more responsible than current federal range policy, as well as more faithful to the BLM and USFS mandates to manage public lands to produce a high level of the various renewable resources "in perpetuity" and "without impairment of the productivity of the land."[121]

C. A Proposal

If removing livestock *would improve* ecological conditions on some public lands, *might improve* conditions (given sufficient time) in other areas, and *would not worsen* weed infestations anywhere, why not do it? Answer: *there is no good reason not to*. The potential benefits of removing livestock from public rangelands are immense: maintenance or enhancement of *every* ecosystem good and service other than livestock production, generated on tens of millions of acres. The costs? Short-term losses of a few low-paying jobs and a tiny fraction of U.S. livestock forage supplies, possible short-term impacts on local community economic structures, and uncertain (but probably mild) effects on the ranching "lifestyle."[122] All of the economic, social, and cultural arguments that have been made in defense of continued public-land grazing have been refuted.[123] Most of them find little support in the law,[124] and none justifies the continuation of an unsustainable land use that alters ecosystems irreversibly. Because the law does not permit cheatgrass- or other weed-infested ranges to be managed *for* livestock,[125] and science suggests that natural conditions cannot be

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nying text. A wealth of experience suggests that continuing to graze arid and semiarid rangelands will push more lands past thresholds. The only way to avoid this, absent more knowledge about where thresholds lie and how to predict them, is to avoid exogenous disturbances—in most cases livestock grazing.

120. *See* Anderson & Inouye, *supra* note 113, at 552-53 (noting that, although cheatgrass had spread to most areas with suitable soils on the INEEL during the forty-five years after grazing ended, it had "displaced the native vegetation on those areas only infrequently").

121. *See infra* notes 181-82 and accompanying text.

122. *See* Thomas M. Power, *Taking Stock of Public Lands Grazing: An Economic Analysis*, *in* WELFARE RANCHING, *supra* note 25, at 263-70; THOMAS MICHAEL POWER, LOST LANDSCAPES AND FAILED ECONOMIES: THE SEARCH FOR A VALUE OF PLACE 182-85 (1996); Debra L. Donahue, *Western Grazing: The Capture of Grass, Ground, and Government*, 35 ENVTL. L. 721, 800-01 (2005).

123. The case against public-land livestock grazing has been made by several writers. *See, e.g.,* WELFARE RANCHING, *supra* note 25; Power, *supra* note 122; LYNN JACOBS, WASTE OF THE WEST: PUBLIC LANDS RANCHING (1992), *available at* http://www.wasteofthewest.com; DONAHUE, *supra* note 19.

124. *See* DONAHUE, *supra* note 19.

125. *See infra* Part III.

restored as long as livestock are present, livestock grazing should be discontinued on public rangelands.

I do not suggest that removal of livestock would, alone, bring about the quick or complete restoration of cheatgrass-dominated landscapes. In some cases there might be no detectable improvement, at least for many years.[126] In most cases, active measures—in particular, reintroduction of native species—will also be required.[127] Nevertheless, there is substantial evidence that simply removing livestock can result in improved ecological conditions.[128]

Restoration will be expensive and difficult.[129] In the near term, costs would be offset partially by the avoided costs of administering grazing on the millions of acres where grazing would no longer be permitted.[130] Long-term public and private benefits—including improved water and air quality, reduced soil erosion, enhanced wildlife populations, and enhanced recreation opportunities and revenues—would vastly outweigh the short-term losses to the government, grazing permittees, and consumers (e.g., grazing fees, private jobs and income, and livestock products, respectively).

At least initially, restoration would be hindered by cost as well

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126. *See, e.g.,* Monsen, *Controlling Plant Competition*, *supra* note 101, at 59 ("[M]any shrublands disrupted by grazing and infested with annual weeds may not recover satisfactorily as a result of simply eliminating grazing."); BELSKY & GELBARD, *supra* note 13, at 18-20 (cautioning that lack of recovery following removal of livestock can be "due to the short time allowed for recovery" or the absence of native seed sources at the site); Valone et al., *supra* note 37, at 999-1000 (reporting "dramatic recovery in perennial grass" on one site after thirty-nine years rest from grazing, but no recovery on another site after fifty years without livestock). *See also supra* notes 37-38 and accompanying text.

127. *See supra* note 81 and accompanying text.

128. *See, e.g.*, Susan L. Earnst et al., *Riparian Songbird Abundance a Decade After Cattle Removal on Hart Mountain and Sheldon National Wildlife Refuges*, *in* PROCEEDINGS OF THE THIRD INTERNATIONAL PARTNERS IN FLIGHT CONFERENCE: USDA-Forest Service Gen. Tech. Rep. PSW-GTR-191, at 550-58 (2005) (documenting increases in bird species in these northern Great Basin locations "consistent with recovery from cattle grazing," similar to findings elsewhere, including the San Pedro River, Arizona); M. Lisa Floyd et al., *Effects of Historic Grazing on Vegetation at Chaco Culture National Historic Park, New Mexico*, 17 CONS. BIO. 1703 (2003) (reporting increases in shrub and grass cover with long-term protection from grazing at four upland sites, higher species richness at all six sites with long-term protection from grazing, and increased biological soil crusts on one site); Kenneth L. Cole et al., *Holocene Vegetation and Historic Grazing Impacts at Capitol Reef National Park Reconstructed Using Packrat Middens*, 57 GREAT BASIN NATURALIST 315 (1997); BELSKY & GELBARD, *supra* note 13, at 18-20 (summarizing results from studies and concluding that "elimination of livestock grazing has often, but not always" reduced weed infestations). *See also supra* notes 114-19 and accompanying text.

129. *See* Statement of Robert V. Abbey, Director, Nevada Bureau of Land Management, before the U.S. Senate Environment and Public Works Committee Concerning Nevada Wildlife Conservation Initiatives, Apr. 10, 2001 [hereinafter Abbey], *available at* http://www.blm.gov/nhp/news/legislative/pages/2001/te010410.htm ("This [restoration] effort is massive, across the millions of acres of the Great Basin. Change will require labor intensive effort and significant amounts of native seed . . . . In some areas we may need to plant sagebrush seedlings and sow native seed by hand.").

130. *See* VEGETATION TREATMENTS PEIS, *supra* note 11, at 3-65 (tbl. 3-20) (reporting total BLM range management costs of $69.2 million in 2005 and $72.5 million in 2004).

as a limited supply of native seeds and planting stock. The BLM is already working to increase the supply of native seeds for restoration work,[131] but greater effort would be needed. Successful restoration requires site-adapted species.[132] An expanded government revegetation program would stimulate the market for native seeds and plants and thus could be expected to encourage growth in supplies and enhanced quality.[133]

One direct means of increasing supplies would be government subsidies for collecting or producing seed and planting stock on relatively healthy public rangelands.[134] Former grazing permittees are the logical persons to do this work.[135] It might strike readers as odd or ironic to pay ranchers to help restore rangelands, *not* for livestock use, but for recreation, wildlife, and watershed benefits. But ranchers have long capitalized on the non-livestock values of their private ranchlands and surrounding federal lands—through hunting- and fishing-related businesses, dude ranches, bed-and-breakfast enterprises, etc. Plus, ranchers (along with other private landowners) would benefit from enhanced water quality and quantity, pollination services, improved air quality and visibility, etc. Alternatively, or in addition, ranchers could market seeds and plants collected from private lands (their own or others'). If the demand for seed and planting stock generated sufficiently high prices, ranchers might decide to devote more of their private lands to native plant production instead of to livestock grazing. This would encourage the protection and restoration of privately owned rangelands and further enhance ecosystem services in the western range region.

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131. *See* Abbey, *supra* note 129 ("The BLM is working with the Plant Conservation Alliance, private seed growers, State and Federal nurseries and seed storage facilities to increase significantly the supply of native seeds available for rehabilitation and restoration work while reducing the cost of producing native seed in large quantities.").

132. *See* Stephen R. Monsen & Richard Stevens, *Seedbed Preparation and Seeding Practices*, *in* RESTORING WESTERN RANGES, *supra* note 77, at 121-22, 129 (noting that successful projects depend on "selection of adapted plant materials," but that "seeds or planting stock of many species are unavailable"); *see generally* Stevens, *Basic Considerations*, *supra* note 81, at 21; Stevens & Monsen, *Guidelines*, *supra* note 81, at 237 ("Broadleaf forbs are essential to arid shrublands, and development of additional sources is necessary.").

133. A demand for native seed already exists, spurred in part by "major wildfires in 1999 and 2000." *See* Abbey, *supra* note 129. Governments are not the only buyers. Homeowners and others seeking to establish more natural looking landscaping or drought-tolerant lawns purchase native seed mixtures. *See, e.g.*, LANDSCAPING WITH NATIVE PLANTS OF THE INTERMOUNTAIN REGION, U.S. Dep't of Interior, Bureau of Land Management, Tech. Ref. 1730-3, BLM/ID/ST-03/003+1730 (Hilary Parkinson, compiler, Dec. 2003).

134. The BLM already issues "permits for harvesting of sagebrush and other native species seeds." *See* Abbey, *supra* note 129.

135. Substantial advice is available to those who wish to participate in the growing business of restoration. Especially useful and authoritative is a three-volume manual recently published by U.S. Forest Service's Rocky Mountain Research Station. *See* RESTORING WESTERN RANGES, *supra* note 77.

Finally, broader range restoration efforts would enable ranchers to supplement their income as well as offer a means of pursuing something approaching their preferred lifestyle. This would go far toward offsetting the economic and cultural impacts of the loss of federal grazing privileges.[136] It would also involve ranchers in land stewardship, a role they have long claimed.[137]

The first step, however, will be to convince federal agencies to discontinue grazing so that the work of restoration can begin. "In the end, range productivity is a political problem that can be overcome only by political courage, the range resource in the shortest supply."[138]

III. PUBLIC RANGELAND ECOSYSTEM SERVICES AND THE LAW

The public land laws do not support the BLM's assumption that livestock grazing should continue on public lands, despite compelling evidence of the ecological impacts.[139] As an Interior official during FLPMA's early years stated, "Rangeland deterioration is . . . inconsistent with the sustained yield principle of public resource management legislated by FLPMA."[140] I have argued elsewhere that ample legal authority exists to remove livestock from public lands, where livestock are causing or contributing to degraded ecological conditions.[141] My purpose in this Part is to revisit that argument, considering more specifically how the law can and should be interpreted in addressing the invasive weeds problem.[142] Federal land management legislation undeniably em-

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136. Another option, which is beyond the scope of this article, is federally funded buyouts of grazing privileges. *See generally* David G. Alderson, *Buyouts and Conservation Permits: A Market Approach to Address the Federal Public Land Grazing Problem*, 12 N.Y.U. ENVTL. L.J. 903 (2005).

137. *See* Donahue, *supra* note 122, at 802-03 & n.538.

138. George Cameron Coggins, *The Law of Public Rangeland Management V: Prescriptions for Reform*, 14 ENVTL. L. 497, 546 (1984).

139. *E.g.*, VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-3 ("The PEIS assumes that . . . future land uses would be similar to those that currently occur on public lands."). The BLM often states that the law "requires" it to allow livestock grazing. *See generally supra* discussion at notes 62-63, 70.

140. IMPROVING THE RANGE CONDITIONS OF THE PUBLIC GRAZING LANDS, H.R. REP. NO. 95-1122, at 31 (1978) (statement of Ass't Secretary of Interior Guy Martin).

141. *See* DONAHUE, *supra* note 19, at ch. 7. The commodification of public rangelands in terms of livestock production can be traced in part to federal statute. PRIA, for instance, defines "public rangelands" as lands managed by the BLM or Forest Service "on which there is domestic livestock grazing or which the Secretary concerned determines may be suitable for domestic livestock grazing." *See* 43 U.S.C. § 1902(a) (2000); *see also infra* text accompanying note 210 (citing Professor Blumm).

142. This Part emphasizes BLM law because most arid and semiarid rangelands are managed by the BLM and because the BLM's organic act, FLPMA, also governs livestock grazing on national forests (where some shrub-steppe rangelands are located). Also, the BLM is the proponent of the weed control efforts described in Part II.B, *supra*.

braces the concept, and occasionally even the terminology, of ecosystem goods and services.[143] This Part attempts to persuade readers that the law does not condone, much less mandate, *any* use of land that promotes the spread of invasive weeds and thus undermines the lands' potential for providing a sustained flow of these products and amenities.

A. Multiple Use and Sustained Yield

The Federal Land Policy and Management Act (FLPMA) identifies "range" as one of the "multiple uses" for which the public lands are to be managed,[144] and "domestic livestock grazing" is included in a list of "principal or major uses."[145] FLPMA states that it is U.S. policy that, inter alia, "the public lands be managed in a manner . . . that will provide food and habitat for fish and wildlife and domestic animals[,]"[146] and "which recognizes the Nation's need for domestic sources of . . . food . . . and fiber from the public land[s]."[147] I suspect that the BLM's unfortunate interpretation of its authority to restrict grazing and other land uses is based mainly on these provisions of FLPMA.[148]

Even a quick review of the statutes reveals flaws in the agency's (presumed) reasoning: To begin with, "range" is only one of many resource uses and values for which public lands are to be managed,[149] and all management is constrained by sustained-yield[150] and non-degradation management principles.[151] Neither

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143. *See infra* text accompanying notes 160-68, 318.

144. *See, e.g.*, 16 U.S.C. § 528 (2000); 16 U.S.C. § 1604(e)(1); 43 U.S.C. § 1702(c). Congress has not defined the term "range." However, in 1978 in PRIA it defined rangelands as "lands administered by [the BLM or Forest Service] . . . on which there is domestic livestock grazing or which . . . may be suitable for domestic livestock grazing." 43 U.S.C. § 1902(a). Multiple uses are listed alphabetically in the Forest Service's Multiple-Use, Sustained-Yield Act. *See* 16 U.S.C. § 528; *see also* COGGINS, WILKINSON & LESHY, *supra* note 25, at 706 (explaining the origin of the alphabetical listing). FLPMA retains basically the same order. *See* 43 U.S.C. § 1702(c). In the FLPMA list, however, "minerals" is inserted after "timber." *See id.* The Forest Service is not directly responsible for managing minerals. *See* 16 U.S.C. § 472.

145. 43 U.S.C. § 1702(l) (defining "principal or major uses" as "domestic livestock grazing, fish and wildlife development and utilization, mineral exploration and production, rights-of-way, outdoor recreation, and timber production").

146. *Id.* § 1701(a)(8).

147. *Id.* § 1701(a)(12). *See, e.g.,* VEGETATION TREATMENTS PEIS, *supra* note 11, at ES-2, 4-32 ("[V]egetation must be managed to protect and enhance the health of the land while providing a source of food, timber, and fiber for domestic needs.").

148. *See, e.g.*, VEGETATION TREATMENTS PEIS, *supra* note 11, at 2-14; *see also supra* notes 62-70 and accompanying text. The BLM has never clearly explained the reasoning that led it to conclude that it must allow livestock grazing on public lands.

149. *See, e.g., infra* discussion at notes 163, 169.

150. *See, e.g., infra* discussion at notes 180-82.

151. *See infra* Part III.B.

FLPMA nor the Taylor Grazing Act[152] mandates any particular level or frequency of livestock grazing or even that any particular lands be used for livestock. Congress specified "principal uses" for the sole purpose of indicating its intent to retain special oversight authority over these resources.[153] FLPMA expressly authorizes the BLM to "total[ly] eliminate[]" any of the enumerated "principal uses"[154] and, specifically, to discontinue grazing to devote public lands to a "public purpose."[155] Finally, the nation scarcely "need[s]" to obtain food or fiber from the public lands. BLM lands and national forests combined account for only about two percent of the total U.S. livestock production,[156] and private lands could easily fill the gap if public land grazing were to cease.[157] Indeed, public lands can provide "food" and "habitat" for domestic livestock even if the animals never set foot on public land. For example, public lands produce water, support pollinators, and provide pest control—all of which serve livestock production on *private* lands.[158]

The clearest evidence that Congress recognized the important ecosystem services generated by public lands is found in the "multiple-use, sustained-yield" (MUSY) scheme adopted in FLPMA,[159] the Multiple-Use, Sustained-Yield Act (MUSYA),[160] and the National Forest Management Act (NFMA),[161] and echoed in the Public Rangelands Improvement Act (PRIA).[162] FLPMA identifies

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152. 43 U.S.C. § 315-315(r) (2000).

153. *See* H.R. REP. NO. 94-1163 (1976), *as reprinted in* 1976 U.S.C.C.A.N. 6175, 6179 ("'Principal or major uses' . . . represent the uses for which Congressional oversight is particularly needed. The definition does not mean to imply that other uses such as 'watershed' are not of great public significance.").

154. 43 U.S.C. § 1712(e).

155. *See* 43 U.S.C. § 1752(b)(2), (g). A grazing permit is not a property right; therefore, suspension, revocation, or nonrenewal of grazing permits does not "take" property in violation of the Fifth Amendment. *See* 43 U.S.C. § 1752(h); 43 U.S.C. § 315(b) (final clause). *Cf.* Reeves v. United States, 54 Fed. Cl. 652, 674 (2002) (holding that application of FLPMA's environmental protection requirements could not be a "taking").

156. *See* RANGELAND REFORM '94, *supra* note 66, at G-16; POWER, *supra* note 122, at 182.

157. *See* POWER, *supra* note 122, at 182. These economic facts should be kept in mind when considering FLPMA's definition of "multiple use," which calls for management that "takes into account the long-term *needs* of future generations for renewable and nonrenewable resources, including . . . range." 43 U.S.C. § 1702(c) (emphasis added).

158. If the reader finds this argument a stretch, consider that a congressional purpose in the 1897 act authorizing establishment of public-land forest reserves was to provide water for downstream, private-land users. *See* United States v. New Mexico, 438 U.S. 696 (1978) (construing 16 U.S.C. § 475 (2000)). Similarly, a 1936 U.S. Department of Agriculture report to Congress identified watershed and private-land agriculture as among the highest values attributable to western rangelands, both public domain and national forest. *See* U.S. DEP'T OF AGRIC., THE WESTERN RANGE: A GREAT BUT NEGLECTED NATURAL RESOURCE, S. DOC. NO. 74-199, at 338, 518 (1936) [hereinafter THE WESTERN RANGE]. *See infra* note 176.

159. 43 U.S.C. §§ 1701-1784.

160. 16 U.S.C. §§ 528-531.

161. 16 U.S.C. §§ 1600-1614.

162. Pub. L. 95-514, 43 U.S.C. §§ 1901-1908.

"range"—*not livestock products*—as among the several "renewable and nonrenewable *resources*" of public lands,[163] which are to be managed "under principles of multiple use and sustained yield."[164] The Act defines multiple-use "management of the public lands and their various *resource values*" in terms of an open-ended list of "renewable and nonrenewable *resources*, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical *values*."[165] The statute expands upon these "resource values," for instance, in stating congressional policy that "public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values."[166] In other words, in FLPMA Congress described public land uses and resource values using the now familiar terminology of ecosystem goods and services.[167]

Similarly, the MUSYA and NFMA (both of which govern the

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163. 43 U.S.C. § 1702(c) (emphasis added).

164. 43 U.S.C. § 1732(a).

165. 43 U.S.C. § 1702(c) (emphasis added). Specifically:

> The term "multiple use" means the management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; the use of some land for less than all of the resources; a combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values; and harmonious and coordinated management of the various resources without permanent impairment of the productivity of the land and the quality of the environment with consideration being given to the relative values of the resources and not necessarily to the combination of uses that will give the greatest economic return or the greatest unit output.

Id. The Supreme Court in *Norton v. Southern Utah Wilderness Alliance* called "[m]ultiple use management" a "deceptively simple term that describes the enormously complicated task of striking a balance among the many competing uses to which land can be put, 'including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and [uses serving] natural scenic, scientific and historical values.'" 542 U.S. 55, 58 (2004) (quoting 43 U.S.C. § 1702(c)). Congress explicitly included "scenic, scientific and historical values" among public-land "resources," *see* 43 U.S.C. § 1702(c), but the Court's insertion of the phrase "uses serving" suggests a certain discomfort with the notion that nonuse values (or perhaps noncommodities) can be "resources."

166. 43 U.S.C. § 1701(a)(8). *See also id.* § 1765(b)(iv) (requiring that right-of-way permitting "protect the interests of individuals living in the general area . . . who rely on the fish, wildlife, and other biotic resources . . . for subsistence").

167. *See, e.g.*, Christensen et al., *supra* note 10, at 667 (Box 1); *see also supra* note 11.

national forests generally[168]) include "range" (again, not livestock per se) within the "*products* and *services*" obtainable from the national forests.[169] The MUSYA also includes "range" among the "purposes" for which "national forests are established and shall be administered . . . ."[170] Specifically, the Act calls for management of national forests for "outdoor recreation, range, timber, watershed, and wildlife and fish purposes[,]"[171] as well as for wilderness,[172] and it defines "multiple use" in terms of "these resources or [their] related *services* . . . ."[173] The NFMA builds on the MUSYA foundation by requiring forest plans: (1) to "provide for multiple use and sustained yield of the *products and services* obtained" from the lands; and (2) to "determine forest management systems, harvesting levels, and procedures in the light of" these uses, the defini-

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168. Livestock grazing on national forests is also governed by FLPMA. *See* 43 U.S.C. § 1752.

169. *See* 16 U.S.C. §§ 529, 531(b) (2000); *id.* § 1604(e)(1) (emphasis added).

170. 16 U.S.C. § 528. According to the Supreme Court, however, national forests were established for two *primary* purposes, to "'conserve the water flows, and to furnish a continuous supply of timber.'" United States v. New Mexico, 438 U.S. 696, 708 & n.14 (1978) (paraphrasing 16 U.S.C. § 475). "[G]razing was merely one *use* to which the national forests *could [possibly]* be put and would not be permitted where it *might* interfere with the specific *purposes* of the national forests including the securing of favorable conditions of water flow." *Id*. at 716 n.23 (emphasis added).

171. The MUSYA provides:

> It is the policy of the Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes. The purposes of [16 U.S.C. §§ 528-531] are declared to be supplemental to, but not in derogation of, the purposes for which the national forests were established as set forth in [16 U.S.C. § 475, namely, "to improve and protect the forest within the boundaries, or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber"] . . . .

16 U.S.C. § 528.

172. 16 U.S.C. § 529 provides: "The establishment and maintenance of areas of wilderness are consistent with the purposes and provisions of sections 528 to 531 of this title."

173. 16 U.S.C. § 531(a) (emphasis added). Specifically:

> Multiple use means: The management of all the various renewable surface resources of the national forests so that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some land will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.

Id.

tions of "multiple use" and "sustained yield," *and* the lands' "*suitability* for resource management."[174]

Congress plainly understood that the values of national forests and BLM lands reside not only in the commodities producible therefrom (and certainly not just the *livestock* commodities), but in a rich array of resources, uses, values, and services.[175] This view was consistent with prevailing understandings long before the so-called MUSY statutes were enacted.[176] Congress too had long understood that emphasis on production of one resource could damage others. Construing the late nineteenth century legislation that established the national forests, for instance, the Supreme Court observed that the national forests were "to be opened up [to] any economic use not inconsistent with the forests' primary purposes."[177] The Court explained that "grazing was merely one use to which the national forests *could [possibly]* be put and would *not be permitted* where it *might* interfere with the specific purposes of the national forests including the securing of favorable conditions of water flow."[178]

Equally self-evident is that Congress intended multiple-use

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174. 16 U.S.C. § 1604(e) (emphasis added).

175. *See, e.g.*, 43 U.S.C. § 1702(c) (2000) (referring to "resource values," "resource uses," "resources or related services," "renewable resources," and "relative values of the resources"); *id.* § 1702(h) ("output of the various renewable resources"); *id.* § 1712(c)(4) ("public lands, their resources, and other values"); *id.* § 1712(c)(5) ("present and potential uses"); 16 U.S.C. § 528 ("outdoor recreation, range, timber, watershed, and wildlife and fish purposes"); *id.* § 529 ("renewable surface resources" and the "products and services obtained therefrom"); *id.* § 531(a) ("various renewable surface resources"; "resources or related services"; "relative values"; "combination of uses"), 531(b) ("output of the various renewable resources"); 16 U.S.C. § 1604(e)(1) ("products and services"); *id.* § 1604(g)(2)(B) ("various renewable resources, and soil and water"); *id.* § 1604(g)(3)(A) ("provide for outdoor recreation (including wilderness), range, timber, watershed, wildlife, and fish"). According to the Ninth Circuit, the values set forth in MUSYA embrace "social" and "ecologic" as well as economic values. *See* Sierra Club v. Butz, 3 ENVTL. L. REP. 20, 292-93 (9th Cir. 1973) (citing a report by scientists A. Starker Leopold and Reginald H. Barrett).

176. *See, e.g.*, S.B. Snow, *The Probable Future Use and Ownership of Rangelands*, *in* THE WESTERN RANGE, *supra* note 158, at 421, 454 ("The multiple-use principle—including timber production, watershed protection, grazing, wildlife propagation, recreation, and other uses—has been adopted on the national forests . . . [and] sustained by the highest court."). Part V (pp. 301-418) of *The Western Range* describes the "social and economic function" of the western range area, including its recreational, watershed, wildlife, and agricultural values. One report author wrote that watershed is the "most valuable service" of rangelands. *See* L.F. Watts et al., *The Management of Range Lands*, *in* THE WESTERN RANGE, *supra* note 158, at 501, 518. *See also infra* text accompanying note 184 (concerning Gifford Pinchot's maxim).

177. United States v. New Mexico, 438 U.S. 696, 716 n.23 (1978) (referring to the acts of 1891 and 1897).

178. *Id.* (emphasis added). The Court added that "a limited and regulated use for pasturage might not be inconsistent with the object sought to be attained by [16 U.S.C. § 475]." *Id.* (quoting United States v. Grimaud, 220 U.S. 506, 515-16 (1911)). The Court in *Grimaud* had noted that grazing "fees were fixed to prevent excessive grazing, and thereby protect the young growth and native grasses from destruction." 220 U.S. 506, 522 (1911).

management prescriptions to consider land productivity and environmental quality.[179] More precisely, Congress intended public-land management to provide for the *long-term*, *sustained yield* of the various products, services, and values of the lands. In 1976 Congress directed both agencies to "use and observe the principles of multiple use and sustained yield" when managing lands and developing and revising land use plans.[180] Congress had defined "sustained yield" in the 1960 MUSYA as "the achievement and maintenance *in perpetuity* of a high-level annual or regular periodic output of the various renewable resources of the national forests *without impairment of the productivity* of the land."[181] It provided a nearly identical definition, applicable to BLM public lands, in FLPMA.[182]

Both notions, sustained yield and sustainable use, can be traced to Gifford Pinchot's "greatest good of the greatest number in the long run" maxim,[183] a guiding principle for multiple-use managers for the past century. Updated and shorn of misconceptions regarding Pinchot's utilitarianism,[184] each still can and should

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179. *See, e.g.*, 43 U.S.C. § 1702(c) (referring to "productivity of the land and the quality of the environment"); 16 U.S.C. § 531(b) ("without impairment of the productivity of the land"); 16 U.S.C. § 1604(g)(3)(C) ("productivity of the land"), *id.* § (g)(3)(A) ("insure consideration of the economic and environmental aspects of various systems of renewable resource management"), *id.* § (g)(3)(C) ("not produce substantial and permanent impairment of the productivity of the land").

180. FLPMA, 43 U.S.C. § 1712(c)(1); *compare* 16 U.S.C. § 1604(e)(1) (directing forest plans to "provide for multiple use and sustained yield of the products and services . . . in accordance with [MUSYA]"). *See also* MUSYA, 16 U.S.C. § 529 (directing the Forest Service "to develop and administer the renewable surface resources of the national forests for . . . sustained yield of the several products and services obtained therefrom"). Each of these statutory provisions is mandatory (i.e., each uses the word "shall"). *Cf.* George Cameron Coggins, *Of Succotash Syndromes and Vacuous Platitudes: The Meaning of Multiple Use*, 53 U. COLO. L. REV. 229, 279 (1982) [hereinafter Coggins, *Succotash Syndromes*] ("The multiple use laws contain a series of 'shalls' and 'shall nots' that ought to be binding on public land managers.").

181. 16 U.S.C. § 531(b) (emphasis added).

182. *See* 43 U.S.C. § 1702(h) (defining sustained yield as "the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the public lands consistent with multiple use"). The meaning of "permanent impairment" can be discerned from the legislative history as "'anything greater' 'than minor alterations of a temporary nature.'" Roger Flynn, *Daybreak on the Land: The Coming of Age of the Federal Land Policy and Management Act of 1976*, 29 VT. L. REV. 815, 839 n.141 (2005) (*citing* H.R. REP. No. 94-1163, at 44 (1976), *as reprinted* in S. COMM. ON ENERGY & NAT. RESOURCES, 95th Cong. 2d Sess., LEGISLATIVE HISTORY OF THE FEDERAL LAND POLICY AND MANAGEMENT ACT OF 1976 (Committee Print 1978)).

183. *See* GIFFORD PINCHOT, BREAKING NEW GROUND 192 (1947); *see also* Robert B. Keiter, *Public Lands and Law Reform: Putting Theory, Policy, and Practice in Perspective*, 2005 UTAH L. REV. 1127, 1159-61 (2005).

184. Pinchot did not believe in profligate use of any resource. He lamented the "gigantic and gigantically wasteful lumbering of the great Sequoias," stating: "I resented then, and I still resent, the practice of making vine stakes hardly larger than walking sticks out of these greatest of living things." *See* PINCHOT, *supra* note 183, at 103. He offered his "greatest good in the long run" formula for those situations "'where conflicting interests must be

guide federal land management.[185] Today, given our deeper understanding of humankind's effect on the environment and its dependence on natural systems, we know that the "greatest good of the greatest number in the long run" indisputably depends on maintaining "viable ecosystems."[186]

Although some courts and commentators have disparaged federal multiple-use mandates as lacking substance or teeth,[187] at least a few have expressed a contrary view.[188] Notably, one court found content in the MUSYA direction to give "due consideration" to the "relative values of the various resources in particular areas" in administering the national forests.[189] In a case challenging a Forest Service decision to sell nearly one hundred percent of the commercial timber on the Tongass National Forest, a panel of the Ninth Circuit accepted the district court's ruling that the Forest Service should "'apply their expertise to the problem after consideration of all relevant values,'" but it rejected the notion that the court "'must presume . . . that the Forest Service *did* give due consideration to the various values specified in the [MUSYA].'"[190] The appellate court cautioned: "'[D]ue consideration' to us requires that the values in question be *informedly and rationally* taken into balance. The requirement can hardly be satisfied by a showing of

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reconciled.'" *See* COGGINS ET AL., , *supra* note 25, at 115 (quoting Harold W. Wood, Jr., *Pinchot and Mather: How the Forest Service and the Park Service Got that Way,* NOT MAN APART, Dec. 1976 (quoting Pinchot)).

185. *See, e.g.*, 36 C.F.R. § 219.3 (1992) (definition of "net public benefits").

186. *See, e.g.*, Scott W. Hardt, *Federal Land Management in the Twenty-First Century: From Wise Use to Wise Stewardship*, 18 HARV. ENVTL. L. REV. 345, 391 (1994) ("Only by maintaining the health of this country's ecosystems can federal land managers ensure that they are providing the greatest good for the greatest number over the long run."); *see also* Christensen et al.*, supra* note 10.

187. *See, e.g.,* Michael C. Blumm, *Public Choice Theory and the Public Lands: Why "Multiple Use" Failed*, 18 HARV. ENVTL. L. REV. 405, 405 (1994); Keiter, *supra* note 183, at 1161 (describing the MU mandate as "amorphous"); *id.* at 1162 (asserting that MU "failed to meet crucial resource needs, instead fostering considerable environmental degradation"); COGGINS ET AL., *supra* note 25, at 710-12 (critiquing the MUSY mandates and citing sources). According to one Ninth Circuit panel, the "so-called standards" of the MUSY Act "contain the most general clauses and phrases," and "can hardly be considered concrete limits on agency discretion. Rather, it is language which 'breathe[s] discretion at every pore.'" Perkins v. Bergland, 608 F.2d 803, 806 (9th Cir. 1979) (quoting Strickland v. Morton, 519 F.2d 467, 469 (9th Cir. 1975)). *See also infra* discussion at notes 209-11.

188. *See, e.*g., George Cameron Coggins, *The Law of Public Rangeland Management IV: FLPMA, PRIA, and the Multiple Use Mandate*, 14 ENVTL. L. 1, 50 (1983) [hereinafter Coggins, *Public Rangeland Management IV*] (asserting that FLPMA's definitions of "multiple use" and "sustained yield" "in fact require fairly definite management emphases and practices"); *id.* (pointing out FLPMA's "emphasis on intergenerational equity, the clear directive to achieve long-term conservation, and the requirement of environmental nonimpairment"); Hardt, *supra* note 186; Coggins, *Succotash Syndromes*, *supra* note 180, at 279.

189. Sierra Club v. Butz, 3 ENVTL. L. REP. 20,292 (9th Cir. 1973) (construing 16 U.S.C. § 529 (1988)).

190. *Id.* at 20,292 (quoting Sierra Club v. Hardin, 325 F. Supp. 99, 124 (D. Alaska 1971) (emphasis added)).

knowledge of the consequences and a decision to ignore them."[191] According to the Ninth Circuit, the "relevant values" to be weighed included "social" and "ecologic" as well as economic.[192] Whether the agency had knowledge of and failed to consider new information bearing on social and ecological considerations was relevant to the issue of "due" consideration.[193] While this case dealt with the MUSYA, similar constraints are now relevant to land use planning and management under both the NFMA and FLPMA.[194]

In a later timber case, this time arising in Wyoming, a federal district court construed the MUSYA as *requiring* forest officials to "consider the relative values of *all* resources within the national forests" when deciding what uses to allow.[195] Relying on the statutes and legislative history, the court rejected out of hand the plaintiffs' assertion that "the national forests must be managed primarily to produce economic benefits."[196] The court pointed out that under both the Organic Act[197] and NFMA the Secretary of Agriculture is accorded discretion to decide "whether *or not* to sell timber."[198] The court observed that "Congress envisioned the domination of non-timber uses in certain forests."[199]

The Ninth Circuit's reasoning in the Tongass case was influential in an appeal of a BLM grazing decision, involving an area of Utah known as Comb Wash. In *National Wildlife Federation v. BLM*, the Interior Board of Land Appeals (IBLA, or Board) affirmed the ruling of District Chief Administrative Law Judge John R. Rampton, Jr., that the BLM had "violated FLPMA, because it failed to engage in any *reasoned or informed* decisionmaking process concerning grazing in the canyons in the [Comb Wash] allotment."[200] The Board ruled that

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191. *Id.* at 20,293 (emphasis added).

192. *See id.*

193. *See id.*

194. *Cf.* Nat'l Wildlife Fed'n v. Bureau of Land Mgmt., 140 IBLA 85, 99 n.11 (1997) (noting the similarity between MUSYA's and FLPMA's multiple-use provisions).

195. Intermountain Forest Indus. Ass'n v. Lyng, 683 F. Supp. 1330, 1337 (D. Wyo. 1988) (citing 16 U.S.C. § 529) (emphasis added).

196. *Id.* at 1338 (finding "no principled basis" for the argument); *see id.* at 1337 ("MUSYA itself rebuts plaintiffs' assertion that the national forests must be managed primarily for economic reasons.").

197. Act of June 7, 1897, 30 Stat. 34.

198. *See Intermountain Forest Indus. Ass'n*, 683 F. Supp. at 1337-38 (citing 16 U.S.C. §§ 476, 472a(a) (emphasis added)); *id.* at 1338 ("NFMA modifies the Organic Act by providing that the Secretary 'may sell' timber located on national forest land. 16 U.S.C. § 472a(a).").

199. *Id.* at 1337 (citing H. REP. NO. 1551, 86th Cong., 2nd Sess. (1960), *reprinted in* 1960 U.S. Code Cong. & Admin. News 2377, 2379).

200. Nat'l Wildlife Fed'n v. Bureau of Land Mgmt., 140 IBLA 85, 101 (1997). The Board noted that Judge Rampton had cited the Ninth Circuit's statement "that the multiple-use principle 'requires that the values in question be informedly and rationally taken

> FLPMA's multiple-use mandate requires that BLM balance competing resource values to ensure that public lands are managed in the manner "that will best meet the present and future needs of the American people." 43 U.S.C. § 1702(c) (1994). Indeed, all parties agree that BLM must conduct some form of balancing of competing resource values in order to comply with the statute.[201]

The purpose of this balancing exercise, according to the IBLA, is to ensure that "'all BLM decisions [are] in the public interest as that interest is defined by Congress in law.'"[202] The Board agreed with Judge Rampton's conclusion that the "'BLM's decision to graze the canyons was not reasoned or informed, but rather based upon [a BLM employee's] misinterpretation of the [land use plan] and a totally inadequate investigation and analysis of the condition of the canyons' varied resources and the impacts of grazing upon those resources.'"[203]

Each of these tribunals discerned "teeth" in Congress's multiple-use mandates. Two of them recognized that Congress has constrained agency discretion in making land-use choices; all three affirmed the importance of noncommodity values in public land planning and management. Each recognized that what qualifies as "due consideration," "relative values," and "best interests" will vary over time. That is, because these analyses are grounded in the present as well as forward looking, the state of scientific knowledge and society's understanding of resource values must influence decisions. Likewise, what constitutes an "adequate investigation and analysis" of resource condition and the impacts of proposed land uses will change depending on what managers know and what Americans care about. As we will see, this interpretation is entirely consistent with other provisions of the statutes.[204]

Legal commentators have also found substance, or at least promise, in MUSY principles. Scott Hardt concluded that "multi-

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into balance,'" and then "concluded that an agency is required to engage in such a balancing test in order to determine whether a proposed activity is in the public interest" under FLPMA. *Id*. at 99.

201. *Id*.

202. *Id.* (noting that even counsel for the BLM agreed with this interpretation and citing BLM's Statement of Reasons at 5).

203. *Id.* at 100-01 (quoting Judge Rampton's decision at 23-25). At the hearing, NWF introduced expert testimony that grazing had impacted "archaeological sites, recreational opportunities, riparian vegetation, soil conditions, water quality, and wildlife habitat." *See id*. at 89.

204. *See infra* notes 229-330 and accompanying text (discussing FLPMA and NFMA planning principles, the UUD provision, and PRIA).

ple use is a viable land management directive as long as it is implemented within an ecologically sound framework."[205] He reasoned that "multiple use, as incorporated in existing law, is not synonymous with commodity development, but rather requires a balancing of commodity uses, noncommodity uses, and environmental protection."[206] In a section entitled "Sustainability Is a Key Element in Multiple Use Management," Hardt argued:

> "[M]anaging for viable ecosystems" implies that the two principles [multiple use and sustained yield] cannot be separated. The federal land laws focus on sustaining the yield of renewable resources, not sustaining ecosystems. Yet, given the expansion of uses and products for which federal lands must be managed, including fish and wildlife, clean air, clean water, wilderness, recreation, and aesthetics, as well as traditional commodity uses, it is clear that the maintenance of viable ecosystems is essential to providing a sustained yield of all federal land uses and renewable resources.[207]

Professor Robert Keiter has taken a more middle-of-the-road approach. He suggests that the "fabled multiple-use doctrine that was long employed to favor industrial uses on the public lands is truly a double edged sword; it can also be used to promote species conservation and ecological restoration goals on those same lands."[208]

Much less sanguine about the MUSY statutes, Professor Mi-

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205. Hardt, *supra* note 186, at 386.

206. *Id.* at 350. The requirement of "sustained yield" gives meaning to Hardt's term "balancing." *Cf.* Norton v. S. Utah Wilderness Alliance, 542 U.S. 55, 58 (2004) (stating that multiple-use management "describes the enormously complicated task of striking a *balance* among the many competing uses to which land can be put") (emphasis added).

207. Hardt, *supra* note 186, at 396-97 (citing 16 U.S.C. § 529 (1988); 43 U.S.C. § 1702(h) (1988)). *Cf.* Seattle Audubon Soc'y v. Lyons, 871 F. Supp. 1291, 1311 (W.D. Wash. 1994*), aff'd sub nom*. Seattle Audubon Soc'y v. Moseley, 80 F.3d 1401 (9th Cir. 1996) ("Given the current condition of the [Northwest] forests, there is no way the agencies could comply with the environmental laws *without* planning on an ecosystem basis."). *Cf.* Oliver A. Houck, *On the Law of Biodiversity and Ecosystem Management*, 81 MINN. L. REV. 869, 898 (1997) ("Multiple use itself cannot be provided when native species are extirpated." (citing *Seattle Audubon Soc'y*, 871 F. Supp. at 1311)).

208. Keiter, *supra* note 183, at 1197. Keiter's comment suggests that nothing in the MUSY concept per se favors either interpretation. Instead, he asserts, "an array of [other] environmental laws . . . have [sic] forced the agencies to incorporate ecological principles into their planning and decision processes." *Id.* In this respect, his view is much closer to Professor Blumm's, *infra* notes 209-11, than to Mr. Hardt's, *supra* notes 205-07. *But cf.* Keiter, *supra* note 183, at 1201 ("Despite some lingering uncertainties, the essentials of ecological sustainability are clear enough to acknowledge it as a viable public land management policy.").

chael Blumm asserted that multiple use is founded upon "a standardless delegation of authority to land managers," that "it cannot fulfill its promise because it is inherently biased toward commodity users," and ultimately that it has "failed" and should be "discarded."[209] In Blumm's view, "the concepts of multiple use and sustained yield have failed to produce sustainable public land ecosystems supporting a variety of renewable resources."[210] He urged a "redefinition of multiple use," which would emphasize the development of sustainable ecosystems and the simultaneous production of renewable resources that do not damage watersheds or fish and wildlife species. This result should be understood as the inevitable consequence of the influence of . . . other statutory commitments [e.g., the Clean Water Act and Endangered Species Act] on the concepts of multiple use and sustained yield.[211]

I concur in Professor Blumm's conclusion that we have "failed to produce sustainable public land ecosystems," nowhere more patently than on western rangelands. But I do not agree that the concepts of multiple use and sustained yield are content-less, nor that *they* are responsible for the condition of the public lands. The blame lies with the agencies, for failing to interpret the statutes rationally or in the public interest[212] and for not incorporating contemporary ecological understanding into management prescriptions,[213] and with the courts for not enforcing congressional intent in the governing legislation.[214] I also agree that Professor Blumm's suggested "*redefinition* of multiple use" should be "inevitable."[215] But the reinterpretation need not hinge on "other statutory commitments" (although I have argued that other governing laws are relevant and support a more ecological view[216]). Con-

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209. *See* Blumm, *supra* note 187, at 407, 415, 422, 428 (describing "MUSYA's statutory directive that land productivity not be impaired [as] a mandate which the courts ruled was too vague to be judicially enforced," and citing Nat'l Wildlife Fed'n v. U.S. Forest Serv., 592 F. Supp. 931, 938-39 (D. Or. 1984), *appeal dismissed as moot*, 801 F.2d 360 (9th Cir. 1987)).

210. Blumm, *supra* note 187, at 429 (arguing that the "failure is demonstrated by the enormous costs of the subsidy system as well as by that system's deleterious effects on wildlife").

211. *Id*. at 430.

212. Indeed, Professor Blumm concedes this point. *See id.* at 422 ("Instead of managing in the public interest, 'captured' land managers serve factional interests, thus undermining the long term sustainability of public land resources."). But the BLM was captured by the livestock industry before the agency had even a temporary MUSY mandate, *see generally* Donahue, *supra* note 122, at 745-58 (exploring the capture thesis and its application to the early BLM).

213. *See, e.g., supra* notes 32, 119, and accompanying text and text preceding note 40.

214. *See supra* note 188 and accompanying text; *see also* Houck, *supra* note 207 (critiquing cases).

215. *See supra* text accompanying note 211.

216. *See* DONAHUE, *supra* note 19, at 222-28 (discussing the National Environmental Policy Act, Endangered Species Act, and Clean Water Act).

gress's evolving understanding of "multiple use," reflected in all three Acts, along with its environmental protection mandates in NFMA and FLPMA, *require* agencies to heed the teachings of ecology in their land-use decisions. Illuminated by modern understandings of sustainable use[217] and ecosystem health,[218] the concept of "multiple use" solidifies into a management directive with substance, one that guides and limits agency discretion.[219]

It might be argued that the Tongass case gives credence to the notion that single-use management could, in theory, be acceptable under the multiple-use statutes.[220] However, the statutes refer to "the *combination*" of uses and resource values that will "best meet the present and future needs of the American people; making the most judicious use of the land for *some* or all of these resources or related services."[221] Not only do the statutes imply that lands should be managed for resource*s* and/or value*s* (plural), but they contemplate that those uses will be compatible and sustainable in perpetuity.[222] Neither expectation is borne out in the case of lands managed for one use at the expense of all others. Management for cheatgrass, for example, is incompatible with or detrimental to all other renewable uses listed by FLPMA, which might be made of these lands, i.e., "recreation, . . . watershed, wildlife and fish, and natural scenic, scientific and historical values."[223]

The Forest Service and the BLM are among several federal agencies that ostensibly have "committed to the principles of ecosystem management,"[224] "*the* central goal or value" of which is "sustainability."[225] The Forest Service embraced this goal whole-

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217. *See, e.g., infra* notes 225-26 and accompanying text.

218. *Cf. supra* text accompanying note 11 (discussing rangeland health).

219. *Cf.* Keiter, *supra* note 183, at 1200-01 ("Ecological principles and sustainability concepts are both well-embedded in the laws governing the public domain.").

220. *See supra* text accompanying note 190. "Dominant use" is a better term than single use since all lands can and do support more than one use, as defined in the MUSY statutes.

221. *See* FLPMA, 43 U.S.C. § 1702(c) (2000) (emphasis added); *cf.* MUSYA, 16 U.S.C. § 531(a) (2000).

222. *See, e.g.,* 43 U.S.C. § 1702(c) ("harmonious and coordinated management"); *id.* ("combination of balanced and diverse resource uses"); *see also supra* notes 181-82 and accompanying text.

223. *See* 43 U.S.C. § 1702(c). The exception is "minerals." *See also supra* discussion at notes 95-96.

224. Christensen et al., *supra* note 10, at 668 (citing CONGRESSIONAL RESEARCH SERVICE, ECOSYSTEM MANAGEMENT: FEDERAL AGENCY INITIATIVES (1994)).

224. *Id*. (noting that eighteen federal agencies endorse ecosystem management); *see also id.* (setting forth several definitions of "ecosystem management"). *See generally* Keiter, *supra* note 183, at 1192-1202; *id.* at 1202 n.401 ("[A] strong case can be made that the courts have introduced ecosystem management principles onto the public lands.").

225. Christensen et al., *supra* note 10, at 668. Indeed, Professor Keiter equates the "concept of ecological sustainability" with "ecosystem management." Keiter, *supra* note 183, at 1192. *See also supra* text accompanying note 207.

heartedly (if temporarily), when it revised its planning rules, recognizing the preeminent importance of "maintain[ing] or restor[ing] *ecological* sustainability to provide a sustainable flow of uses, values, products, and services."[226] "In practice, however, [agency] management strategies and tactics have often focused on maximizing short-term yield and economic gain, rather than long-term sustainability."[227] As one ecologist put it: "Historically, western ecosystems have been used economically."[228]

"Multiple use" and "sustained yield," of course, must be interpreted in the context of each Act as a whole. The planning statutes illuminate what Congress had in mind in the MUSY mandates. The NFMA directs the Forest Service to "promulgate regulations, *under the principles of* [*the MUSYA*], that set out the process for the development and revision of the land management plans, and the guidelines and standards prescribed" for resource management.[229] Some of these "guidelines" include:

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226. *See* 36 C.F.R. §§ 219.1 - .2 (1999) (emphasis added). The relevant provisions were:

> Sustainability, composed of interdependent ecological**,** social, and economic elements, embodies the principles of multiple-use and sustained-yield without impairment to the productivity of the land. Sustainability means meeting needs of the present generation without compromising the ability of future generations to meet their needs. Planning contributes to social and economic sustainability without compromising the basic composition, structure, and functioning of ecological ***67569*** systems. . . .
> . . .
> The first priority for planning to guide management of the National Forest System is to maintain or restore ecological sustainability of national forests and grasslands to provide for a wide variety of uses, values, products, and services. The benefits sought from these lands depend upon long-term ecological sustainability. Considering increased human uses, it is essential that uses of today do not impair the functioning of ecological processes and the ability of these natural resources to contribute to sustainability in the future.

Id. §§ 219.1(b)(3), 219.2. The Forest Service deleted these sections when it revised its planning rules in 2005. *See* Nat'l Forest Sys. Land Mgmt. Planning, 70 Fed. Reg. 1023 (Jan. 5, 2005); 36 C.F.R. §§ 219.1 to -.16 (2005). The current rule provides in part that the "overall goal of [ecological] sustainability is to provide a framework to contribute to sustaining native ecological systems." *See id.* § 219.10(b). *See generally* Robert B. Keiter, *Ecological Concepts, Legal Standards, and Public Land Law: An Analysis and Assessment*, 44 NAT. RESOUR. J. 943 (comparing the two sets of rules).

227. Christensen et al., *supra* note 10, at 667; *accord* Houck, *supra* note 207, at 977 ("The emerging ecosystem approach is friendly and non-threatening; it perpetuates business-as-usual and defers the hard decisions to a later day.").

228. Duncan T. Patten, *Restoration as the Order of the 21st Century: An Ecologist's Perspective*, 18 J. LAND, RES. & ENVTL. L. 31, 40 (1998).

229. 16 U.S.C. § 1604(g) (2000) (emphasis added).

- identifying "the *suitability* of lands for resource management,"
- obtaining "inventory data on the various renewable resources, *and soil and water,*"
- insuring "consideration of the *economic and environmental* aspects of various systems of renewable resource management,"
- providing "for *diversity* of plant and animal communities based on the *suitability* and *capability* of the specific land area," and
- insuring "evaluation of the effects of each management system to the end that it will not produce substantial and permanent *impairment* of the *productivity* of the land."[230]

FLPMA contains many functionally comparable provisions. It requires the BLM to "prepare and maintain on a continuing basis an inventory of all public lands and their resource and other values (including . . . outdoor recreation and scenic values), giving priority to areas of environmental concern";[231] to "rely" on that inventory in developing and revising land use plans;[232] and to "manage the public lands under principles of multiple use and sustained yield, in accordance with [available] land use plans."[233] FLPMA does not contain a similarly explicit diversity mandate, but several provisions of the Act, taken together, clearly embody such a requirement,[234] and the BLM has discerned a duty.[235] Similarly, FLPMA does not direct the agency expressly to consider the "suitability" or "capability" of land to support particular uses,[236] but the

230. *See id.* § 1604(g)(2)-(3) (emphasis added).

231. 43 U.S.C. § 1711(a) (2000).

232. *Id.* § 1712(c)(4).

233. *Id.* § 1732(a).

234. *See* Keiter, *supra* note 183, at 1197 & n.426 (pointing to 43 U.S.C. § 1701(a)(8) as the source of the BLM's "clear biodiversity conservation legal obligations").

235. *See, e.g.,* VEGETATION TREATMENTS PEIS, *supra* note 11, at ES-2, 4-32 (declaring that public lands "should be rehabilitated when necessary to safeguard the long-term diversity and integrity of the land"). The BLM's "fundamentals of rangeland health" require that "[e]cological processes . . . are maintained, or there is significant progress toward their attainment, in order to support healthy biotic populations and communities." *See* 43 C.F.R. § 4180.1 (2006). The National Environmental Policy Act (NEPA) makes it the "continuing responsibility of the Federal Government to use all practicable means . . . to the end that the Nation may . . . preserve important . . . natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity." *See* 42 U.S.C. § 4331(b) (2000).

236. The Forest Service does, or should, determine the suitability or capability of national forest lands for grazing before authorizing livestock use. *See supra* text accompanying notes 174, 230; *see also* Scott McMillion, *Grazing Cutbacks Proposed for Crazies*, BOZEMAN DAILY CHRON., Aug. 31, 2005, *available at* http://www.bozemandailychronicle.com/articles/

admonition is implicit in several statutory provisions discussed above, taken together.[237] Furthermore, grazing on BLM lands is governed by the Taylor Grazing Act, which on its face requires not mere "suitability," but an affirmative determination that the land be "chiefly valuable for grazing and raising forage crops."[238]

Other relevant FLPMA planning directives[239] include:

- "use and observe the principles of multiple use and sustained yield,"
- "use a systematic interdisciplinary approach to achieve *integrated consideration* of physical, biological, economic, and other sciences,"
- "give priority to the designation and protection of *areas of critical environmental concern*" (ACECs),

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2005/08/31/news/03crazygrazing.prt (reporting Forest Service decision to reduce cattle grazing on an unfenced, 8400-acre allotment, only one-quarter of which was deemed "suitable for grazing," because of declining condition due to overstocking and weeds); W Watersheds Project v. U.S. Forest Serv., No. 05-cv-189-E-BLW (D. Id. Feb. 7, 2006) (holding that "the Sawtooth National Forest must assess the 'capability' of forest lands for grazing on a site-specific basis, before authorizing grazing"), cited and quoted in Letter from Lauren M. Rule, Attorney for WWP, to Ruth Monahan, Sawtooth National Forest Supervisor et al., Mar. 22, 2006 (copy on file with author).

237. Several references in the "multiple use" definition support this interpretation, including: "judicious use"; "a combination of balanced . . . resource uses that takes into account the long-term needs of future generations"; "management of the various resources without permanent impairment of the productivity of the land and the quality of the environment"; and "the relative values of the resources." *See* 43 U.S.C. § 1702(c). Similarly, the "sustained yield" definition calls for "maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources . . . consistent with multiple use." *See* 43 U.S.C. § 1702(h). Only if a land area is "suitable" for a resource use could long-term, high-level production of that resource be maintained. PRIA also contemplates a suitability determination. *See* 43 U.S.C. § 1902(a) (stating that "rangelands" "means lands administered by [either] Secretary . . . on which there is domestic livestock grazing or which the Secretary concerned determines may be suitable for domestic livestock grazing"). It might be argued that this definition allows any public lands—suitable or not—to be used for livestock grazing. But the interpretation more consonant with pre-existing law is that Congress assumed that lands *presently* used for grazing *had been* determined suitable for that use, and that suitability *would be* determined before any *other* lands were opened to grazing in the future. PRIA refers expressly to removing livestock where necessary to improve range conditions. *See* 43 U.S.C. § 1903(b); *infra* notes 321-25 and accompanying text. Also keep in mind that PRIA applies to the BLM *and* the Forest Service, and it was enacted two years *after* NFMA, which expressly requires that national forest lands be suitable for a prescribed use. *See* 16 U.S.C. § 1604(e)(2), (g)(2)(A), (g)(3)(B) (2000).

238. *See* 43 U.S.C. § 315.

239. Professor Coggins has called the planning criteria in 43 U.S.C. § 1712(c) "remarkable for their lack of specificity." George Cameron Coggins, *The Developing Law of Land Use Planning on the Federal Lands*, 61 U. COLO. L. REV. 307, 321 (1990) [hereinafter Coggins, *Developing Law*]. Coggins conceded that a court "possibly could fashion primitive, loose standards of review from" these criteria, if it "were to carefully examine these provisions in the context of an actual plan that arguably ignored one or more" of them. *Id.* at 323. I argue that the planning criteria do have content, which can be gleaned from the statute as a whole and which should be informed by improvements in scientific understanding. *See generally infra* discussion at notes 247-97.

- "consider present and *potential* uses of the public lands,"
- "consider the *relative scarcity* of the values involved and the availability of alternative means (including recycling) and sites for realization of those values,"
- "weigh *long-term benefits to the public* against short-term benefits," and
- "provide for compliance with applicable pollution control laws."[240]

Congress repeatedly emphasized the "priority" it accorded to "the designation and protection of [ACECs],"[241] which FLPMA defines as "areas within the public lands where special management attention is required . . . to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources or other natural systems or processes, or to protect life and safety from natural hazards."[242] ACECs are to be given "priority" in land use plans[243] and in public-land inventories,[244] and "regulations and plans for [their] protection" were to be "promptly developed."[245] Professor Coggins has argued that "Congress certainly intended the double priority in designation and protection it placed on ACECs to be more than consideration—even 'due' or 'full' consideration."[246]

The BLM's implementation notwithstanding,[247] FLPMA's ACEC provisions reveal an overriding congressional concern for protecting the ecological health and amenity values of public lands,

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240. 43 U.S.C. § 1712(c) (emphasis added). FLPMA's reference to the "availability of alternative means . . . and sites for realization of those values," *id.* § 1712(c)(6), resembles the CERCLA- and CWA-implementing regulation, which provides for "acquisition of equivalent resources" to compensate for damage to natural resources. *See* 43 C.F.R. § 11.15(a)(3)(ii) (2006) (implementing 42 U.S.C. § 9607(a)(4) and 33 U.S.C. § 1321). Both rules contemplate the varying ability of lands and resources to produce ecosystem services.

241. *See infra* notes 243-45, 248-49 and accompanying text.

242. 43 U.S.C. § 1702(a).

243. *See* 43 U.S.C. § 1711(a) ("The Secretary shall prepare and maintain on a continuing basis an inventory of all public lands and their resource and other values . . . , giving priority to areas of environmental concern.").

244. *See* 43 U.S.C. § 1712(c)(3).

245. 43 U.S.C. § 1701(a)(11).

246. Coggins, *Developing Law*, *supra* note 239, at 321-22 (citing Sierra Club v. Butz, 3 ENVTL. L. REP. (Envtl. L. Inst.) 20,292 (9th Cir. 1973)). *See supra* discussion of "due consideration" at notes 189-93, 200. In fact, ACECs receive "triple" priority in FLPMA. *See supra* text accompanying notes 243-45.

247. According to the BLM, "903 areas comprising nearly 13 million acres are designated as ACEC." VEGETATION TREATMENTS PEIS, *supra* note 11, at 3-56. This area amounts to less than five percent of all BLM lands. *See also infra* note 252 and accompanying text.

not for producing commodities, and assuredly not for domestic livestock production. This preference is unambiguous in the Act's directions to "*give priority*" to protecting areas designated for their "cultural, or scenic values, [or] fish and wildlife resources or other natural systems or processes"[248] and to "prevent irreparable damage" to these areas.[249] It also comports with the national policy to manage public lands "in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, *and* archeological values."[250] Protecting these values (which embrace the full array of ecosystem services) will not be possible if livestock or other commodity production is emphasized.[251]

The deeper understanding of ecology and ecological economics acquired since 1976 argues in favor of more liberal and effective use of the ACEC designation than has been the BLM's practice to date.[252] Ecosystems at risk of "collapse" due to fire and weeds are surely "areas of critical environmental concern." At least one judge has upheld BLM authority to "close off 'areas of critical environmental concern' [to grazing] under its multiple use mandate."[253]

Public-land livestock grazing would not fare very well in an honest, conscientious, science-informed application of the foregoing statutory provisions.[254] Certainly, these provisions would not support a decision to manage deteriorating rangelands[255] for their

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248. *See* 43 U.S.C. § 1702(a).

249. *See id.*

250. *See* 43 U.S.C. § 1701(a)(8) (emphasis added).

251. *See, e.g.,* Christensen et al., *supra* note 10, at 673 ("[O]verexploitation of resources resulting in diminished diversity often has both ecological and economic long-term opportunity costs that far exceed the short-term benefits."); Rudolf S. de Groot et al., *A Typology for Classification, Description, and Valuation of Ecosystem Functions, Goods, and Services*, 41 ECOL. ECON. 393, 397 (2002) (The "use of one [ecological] function may influence the availability of other functions, and their associated goods and services."). "Expansion of livestock production around the world has often led to overgrazing and dryland degradation, rangeland fragmentation, loss of wildlife habitat, dust formation, bush encroachment, deforestation, nutrient overload through disposal of manure, and greenhouse gas emissions." MILLENNIUM ASSESSMENT, *supra* note 33, at 47. *Cf. supra* note 203.

252. *See* David C. Williams & Faith Campbell, *How the Bureau of Land Management Designates and Protects Areas of Critical Environmental Concern: A Status Report with a Critical Review by the Natural Resources Defense Council*, 8 NAT. AREAS J. 231 (1988). *See also supra* note 247.

253. Joe Baird, *Activists Win Fight on Rights to Grazing*, SALT LAKE TRIB., Jan. 31, 2006 (reporting administrative law judge's approval of the Grand Canyon Trust's purchase and retirement of grazing permits in the BLM-managed Grand Staircase-Escalante National Monument).

254. *See generally* DONAHUE, *supra* note 19, at 210-17 (applying these principles to livestock grazing).

255. There is growing evidence that range conditions have worsened through the twentieth and into the twenty-first centuries. Consider the following: Congress attempted to legislate remedies in 1934, in 1976, and again in 1978. *See* Taylor Grazing Act, 48 Stat. 1269 (1934); Federal Land Policy and Management Act, 43 U.S.C. § 1751(b)(1); Public

nonindigenous forage.

Consider "scarcity," for example. There is nothing scarce about livestock or livestock forage (or cheatgrass, for that matter[256]), nor do the public lands contribute to livestock production in a manner not replicated by *non*federal lands.[257] Livestock products are among the few ecosystem goods that have actually increased in recent years.[258] Livestock forage is fungible and substitutable.[259] Public-land forage can easily be replaced by the rest of the industry. In other words, "alternative means . . . and sites for realization of [public land grazing] values" are readily available.[260]

In contrast, "native-plant communities [are] the most precious asset on the range."[261] Along with their uses and services, these communities are increasingly scarce and declining in condition and

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Rangeland Improvement Act, 43 U.S.C. §§ 1901-1904. PRIA reported Congress's findings that "vast segments of the public rangelands are . . . in an unsatisfactory condition" and "some areas may decline further under present . . . management." *Id.* § 1901(a)(1), (2). In reports published in the 1980s and 1990s, the General Accounting Office, USFS, and BLM all documented deteriorating range conditions. *See* RANGELAND HEALTH, *supra* note 10, at 25 (citing several reports that documented soil erosion and compaction, the spread of introduced weeds, reduced water quality and wildlife habitat, and riparian habitat degradation). In 1994, the Department of the Interior reported that riparian areas on BLM-managed lands were in their *worst condition* in history and that conditions on dry uplands had *not improved* under fifty years of BLM range management. *See* RANGELAND REFORM '94, *supra* note 66, at 45. An agency analysis in 2000 of public lands in the Interior Columbia Basin "showed a general *downward* trend in habitat value from historical conditions for nearly *all habitat types* evaluated." *See, e.g.*, VEGETATION TREATMENTS PEIS, *supra* note 11, at 4-211 (emphasis added) (attributing the habitat modification to "grazing by domestic livestock and wild horses and burros, timber management, fire suppression, and invasion by weeds and other unwanted vegetation," and citing BLM/USFS (2000)). In 2006, the BLM reported that fifty-seven percent of its rangeland is rated fair or poor for "habitat quality," VEGETATION TREATMENTS PEIS, *supra* note 11, at 3-34, and it plans to spend millions of dollars to treat invasive plant species on six million acres of public lands across the West—*triple* the area treated annually under a prior program, *see* VEGETATION TREATMENTS PER, *supra* note 17, at ES-2.

256. *See supra* notes 94, 108.

257. *See supra* notes 122, 156-57; *infra* note 289, and accompanying text.

258. *See* MILLENNIUM ASSESSMENT, *supra* note 33, at 6-7 (concluding that livestock production was among only four ecosystem services [of twenty-four studied] that had "been enhanced in the past 50 years").

259. Substituting private-land livestock forage for public-land forage is like substituting baked potatoes for French fries—or even baked potatoes for baked potatoes. *See* R. David Simpson, *Economic Analysis and Ecosystems: Some Concepts and Issues*, 8 ECOLOGICAL APPLICATIONS 342, 344 (1998); *cf.* POWER, *supra* note 122, at 254 ("Such commodities . . . are not only uniform, they are abundant, and oversupply regularly plagues their markets."). For sagebrush obligate species, such as sage grouse or pygmy rabbits, however, there is no substitute for sagebrush. Similarly, there is no substitute for the black-footed ferret's prey, black-tailed prairie dogs. For these species, in other words, sagebrush and black-tailed prairie dogs are simply *food*, for which there is no substitute. *See id.*

260. *See* 43 U.S.C. § 1712(c).

261. *See* Jones, *supra* note 107 (citing botanist and range restoration expert Stephen Monsen). *Ungrazed* sage-steppe is among the rarest of native communities. *See* REED F. NOSS ET AL., ENDANGERED ECOSYSTEMS OF THE UNITED STATES: A PRELIMINARY ASSESSMENT OF LOSS AND DEGRADATION app. B (Biological Rep. 28, 1995).

often cannot be replaced on nonfederal lands.[262] Livestock and weeds are homogenizing habitats across entire landscapes and regions.[263] Among the casualties are healthy arid and semiarid shrub-steppe communities, secure habitats for rare or sensitive plants and animals, functioning riparian areas, healthy soils, intact biological soil crusts, high-quality recreational opportunities, cultural resources, and scenery. According to a prominent western economist:

> Intact ecosystems are rare islands surrounded by the 'econo-tech' culture of the late twentieth century. What natural landscapes remain are shriveled vestiges . . . . Their value lies in their fragile, irreplaceable biodiversity. Intact ecosystems are increasingly scarce and unique. We are down to the last, and what we lose now we cannot regain.[264]

FLPMA's "relative scarcity" criterion overlaps somewhat with the statute's requirement to "weigh" the relative short- and long-term benefits of competing uses, paying special heed to *public* benefits.[265] Access to public-land forage, including cheatgrass, for livestock is the quintessential "short-term [private] benefit"; it inures solely to a handful of grazing permittees.[266] It is inconceivable that Congress intended short-term private benefits to be given priority in *public land* management. In fact, the statute plainly authorizes either agency to discontinue grazing to devote public

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262. While private lands afford many recreation opportunities, they cannot substitute—in quality, quantity, or diversity—for the kinds of opportunities available on public-lands, nor would the quality of the experience survive the increased densities of recreational users concentrated in smaller areas.

263. *See, e.g.,* Quammen, *supra* note 30. Cheatgrass and other Eurasian species are reducing vegetative diversity worldwide. *See, e.g.,* University of California, Bromus tectorum (reporting occurrence in Europe, southern Russia, west central Asia, North America, Japan, South Africa, Australia, New Zealand, Iceland, and Greenland), http://ucce.ucdavis.edu/datastore/detailreport.cfm?usernumber=21&surveynumber=182 (last visited June 22, 2007).

264. POWER, *supra* note 122, at 254.

265. *See* 43 U.S.C. § 1712(c)(7). The statute's phrasing, "weigh *long-term benefits to the public* against short-term benefits," intimates that Congress was distinguishing between short-term *private* benefits and long-term benefits which, by their nature, would tend to accrue to the public at large, rather than to a relative few individuals. *Id.* (emphasis added).

266. And even then, the "value of these grazing permits and the acreage they entail vary widely depending on the location, soil characteristics, and precipitation." VEGETATION TREATMENTS PEIS, *supra* note 11, at 3-62. The BLM, grazing permittees, and others often argue that local communities benefit as well. *See, e.g.,* VEGETATION TREATMENTS PEIS, *supra* note 11, at 3-62 ("The availability of public land grazing leases is highly beneficial, if not crucial, to some ranching operations, however, and consequently is very important to many rural communities throughout the west."). However, little or no evidence has ever been offered to support this claim. *See* Donahue, *supra* note 122, at 799-800.

lands to a "public purpose."[267] The statute also refers repeatedly to the national interest, general public, American people, and the nation's need for resources.[268] References to local interests are few and qualified.[269]

Moreover, experience tells us that livestock grazing is not sustainable in the Great Basin, and it suggests that grazing will not be sustainable on cheatgrass rangelands either.[270] Livestock production on any native rangelands, but especially in the arid and semi-arid West,[271] is possible only at the expense (in quality or quantity) of other goods and services, all of which otherwise would contribute to "long-term, *public* benefits." Livestock production plainly leads to a net loss of public benefits. The difficulty of quantifying costs and benefits does not foreclose our ability to weigh the broad choices presented.[272] Predicting how much beef or lamb the public lands can produce is far easier than estimating the long-term values of "watershed protection, stability of wildlife popula-

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267. *See* 43 U.S.C. § 1752(b)(2), (g). FLPMA's grazing provisions apply to both the BLM and to the Forest Service.

268. *See, e.g.*, 43 U.S.C. § 1701(a)(1) (providing for disposal of land parcels if it would serve the national interest); *id.* § 1701(a)(2) (realizing the national interest through inventories and planning); *id.* § 1701(a)(12) (concerning the nation's need for food, fiber, and minerals); *id.* § 1702(c) (defining multiple use in terms of needs of American people); *id.* § 1702(j) (defining withdrawal in terms of public values and public purposes).

269. *See, e.g.*, 43 U.S.C. § 1712(c) (calling for coordination with "local government" land use plans "to the extent consistent with" federal public land laws); *id.* § 1716(a) (referring to the "needs of . . . local people" for land exchanges). According to Professor Keiter, "it remains unclear whether . . . local views should trump more distant voices on any particular [public-land] issue." *See* Keiter, *supra* note 183, at 1191. But this statement was not based on an analysis of FLPMA as a whole or its qualifications concerning the role of local land use plans. *See id.* at 1175, n.295. In contrast, Professor Coggins pointed out that FLPMA "does *not* refer to such specific goals as supporting local economies," and he concluded, "[W]hile local or limited aims are not barred by the law as management goals, the lesser aims should be subservient to national requirements." Coggins, *Public Rangeland Management IV*, *supra* note 188, at 51. Professor Blumm recommended that "multiple use should be *re*defined to reflect *national* interests expressed in other statutory directives, such as the Endangered Species Act and the Clean Water Act." Blumm, *supra*, note 187, at 408 (emphasis added). As I argue herein, however, national interests *are* the overriding concern in the federal land management statutes. Furthermore, relying on the Clean Water Act may not ensure that national, rather than local, interests are favored. A federal district court relied on state law in declining to hold grazing permittees or the Forest Service responsible for livestock-caused water quality standards (WQS) violations in streams on national forests. *See* Center for Native Ecosystems v. Cables, No. 04-cv-02409-PSF-CBS, 2006 WL 57935, at *6 (D. Colo. Jan. 9, 2006) (explaining that "Wyoming 'will not take enforcement action against a non-point source discharger who is implementing [best management practices] in good faith, even where an exceedance of [WQS] is demonstrated'" (apparently quoting a Forest Service pleading)).

270. *See generally supra* notes 54, 99, 102-05, 119 and accompanying text.

271. *See supra* note 54 and accompanying text; DONAHUE, *supra* note 19, at ch. 7.

272. "[T]he most important decisions to get right are those where benefits greatly outweigh costs or vice versa, and in such cases, complete accuracy is unnecessary." Gretchen C. Daily et al., *The Value of Nature and the Nature of Value*, 289 SCI. 395, 396 (2000).

tions, esthetics, [or] recreational uses."[273] But that does not prevent us from *knowing* that the latter are more valuable.

To defend continued public-land grazing, the BLM and livestock producers rely on FLPMA's "policy" that "the public lands be managed in a manner which recognizes the Nation's need for domestic sources of minerals, food, timber, and fiber from the public lands."[274] But this provision—the penultimate in a list of fourteen policy statements[275]—hardly obligates the BLM to *provide* "food . . . and fiber" *from domestic livestock produced on the public lands*.[276] For one thing, the public lands contain myriad food sources in the form of native, wild game—deer, elk, antelope, moose, bighorn sheep, upland birds (including several species of grouse), and small game animals, such as rabbits.[277] Wild animals convert native plants to high-quality protein, without inputs of fertilizers, feed supplements, pharmaceuticals, or fossil fuels.[278] Wild meat costs less to produce and harvest than livestock, and it generates more jobs, income, and tax revenues.[279] Native animals also produce "fiber," e.g., furs and hides (although no one is lobbying Congress

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273. *See* Monsen, *Controlling Plant Competition, supra* note 101, at 64 (discussing the difficulty of weighing the costs and benefits of restoration projects, but emphasizing that these "long-term values" are "important considerations," as are the "continued degradation and loss of resource values" if "deteriorated sites . . . are left untreated").

274. 43 U.S.C. § 1701(a)(12).

275. *See id.* § 1701(a).

276. *Id.* § 1701(a)(12). I can't resist adding that it's highly unlikely that *horses* pastured on federal grazing allotments are raised to produce either food or fiber.

277. "During some part of the year, rangeland ecosystems are associated with eighty-four and seventy-four percent of the total number of mammalian and avian species, respectively, found in the United States." RANGELAND HEALTH, *supra* note 10, at 20.

278. Wild meat is almost certainly healthier for humans than most domestic meat products. Most beef is "finished" on corn or other grains and has a higher fat content than the meat of wild game or cattle fed a strict grass diet. *See* Medline Plus Medical Encyclopedia: Heart disease and diet: Food Sources (recommending "very lean beef" and "wild game"), http://www.nlm.nih.gov/medlineplus/ency/article/002436.htm#Food%20Sources (last visited June 22, 2007). *See generally* Virginia Kisch Messina*, It's What's for Dinner: The Health Costs of Meat*, *in* WELFARE RANCHING, *supra* note 25, at 279; Margot Roosevelt, *The Grass-Fed Revolution,* TIME, June 11, 2006, *available at* http://www.time.com/time/archive/preview/0,10987,1200759,00.html (describing the nutritional advantages of grass- over grain-fed beef, noting that less than one percent of the nation's beef supply is grass-fed, and noting that "feeding steers grain and supplements can create safety issues"). In addition, most cattle are produced using other supplements, including animal parts, antibiotics, growth hormones, etc. *See* MILLENNIUM ASSESSMENT, *supra* note 33, at 114 ("Intensive livestock agriculture that uses subtherapeutic doses of antibiotics has led to the emergence of antibiotic-resistant strains of [several species of bacteria].").

279. *See generally* Kenneth H. Mathews, Jr. et al., *Public Lands & Western Communities*, AGRIC. OUTLOOK, June-July 2002, at 18-19; Laitos & Carr, *supra* note 11, at 143-66. Some would argue that wild meat is expensive, pointing to the fuel and travel costs incurred by big game hunters and fishermen. But these costs reflect not just the value of the meat but the recreational value of the wild animal and the hunting experience to the hunters—and they are revenues to those providing the lodging, food, and other services demanded by the hunters and anglers.

or local agencies to institute more liberal trapping rules).[280] Cattle, sheep, goats, and horses pastured on the public lands reduce the numbers, and thus the collective food and fiber value, of wild animals. They do this not only by competing directly with native animals for food, water, and shelter, but also in countless other, indirect ways—by causing erosion, spreading weeds, altering fire cycles, polluting streams, introducing disease.[281]

Congress surely intended that, if the nation has relatively little "need" for food or fiber from public-land-raised domestic livestock, managers can and should emphasize *other* values of public lands. The definition of "multiple use" supports this reasoning. Most instructive are the provisions calling for "periodic adjustments in use to conform to changing needs and conditions" and consideration of "the long-term needs of future generations" and "the relative values of the resources."[282] The definition's caveat that "multiple use" does "not necessarily" mean "the combination of uses that will give the greatest economic return or the greatest unit output"[283] should defuse any argument that commodity production is preferred. Moreover, FLPMA's directions to "consider the relative scarcity of the values involved and the availability of alternative means . . . and sites for realization of those values" and to "weigh long-term benefits to the public against short-term benefits" should overwhelm arguments based on a purported "need" for public-land livestock products.[284] In sum, livestock products are neither scarce nor relatively valuable, livestock can be produced more efficiently elsewhere, and using public lands to produce livestock serves the short-term interests of a narrow class of users while sacrificing long-term public values.

The corollary argument that maintaining public-land beef production is justified because of humans' need for protein simply does not withstand scrutiny. As a practical matter, beef is not feeding the world's poor,[285] and substantially more food would be

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280. Furbearers that can legally be trapped or killed in some states include bobcat, marten, river otter, beaver, mink, weasels, raccoons, squirrels, coyotes, badgers, and black bears. Some hunters keep the hides of deer, elk and moose, and tan them for use in making leather clothing. *See* Hidemarket.com, Directory of U.S./Canadian Tannery websites, http://www.hidemarket.com/public/Directories/usatanners.htm (last visited Apr. 21, 2007).

281. *See, e.g.*, Bill Willers, *Where Bison Once Roamed: The Impacts of Cattle and Sheep on Native Herbivores*, *in* WELFARE RANCHING, *supra* note 25, at 241. Even in the Greater Yellowstone Ecosystem, renowned as "the premier wilderness of the lower 48 states," domestic livestock outnumber native ungulates by more than four to one *on national forest lands*! *See* Bill Willers, *Animals Wild and Domestic: A Comment on Ratios*, WILD EARTH, Spring 1995, at 6 (citing U.S. Fish & Wildlife Service figures from 1993).

282. 43 U.S.C. § 1702(c).

283. *Id.*

284. *Id.* § 1712(c)(6), (7).

285. Fish is a much more important source of protein worldwide, and especially to poor

available to the hungry if less grain went to feeding cattle and other livestock.[286] "Eradicating hunger . . . depends on sustainable and productive agriculture, which in turn relies on conserving and maintaining agricultural soils, water, genetic resources and ecological processes."[287] Judged by these criteria, public-land livestock production is plainly not sustainable. As a legal matter, FLPMA refers to "the *Nation's* need for domestic sources of food . . . and fiber *from the public lands*," not to the nation's needs for food in general, nor to world or local needs. Granted, the United States is a huge importer of beef.[288] But this would be so even if public-land forage were unavailable. As University of Montana economist Thomas Michael Power has demonstrated, the federal lands' contribution to U.S. beef production could readily be replaced by private land producers, particularly in other regions of the country.[289] If the beef that the United States imports from developing nations comes (as it certainly does) at the expense of local peoples or the environment in the exporting countries,[290] the solution is *not* to increase production on U.S. public lands. Better alternatives include cutting U.S. imports, imposing higher import taxes, or (best of all) seeking to reduce Americans' beef consumption.[291]

Two increasingly common defenses of public-land grazing are that it maintains a historically significant lifestyle (ranching) and supports local communities.[292] These arguments find little support

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people. *See, e.g.,* MILLENNIUM ASSESSMENT, *supra* note 33, at 103 (reporting that total fish consumption "has nearly doubled in the developing world since 1973"); EFTEC, *supra* note 32, at 4; JEREMY RIFKIN, BEYOND BEEF: THE RISE AND FALL OF THE CATTLE CULTURE 155-56 (1992) (noting that increased consumption of animal protein, particularly beef, is directly related to rising income).

286. *See,* RIFKIN, *supra* note 285, at 161-63; Douglas A. Kysar, *Law, Environment, and Vision*, 97 NW. U. L. REV. 675, 722 (2003) ("Each kilogram of red meat requires three thousand liters of water, the equivalent of two liters of gasoline in petrochemicals and other farm inputs, and five kilograms of corn and meal that otherwise could be used to feed humans.")

287. EFTEC, *supra* note 32, at 4. Eradicating hunger is the United Nations Development Programme's "Millennium Development Goal" number one. *Id.*

288. *See* RIFKIN, *supra* note 285, at 192-93. But the U.S. is also the world's major beef producer. *Id*. at 154. U.S. beef production for 2006 was projected to be nearly 12 million tons (of a worldwide total of more than 53 million tons). U.S. DEP'T OF AGRIC., LIVESTOCK & POULTRY: WORLD MARKETS AND TRADE 5-6 (2005), *available at* http://www.fas.usda.gov/dlp/circular/2005/05-11LP/dlp05_11LP.pdf.

289. *See* POWER, *supra* note 122, at 184–86.

290. *See, e.g.,* RIFKIN, *supra* note 285, at 163, 180-81, 192-99, 282. Regarding the global environmental impacts of livestock production, *see generally* HENNING STEINFELD ET AL., LIVESTOCK'S LONG SHADOW: ENVIRONMENTAL ISSUES AND OPTIONS (Rome: Food & Agriculture Organization 2006).

291. *See generally* RIFKIN, *supra* note 285; EFTEC, *supra* note 32, at 27; Messina, *supra* note 278.

292. *See generally* Donahue, *supra* note 122, at 730 & nn.40-42, 800-01 & nn.530-32 (and sources cited therein). Readers who might be inclined to accept that this lifestyle is worthy of preservation would do well to consider the agrarian attitude toward predators and

in the facts, however,[293] and none in legislation. The closest Congress has come to recognizing a federal interest in communities that (allegedly) depend on public-land livestock grazing is its direction to the Secretary of the Interior in the preamble to the Taylor Grazing Act to "do any and all things necessary . . . to stabilize the livestock industry dependent upon the public range."[294] This objective was not codified, and it was accompanied by two other goals—to "stop injury to the public grazing lands by preventing overgrazing and soil deterioration [and] to provide for [the lands'] orderly use, improvement, and development."[295] The Tenth Circuit Court of Appeals concluded that this language leaves the Secretary of the Interior "free to consider" the minor contribution of BLM lands to livestock production when "balancing the need for industry stability against the *need to protect the federal lands from deterioration*."[296]

FLPMA's more comprehensive provisions, which supplement the Taylor Act, leave no doubt that the Secretary is *not* free to elevate the economic interests of a few public land users (or even local communities) over long-term public interests in the lands.[297] Live-

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so-called pests. *See generally* WELFARE RANCHING, *supra* note 25, at 221-30, 257-50.

293. *See supra* notes 122-23 and accompanying text.

294. Taylor Grazing Act, 48 Stat. 1269 (1934). This language was not codified.

295. *Id*. Moreover, the codified Taylor Act described the "objects" of grazing districts as "to regulate their occupancy and use, to preserve the land and its resources from destruction or unnecessary injury, [and] to provide for the orderly use, improvement, and development of the range." 43 U.S.C. § 315a. *See also* DONAHUE, *supra* note 19, at 36-37, 195-96 (discussing significance of the industry stability objective).

296. Pub. Lands Council v. Babbitt, 154 F.3d 1160, 1172 (1998) (emphasis added), *aff'd in (relevant) part and rev'd in part*, 529 U.S. 728, 742 (2000) (observing that the "Secretary is free reasonably to determine just how, and the extent to which, 'grazing privileges' shall be safeguarded in light of the Act's basic purposes"). It can seriously be questioned whether there *is* now a livestock industry dependent upon the public range, as there arguably was in the early era of range livestock grazing. Certainly, the U.S. livestock industry as a whole depends but little on public-land forage. *See supra* notes 156-57 and accompanying text. And there is no separate "public-land livestock industry" for the simple reason that few if any animals are fed solely on federal lands. Federal forage provides an average of twelve percent of the total feed requirements of beef cattle produced in the eleven western states. *See* POWER, *supra* note 122, at 182-83 (reporting that the percent by state ranges from two in Washington to forty-three in Nevada, which is more than eighty percent federal land).

297. A federal district court's interpretation of a Forest Service regulation (for which the BLM has no analog) is instructive. The court in *Intermountain Forest Industry Association v. Lyng* construed 36 C.F.R. § 221.3(a)(3), which provides, "One purpose of timber planning is to facilitate the stabilization of communities and of opportunities for employment." 683 F. Supp. 1330, 1339 (D. Wyo. 1988). After noting that the regulation "contains an escape clause: timber management plans shall stabilize dependent communities and promote employment '*so far as feasible,*" the court continued:

> Recognizing that strong local economies are a desirable result of timber harvest planning, the lack of commercially profitable timber, limited funds, and protection of other forest resources may supersede local economic development. Indeed, the regulation requires coordination of timber production with other forest uses. [36 C.F.R.] § 221.3(a)(4). The regu-

stock grazing pursued on arid and semiarid lands is simply not sustainable. If it is pursued on the pretext of supporting local communities, the economic boost will be minimal and short-lived, and when the grazing lands are depleted so will be the capacity of local ecosystems to provide many other goods and services. The BLM's rangeland health regulations reflect this understanding:

> The objectives of these regulations are to promote healthy sustainable rangeland ecosystems; to accelerate restoration and improvement of public rangelands to properly functioning conditions; to promote the orderly use, improvement and development of the public lands; to establish efficient and effective administration of grazing of public rangelands; and to provide for the sustainability of the western livestock industry and communities that are dependent upon productive, healthy public rangelands. These objectives shall be realized in a manner that is consistent with land use plans, multiple use, sustained yield, environmental values, economic and other objectives [of the law].[298]

When the BLM chooses to allow grazing on lands unsuited to that use, it fails to provide either for sustained yield of rangeland resources—water, forage, fish and wildlife habitat, recreation, and natural scenic and scientific values—or for western "communities that are dependent upon productive, healthy public rangelands."[299]

Dr. Power has written extensively about the economic tradeoffs between commodity production and protection of natural landscapes. In the following pithy observation he captures the rationality of FLPMA's preferences for long-term over short-term interests, public over private benefits, and land uses that recognize the value of scarcity:

> Commodities are cheap and easily replaced, and additional increments produce little net economic value. Remnant natural landscapes are scarce, relatively unique, irreplaceable assets. In many cases, if we opt for extractive activity to keep the local econ-

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lation imposes no absolute requirement that the national forests be managed to promote local economies.

Id. Cf. supra notes 122-23 and accompanying text.

298. 43 C.F.R. § 4100.0-2 (2006).

299. *See id.*

> omy afloat, we will be sacrificing what is scarce and unique for what is common and cheap. [W]e as a people can no longer afford such irrational waste. Neither can the planet.[300]

B. FLPMA's "No Degradation" Requirement

Congress paired FLPMA's command to "manage the public lands under the principles of multiple use and sustained yield"[301] with another mandate, arguably the Act's most important provision: "In managing the public lands, the Secretary shall, by regulation or otherwise, take any action necessary to prevent unnecessary or undue degradation [UUD] of the lands."[302]

The only court that has parsed the UUD provision held that, plainly, "Congress intended to prevent 'unnecessary degradation' *as well as* 'undue degradation.'"[303] The court further interpreted the UUD provision (in the mining context) as vesting the Secretary "with the authority—and indeed the obligation—to disapprove of an otherwise permissible mining operation because the operation, though necessary for mining, would *unduly harm or degrade the public land*."[304] In contrast to holders of valid mining claims,[305] public-land grazing permittees possess no property right in public lands or in public-land resources. If a miner's vested property interest in public lands may be regulated to the point of prohibiting a "necessary" mining operation because it would "unduly harm" the

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300. *See* POWER, *supra* note 122, at 254.

301. FLPMA, 43 U.S.C. § 1732(a).

302. *Id.* § 1732(b). *See generally* Flynn, *supra* note 182 (discussing this provision of FLPMA and its interpretation in Mineral Policy Ctr. v. Norton, 292 F. Supp. 2d 30 (D.D.C. 2003)). Indeed, the Interior Secretary's authority to "preserve the land and its resources from destruction or *unnecessary injury*" caused by grazing dates to the 1934 Taylor Grazing Act. *See* 43 U.S.C. § 315a (emphasis added) (stating that the "objects" of grazing districts include "preserv[ing] the land and its resources from destruction or unnecessary injury"). The Taylor Act authorized the Secretary to establish grazing districts on lands which, in his opinion, were "chiefly valuable for grazing." *See* 43 U.S.C. § 315. The Act's legislative history is replete with evidence that Congress knew of the damage that inappropriate grazing had wrought, and that some western rangelands were simply unsuited to grazing. *See* DONAHUE, *supra* note 19, at 197-98.

303. Mineral Policy Ctr. v. Norton, 292 F. Supp. 2d 30, 42 (D.D.C. 2003) (rejecting a contrary interpretation by the Interior Solicitor) (emphasis added).

304. *Id.* (emphasis added). According to the BLM: "Land-disturbing activities must be conducted in a manner that *minimizes* ecosystem fragmentation and degradation . . . ." VEGETATION TREATMENTS PER, *supra* note 17, at ES-2 (emphasis added, no authority cited). I have argued that, under the UUD standard, resource conditions should "not be allowed to decline to a point that would interfere with the sustained yield of [any resource] or with realizing the land's values." DONAHUE, *supra* note 19, at 205; *see also id.* at 209-10 (discussing UUD standard as applied to livestock grazing).

305. *See* Flynn, *supra* note 182, at 829-32 (discussing mining claims and FLPMA).

land, exercise of the grazing "privilege"[306] certainly may be prohibited for the same reason. Livestock grazing that "unduly harm[s] or degrade[s] the public land" is not "permissible" under FLPMA.[307] Discontinuing livestock grazing will be a *sine qua non* in stopping the ongoing degradation of public lands by invasive weeds and fire; therefore, it is clearly within the "any necessary action" called for by section 302(b).[308]

Furthermore, FLPMA's command to *prevent* land degradation counsels a proactive, precautionary approach to management. Section 302(b) should be construed as requiring managers to consider whether land uses and activities are likely, in the aggregate, to cause UUD. In other words, in determining whether to allow and how to regulate any activity, including grazing, land managers should consider whether it, along with other ongoing and reasonably foreseeable uses, could result in UUD, not whether the activity, considered alone, would have such effect.[309] Applying available ecological knowledge, for instance, regarding livestock impacts and the operation of thresholds in arid and semiarid ecosystems, is essential to this analysis.[310]

C. PRIA and "The Goal" of Rangeland Management

In the PEIS and PER, the BLM cited only FLPMA for its reservations about discontinuing livestock grazing.[311] But the Public Rangeland Improvement Act also warrants mention here.[312] PRIA was enacted just two years after FLPMA and signaled Congress's

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306. *See* Pub. Lands Council v. Babbitt, 529 U.S. 728, 735-36, 740-44 (2000) (consistently using the term "grazing privileges" from the Taylor Grazing Act, 43 U.S.C. § 315b).

307. *Cf. Mineral Policy Ctr.*, 292 F. Supp. 2d at 42 (referring to an "*otherwise* permissible mining operation").

308. 43 U.S.C. § 1732(b) ("[T]ake any action necessary to prevent unnecessary or undue degradation.").

309. A familiar model for such an analysis is the environmental statement required by NEPA, 42 U.S.C. § 4332(C) (2000), and the CEQ guidelines. *See, e.g.*, 40 C.F.R. § 1502.16(a), (b) (2006) (requiring discussions of direct and indirect consequences and their significance), *id.* § 1508.8 (defining "effects" or "impacts" to include "reasonably foreseeable" and "cumulative" impacts), *id.* § 1508.7 (defining "cumulative impacts" as the "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions" including impacts that "result from individually minor but collectively significant actions taking place over a period of time").

310. Again the CEQ rules could provide guidance for this analysis. *See* 40 C.F.R. § 1502.22 (regarding the significance of incomplete or unavailable information, particularly regarding impacts that could have "catastrophic consequences").

311. *See supra* notes 262-63, 266-68 and accompanying text.

312. PRIA, like FLPMA's grazing provisions, applies to the Forest Service. Other statutes also bear on both agencies' duties and discretion to regulate or discontinue livestock grazing, but they are beyond the scope of this Article. For a discussion of some of these statutes, see DONAHUE, *supra* note 19, at 222-28 (addressing NEPA, ESA, and CWA); *see also* Blumm, *supra* note 187.

deepening concern about the unsatisfactory and declining condition of the public rangelands.[313] The Act neither modified the BLM's land management responsibilities nor limited the agency's authority to take action to address "unsatisfactory" range conditions, including, if necessary, discontinuing livestock grazing.[314] The Act does, however, reflect a heightened awareness of ecosystem services and an appreciation of the tradeoffs in managing public rangelands.

PRIA makes it absolutely clear that less-than-potential production of ecosystem services, namely, "wildlife habitat, recreation, forage, and water and soil conservation benefits," is evidence of rangelands' "unsatisfactory condition."[315] The Act defines "range condition" in ecological terms, relating the "the quality of the land" to its "productivity," and in turn to

> soil quality, forage values (whether seasonal or year round), wildlife habitat, watershed and plant communities, the *present state of vegetation* of a range site *in relation to the potential plant community* for that site, and the relative degree to which the kinds, proportions, and amounts of vegetation in a plant community resemble that of the desired community for that site.[316]

PRIA does not refer explicitly to invasive species. Congress demonstrated its cognizance of the issue, however, in the quoted language's juxtaposition of "present . . . vegetation" with "potential plant community," and in the Act's correlation of "healthy and productive range condition" with "*native* vegetation."[317]

Congress was well informed of the risks of letting range conditions stagnate or worsen, as PRIA's opening paragraph reveals:

> [U]nsatisfactory conditions on public rangelands present a high risk of soil loss, desertification, and a

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313. Pub. L. No. 95-514, 43 U.S.C. §§ 1901-1908.

314. *See supra* notes 155 and 267, *infra* note 327 and accompanying text.

315. *See* 43 U.S.C. § 1901(a)(1) ("[V]ast segments of the public rangelands are producing *less than their potential* for livestock, wildlife habitat, recreation, forage, and water and soil conservation benefits, *and for that reason* are in an unsatisfactory condition.") (emphasis added)).

316. *See id.* § 1902(d) (emphasis added).

317. *See* 43 U.S.C. § 1902(d), (e) (emphasis added) (defining "native vegetation" as "those plant species, communities, or vegetative associations which are endemic to a given area and which would normally be identified with a healthy and productive range condition occurring as a result of the natural vegetative process of the area."). Surprisingly, the term "native vegetation" does not appear elsewhere in PRIA.

> resultant underproductivity for large acreages of the public lands; contribute significantly to unacceptable levels of siltation and salinity in major western watersheds including the Colorado River; negatively impact the quality and availability of scarce western water supplies; threaten important and frequently critical fish and wildlife habitat; prevent expansion of the forage resource and resulting benefits to livestock and wildlife production; increase surface runoff and flood danger; reduce the value of such lands for recreational and esthetic purposes; and may ultimately lead to unpredictable and undesirable long-term local and regional climatic and economic changes . . . .[318]

Section 4(b) of PRIA sets forth what Professor Coggins referred to as the "most important provision in all of the range management statutes": Congress's pronouncement that "*the goal* of [public rangeland] management shall be to improve the range conditions of the public rangeland so that they become as productive as feasible [for all rangeland values]."[319] This section is important for another reason. It controverts the BLM's assertions that FLPMA limits restrictions on livestock grazing and that a decision to discontinue grazing may be made only at the local level.[320] Because the text of section 4(b) is a bit muddy, and its messages of utmost importance, I quote it in full:

> Except where the land use planning process required pursuant to [FLPMA, 43 U.S.C. § 1712] determines otherwise *or the Secretary determines*, and sets forth his reasons for this determination, *that grazing uses should be discontinued (either temporarily or permanently*) on certain lands, *the goal* of such management shall be *to improve the range conditions* of the public rangelands so that they become as productive as feasible in accordance with the rangeland management objectives established through the land use planning process, and consistent with the values and objectives listed in sections 1901(a) and (b)(2) of this

318. 43 U.S.C. § 1901(a).

319. Coggins, *Public Rangeland Management IV*, *supra* note 188, at 115–16 (emphasis added).

320. *See supra* note 62; text accompanying note 63.

title.[321]

The "objectives" to which this section refers are to "manage, maintain and improve the condition of the public rangelands so that they become as productive as feasible for all rangeland values,"[322] namely, "livestock, wildlife habitat, recreation, forage, and water and soil conservation benefits."[323]

By indicating that it might be necessary or desirable to "discontinue[ ]" grazing, "either temporarily *or permanently*," Congress acknowledged the major ecological role of livestock, and it effectively prioritized rangeland values, subordinating "livestock" to others, specifically, "wildlife habitat, recreation, forage, and water and soil conservation benefits." Section 4(b) recognizes not only that discontinuing grazing temporarily may be necessary to improve range condition and productivity, but that ending grazing permanently may be advisable. The latter authority is consistent with Congress's understanding that some lands are simply incapable of livestock production.[324] For these lands, being "as productive as feasible" does *not* include supporting livestock. To put it another way, some lands will *become* "as productive as feasible" *only if* livestock grazing ends.[325]

The second important message of section 4(b) is that authority exists to discontinue grazing, whether temporarily or permanently. The authority resides in the Secretary of the Interior, whether exercised by the BLM field manager via FLPMA's planning process,[326] or by the Secretary directly, acting outside the planning process.[327] The only prerequisite for the latter is that the Secre-

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321. 43 U.S.C. § 1903(b) (emphasis added).

322. *Id.* § 1901(b)(2).

323. *Id.* § 1901(a)(1).

324. Congress understood this in 1934 when it authorized the Interior Secretary to establish grazing districts and to regulate grazing on the public domain. *See* DONAHUE, *supra* note 19, at 198.

325. Significantly, nothing in PRIA suggests a need to discontinue *any other* land use in order to pursue the productivity objective.

326. *See* 43 U.S.C. § 1712(a) ("The Secretary shall . . . develop, maintain, and, when appropriate, revise land use plans which provide by tracts or areas for the use of the public lands . . . ."). This authority has been delegated to BLM officials. *See* 43 C.F.R. § 1601.0-4 (2006) (specifying planning duties at the national, state, and field levels). BLM field managers are responsible for preparing and amending, and state directors for approving, land use plans. *Id.* § (c).

327. This is not new authority. PRIA states that its "policies" are to be "construed as supplemental to and not in derogation of the purposes for which public rangelands are administered under other provisions of law." 43 U.S.C. § 1901(c). The same paragraph indicates that PRIA's "policies . . . shall become effective only as specific statutory authority for their implementation is enacted." *Id.* The authority to cancel grazing permits or to eliminate grazing had already been conferred by Congress in FLPMA. *See* 43 U.S.C. §§ 1712(e)(2), 1752(g).

tary "set[] forth his reasons."[328] It is this authority upon which the future of the Great Basin likely rests.

Plainly, the BLM cannot rationalize the continued degradation of public rangelands on the specious ground that grazing is "*allowed under FLPMA*."[329] PRIA reinforces the conclusions reached based on FLPMA: Congress intends public lands to provide a broad array of goods and services and to do so sustainably into the future. Agency decisions about land use should favor values whose supply is limited, which cannot (readily) be provided or realized elsewhere or by other means, *and* which will serve long-term, public interests. The BLM has the power to discontinue or eliminate livestock grazing and, in fact, has a *responsibility* to do so where necessary to prevent "unnecessary or undue degradation of the lands" and to achieve the goal of improving range condition.[330]

IV. CONCLUSION

Reading about the western weed problem, one cannot escape the sense of urgency. Dire warnings pervade the scientific literature, popular press, government publications, and congressional hearings.[331] A botanist, among the most knowledgeable on the

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328. 43 U.S.C. § 1903(b). When canceling grazing permits "to devote the lands . . . to another public purpose," the Secretary (or his delegee) also must give two years notice or declare an emergency, and permittees would be entitled to "reasonable compensation for the adjusted value . . . of [their] interest in authorized permanent improvements" on the allotment. *See* 43 U.S.C. § 1752(g). A BLM regulation provides:

> When the authorized officer determines that the soil, vegetation, or other resources on the public lands require immediate protection because of conditions such as drought, fire, flood, insect infestation, or when continued grazing use poses an imminent likelihood of significant resource damage, after consultation with, or a reasonable attempt to consult with, affected permittees or lessees, the interested public, and the State having lands or responsible for managing resources within the area, the authorized officer shall close allotments or portions of allotments to grazing by any kind of livestock or modify authorized grazing use . . . .

43 C.F.R. § 4110.3-3(b). The rule provides that the closure shall remain in effect during any appeal. *Id.* Ample evidence should be available in any case to withstand a challenge, brought under the Administrative Procedure Act, that permit cancellation was "arbitrary, capricious, [or] an abuse of discretion." 5 U.S.C. § 706(2)(A) (2000).

329. *See supra* note 62 and accompanying text (emphasis added).

330. 43 U.S.C. § 1732(b).

331. A science advisor to then-Secretary of the Interior Gale Norton described the weeds problem as having "a long fuse and a big boom. In some cases, [as with cheatgrass], we are approaching the boom. The fuse is getting very short . . . ." H.R. 1462, TO CONTROL OR ERADICATE HARMFUL NON-NATIVE WEEDS ON PUBLIC AND PRIVATE LAND, HEARING BEFORE THE H. SUBCOMM. ON NATIONAL PARKS, RECREATION, AND PUBLIC LANDS, 107th Cong. 25 (2001) (statement of Dr. James Tate, Jr.). *See also* HEALING THE LAND, *supra* note 1, at Letter to Reader ("75 million acres of public land in the Great Basin are at stake and the

western weeds problem, admitted that he was "scared to death."[332] "I think that we have weeds on the scene now that we aren't going to be able to contain," Dr. Stephen Monsen warned. "I think we have a window of time right now. We may be able to prevent these weeds that are displacing cheatgass."[333] That was six years ago.

Monsen recommended taking weedy lands out of livestock production and either "aggressively" replanting and restoring native vegetation or allowing natural recovery, depending on range condition.[334] The latter, he advised, is "'the best way to allow [the lands] to heal, and it's the cheapest thing for us to do.'"[335] His proposed treatment addresses the causes of the disease whereas the BLM treats only the symptoms and only on some lands.[336] Faced with a metastasizing cancer, the BLM rejects the best and cheapest antidote and falls back on palliatives that are expensive and environmentally risky but politically expedient.[337]

The law requires that public land goods and services be produced sustainably, in perpetuity, and in the combination that will best meet the needs of the American people.[338] Weeds are capable of transforming entire ecosystems, shutting off or reducing to a trickle future streams of ecosystem goods and services. Management that promotes weeds contravenes the law.

The BLM knows—all informed persons know—that livestock is a major cause of the weed problem. We know that rangelands are deteriorating as grazing continues. We also know that removing livestock would not cause range conditions to worsen.[339] Granted, uncertainties remain—about thresholds, which lands have potential for natural recovery, how long recovery will take, etc. Never-

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clock is ticking. The time for us to move forward is now."); *see also supra* note 21 and accompanying text.

332. *See* Jones, *supra* note 107 (describing the views and concerns of now-retired Forest Service botanist and range restoration expert Stephen Monsen).

333. *Id*. In the same year the BLM exhorted: "Restoration work must begin now . . . ." HEALING THE LAND, *supra* note 1, at 36.

334. *See* Jones, *supra* note 107. Monsen also recommended compensating ranchers. *Id.*

335. *Id.* (quoting Monsen). Elsewhere, Monsen has written about the potential for "natural recovery" on lands where some native plant species persist, at least where livestock are removed. *See supra* note 77 and accompanying text.

336. *See generally supra* notes 43-45, 88 and accompanying text.

337. One million cattle per month (or the equivalent) overrun the public lands, carrying billions of weed seeds on their coats and in their digestive tracts. *See* VEGETATION TREATMENTS PEIS, *supra* note 11, at 3-42, 3-62 (reporting fiscal year 2004 livestock use of BLM lands as 12.7 million animal unit months (AUMs)). But instead of recommending reductions in livestock use, the BLM, astonishingly, suggests that public land visitors groom their "*pets* . . . to remove weed seeds prior to entering public lands"! *See* VEGETATION TREATMENTS PER, *supra* note 17, at 2-16 (emphasis added).

338. *See generally supra* Part III.

339. The only suggestion to this effect that I have encountered is the argument that *not* grazing will increase annual weed fuel loads. *See supra* note 102 (emphasis added).

theless, every day brings better scientific understanding of the long-term, potentially irreversible impacts of weeds and livestock on arid and semiarid lands and more evidence that removing livestock is an essential part of the cure on these lands. According to Monsen: "'We know what we should be doing, but we don't have the wherewithall [sic] to do it.'"[340] Unless that changes very soon, cheatgrass (and its virulent cousins) *will* win the West.[341]

340. Jones, *supra* note 107 (quoting Monsen, who was referring to an inadequate native seed supply and "land managers who don't accept the transition" of de-stocking and using native plants, rather than introduced forage grasses, for range rehabilitation).

341. Recall that Pellant called cheatgrass *The Invader that Won the West*. *See* Pellant, *Invader*, *supra* note 93. *Cf.* Quammen, *supra* note 30, at 65 ("Nature won't come to an end, but it will look very different.").

VALUING COASTAL AND OCEAN ECOSYSTEM SERVICES: THE PARADOX OF SCARCITY FOR MARINE RESOURCES COMMODITIES AND THE POTENTIAL ROLE OF LIFESTYLE VALUE COMPETITION

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I. INTRODUCTION

In their seminal, if controversial, 1997 article in *Nature*, Robert Costanza and his fellow researchers estimated that the world's ecosystem services were worth over thirty-three trillion dollars.[1] That thirty-three-trillion-dollar figure, and the *Nature* article in general, garnered much attention and criticism, both popular and professional, and this paper will not revisit those debates.

Nevertheless, whatever one thinks of the precise monetary figures that Costanza and his colleagues calculated or of their whole attempt to assign value to services that are, when push comes to shove, indispensable to life and therefore priceless, the *relative* values that the researchers assigned to various types of ecosystems and to the services that those ecosystems provide are suggestive of where public, political, and regulatory attention should focus in order to best effectuate sustainable development. From that perspective, it is significant that, as the researchers themselves noted, "[a]bout 63% of the estimated value is contributed by marine systems…" and "[m]ost of this comes from coastal systems . . . ."[2] In other words, almost two-thirds of the value of the world's natural capital comes from marine ecosystems, and about sixty percent of the value of marine ecosystem services derives from coastal ecosystems.[3]

Thus, as Costanza has emphasized elsewhere, "[c]oastal environments, including estuaries, coastal wetlands, beds of sea grass and algae, corals reefs, and continental shelves are of disproportionately high value. They cover only 6.3% of the world's surface, but are responsible for 43% of the estimated value of the world's ecosystem services."[4] It follows that loss of coastal and open ocean ecosystems, which is occurring throughout the world, represents a significant loss to the world's and to individual coastal nations' natural capital.

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1. Robert Costanza et al., *The Value of the World's Ecosystem Services and Natural Capital*, 387 NATURE 253, 259 (1997). The $33 trillion estimate is the average of total values ranging from $16 to $54 trillion. *Id*. All dollar figures from this article are in 1994 United States dollars. *See id*. at 256 tbl. 2.

2. *Id.* at 259.

3. *Id*. at 256, tbl. 2. *See also* UN Atlas of the Oceans, *Ecosystem Issues,* http://www.oceansatlas.org (follow "USES" hyperlink; then follow "Fisheries and Aquaculture" hyperlink; then follow "Issues" hyperlink under Sub-topics, then follow "Ecosystem Issues" hyperlink) (last visited June 20, 2007) ("About 95% of world marine production originates from coastal ecosystems, such as estuaries, marshes, shallow bays and wetlands, mangroves, coral reefs, and sea-grass beds. These play a major role in the life cycle of many marine organisms, including economically important fish species, by providing breeding, nursery, and feeding grounds.")

4. Robert Costanza, *The Ecological, Economic, and Social Importance of the Oceans*, 31 ECOLOGICAL ECONOMICS 199, 201 (1999).

Water-based ocean and coastal ecosystems are classic examples of environmental commons. Traditionally subject to an international law regime based on "freedom of the seas,"[5] private property rights in ocean resources were (and still are) generally limited to and by the commodity-focused rule of capture — *i.e.*, in general, no private property rights accrue in fish or other ocean resources until an individual effectively (and preferably legally, but enforcement in the oceans is also a problem) brings those resources under his or her dominion and control. Private or even community ownership of actual *areas* of the sea is rare and limited.[6]

In contrast, public property rights in the ocean *are* territorial and are based on the physical area of the ocean that coastal nations can regulate under principles of international law. From the late nineteenth century until the 1970s, the generally accepted limit of governmental control was three nautical miles out to sea, but the third United Nations Convention on the Law of the Sea (1982) substantially extended this limit and the regulatory authority of coastal nations.[7] Thus, when ocean resources are threatened with overexploitation — as they are — classic environmental economics theory, typified by Garrett Hardin's essay on the "tragedy of the commons," would counsel that, given this established, predominantly public, property rights regime, government regulation of marine ecosystems is the most effective way of protecting those ecosystems.

Terrestrial coastal ecosystems are more complex because they are far more likely to consist of what Professor Daniel H. Cole has called a "mixed property regime," where public, group, and private

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5. *See generally, e.g.*, HUGO GROTIUS, THE FREE SEA (David Armitage ed., Richard Hakluyt trans., Liberty Fund 2004) (1609).

6. I rely here on Professor Daniel H. Cole's typology of properties. Professor Cole distinguishes five types of property regimes: public property, which is property owned or regulated by governments or the international community; private property, typified by individual private property; common property (*res communes*), which describes a situation where there are "at least two groups, one of which collectively controls the resource with the authority and the ability to exclude the other;" mixed property, where public, common, and private property rights exist simultaneously, in proportions that can vary; and nonproperty/open access/*res nullius*, where no individual, government, or group has the right to exclude. DANIEL H. COLE, POLLUTION & PROPERTY 9-13 (2002). Most important, and especially critical for the oceans and coasts, is Professor Cole's recognition "that all existing property regimes are actually admixtures of private, group, and public rights . . . ." *Id.* at 13.

7. Under the 1982 United Nations Convention on the Law of the Sea [hereinafter UNCLOS III] which became effective internationally on November 16, 1994, individual nations can assert regulatory control over marine resources out to 200 nautical miles from shore, through the establishment of an Exclusive Economic Zone (EEZ). UNCLOS III, arts. 56.1, 57, Dec. 10, 1982, 1833 U.N.T.S. 397 (entered into force on Nov. 16, 1994). Regulatory control over seabed natural resources may extend even further pursuant to the Convention's continental shelf provisions. *Id.* at art. 76.1.

rights all exist simultaneously.[8] Nevertheless, because coastal property is limited in availability and provides public goods and services in the form of fish, birds, habitat, nutrient production and recycling, toxics sequestration, and so forth, coastal ecosystems can also legitimately be viewed as commons. Moreover, since at least the mid-twentieth century, the highest private commercial value accorded to coastal property has been its development value, which this article will treat as a commodity value because commercial development almost inevitably interferes with coastal ecosystem services, or amenities values. As such, to the extent that terrestrial coastal ecosystems have been privatized, the assertions of those private property rights have worked largely to sacrifice the public rights in and values of these ecosystems, again suggesting that governmental regulation is the necessary corrective to avert any impending tragedy of the commons.

So much is neither new nor particularly controversial. Indeed, the inadequacy of private property rights regimes to prevent the degradation of ocean and coastal ecosystems helps to explain the existence of the various regulatory programs that do already exist, including: the federal Coastal Zone Management Act and the state coastal regulatory programs that implement that Act; the application of section 404 of the Clean Water Act to wetlands, including coastal wetlands, and the Clean Water Act's National Estuary Program; the National Marine Sanctuaries Act; the Marine Mammal Protection Act; and the Magnuson-Stevens Fishery Conservation and Management Act, among others.

Nevertheless, mounting evidence suggests that these programs are insufficient to protect and restore coastal and ocean ecosystems. Within the last five years, numerous scientific and public interest groups, including both the Pew Oceans Commission[9] and the U.S. Commission on Ocean Policy,[10] have recommended numerous changes to U.S. ocean law and policy to both Congress and the Executive Branch in order to better protect, preserve, and restore the United States' ocean and coastal resources. Given its focus on ecosystem services, this article focuses on one particular recurring recommendation: that the United States set aside a sub-

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8. *See* COLE, *supra* note 6, at 13-14 (describing mixed property regimes and distinguishing them from common property regimes).

9. *See generally* PEW OCEANS COMMISSION, AMERICA'S LIVING OCEANS: CHARTING A COURSE FOR SEA CHANGE: RECOMMENDATIONS FOR A NEW OCEAN POLICY (May 2003), *available at* www.pewtrust.org/pdf/env_pew_oceans_final_report.pdf.

10. *See generally* U.S. COMMISSION ON OCEAN POLICY, AN OCEAN BLUEPRINT FOR THE 21ST CENTURY (2004), *available at* http://oceancommission.gov/documents/full_color_rpt/000_ocean_full_report.pdf. The U.S. Commission on Ocean Policy was created as a result of the Oceans Act of 2000, Pub. L. No. 106-256, 114 Stat. 644 (2000).

stantial percentage, most often quantified as twenty percent, of its ocean and coastal territory in marine protected areas (MPAs) and marine reserves.

To recap so far, evidence is mounting that ocean and coastal ecosystems are suffering numerous tragedies of the commons, interfering with these ecosystems' abilities to provide the ecosystem goods and services that are critical to the United States' continued well-being. Given the existing property rights regimes that govern these ecosystems and the sources of the tragedies, government regulation is presumptively the most effective solution. Moreover, experts in the field have indicated what at least part of that regulatory solution should be.

The relative values of marine and terrestrial ecosystem services suggest that protection of marine ecosystems and the services that they provide should be of relatively high political and regulatory priority. Nevertheless, the United States has not comprehensively implemented the MPA regulatory solution. Indeed, the United States protects marine areas far less often than terrestrial sites,[11] even though the United States has regulatory jurisdiction over more square miles of ocean than it does of land.[12]

There is no conceptual impediment to extending the idea of terrestrial protected areas into the coastal and marine realms. In both cases, "'[i]n the past the goods and services delivered by nature have all too often been seen as free and available at little or no cost.'"[13] In addition, as is true with respect to terrestrial ecosystem services, many ocean and coastal ecosystem services have been impaired.[14] Finally, in both cases, humans' concentrated exploitation of some ecosystem goods (commodities) and services (amenities), particularly the extractive use of natural resources commodities (timber, fish) and the relatively recently regulated use of natural resources amenities associated with development (garbage disposal, sewage disposal), can destroy the very ecosys-

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11. Robin Kundis Craig, *Taking Steps Toward Marine Wilderness Protection? Fishing and Coral Reef Marine Reserves in Florida and Hawaii*, 34 MCGEORGE L. REV. 155, 158-59, 167 (2003) [hereinafter Craig, *Taking Steps*]; Robin Kundis Craig, *Taking the Long View of Ocean Ecosystems: Historical Science, Marine Restoration, and the Oceans Act of 2000*, 29 ECOLOGY L.Q. 649, 651-53, 673-76 (2002) [hereinafter Craig, *Taking the Long View*].

12. National Marine Fisheries Service, NOAA, *The United States Is an Ocean Nation*, http://www.nmfs.noaa.gov/sfa/reg_svcs/Council stuff/council orientation/msa overview 1.macpherson.pdf (last visited June 20, 2007) (noting that the United States' Exclusive Economic Zone encompasses "3.4 million square nautical miles of ocean — larger than the combined land area of all fifty states. (A square nautical mile is equal to 1.3 square miles.)").

13. *Business Must Conserve Ecosystem Services or Pay the Price*, ENVTL. NEWS SERVICE (July 12, 2005), http://www.ens-newswire.com/ens/jul2005/2005-07-12-02.asp (quoting Klaus Toepfer, Executive Director of the United Nations Environment Programme (UNEP)).

14. *See*, *e.g.*, *Id.*

tems that provide those services.[15]

Moreover, existing property rights regimes do not pose a significant impediment to the MPA regulatory solution, particularly with regard to aquatic marine ecosystems. While open ocean ecosystems generally require international cooperation to establish protective regimes,[16] individual coastal nations can assert legal authority over coastal ecosystems.[17] Such assertion of legal control and unilateral regulatory protection is especially feasible in nations like the United States, which has over 13,000 miles of coastline that it shares with only two other nations.[18] Moreover, a number of legal doctrines in the United States undergird governments' ability to protect the public rights and interests in the coastal zone, including with respect to privately owned coastal ecosystems such as coastal wetlands.

Limited scientific understanding of ocean and coastal ecosystems *is* a potential stumbling block to effective regulation of these resources. Nevertheless, one of the virtues of MPAs and marine reserves as regulatory measures is that, at least on a first pass, they do not require detailed understanding of how ecosystems and the species within them function and interact. For example, at the extreme, common sense and relatively inexpensive observations should lead to conclusions that cyanide fishing, blast (dynamite) fishing, bottom trawling, and dredging and filling destroy the ecosystem functions of coral reefs, mangrove forests, sea-

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15. According to the United Nations, "Various human activities, including fishing, have an impact on marine ecosystems." UN Atlas of the Oceans, *supra* note 3. "Degradation of coastal ecosystems often happens as a result of other competing uses of resources, such as land reclamation, drainage, coastal construction and sewage discharge." *Id*. Moreover, "[i]n implementing a plan to conserve ecosystem structures and processes, fishing practices that involve excessive use of resources, or use of fishing gear in a manner or at a location that causes destruction of habitat, or the use of fishing methods that are themselves destructive, need to be stopped in the interest both of conserving the ecosystem and of ensuring optimal productivity in its use." *Id*.

16. Under UNCLOS III, which became effective internationally on November 16, 1994, open ocean ecosystems that exist beyond the continental shelf and/or more that 200 nautical miles out to sea are in international waters, and hence must be protected through international law. UNCLOS III, *supra* note 7, at art. 87 (establishing the high seas, in which nations' enjoy a traditional "freedom of the seas").

17. Under UNCLOS III, which became effective internationally on November 16, 1994, individual nations can assert regulatory control over marine resources out to 200 nautical miles from shore, through the establishment of an Exclusive Economic Zone (EEZ). UNCLOS III, *supra* note 7, at arts. 57, 56.1. Regulatory control over seabed natural resources may extend even further pursuant to the Convention's continental shelf provisions. *Id*. at art. 76.1.

18. Although the United States has not ratified UNCLOS III, it has asserted UNCLOS-like national jurisdiction over both the EEZ and the continental shelf. Policy of the United States with Respect to the Natural Resources of the Subsoil and Seabed on the Continental Shelf, Proclamation No. 2667 (Sept. 28, 1945); Exclusive Economic Zone of the United States of America, Proclamation No. 5030, 48 Fed. Reg. 10,605 (March 10, 1983).

grass beds, and coastal wetlands. These ecosystems can then be protected by delineating boundaries around them and prohibiting destructive activities within those boundaries.

Instead, the most significant impediment to implementing the MPA regulatory solution is lack of sufficient political will. Efforts to protect ocean and coastal ecosystems and the services that they provide often must overcome political and practical difficulties that similar efforts on land can avoid. First, and most basically, humans are a terrestrial species. Even those of us who love the water spend far more time on land than we do in the sea. As a result, the ecosystem services that are most immediately vital to human beings, i.e., fresh air, clean water, soil nutrients, pollination of crops, are (or appear to be) terrestrial in origin; only divers, surfers, fishers, and fish-eaters are likely to be aware of any direct dependence on the ocean. Second, loss or degradation of terrestrial ecosystems is often obvious: the clear-cutting of a forest, the damming of a river, and the formation of smog will be visible to any interested person who cares to look. In contrast, with a few important exceptions such as near-shore coral reefs, kelp beds, and fishing grounds, most coastal and ocean ecosystems receive relatively few human visitors, and changes even to those ecosystems that are subject to more frequent human attention are not necessarily immediately obvious,[19] leading to a "paradigm of inexhaustibility" for marine resources.[20] Third, and closely related, loss of at least some of the ecosystem goods and services provided by terrestrial ecosystems is also often obvious, particularly when cultural or recreational services or production of raw materials are involved. In contrast, and again with important exceptions for highly used near-shore marine ecosystems, even scientists do not understand the "natural" functioning of most marine ecosystems; therefore, recognition of loss of those ecosystem services may simply be beyond current human ken.[21]

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19. *See*, *e.g.*, Costanza, *supra* note 4, at 199. (noting that the oceans' "vastness has made them appear to be limitless sources of food, transportation, recreation, and awe."); Stefan Gössling, *Human-Environmental Relations with Tourism*, 29 ANNALS OF TOURISM RESEARCH 539, 551-52 (2002) ("The difficulty of mediating environmental change to the public is that global changes are very complex and hard to grasp. Garbage disposed of along a motorway, the eutrophication of a bay, or the clearcutting of a rainforest are environmental problems that can be visually perceived. However, such a visual perception seems to be an important precondition for most to believe in their existence.").

20. Craig, *Taking Steps*, *supra* note 11, at 159; Robin Kundis Craig, *Oceans and Estuaries*, *in* STUMBLING TOWARD SUSTAINABILITY 227, 229-30, 247 (John C. Derbach ed.) (2002) [hereinafter Craig, *Oceans*].

21. For example, historical ecologists are just now beginning to hypothesize about the pre-fishing "natural" state of many marine ecosystems, after sifting through centuries of ecological changes to these ecosystems resulting from centuries of overfishing. *See*, *e.g.*, Jeremy B.C. Jackson et al., *Historical Overfishing and the Recent Collapse of Coastal Eco-*

This article, therefore, is primarily interested in the world of political reality: Why haven't the relevant governments implemented the necessary solution, and, more importantly, how do we get from the economics and the science to the law? The answer to the first question is relatively easy. Political resistance to MPAs and marine reserves is often significant, and often because the political debate is dominated by commercial commodities users (fishers, developers) for whom MPAs and marine reserves threaten reduced access to productive ecosystems and hence reduced profits. Or, viewed from the opposite perspective, it is no accident that the governments that *have* been willing to create MPAs and marine reserves and to enact marine zoning — i.e., Australia, New Zealand, various island nations, Hawaii, and California — are usually governments that represent constituents with significant economic interests that depend on the continued existence of relatively intact and functional coastal and ocean ecosystems, usually as a result of a significant tourism industry. In other words, the existence of amenities users is often critical to the political viability of the MPA regulatory solution.

This article argues that lack of varied demand competition for marine resources — in particular, lack of competition from demanders of marine resources amenities — has thwarted accurate political and economic valuation of marine ecosystem services and the ocean and coastal ecosystems that support them. It begins and builds on a truism of capitalist economics, that competition among persons demanding scarce resources tends to increase the value (price) assigned to them. Moreover, demanders/users also tend to protect — to ensure the continued flow of — desirable goods (commodities) and services (amenities) *if they recognize* that those goods and services are scarce.

The existence of demand competition for marine resources is of course conceptually distinct from those resources' abundance or scarcity. The mere fact that several people want to use the same ecosystem says nothing about the relevant ecosystem's ability to satisfy all, or none, or some, of their desires. Nevertheless, and just as obvious, demand competition and scarcity are related. Ocean and coastal law and policy suffer both as a result of a lack of varied demand competition for marine resources amenities and as a result of a lack of a perception that marine resources in general, commodities or amenities, are scarce. The issue, therefore, is how,

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systems, 293 SCIENCE 629, 629-39 (2001) (arguing that coastal ecosystems have suffered enormous changes in "natural" function, including complete collapse, as a result of centuries of overfishing); Craig, *Taking the Long View*, *supra* note 11 (exploring the political and regulatory implications of Jackson's article).

in the context of a general failure of markets and property rights to protect marine ecosystem services, to foster proxy demands for marine ecosystem amenities that can translate into an economic and political will to protect the supporting ecosystems from over-exploitation, generally by marine commodities users.

This article discusses the roles of competition and scarcity in the recognition and preservation of marine ecosystems and their associated services. Specifically, it addresses the emergence, manufacture, and political and economic cognizability of "lifestyle value" demand competition for marine resources amenities. The emergence of a consumer demand, desire plus a willingness to pay and often pay well, for coastal lifestyle values often introduces varied competition for the marine resources in a given ecosystem — that is, demand for marine resources amenities that can compete with the often pre-existing, and often ecosystem destroying, demand for marine resources commodities such as fish and developable coastal property. Moreover, the multi-use marine resource demand competition and the marketing of lifestyle values can create perceptions of scarcity that promote the political will to preserve and regulate access to marine ecosystems, in effect allowing the relatively limited demands for lifestyle value to stand proxy for as-yet-nonexistent markets in marine ecosystem services more generally.

II. OCEAN AND COASTAL ECOSYSTEM SERVICES AND MARINE ECOSYSTEM DEGRADATION

A. Marine Ecosystem Services

As noted, "[c]oastal ecosystems are among the most rich and diverse in the world, providing important global functions (ecosystem services) for marine ecosystems and atmospheric composition."[22] "Estuaries and coastal seas have been focal points of human settlement and marine resource use throughout history."[23] In addition, though more difficult to access through much of human history, "[t]he oceans have long been recognized as one of humanity's most important natural resources."[24] In fact, marine ecosystems and their services dominate the biosphere and the surface systems of Planet Earth:

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22. Sara Curran et al., *Interactions between Coastal and Marine Ecosystems and Human Population Systems: Perspectives on How Consumption Mediates this Interaction*, 31 AMBIO 264, 264 (2002).

23. Heike K Lotze et al., *Depletion, Degradation, and Recovery Potential of Estuaries and Coastal Seas*, 312 SCIENCE 1806, 1806 (2006).

24. Costanza, *supra* note 4, at 199.

> The fact that 71% of the earth's surface is ocean determines a significant part of its climate and ecology. The hydrologic cycle is dependent on the vast amounts of water evaporated by solar energy from the oceans and deposited as rain on the land. Without this reservoir of open water, the earth would quickly become a desert. The oceans also provide a sink for nutrients eroded from the land. The seas regulate the global climate by serving as an enormous thermal mass for heat storage and as a reservoir for CO_2. From a purely physical point of view, the presence of the oceans can be seen as essential for a climate on earth suitable for human life.[25]

Life itself almost certainly began in the seas, and, "[e]ven now, almost all life on earth, both on land and in the seas, takes place in an internal aqueous medium, not much different from the chemical composition of the oceans. In several real senses, the oceans are the source of all life on earth."[26]

In their *Nature* article, Costanza and his colleagues provided a summary of the more specific ecosystems services that ocean and coastal ecosystems provide. For example, both the open ocean and the various coastal ecosystems provide nutrient cycling, cultural services, food production, biological control, and raw materials.[27] The open ocean is also important for gas regulation, including carbon dioxide absorption (the oceans are the world's largest carbon sink),[28] while, collectively, coastal ecosystems also provide disturbance regulation, recreational values, and habitat and refugia.[29]

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25. *Id.* at 200.

26. *Id.*

27. Costanza et al., *supra* note 1, at tbl. 2. "Nutrient cycling" consists of the "[s]torage, internal cycling, processing, and acquisition of nutrients" and includes nitrogen fixation and phosphorus cycling. *Id.* at 254, tbl. 1. "Cultural" services refer to an ecosystem's ability to "provid[e] opportunities for non-commercial uses," including "[a]esthetic, artistic, educational, spiritual, and/or scientific values . . . ." *Id.* "Food production," somewhat obviously, refers to "[t]hat portion of gross primary production extractable as food," including "[p]roduction of fish, game, crops, nuts, fruits" collected "by hunting, gathering, subsistence farming or fishing." *Id.* Finally, "biological control" refers to the "trophic-dynamic regulations of populations," such as "[k]eystone predator control of prey species" and "reduction of herbivory by top predators." *Id.* "Raw materials" refers "[t]hat portion of gross primary production extractable as raw materials," such as "[t]he production of lumber, fuel, or fodder." *Id.*

28. "Gas regulation" refers to the "[r]egulation of atmospheric chemical composition," including regulation of the "CO2/O2 balance, O3 for UVB protections, and SOX levels." *Id.* at 256, tbl.1. Each hectare of open ocean provides, on average, $38 of gas regulation each year. *Id.*

29. "Disturbance regulation" refers to the "[c]apacitance, dampening and integrity of ecosystem response to environmental fluctuations," including "[s]torm protection, flood con-

In addition, in the tropics (including Florida), "[m]angroves have been classified as keystone ecosystems, as they are important for other ecosystems and generate a wide range of natural resources and ecosystem services."[30]

The *Nature* summary also indicates that (1) on average, coastal ecosystems provide more value in ecosystem services per hectare than open ocean ecosystems; and (2) more importantly, coastal ecosystems vary considerably in the type and value of the ecosystem services that they provide. For example, coral reefs provide almost five times the value in disturbance regulation as estuaries, while seagrass and algae beds and the continental shelf provide almost no value for disturbance regulation.[31] In contrast, coral reefs provide little value in terms of nutrient cycling, while seagrass and algae beds and estuaries provide significant levels of nutrient cycling services,[32] which in turn "control the productivity of plants on land and in the sea."[33] Coral reefs provide waste treat-

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trol, drought recovery and other aspects of habitat response to environmental variability mainly controlled by vegetation structure." *Id*. at 254, tbl. 1. "Recreation" refers to an ecosystem's ability to "[p]rovid[e] opportunities for recreational activities," including "[e]cotourism, sport fishing, and other outdoor recreational activities." *Id*. "Refugia" refers to "[h]abitat for resident and transient populations," including "[n]urseries, habitat for migratory species, regional habitats for locally harvested species, or overwintering grounds." *Id*.

30. Fredrik Moberg & Patrik Rönnbäck, *Ecosystem Services of the Tropical Seascape: Interactions, Substitutions and Restoration*, 46 OCEAN & COASTAL MANAGEMENT 27, 30 (2003) (citations omitted).

> Ecosystem services like protection against floods and hurricanes, reduction of shoreline and riverbank erosion and maintenance of biodiversity are key features that sustain economic activities in coastal areas throughout the tropics. Mangrove forest products like construction materials, charcoal, tannins, medicines, and honey are vital to subsistence economies and provide a commercial base to local and national economies. Fish and shellfish constitute the major value of marketed products from unexploited mangroves, and the support to commercial, recreational and subsistence fisheries is well documented. For instance, 80% of all marine species of commercial or recreational value in Florida, USA, have been estimated to depend upon mangrove estuarine areas during some stage in their life cycles.

Id. at 30-32 (citations omitted).

31. Costanza et al., *supra* note 1, at 256, tbl. 2. *See also* Moberg & Rönnbäck, *supra* note 30, at 29. ("Coral reefs physically dissipate the force of currents and waves, creating over geologic time scales calm lagoons that are suitable environments for seagrass beds and mangroves.").

32. Costanza et al., *supra* note 1, at 256, tbl.2. *See also* Moberg & Rönnbäck, *supra* note 30, at 29. ("Mangroves and seagrass beds prevent shoreline and riverbank erosion and increase the residence time of water, which enable the assimilation of inorganic nutrients and entrapment of particles and pollutants carried by rivers.").

33. Costanza, *supra* note 4. *See also* Moberg & Rönnbäck, *supra* note 30, at 27-28. ("The tropical coastal 'seascape' often includes a mosaic of mangrove forests, seagrass beds, and coral reef ecosystems. This tropical seascape is one of the richest repositories of marine biodiversity and provides a number of natural resources and ecosystem services that are vital to human survival and well-being." (citations omitted)).

ment services that the other three kinds of coastal ecosystems generally do not,[34] and coral reefs and estuaries are the most important coastal ecosystems for providing recreational values.[35]

B. Marine Ecosystem Degradation

Despite, or perhaps more accurately because of, the value of their various ecosystem services, marine ecosystems are also highly stressed and often degraded, especially coastal ecosystems. "Coasts presently support a large share of the Earth's population, and this share is growing faster than that of other ecosystems. In 1995, 39% of the world's population lived within 100 km of a coast, on just 20% of the Earth's land area."[36] World-wide, coastal ecosystems are suffering from this concentrated human use:

> Most fisheries throughout the world are now recognized as heavily exploited, and many are overexploited to a serious extent. This is especially true in the Asian region, where many coastal fish stocks are down to only 10% to 30% of the biomass that existed before the start of heavy fishing three decades ago. The very species composition of the fish communities has changed, as larger and more valuable fish have been taken and smaller, faster-growing, and less valuable species now dominate. The marine ecosystems that form fisheries habitat are deteriorating due to deliberate destruction for other uses or as sinks for the world's refuse. Half the world's wet-

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34. Costanza et al., *supra* note 1, at 256, tbl. 2.

35. *Id*. *See also* David W. Souter & Olof Lindén, *The Health and Future of Coral Reef Systems*, 43 OCEAN & COASTAL MANAGEMENT 657, 658-61 (2000) (relying on the calculations in the *Nature* article to argue that "[a]s coral reefs constitute only 0.2% of the world's marine ecosystems these figures demonstrate that the contribution of coral reefs to the welfare of the globe and the people living on it is disproportionately large," and emphasizing that coral reefs provide food, support tourism, provide coastal protection, support biodiversity, supply medicines, and serve as resources for biotechnology); Liam Carr & Robert Mendelsohn, *Valuing Coral Reefs: A Travel Cost Analysis of the Great Barrier Reef*, 32 AMBIO 353, 357 (2003) (calculating the total value of the Great Barrier Reef in Australia through the travel cost method, and hence emphasizing its value for tourism, to be US $700 million to $1.6 billion).

36. Curran et al., *supra* note 22, at 264. *See also* Costanza, *supra* note 4, at 204. ("There is also one other important complicating factor of particular relevance to the oceans. The geographic distribution of humans over the face of the earth is nowhere near homogenous. Most of the human population lives near the coast, where the impacts on the ocean environment are greatest, and this percentage is increasing."); Moberg & Rönnbäck, *supra* note 30, at 28. ("The pressure on coastal ecosystems from growing populations, new technologies and changing lifestyles is particularly evident throughout the tropics." (citation omitted)).

> lands disappeared in the 20th century; 60% of world-wide coral reefs are threatened, with 80% in Asia, the worst affected region, under severe threat; mangrove destruction has been rampant; the flows of most rivers are now interrupted by dams or will be over the next 10 to 50 years; the competition for fresh water running to the sea is intense, even as its quality is polluted by industrial, agricultural, urban, and environmental contamination.[37]

This pattern of dense populations, intense use, and degradation holds for the United States. U.S. fish stocks are recognized as being in trouble.[38] As the Pew Oceans Commission noted in 2003, "[w]e only know the status of one-third of the commercially fished stocks in U.S. waters, and 30 percent of the fish populations that have been assessed are overexploited to some degree. Put another way, the government can only assure us that 22 percent of managed fish stocks are being fished sustainably."[39] Commercial and residential land development has been increasing and occurring mostly along the coasts,[40] and "[c]oastal counties, which comprise just 17 percent of our land area, are now home to more than half of the U.S. population."[41] As California coastal managers graphically described this coastal crowding in 1992, "[t]he state now has over 25,000 residents for each mile of coastline, or five people per front foot."[42]

Coastal ecosystem destruction in the United States has been common. In highly urbanized southern California, "90% of the coastal wetland area has been destroyed, and remaining wetlands continue to be damaged; even the region's protected reserves are threatened by highway and utility-expansion projects."[43] On the

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37. Curran et al., *supra* note 22, at 264-65 (citations omitted). *See also* Moberg & Rönnbäck, *supra* note 30, at 28 ("More than 50% of the world's mangroves have been removed, and in Asia and the Pacific region there is an estimated areal loss of at least 1%/year." (citation omitted)); Sara R. Curran & Maria C. Cruz, *Markets, Population Dynamics, and Coastal Ecosystems*, 31 AMBIO 373, 376 (2002) ("An increasing portion of the world's population is living along coastal areas," and "[c]oastal and marine ecosystems are exploited heavily as a result of the increasing intensity in globalized production and trade").

38. PEW OCEANS COMMISSION, AMERICA'S LIVING OCEANS: CHARTING A COURSE FOR SEA CHANGE: RECOMMENDATIONS FOR A NEW OCEAN POLICY: SUMMARY REPORT 5-6, 9 (May 2003) [hereinafter PEW OCEANS COMMISSION, SUMMARY REPORT].

39. *Id*. at 5.

40. *Id*. at 6.

41. *Id*. at 6. *See also* U.S. COMMISSION ON OCEAN POLICY, *supra* note 10, at 14-15, ES. 7 ("While coastal watershed counties comprise less than 25 percent of the land area in the United States, they are home to more than 52 percent of the total U.S. population.").

42. Gary B. Griggs et al., *California's Coastal Hazards: A Critical Assessment of Existing Land-Use Policies and Practices*, 4.5 CPSBRIEF 1 (April 1992).

43. Joy B. Zedler et al., *Declining Biodiversity: Why Species Matter and How Their*

other side of the country:

> Florida has experienced some of the nation's most rapid coastal development. From 1940 to 1996, the state population increased 700 percent, from 1.8 million to 14.3 million.
>
> Development has altered both water quality and water quantity, leading to the loss of more than half of the Everglades, the largest contiguous wetland in the U.S.[44]

More generally, "[o]ver the past several decades the nation has lost millions of acres of wetlands, seen the destruction of seagrass and kelp beds, and faced a loss of significant mangrove forests."[45] Moreover, "[i]n 2001, 23 percent of the nation's estuarine areas were considered impaired for swimming, fishing, or supporting marine species."[46]

Even where outright destruction of the ecosystem and its attendant services does not occur, overfishing and coastal development can reduce marine biodiversity,[47] which in turn impairs ecosystem function and the services ecosystems provide.[48] Many of these studies have occurred in California, where "[u]rban sprawl, for example, contributed to the decline of 188 of the 286 California species that are listed under the Endangered Species Act, making it the leading cause of species decline in that state."[49] In addition, in coastal southern California, "[t]he spatial pattern of fewer species in wetlands with impaired tidal flow suggests that mouth closure has reduced biodiversity."[50] Increasing the numbers of plant species in estuaries and coastal wetlands "lead to increases in pro-

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Functions Might Be Restored in Californian Tidal Marshes, 15 BIOSCIENCE 1005, 1005 (2001).

44. PEW OCEANS COMMISSION, SUMMARY REPORT, *supra* note 38, at 6.

45. U.S. COMMISSION ON OCEAN POLICY, *supra* note 10, at 16. *See also* PEW OCEANS COMMISSION, SUMMARY REPORT, *supra* note 38, at 8 (May 2003) ("Sprawl development is consuming land at a rate of five or more times the rate of population growth in many coastal areas. Sprawl needlessly destroys wildlife habitat and degrades water quality.").

46. U.S. COMMISSION ON OCEAN POLICY, *supra* note 10, at 3.

47. PEW OCEANS COMMISSION, SUMMARY REPORT, *supra* note 38, at 20, fig. 7 (illustrating how development and overfishing can combine to reduce biodiversity).

48. *Id*. at 16, fig. 5 (illustrating how overfishing can reduce ecosystem function); *see also* Lotze et al., *supra* note 23, at 1806 ("Centuries of overexploitation, habitat transformation, and pollution have obscured the total magnitude of estuarine degradation and biodiversity loss and have undermined their ecological resilience.") (citation omitted); Scott Norris et al., *Thinking Like an Ocean: Ecological Lessons from Marine Bycatch*, CONSERVATION IN PRACTICE, Fall 2002, at 10, 13, 18 (connecting bycatch in overfishing to loss of marine ecosystem function).

49. PEW OCEANS COMMISSION, *supra* note 9, at 51 (citation omitted).

50. Zedler et al., *supra* note 43, at 1008.

ductivity, nutrient retention, resiliency, reliability, and decreases in invasibility of other species."[51] In contrast, other research indicates "that a 50% decline in species richness reduced aboveground biomass by 10%-20%."[52]

Nevertheless, interdisciplinary studies are demonstrating that population increases are, at best, an inadequate sole explanation of ocean and coastal ecosystem degradation.[53] In particular, "the sheer number of people does not on its own explain the dire state that many ecosystems are in — how people and institutions use those resources, or consume them, is as important. The organization of consumption then becomes a key mediating factor."[54] As a corollary, therefore, changes in use patterns could lead to better protection for coastal and open ocean ecosystems.

C. Marine Ecosystem Service Preservation and Marine Protected Areas

Although "[t]he state of the coastal environment is most critical for those who dwell along the coast, . . . it is also important for all citizens of coastal states because of the effects on national economic well-being."[55] Disasters, exacerbated by interference with some of these ecosystem services, have already resulted in regulatory, economic, and technological responses. For example, erosion of beaches as a result of coastal development reduces shorelines' abilities to provide storm protection, other protection of coastal properties, and habitat.[56] Recognition of interference with these ecosystem services — and the resulting insurance claims — have led to regulatory action at both the federal and state levels.[57]

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51. *Id.* at 1006 (citations omitted).

52. *Id.*

53. *See* Curran et al., *supra* note 22, at 264. *See also* Jeffrey A. Krautkraemer, Resources for the Future, Economics of Natural Resource Scarcity: The State of the Debate, Discussion Paper 05-14, at 5 (April 2005) (noting that "[w]hile exponential growth can be expected to lead to increasing resource scarcity, human creativity can ameliorate increased scarcity. Humans have been quite adept at finding solutions to the problem of scarce natural resources: finding more abundant substitutes for various natural resources, exploration for and discovery of new reserves, recovery and recycling of materials, and, perhaps most importantly, the development of new technologies that economize on scarce natural resources or that allow the use of resources that were previously uneconomical."); Sara R. Curran & Tundi Agardy, *Common Property Systems, Migration, and Coastal Ecosystems*, 31 AMBIO 303, 303 (2002) (noting that in coastal ecosystems in particular, "[t]he human ecology literature finds open-access conditions rare and therefore, by implication, Malthusian predictions of population size overwhelming environmental resource quality unlikely.") (citation omitted).

54. Curran et al., *supra* note 22, at 264 (citation omitted).

55. *Id.* at 265.

56. Charles H. Peterson & Melanie J. Bishop, *Assessing the Environmental Impacts of Beach Nourishment*, 55 BIOSCIENCE 887, 887 (2005).

57.

"Nevertheless, development on coastal barriers has burgeoned dramatically," and "demand for engineered solutions to shoreline erosion is intensifying."[58]

However, restoring marine ecosystem services in degraded marine ecosystems has proven technologically difficult, even when (as with beach and coastal barrier erosion) the value of those services is recognized and the political will to restore them exists.[59] First, even on-shore technological substitutes generally lack the richness and complexity of the original ecosystems.[60] Second, off-shore,

> coastal environments cannot ever be truly managed — that is, they are not akin to agroforestry systems in which we can actually manage inputs and outputs. The coastal zone is an ecologically open system, to a much greater degree than other biomes. Inputs are borne from land, through rivers and streams, *via* the atmosphere, and from other coastal and open-ocean systems. This creates enormous challenges for managers trying to keep coastal systems productive in terms of goods and services.[61]

When combined with the facts that few marine ecosystems are well understood scientifically, even in "isolation"[62]; that marine ecosystems interact physically, chemically, and biologically across time and space in ways that are barely documented, let alone understood[63]; but that, because of those spatial and temporal connections, many marine ecosystems can restore themselves if simply

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> In recognition of the vulnerability of coastal development to shoreline erosion and flooding, and in response to the value of fish and wildlife habitat, the US Congress passed the Coastal Barrier Resources Act in 1982 to discourage overdevelopment of largely undeveloped coastal barriers along the Atlantic and Gulf coasts. Under incentives from the federal Coastal Zone Management Act, individual states have also developed coastal management programs that establish setbacks and impose other restrictions on development along coastal beaches.

Id. (citation omitted). The Coastal Barrier Resources Act is codified at 16 U.S.C. §§ 3501-3510 (2000). The Coastal Zone Management Act is codified at 16 U.S.C. §§ 1451-1465 (2000).

58. Peterson & Bishop, *supra* note 56, at 887 (citation omitted).

59. *See*, *e.g.*, Moberg & Rönnbäck, *supra* note 30, at 34-41 (describing the inadequacies of marine restoration efforts in tropical coastal ecosystems).

60. *Id*. at 41.

61. Tundi Agardy, *Population, Consumption, and Environment: Lessons Learned and Future Research about Coastal and Marine Ecosystems: Roundtable Discussion*, 31 AMBIO 377, 379 (2002).

62. Craig, *Taking the Long View, supra* note 11, at 688 and sources cited therein.

63. Craig, *Taking Steps, supra* note 11, at 173-74, 177-79; Craig, *Taking the Long View, supra* note 11, at 689-98.

left alone,[64] these limitations on technological fixes indicate that one of the surest means of preserving marine ecosystem services is to place marine ecosystems legally out of bounds, or at least to severely limit the marine resource commodity uses that are made of them.[65]

This recognition, variously described, has led to an increasing number of calls by scientists for the establishment of marine protected areas (MPAs) and marine reserves, including protected area status for land-based coastal wetlands.[66] However, the politics of MPAs and coastal reserves are often intensely divisive, in part because those MPAs and reserves often demand changes in public use patterns to acknowledge an absolute, or ecological, scarcity of marine resources that the public often has not perceived. When the politics are successful, moreover, it is often because multiple-use demand competition and demand for a particular ecosystem's amenities have already arisen.

III. PROPERTY RIGHTS, SCARCITY, AND THE VALUATION OF MARINE RESOURCES

A. The Limitations of Property Rights in Marine Resources

One of the general problems in valuing ecosystem services is the fact that, usually, no one pays for them — *i.e.*, there is no private property rights regime or private market mechanism to alert people to their value — or even, oftentimes, their existence.[67] As Robert Costanza has noted, "If ecosystem services were actually paid for, in terms of their value contribution to the global economy,

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64. *See*, *e.g.*, Lotze et al., *supra* note 23, at 1809 ("Despite some extinctions, most species and functional groups persist, albeit in greatly reduced numbers. Thus, the potential for recovery remains, and where human efforts have focused on protection and restoration, recovery has occurred, although often with significant lag times") (citation omitted).

65. *See*, *e.g.*, Craig, *Taking Steps, supra* note 11, at 166-222 (discussing the value of MPAs and marine reserves in the context of coral reef ecosystems); Craig, *Taking the Long View, supra* note 11, at 681-97 (discussing MPAs as a general regulatory strategy for restoring and protecting marine ecosystems).

66. *See*, *e.g.*, AARON M. FLYNN, MARINE PROTECTED AREAS: FEDERAL LEGAL AUTHORITY, ORDER CODE RL32486, 1-2 (2004) (reviewing the interest in MPAs); PEW OCEANS COMMISSION, SUMMARY REPORT, *supra* note 38, at 21 (recommending a national system of marine reserves in the United States "to protect marine ecosystems"); Roger T. Rufe, *The Status of Marine Ecosystems and the Imperative of Improved Management*, *in* WORKSHOP PROCEEDINGS: WORKSHOP ON IMPROVING REGIONAL OCEAN GOVERNANCE IN THE UNITED STATES 29, 32 (Dec. 9, 2002) (arguing that MPAs are necessary to restore marine ecosystem function); Exec. Order No. 13,158, 65 Fed. Reg. 34,909 (May 26, 2000) (calling for the creation of a national system of MPAs in the United States).

67. *See* Ecosystem Services, http://www.amonline.net.au/factsheets/ecosystem_services.htm (last visited Aug. 14, 2007) (noting that the "total annual value" of ecosystem services in Australia "has been estimated . . . to be $1327 billion and they are free!").

the global price system would be very different than it is today. The price of commodities utilizing ecosystem services directly or indirectly would be much greater."[68]

This private property rights/market difficulty is particularly acute for marine ecosystems and their services, as Costanza has also noted:

> It is fairly easy to assign and enforce property rights to some resources and ecosystems such as agricultural fields, trees or a lake because excluding non-owners from using the resource is fairly straightforward. However, it is much more difficult to assign and enforce property rights to resources such as migrating fish populations, biological diversity, nutrient cycles, water cycles, and many other ecological services. The reason is that it is either too expensive or literally impossible to exclude non-owners from using these resources and services, partly because they are highly interconnected with other ecosystems thereby transcending several property rights regimes.
>
> The oceans are the classic case of an open access (i.e. no property rights) resource because of their fluid interconnectedness, their vast size, and the resulting difficulty of enforcing property rights to any particular area or resource.[69]

With respect to offshore marine resources commodities, such as fish, effective enforcement of rights and laws in the open ocean is next to impossible, even with modern technology and even with respect to unquestioned crimes of piracy.[70] Nor does proximity to land make enforcement of rights and obligations in the offshore coastal zone much easier.[71] In addition, "[t]he role of the oceans in the global ecological system . . . favor a tendency to free ride on conservation issues"; "[t]he intergenerational and interspatial ef-

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68. Costanza, *supra* note 4, at 201.

69. *Id*. at 204. There is an unfortunate tendency in the non-legal ecosystems services literature to acknowledge only limited forms of property — generally only private property and nonproperty, with occasional head-nodding toward community property.

70. *See*, *e.g.*, G. BRUCE KNECHT, HOOKED: PIRATES, POACHING, AND THE PERFECT FISH 15-27, 33-43 (2006) (describing Australian officials' difficulties in capturing a fishing vessel illegally fishing for Chilean sea bass); WILLIAM LANGEWIESCHE, THE OUTLAW SEA: A WORLD OF FREEDOM, CHAOS, AND CRIME 44-46, 61-62 (2004) (describing the continued existence of piracy and the difficulty of finding — let alone capturing — vessels on the high seas).

71. LANGEWIESCHE, *supra* note 70, at 63-70 (discussing the U.S. Coast Guard's limitations in enforcing U.S. law along the coast).

fects of the use of ocean resources result in a tendency to ignore effects that might be distant in time and space"; "[t]he impact of human activity on the oceans is subject to fundamental uncertainty about the behavior of the system"; and "[a]ll of the above lead to 'market failure.' Hence, market prices are inadequate measures of the social value of ocean assets and require corrective incentives to guide behavior."[72]

As a result, to no one's great surprise, private property rights regimes and private markets have proven inadequate to protect marine ecosystems — even the relatively nearshore coastal ecosystems — and their services. With regard to the vast open oceans, as noted in the introduction, the very creation of private property regimes is practically very difficult, and "[t]he difficulty of fencing and policing them has left them largely as open access resources to be exploited by anyone with the means."[73] Similarly, "coastal ecosystems [also] have proven . . . difficult to manage through privatization or market relations."[74] As a result, in the United States, ocean and aquatic coastal ecosystems are and have been dominated by a public property regime. While the 1982 United Nations Convention on the Law of the Sea, which took effect in 1994, allowed coastal nations to assert sovereign rights over a territorial sea extending twelve nautical miles into the ocean and regulatory rights over the continental shelf and an Exclusive Economic Zone (EEZ) extending out to 200 nautical miles,[75] little else has changed

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72. Costanza, *supra* note 4, at 205. Other researchers have also noted the issue of externalities and free ride problems in the regulation of marine and coastal ecosystems:

> [I]t is the extensive and borderless nature of coastal ecosystems that makes them important. Within shared coastlines, for example, regulations and practices to control fish harvesting in one community would have benefits that other communities [would] share. . . . At the same time, pollutants from domestic and industrial waste are carried by ocean currents worldwide.

Agardy, *supra* note 61, at 379.

73. Costanza, *supra* note 4, at 199.

74. Curran et al., *supra* note 22, at 264.

> The human relationship to coastal and marine ecosystems increasingly has recognized some form of community property resource regimes predominating. Open access conditions once were assumed to prevail in marine systems, although there is a growing chorus of dissidents on this point. In fact, fishing in many locales often is regulated, with varying success by, at the very least, norms. . . . The growing recognition of the prevalence of common property regimes has generated concern about the institutions' resilience in the face of social change, their dynamics, and the varying role of local and national governance.

Curran & Agardy, *supra* note 53, at 303 (citation omitted).

75. United Nations Convention on the Law of the Sea, arts. 2.1, 2.2, 3, 56.1, Dec. 10,

regarding property rights over marine ecosystems.[76]

Terrestrial coastal ecosystems, in contrast, are more often governed by a truly mixed property regime, and much coastal property is in private ownership. Nevertheless, the private property regime does not generally or adequately account for all of the ecosystem services values of those properties, particularly services associated with wetlands. In the United States, for example, the "bundle of sticks" associated with private property does not include the right to continued water purification from upstream wetlands beyond the limits of common law nuisance, nor do markets exist in which an owner of wetlands can sell those filtration rights independently of the property itself. And even in the rare instance when the particular services *are* what makes property valuable — most famously in New York City's purchase of the Catskills Mountains watershed to protect the quality of its drinking water[77] — the purchase price still does not reflect the values of the other ecosystem services that the property provides. As Professor Cole has noted, "private property owners do not always (ever?) maximize the value of the ecosystem services of the resources they own. This is obviously true of wetlands, which are often considered by their owners to have negative value. . . . Private owners manage the resources they own to maximize their private preferences, whatever those might be. Only rarely will their private preferences map well onto social valuations of resources."[78] As evidence of these limitations of the private property rights within most coastal property regimes, the market for undevelopable coastal property to preserve ecosystem services is limited or non-existent in most places,[79] as

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1982, 1833 U.N.T.S. 397 (entered into force Nov. 16, 1994).

76. *See* Costanza, *supra* note 4, at 204 (noting that "[t]he extension of territorial waters to 200 miles, the Law of the Sea, international fishing commissions, and various other institutions are beginning to establish property rights regimes on various parts of the ocean. . . . [b]ut there is much more to be done").

77. For descriptions of New York City's decision to protect the Catskill watershed rather than investing in a new drinking water purification plant, see Geoffrey M. Heal & Edward B. Barbier, *Valuing Ecosystem Services*, 2006 ECONOMISTS' VOICE, Jan. 2006, at 2-3, *available at* http://www2.gsb.columbia.edu/faculty/gheal/Economists-Voice-published.pdf; Albert F. Appleton, How New York City Used an Ecosystem Services Strategy Carried Out Through an Urban Rural Partnership to Preserve the Pristine Quality of Its Drinking Water and Save Billions of Dollars, address at the Forest Trends-Tokyo Conference, at 8-9 (Nov. 5, 2002), *available at* http://www.foresttrends.org/documents/meetings/tokyo_2002/NYC_H2O_Ecosystem_Services.pdf; Ecological Society of America, *Ecosystem Services* 2 (Summer 2000), *available at* http://www.esa.org/education/edupdfs/ecosystemservices.pdf.

78. E-mail from Daniel H. Cole, Professor, Ind. Univ. Sch. of Law at Indianapolis, to author (Aug. 1, 2006) (on file with author).

79. Notably, some organizations such as the Nature Conservancy will buy undeveloped or lightly developed properties with the intended purpose of preserving those properties from further development. The Nature Conservancy, How We Work: Conservation Buyer Program, http://www.nature.org/aboutus/howwework/conservationbuyer (last visited June 20, 2007). Some landowners will also restrict further development of their properties

constitutional "takings" litigation in the United States over coastal management regulation and wetlands filling permits attests.[80]

The relationship between property rights regimes, population and community structure, and marine ecosystem degradation is still poorly understood but has been the subject of increasing study. For example, "[i]t has been argued [both] that common property regimes are necessarily diminished by population growth (either through natural increase or migration), and thereby population growth contributes to environmental deterioration," and "that common property resource institutions respond resiliently to the pressures of population, economy, and politics if the management tools are in the hands of local communities with the support of national governments for enforcement."[81]

However, "[t]he findings in this literature also argue against a solution that involves [further] privatization or socialization."[82] Instead, "various forms of community ownership . . . are proving to be better adapted to complex systems like the oceans."[83] In the United States, for example, a community rights regime based on a strong precautionary principle and a robust and pervasive public

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through conservation easements, often for personal preference reasons and/or for tax advantages. However, these preservationist actions are limited compared to the total volume of property transactions, and they do not reflect a market in ecosystem services *per se*. Moreover, the fact remains that developed and developable properties almost always command a higher market price than undeveloped and undevelopable properties. Warren Kriesel et al., University of Georgia, *Coastal Erosion Hazards: The University of Georgia's Results, Executive Summary* 2 (2001), *available at* http://www.agecon.uga.edu/faculty/wkriesel/PDFfiles/executive.PDF (finding that "[o]ver the last 50 years, the value of coastal properties appreciated at an average annual 7 percent nominal rate," that "[b]y comparison, the national housing price index has risen an average of 6.6 percent per year since 1965"; and that "[a] waterfront property was worth from 8 percent (Gulf) to 45 percent (Great Lakes) more than a comparable property that is inland."); *see also* Griggs et al., *supra* note 42 at 22 (noting that "[u]ndeveloped oceanfront lots along the Malibu coast . . . typically have price tags in the $1 to $3 million range.").

80. *See*, *e.g.*, Tahoe-Sierra Pres. Council, Inc. v. Tahoe Reg'l Planning Agency, 535 U.S. 302, 330-31 (2002); Lucas v. S.C. Coastal Council, 505 U.S. 1003, 1016-18, 1027-28 (1992); Phillips Petroleum Co. v. Mississippi, 484 U.S. 469 (1988); Nollan v. Cal. Coastal Comm'n, 483 U.S. 825, 831-32 (1987); United States v. Riverside Bayview Homes, 474 U.S. 121, 127 & n.4, 129 n.6 (1985); Kaiser Aetna v. United States, 444 U.S. 164, 175 (1979); Cooley v. United States, 324 F.3d 1297, 1301-04 (Fed. Cir. 2003); Howard W. Heck & Assocs. v. United States, 134 F.3d 1468, 1471-72 (Fed. Cir. 1998); Rybachek v. EPA, 904 F.2d 1276, 1300 (9th Cir. 1990); Pax Christi Memorial Gardens, Inc. v. United States, 52 Fed. Cl. 318, 324 (2002); Robbins v. United States, 40 Fed. Cl. 381, 385-86 (1998); Moore v. United States, 943 F. Supp. 603, 611-12 (E.D. Va. 1996); Applegate v. United States, 35 Fed. Cl. 406 (1996); Formanek v. United States, 18 Cl. Ct. 785, 793 (1989); Beure-Co. v. United States, 16 Cl. Ct. 42, 49-50 (1988); Loveladies Harbor, Inc. v. United States, 15 Cl. Ct. 381, 386-87 (1988); United States v. Robinson, 570 F. Supp. 1157, 1166 (M.D. Fla. 1983); Hay v. Bruno, 344 F. Supp. 286 (D. Or. 1972); Wernberg v. Alaska, 516 P.2d 1191, 1196 (Alaska 1973).

81. Curran & Agardy, *supra* note 53, at 303 (citations omitted).

82. *Id.*

83. Costanza, *supra* note 4, at 204.

trust doctrine arguably could do much to preserve marine resources, especially the commodities resources.[84]

Even so, a common/community property rights regime would still likely fail to protect and effectively regulate marine resource amenities,[85] making even community property a poor choice for protecting and preserving marine ecosystem services. "There is no reason to presume that a common property regime instituted to govern a fishery, for example, will preserve related, noncommodity amenities. While fish stocks are sustained, other marine resources may be degraded or even intentionally destroyed because they have no commodity or exchange value *to the users*."[86] "The real challenge in the sustainable governance of the oceans is in designing an appropriate set of institutions, including property rights regimes and other management institutions, that can adequately deal with the complexities of both the ocean system itself and humans involved."[87]

In the United States, pure private-property rights and market-based solutions to marine ecosystem degradation are unlikely. In addition to the ubiquitous problems of assigning and enforcing property rights in the ocean and the various levels of market failure, in the United States a complex layering of public, community, and private property rights, which can vary from location to location, impedes the development of any comprehensive property and market- based regime that can adequately protect marine ecosystems, let alone value marine ecosystem services, on a national basis.

Comprehensive discussion of coastal property and regulatory rights in the United States is beyond the scope of this article, but even general principles give some sense of the complexity. Under the equal footing doctrine, states received title to the beds and banks of all of the internal waters that were navigable-in-fact at the time of statehood, including waters subject to the ebb and flow of the tide, such as estuaries, tidally-influenced rivers, and some

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84. *See* Krautkraemer, *supra* note 53, at 11 ("Resource amenities present significant management challenges for social institutions. The natural resources that provide these amenities are often open access resources, and many of the goods and services public goods. Consequently, one can expect far different outcomes than for natural resource commodities.").

85. COLE, *supra* note 6, at 128-29.

86. *Id. But see* CHRISTOPHER HALLOWELL, HOLDING BACK THE SEA: THE STRUGGLE ON THE GULF COAST TO SAVE AMERICA 87-92 (Harper Perennial ed. 2005) (2001) (describing one Louisiana marsh owner's success in suing oil companies for failure to restore privately owned marshes damaged by the oil extraction process, including damages awards that take into account the ecosystem services values of coastal wetlands that Robert Costanza and his fellow researchers calculated).

87. *See* Krautkraemer, *supra* note 53, at 11.

navigable coastal wetlands and marshes.[88] However, these waters are impressed with a federal public trust obligation that limits states' ability to alienate the lands beneath these waters in derogation of the public's rights of navigation, commerce, and fishing.[89] Moreover, these waters are subject both to federal regulation pursuant to the Commerce Clause[90] and to a federal navigation servitude that supersedes any state-defined private property rights along the banks of navigable waters.[91]

However, the equal footing doctrine applies only to internal waters. In 1947, the Supreme Court assigned ownership of all marine lands and waters under United States jurisdiction to the federal government.[92] In response, Congress, through the Submerged Lands Act of 1953,[93] transferred title to coastal lands and regulatory control over the oceans above to the states. State control generally extends out to three nautical miles from shore,[94] although Texas and Florida successfully litigated for ownership and control in the Gulf of Mexico out to three marine leagues (about ten miles).[95]

State-controlled coastal waters may be impressed with a state public trust doctrine as well as a federal public trust doctrine. Depending on the state, the state doctrine may be more protective of public rights to the beach and coastal waters, including rights of

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88. *See* Phillips Petroleum Co. v. Mississippi, 484 U.S. 469, 477 (1988); Utah Div. of State Lands v. United States, 482 U.S. 193, 207 (1987); Montana v. United States, 450 U.S. 544, 552 (1981); Oregon *ex rel*. State Land Bd. v. Corvallis Sand & Gravel Co., 429 U.S. 363, 374 (1977); Shively v. Bowlby, 152 U.S. 1, 56-57 (1894); Knight v. U.S. Land Ass'n, 142 U.S. 161, 183 (1891); Pollard's Lessee v. Hagan, 44 U.S. 212, 224 (1845).

89. *See Shively*, 152 U.S. at 57; Ill. Cent. R.R. Co. v. Illinois, 146 U.S. 387, 406 n.3, 450-60 (1892); Stone v. Mississippi, 101 U.S. 814, 820-21 (1879); Smith v. Maryland, 18 How. 71, 74-75 (1855). *See also* JOSEPH J. KALO ET AL., COASTAL AND OCEAN LAW: CASES AND MATERIALS 44 (1999) (referring to these uses as the "traditional triad of public trust rights").

90. *See* United States v. Appalachian Power Co., 311 U.S. 377, 407-09 (1940); The Daniel Ball, 77 U.S. 557, 563 (1870).

91. *See* Oklahoma v. Atkinson, 313 U.S. 508, 534 (1941); Arizona v. California, 283 U.S. 423, 456 (1931); Lewis Blue Point Oyster Cultivation Co. v. Briggs, 229 U.S. 82 (1913).

92. California v. United States, 332 U.S. 19 (1947); *see also* United States v. Maine, 420 U.S. 515 (1975) (holding that the same rule applies to the 13 original states); United States v. Texas, 339 U.S. 707 (1950). In concert with this decision, the U.S. Supreme Court has repeatedly held that private property rights for littoral properties deriving from a federal patent are to be determined by *federal* common law, unlike riparian rights, which are established by state law. *See* California *ex rel*. Lands Comm'n v. United States, 457 U.S. 273 (1982); Hughes v. Washington, 389 U.S. 290, 293 (1967).

93. 43 U.S.C. §§ 1301-1315 (2000).

94. *Id*. §§ 1311(a), 1312. "When you stand on a beach at the water's edge, three miles is where the horizon lies — and it is near. You can row to it and return in a very short time." LANGEWIESCHE, *supra* note 70, at 36.

95. United States v. Florida, 420 U.S. 531, 532 (1975); United States v. Louisiana, 394 U.S. 1 (1969); United States v. Louisiana, 389 U.S. 155 (1967); United States v. Florida, 363 U.S. 121, 129 (1960); United States v. Louisiana, 363 U.S. 1, 35-36 (1960).

access and recreational use, than the federal doctrine.[96] Alternatively, the public may have rights of access to and use of beaches and coastal waters, especially below the high tide line, through a variety of other legal doctrines.[97]

The exact private property rights enjoyed by coastal owners whose titles derive from state patents or grants depend on state law,[98] subject, again, to federal regulation and the federal navigation servitude. Depending on the state, private owners of coastal property may enjoy a right to maintain contact with the sea,[99] littoral rights of use,[100] a right to wharf out,[101] rights to underground minerals such as oil and gas,[102] ownership of any land accreting to

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96. *See* Shively v. Bowlby, 152 U.S. 1, 26 (1894); McCready v. Virginia, 94 U.S. 391, 395-97 (1876); Ryals v. Pigott, 580 So. 2d 1140, 1151 (Miss. 1990); CWC Fisheries, Inc. v. Bunker, 755 P.2d 1115, 1117-18 (Alaska 1988); Caminiti v. Boyle, 732 P.2d 989, 997 (Wash. 1987); Matthews v. Bay Head Improvement Ass'n, 471 A.2d 355, 363 (N.J. 1984); State v. McIlroy, 595 S.W.2d 659 (Ark. 1980); Kelly *ex rel.* MacMullan v. Hallden, 214 N.W.2d 856 (Mich. 1974); Marks v. Whitney, 491 P.2d 374, 380 (Cal. 1971); Treutling v. Bridge & Park Comm'n of Biloxi, 199 So. 2d 627, 632-33 (Miss. 1967); White v. Hughes, 190 So. 446, 449 (Fla. 1939); Shepard's Point Land Co. v. Atlantic Hotel, 44 S.E. 39, 41-42 (N.C. 1903); State v. Black River Phosphate Co., 13 So. 640, 645-47 (Fla. 1893); Arnold v. Mundy, 6 N.J.L. 1 (1821); Swan Island Club Inc. v. White, 114 F. Supp. 95, 103-05 (1953). *See also* Weden v. San Juan County, 958 P.2d 273, 283-84 (Wash. 1998) (holding that Washington's public trust doctrine, even though it protects recreational uses, did not prevent the state from banning jet skis in certain coastal waters); Colberg, Inc. v. California *ex rel.* Dep't of Public Works, 432 P.2d 3, 13-15 (Cal. 1967) (establishing, unusually, a state navigation servitude). *But see In re* Opinion of the Justices, 313 N.E.2d 561, 566 (Mass. 1974) (holding that proposed legislation to ensure public access to public beaches would take private property rights in violation of the United States and Massachusetts Constitutions because littoral properties in Massachusetts extend to the low tide line).

97. *See*, *e.g.*, Concerned Citizens v. Holden Beach Enters., 404 S.E.2d 677, 686 (N.C. 1991) (discussing public rights acquired through prescription); Gion v. City of Santa Cruz, 465 P.2d 50, 55-56 (Cal. 1970) (discussing public rights acquired through implied dedication); State *ex rel.*Thornton v. Hay, 462 P.2d 671, 676-78 (Or. 1969) (discussing public rights acquired through the common law doctrine of customary rights).

98. *See* Phillips Petroleum Co. v. Mississippi, 484 U.S. 469, 475 (1988); Hughes v. Washington, 389 U.S. 290, 295 (1967) (Stewart, J. concurring).

99. *See* Becker v. Litty, 566 A.2d 1011, 1104 (Md. 1989); *see also* KALO ET AL., *supra* note 89, at 45-46 (quoting I. FARNHAM, WATER AND WATER RIGHTS § 62 (1904) and citing 1 WATER AND WATER RIGHTS § 6.01(a) (1991); Game & Fresh Water Fish Comm'n, 407 So. 2d at 191-92; Smith Tug & Barge Co., 443 P.2d at 208; 3 AMERICAN LAW OF PROPERTY § 12.32 (1952)).

100. *See* Lee County v. Kiesel, 705 So. 2d 1013, 1015 (Fla. App. 1998); Dorrah v. McCarthy, 462 S.E.2d 708, 709-10 (Ga. 1995); *In re* Protest of Mason, 337 S.E.2d 99, 104 (N.C. App. 1985); *see also* KALO ET AL., *supra* note 89 at 45-46 (quoting I. FARNHAM, WATER AND WATER RIGHTS § 62 (1904), and citing 1 WATER AND WATER RIGHTS § 6.01(a) (1991); Game & Fresh Water Fish Comm'n, 407 So. 2d at 191-92 (Fla. 1982); Smith Tug & Barge Co., 443 P.2d at 208; 3 AMERICAN LAW OF PROPERTY § 12.32 (1952)).

101. *See* Caminiti, 732 P.2d at 989; *see also* KALO ET AL., *supra* note 89, at 45-46 (quoting I. FARNHAM, WATER AND WATER RIGHTS § 62 (1904) and citing 1 WATER AND WATER RIGHTS § 6.01(a) (1991); Game & Fresh Water Fish Comm'n, 407 So. 2d at 191-92; Smith Tug & Barge Co., 443 P.2d at 208; 3 AMERICAN LAW OF PROPERTY § 12.32 (1952)). *But see* KALO ET AL., *supra* note 89, at 68-69 (explaining that the right to wharf out applies mostly to riparian owners and that states have generally limited the right for littoral owners).

102. *See* Wagner & Brown Ltd. v. Sheppard, 198 S.W.3d 369, (Tex. Ct. App. 2006); Maples v. Kern County Assessment Appeals Bd., 103 Cal. App. 4th 172, 186-87 (2002); Valls

their property,[103] a right to fill submerged lands,[104] a right to purchase filled submerged lands,[105] continued ownership of land that becomes submerged,[106] and/or a right to exclude the public from all or some part of the beach.[107]

Beyond the three-nautical-mile line, coastal waters and submerged lands remain completely federal.[108] Under international law, the United States controls the waters twelve nautical miles out as a territorial sea (essentially, the same as United States soil)[109] and regulates marine resources out to 200 nautical miles as its Exclusive Economic Zone, or EEZ.[110]

Comprehensive changes to this complex mix of public and private property rights in the United States' coastal zones and open ocean are unlikely. Moreover, the resulting, often divergent, state, federal, public, and private interests in marine ecosystems compound the problem of implementing the MPA regulatory solution, even though the federal government technically has sufficient legal authority (public property rights) to implement a comprehensive

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v. Arnold Indus., Inc., 328 So. 2d 471, 473 (Fla. App. 1976) (overruled as to ground water, Village of Tequesta v. Jupiter Inlet Corp., 371 So. 2d 663 (Fla. 1979); Picou v. Fohs Oil Co., 64 So. 2d 434, 435-36 (La. 1953).

103. *See* Lechuza Villas West v. Cal. Coastal Comm'n, 70 Cal. Rptr. 2d 399, 411-16 (Cal. App. 1997) (holding that the boundary is ambulatory for natural accretions); Cal. State Lands Comm'n v. Superior Court, 11 Cal. 4th 50 (1995) (holding that accretions resulting artificially from human activities belong to the landowner); Bd. of Trs. of Internal Improvement Trust Fund v. Sand Key Assocs., Ltd., 512 So. 2d 934, 941 (Fla. 1987); Hudson House, Inc. v. Rozman, 509 P.2d 992, 995 (Wash. 1973); Ford v. Turner, 142 So. 2d 335, 340 (Fla. 2nd DCA 1962); KALO ET AL., *supra* note 89, at 45-46 (quoting I. FARNHAM, WATER AND WATER RIGHTS § 62 (1904) and citing 1 WATER AND WATER RIGHTS § 6.01(a) (1991); Game & Fresh Water Fish Comm'n, 407 So. 2d at 191-92; Smith Tug & Barge Co. v. Columbia-Pacific Towing Corp., 443 P.2d 205, 208 (Or. 1968); 3 AMERICAN LAW OF PROPERTY § 12.32 (1952)).

104. KALO ET AL., *supra* note 89, at 45-46 (1999) (quoting I. FARNHAM, WATER AND WATER RIGHTS § 62 (1904) and citing 1 WATER AND WATER RIGHTS § 6.01(a) (1991); Game & Fresh Water Fish Comm'n v. Lakes Islands, Ltd., 407 So. 2d 189, 191-92 (Fla. 1982); Smith Tug & Barge Co. v. Columbia-Pacific Towing Corp., 250 Or. 612, 616, 443 P.2d 205, 208 (1968); 3 AMERICAN LAW OF PROPERTY § 12.32 (1952)).

105. KALO ET AL., *supra* note 89, at 45-46 (1999) (quoting I. FARNHAM, WATER AND WATER RIGHTS § 62 (1904) and citing 1 WATER AND WATER RIGHTS § 6.01(a) (1991); Game & Fresh Water Fish Comm'n v. Lakes Islands, Ltd., 407 So. 2d 189, 191-92 (Fla. 1982); Smith Tug & Barge Co. v. Columbia-Pacific Towing Corp., 250 Or. 612, 616, 443 P.2d 205, 208 (1968); 3 AMERICAN LAW OF PROPERTY § 12.32 (1952)).

106. *See*, *e.g.*, HALLOWELL, *supra* note 86, at 74 n.1 (describing the reversion under Louisiana law of privately owned land to the state as the Gulf of Mexico invades).

107. *In re* Opinion of the Justices, 313 N.E.2d at 567.

108. *See*, *e.g.*, Pacific Legal Found. v. Costle, 586 F.2d 650, 655-56 (9th Cir. 1978) (holding that only the federal Environmental Protection Agency (EPA) has the authority to issue permits pursuant to the Clean Water Act for discharges that occur more than three miles out to sea); *see also* HALLOWELL, *supra* note 86, at 74-75 (describing the effects of property law in Louisiana on economic motivations in the oil industry, including the importance of the three-mile line to royalty revenues).

109. UNCLOS III, *supra* note 7, at arts. 2.1, 2.2, 3.

110. *Id*. at art. 56.1.

MPA policy throughout the United States' coastal zone.

Within that property rights complexity, however, is the potential for changing patterns of marine resource use. Specifically, in the absence of markets or other pricing mechanisms for marine ecosystem services, one indirect means of valuing those services is to create market demand for — and a derivative political will to protect — the intact and functional ecosystems that produce them.

As Costanza suggested, creating a market for the most important marine ecosystem services, like the nutrient cycling services of an estuary, is difficult. However, creating proxy demands — marketable demands for certain uses that de facto require ecosystems functional enough to continue producing the more important but non-marketable ecosystem services — is often possible. For example, if creating a market for an estuary's nutrient cycling services is difficult, it is relatively easy to create demand — and a willingness to pay — for estuaries that are healthy enough to support large and healthy shellfish and fish populations, shelter a variety of coastal and migratory bird species, and provide clean waters for swimming and boating. Recreational demand for national and state parks is great — great enough that the federal and state governments have been able (despite some public grumbling) to repeatedly add or increase admission fees.[111]

Of course, translating that market demand into a political will to protect the relevant ecosystems depends on many factors. Nevertheless, such translation is possible. For example, governments have been able to limit access to some popular recreational areas, such as the Colorado River in Grand Canyon National Park, to attain sustainable levels of use.[112] Beyond property rights, important factors in the public political will to protect marine ecosystems include the real (absolute, biological, ecological) scarcity, pub-

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111. *Compare*, *e.g.*, National Parks Conservation Association, *Congressional Testimony on S. 2607 and S. 2473 to permanently establish the Recreation Fee Program* (June 19, 2002), *available at* http://www.npca.org/media_center/testimonies/testimony061902.html (applauding the fee program and increased fees for National Parks based on the public's willingness to pay), *with*, *e.g.*, NTA: The National Tour Association, NTA Receives Fee Increase Notification from National Park Service, http://www.ntaonline.com/index.php?s=&url_channel_id=28&url_article_id=2771&change_well_id=2 (last visited Aug. 14, 2007) (registering dissatisfaction with the notice that "[t]wenty-three national park sites will be increasing entrance fees in 2006 following an increase at 17 sites in July 2005.").

112. Grand Canyon National Park River Trips & Rafting Guide, Noncommercial River Permit System Guidelines I-III, http://www.grand.canyon.national-park.com/river.htm (last visited June 20, 2007) (describing the waitlisting, permitting, and fee systems for noncommercial rafting on the Colorado River within the Park). On March 23, 2006, the National Park Service changed the waitlist system that had been in place for many years to a weighted lottery system for determining who can raft the river. Grand Canyon National Park, 12 to 25 Day Non-Commercial River Trips: Lees Ferry to Diamond Creek (U.S. National Park Service), http://www.nps.gov/grca/planyourvisit/overview-lees-ferry-diamond-ck.htm (last visited Aug. 14, 2007).

lic perceptions of scarcity and the economic consequences of those perceptions (relative scarcity), and ecosystem use competition.[113]

B. Absolute Scarcity, Relative Scarcity, and Ecosystem Services

As Stefan Baumgärtner and his colleagues have recently observed,

> the notion of *scarcity* . . . is the crucial concept in economics and also plays an important role in ecology and ecological economics. A general and intuitive understanding of scarcity is as follows: something is *scarce*, if people want to have more of it than is available. Thus, scarcity describes a certain relation between subjective needs and given possibilities to satisfy them. Generally speaking, the concept of scarcity describes a relation between humans and nature.[114]

However, there are two kinds of scarcity: *absolute* scarcity, which in the biological or ecological realm describes a scientific assessment that species and/or ecosystems are impaired/ destroyed/eliminated to the point of reduced- or non-viability or nonfunction; and *relative* scarcity, an economics concept.

> In economics, a means of production or a consumption good is said to be *scarce* if it carries opportunity costs. In order to obtain one additional unit of the good one must give up something else — some amount of another good, or an opportunity to do something — or pay a monetary price. Thus, scarcity is defined in a relative way: a good is scarce in relation to other scarce goods. This definition is one of *relative scarcity*.
>
> Such a relative notion of scarcity relies on one particular assumption both about (i) the objective possi-

113. *See* Krautkraemer, *supra* note 53, at 5-6 (noting that "[o]ne significant change [in the debate over economic scarcity of natural resources] in recent years is a greater focus on the ecosystem services and the resource amenities yielded by natural environments—a shift from food, timber, coal, iron, copper, and oil to air and water quality, global climate, and ecosystem preservation.").

114. Stefan Baumgärtner et. al., *Relative and Absolute Scarcity of Nature: Assessing the Roles of Economics and Ecology for Biodiversity Conservation,* 59 ECOLOGICAL ECONOMICS 487, 488 (2006) (citation omitted).

> bilities of consumption and (ii) peoples' subjective preferences over these options, namely *substitutability*. First of all, the idea of relative scarcity presupposes the existence of alternative consumption bundles. Usually, there exists a wide spectrum of consumption possibilities which can all be produced from a number of elementary resources. . . . Furthermore, the concept of relative scarcity presupposes that peoples' preferences are characterized by substitutability. Saying that people are willing to give up something else in order to obtain one additional unit of a scarce good, rests on the implicit assumption that people consider these two goods to be substitutes. [115]

In contrast, absolute scarcity denotes a situation where substitutes are simply not available.[116] As a discipline, economics has little or nothing to say about absolute scarcity:

> This aspect of absolute scarcity is not within the scope of economics. The very definition of economics presupposes that scarce means have alternative ends, in other words, that there is a possibility of substitution and that there is room for choice. Choice, thus, is the true substance matter of economic analysis. For this reason, absolute scarcity, which implies that there is no choice, is generally beyond the horizon of economic analysis.[117]

That is not to say, however, that there is *no* relation between absolute scarcity and markets. At one extreme, for example, there can be no market in a species that has become extinct. At the other, biological abundance of a species may affect the market in that species, especially at a local or regional level. New York City's poor could afford the abundant local oysters until industrialization and development destroyed the ecosystems that sustained them, requiring New York dealers to import oysters from elsewhere.[118]

Of course, demand for ecosystem goods and services is also relevant to scarcity. Moreover, especially in the context of ocean

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115. *Id.* at 489 (citation omitted).

116. *Id.*

117. *Id.* at 490-91. *See also* Crass & Jones, *supra* note 67 ("The scale of most of these services is so large that it would be impossible to find technological substitutes.").

118. MARK KURLANSKY, THE BIG OYSTER: HISTORY ON THE HALF SHELL 244-80 (2006).

and coastal ecosystems, it is worth recognizing that demand for ecosystem goods and services can be of two types, as Jeffrey A. Krautkraemer has detailed. First, there are natural resource commodities — the ecosystem services and ecosystem goods "used to produce material goods and services" that are "commonly treated as economic goods and services," such as the production of timber, coal, fish, and so on.[119] Second, and more recently recognized, are natural resource amenities — the non-commodified economic goods and services that ecosystems provide, such as

> the basic life support systems of the earth: the air, fresh water, carbon, nitrogen, and nutrient cycles; the climate in which we live and to which the flora and fauna have adapted; the sinks where we deposit the waste products of production and consumption; and the ecosystems that support our agricultural and other economic activities. The natural world serves as a storehouse of genetic information and the original source of many of the world's pharmaceutical products. It provides the "playgrounds" where many of us recreate and which we often observe with wonder.[120]

Demand for natural resource commodities is almost always consumptive/destructive (e.g., timber harvesting and fishing). Most extraction of natural resource commodities, moreover, can degrade the ecosystem that supports production of those commodities.[121] As Krautkraemer has observed, "[m]any economic activi-

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119. Krautkraemer, *supra* note 53, at 9.

120. *Id.*

121. *See, e.g.*, Lotze et al., *supra* note 23, at 1807 (noting that coastal marine ecosystems "with the longest history of intense human impacts and highest total human population were among the most degraded, including the Adriatic, Wadden, and Baltic Seas). The authors further note that, worldwide, in coastal ecosystems

> [m]ost mammals, birds, and reptiles . . . were depleted by 1900 and declined further by 1950 because of intense exploitation for food, oil, or luxury items including furs, feathers, and ivory. Among fish . . ., diadromous species such as salmon and sturgeon were highly desired, easily accessible, and depleted first, successively followed by large pelagics such as tuna and sharks, groundfish such as cod and halibut, and small pelagics such as herring and sardines. Oysters were the first invertebrate suffering depletion . . . because of high value, accessibility, and destructive exploitation methods. Because of their reef-forming and filtration capacity, depletion of oysters reduced the ecosystem's ability to provide high water quality and complex habitats. Other habitat-building filter-feeders including corals, sponges, and hydrozoans were little affected until the development period, but rapidly declined with expanding seafloor trawling. Mussels, crustaceans, and other mobile in-

ties, from the extraction of resource inputs to the emission of wastes, damage resource amenities. . . . It is difficult to imagine any extractive use of natural resources that does not in some way affect natural resource amenities . . . ."[122] For example, apropos of coastal development and wetlands destruction, "[c]onversion of land from its natural state to human use, or degradation of land from human use, is a primary reason for the loss of ecosystem services."[123] Overfishing can equally impair offshore marine ecosystem services,[124] and the synergy between on-shore coastal development and overfishing in coastal estuarine ecosystems becomes particularly destructive.[125]

In contrast to natural resources commodities, the effects of demand for natural resource amenities can occupy many points on a continuum between consumptive/destructive use and non-consumptive/observational use. For example, minimalist ecotourism ("roughing it") would fall close to the non-consumptive/observational end of the spectrum. Commercial ecotourism, depending on exactly how it is implemented, can rest less decisively on the non-consumptive/observational side, somewhere in the middle, or even somewhat on the consumptive/destructive side.[126]

> vertebrates have been harvested throughout history, but only recently became targets of expanding low-trophic level fisheries. Thus, among mammals, fish, and invertebrates, we see sequential depletion of the most valued and largest species and subsequent replacement with smaller, less valuable ones.
>
> Over time, 67% of wetlands, 65% of seagrasses, and 48% of other submerged aquatic vegetation (SAV) were lost because of reclamation, eutrophication, disease, destruction, and direct exploitation . . . . Declines in coastal vegetation caused substantial losses of nursery habitats, nutrient and sediment sinks, and coastline protection. By the late 20th century, 91% of the recorded species were depleted; 31% were rare; and 7% were extinct.

Id. at 1808 (citations omitted).

122. Krautkraemer, *supra* note 53, at 10.

123. *Id*. at 31.

124. *See* Lotze et al., *supra* note 23, at 1808 (associating overfishing with loss of aquatic vegetation and reductions in water quality and noting that "[e]xploitation stands out as the causative agent for 95% of species depletions and 96% of extinctions in our study systems, followed by habitat destruction"). *See also id*. at 1809 ("The structure and functioning of estuarine and coastal ecosystems has been fundamentally changed by the loss of large predators and herbivores, spawning and nursery habitat, and filtering capacity that sustains water quality."); Jackson, *supra* note 23, at 629-36 (arguing that historical overfishing is largely responsible for the degradation of coastal ecosystems).

125. Lotze et al., *supra* note 23, at 1808-09.

126. *See*, *e.g.*, Charles Braman, *Environmental Problems and Efforts to Save Mount Everest* (Aug.13, 2005), http://www.associatedcontent.com/article/6869/environmental_problems_and_efforts.html (discussing the environmental effects of increasing tourism to Mount Everest); Craig, *Taking Steps*, *supra* note 11, at 192-96 (discussing the various kinds of environmental impacts from coral reef tourism); Gössling, *supra* note 19, at 547-52 (not-

C. Absolute Scarcity, Relative Scarcity, Marine Resources, and Marine Ecosystems

Biologically and economically, absolute and relative scarcity are both at play in marine ecosystems. However, distinguishing relative and absolute scarcity for any particular natural resource is not always easy. "Whether there exist possibilities of substitution for a certain good or service depends on a number of factors, such as, e.g. the time-scale, the spatial scale, the institutional setting, the organization of interaction, and the hierarchical level of analysis of the problem under study."[127]

1. Marine Resources Commodities: Scarcity in Marine Fisheries

Marine fisheries provide both elementary needs (food, specifically protein) and imaginary needs (tuna instead of dogfish, sushi made from bluefin instead of yellowfin tuna). To the extent that various target species are substitutable, marine fisheries deal in issues of relative scarcity: if a preferred target species (e.g., cod, grouper, or bluefin tuna) is fished to depletion, fishers can often substitute other species, or diners can eat beef or chicken instead of fish. However, such issues of relative scarcity operate against a backdrop of actual or potential absolute scarcity in three senses. First, to the extent that a particular species has no adequate substitute at a certain spatial scale[128] (usually framed in terms of a community, a region, or a nation) for either cultural, aesthetic or culinary reasons, overfishing of that species can result in absolute scarcity at that scale. Abalone on the west coast of the United States, salmon in the Pacific Northwest, cod in New England and eastern Canada, bluefin tuna in Japan, and conch in Bermuda and the Caribbean are all examples of market- and politically recognized- absolute scarcity.

Second, to the extent that overfishing of preferred species leads to "fishing down the food web" and the depletion of lower-valued species, the entire food web in a given ecosystem can be eliminated.[129] As such, fishing down the food web can lead to an absolute scarcity of fish protein and, at least in some communities, a resultant absolute scarcity of all food protein over a temporal scale.

Third, certain fishing methods can destroy the ecosystems upon

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ing disjunctions between environmental tourism and environmental protection in Zanzibar).

127. Baumgärtner et al., *supra* note 114, at 493.

128. "A good, which is absolutely scarce on a given spatial scale, may be relatively scarce on a larger spatial scale." *Id*.

129. PEW OCEANS COMMISSION, SUMMARY REPORT, *supra* note 38, at 16, fig. 5.

which all commercially important fish species depend.[130] Thus, the organization of societies and trade exchanges that encourage such fishing practices can again lead to absolute scarcity of fish protein and, depending on the other resources available, protein in general.

2. Marine Resources Commodities: Coastal Real Estate Development

Coastal development partakes more of relative scarcity than of absolute scarcity, but both concepts are again at play. In terms of housing and shelter, admittedly essential needs, much of the development reflects the substitutable desires of people to live in certain coastal locations and hence deals in relative scarcity — the availability of land in popular coastal communities as opposed to land in less attractive coastal locations or land in upland locations. As one example, in highly developed California, oceanfront property with a view is both absolutely and relatively scarce, especially from San Francisco south. Even over a decade ago, therefore, "[u]ndeveloped oceanfront lots along the Malibu coast . . . typically have price tags in the $1 to $3 million range."[131]

However, certain kinds of development, notably development related to vessel transportation and fishing, must occur on the coast, and coastal development to satisfy these needs may experience absolute scarcity if suitable coastal locations are no longer available. In addition, the potential for absolute scarcity is arguably increased by an institutional setting that imposes regulatory restraints, such as the Clean Water Act's section 404 "dredge and fill" permit program[132] and the Rivers and Harbors Act's permit programs,[133] which could impede the development of certain coastal areas, although in practice these programs seldom have barred coastal development.[134]

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130. *See*, *e.g.*, *id.* at 8 (noting that trawling can destroy seafloor ecosystems and emphasizing the problem of bycatch); Souter & Lindén, *supra* note 35, at 664-66 (detailing how fishing practices such as blasting, cyanide, muro-ami, and kayakas destroy coral reefs).

131. Griggs et al., *supra* note 42, at 2.

132. 33 U.S.C. § 1344 (2006) (prohibiting the discharge of dredged or fill material into the navigable waters without a permit).

133. 33 U.S.C. § 403 (2006) (requiring congressional approval to build obstructions such as dams and causeways in the navigable waters and requiring a permit from the Army Corps to build other structures, such as piers and wharfs), 33 U.S.C. § 407 (prohibiting the discharge of refuse into the navigable waters without an Army Corps permit).

134. For example, pursuant to section 404 of the Clean Water Act, 33 U.S.C. § 1344, the U.S. Army Corps received 81,302 permit applications in FY2002, only 128 of which were denied; a further 4,143 were withdrawn. The next year, the Corps received 86,177 permit applications, only 299 of which were denied; an additional 4,494 applicants withdrew their applications. U.S. Army Corps of Engineers, *U.S. Army Corps of Engineers Regulatory Pro-*

3. Marine Resources Amenities

At the extreme, marine resources amenities fulfill elementary needs and hence are nonsubstitutable.[135] Therefore, when marine ecosystems degrade to the point where they can no longer provide these services and amenities, we are dealing in absolute scarcity. Moreover, there is growing evidence that the oceans' ability to keep providing these essential services is indeed being impaired and that marine resources amenities are becoming absolutely scarce. For example, one of the services that marine ecosystems provide is carbon sequestration, through the water's dissolution of carbon dioxide.[136] Mounting scientific evidence suggests that the oceans may be at or past capacity for absorbing carbon dioxide and that increased levels of atmospheric carbon dioxide are altering ocean chemistry, acidifying the oceans to the point of interfering with marine life and other marine processes.[137]

Nevertheless, no markets (yet) exist to reflect or signal that scarcity. As a result, the market for marine resources amenities generally operates through demands — variously formulated — for relatively non-consumptive use of intact and functional marine ecosystems. Most such demands to date have involved the availability of and access to coastal recreation areas — beaches, surf, reefs, kelp forests, boating bays, recreational fishing grounds. Such demands may create associated markets in tourism and equipment suppliers, and the demands themselves and access limitations (such as fees) may reflect relative scarcity and comparative valuation of the ecosystems involved: some beaches are cleaner, some beaches have better surf, some reefs are easier to snorkel, some reefs have more varieties of marine life, some reefs have sharks. However, such demands, and the money paid to visit such ecosystems, rarely reflects any sense of the actual or potential absolute scarcity of the ecosystem services at play.

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gram: All Permit Decisions FY2003, http://www.usace.army.mil/cw/cecwo/reg/2003webcharts.pdf (last visited June 20, 2007). Thus, even including the permit application withdrawals — which are in fact often withdrawn because of conditions the Corps would impose — the Army Corps grants well over 90 percent of the permit applications it receives.

135. "Although often taken for granted, the . . . services provided by coastal and marine ecosystems would be difficult — if not impossible — to replace. These benefits include protection from coastal storm damage, the filtering of toxins and nutrients, production of oxygen, and sequestration of carbon dioxide." PEW OCEANS COMMISSION, SUMMARY REPORT, *supra* note 38, at 14, Box 2.

136. *Id.*

137. The main scientific report on ocean acidification is from the Royal Society of the United Kingdom. ROYAL SOCIETY, OCEAN ACIDIFICATION DUE TO INCREASING ATMOSPHERIC CARBON DIOXIDE (2005), *available at* http://www.royalsociety.ac.uk/displaypagedoc.asp?id=13539.

D. The Role of Perception in Responding to Marine Resources Scarcity

As the complexity of marine fisheries and coastal development suggests, "the question of substitutability, and the question of relative versus absolute scarcity, cannot be answered in a general way, once and for all, but needs to be addressed in a particular context."[138] In the context of marine ecosystems, an additional complication in the market and political reaction to scarcity is the role of perception.

As noted, the notion of scarcity depends on needs and preferences — subjective perceptions — as well as objective ecological reality. A perception of natural resource scarcity can affect cultural values. For example, in one of the more interesting studies on this subject, four researchers concluded that resource scarcity was associated with cultural valuation of plump women as beautiful.[139]

Conversely, a lack of perception of natural resource scarcity can result in a resistance to cultural change, such as increased regulation of use. Researchers have noted that, in general, "a visual perception [of environmental changes] seems to be an important precondition for most to believe in their existence."[140]

The impetus to protect ecosystems and their services generally derives from a scientific acknowledgment of impairment or degradation and hence increasing absolute (biological, ecological) scarcity. A significant percentage of coastal wetlands have been destroyed, reducing the water storage and filtering and coastline protection services that they can provide. Global warming is increasing ocean temperatures and acidity in many parts of the world, destroying coral reefs and hence reducing the biodiversity, fish production, and recreational services they provide. Overfishing and the related phenomena of 'fishing down the food web,' bycatch, and habitat destruction are destroying a variety of aquatic coastal ecosystems, reducing the numbers and varieties of fish commercially available for food.

Absolute scarcity has been inadequately addressed politically, often because it is physically difficult to perceive. "The oceans are so large that during the development of most of the world's cul-

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138. Baumgärtner et al., *supra* note 114.

139. J.L. Anderson et al., *Was the Duchess of Windsor right? A Cross-Cultural View of the Socioecology of Ideal Female Body Shape*, 13 ETHOLOGY & SOCIOBIOLOGY 197 *passim* (1992). *But see* Carol R. Ember et al., *Valuing Thinness or Fatness in Women: Reevaluating the Effect of Resource Scarcity*, 26 EVOLUTION & HUMAN BEHAVIOR 257 *passim* (2005) (disputing the association).

140. Gössling, *supra* note 19, at 551-52.

tures they could be considered to be almost infinite, with little risk of their over-exploitation."[141] In addition, scientific evidence regarding marine ecosystem degradation and marine resource scarcity is often incomplete or simply non-existent. "Because of the relative vastness and inaccessibility of the oceans, their scientific exploration had, in many senses, lagged behind the study of terrestrial systems,"[142] with the result that "[w]e are better informed about the Moon and Mars than about the bottom of the ocean floor; we know more about the life cycle of stars than those of the sperm whale, giant squid, and many of the creatures sought by the world's fishing fleets."[143]

Complicating the perception issue are the disjunctions between absolute scarcity and relative scarcity in the realm of natural resources. These disjunctions mean that scientific demand for regulation of resources that are becoming or have become absolutely scarce and market valuation of those resources based on relative scarcity rarely reflect the same perception of reality, complicating the formation of a political will to enact the scientifically necessary regulatory regime, even for ecosystem commodities. Where no markets exist at all, as is the case for most marine ecosystem services, public perception of a problem — absolute scarcity — and the formation of the necessary political will may become more difficult yet.

Given the fact that most marine ecosystems exist out of direct public view,[144] in commodities markets the public is unlikely to believe that a marine resource is scarce, and hence valuable, unless: (1) individual demands for the resource exist; and (2) individuals perceive a threat to or limitation on the fulfillment of those demands. Advertising, as in all other areas of the market, can do much to increase both the demands for a marine resource, especially if it is legitimately appealing to consumers, and the perception that the resource is relatively and/or absolutely scarce.

Two fish provide examples of such market forces at work. Wild Copper River salmon are prized as a delicacy, even among salmon. However, while the species is not endangered or threatened, its market availability is limited by biology and regulation to a few weeks in late spring and early summer,[145] when the fish return to

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141. Costanza, *supra* note 4, at 203.

142. *Id*. at 200.

143. COLIN WOODWARD, OCEAN'S END: TRAVELS THROUGH ENDANGERED SEAS 30 (2000).

144. *See*, *e.g.*, Agardy, *supra* note 61, at 379 (noting that "it is almost impossible to measure the externalities because of the hidden nature of the marine environment").

145. *See* Copper River Management Area Home Page — Commercial Fisheries — Alaska Department of Fish and Game, http://www.cf.adfg.state.ak.us/region2/crhome.php

the Copper River in Alaska to spawn. Because both the gastronomic pleasures and the limited availability of these salmon are widely advertised regionally, the opening of Copper River salmon season is a culinary and marketing event in the Pacific Northwest,[146] with Copper River salmon products routinely commanding prices of at least $5.00 per pound more than other kinds of salmon.[147]

In contrast, demand for Chilean sea bass is almost entirely the work of advertising. Before commercial marketers renamed it, this ugly fish was known as the Patagonian toothfish and was not in great demand, even by people who lived near its home waters near South America and Antarctica.[148] After the fish's 1977 marketing discovery and renaming — coupled with the fact that the white flesh readily absorbs the flavors of delicate spices and sauces — its market price climbed from about $1.00 a pound to $10.00 a pound.[149] At the same time, overfishing of the species has imperiled its continued survival, prompting black market trade in individual fish,[150] warnings against consumption from several environmental organizations,[151] and consumer prices that reach $60.00 per pound.[152]

However, when one or both of the necessary predicates — demand and perception of threat or limitation — are missing, the

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(last visited Aug. 14, 2007).

146. *See, e.g.*, Copper River Salmon - What's the Big Deal?, http://gonw.about.com/od/fooddrink/a/copperriver.htm (last visited Aug. 14, 2007) (extolling the culinary properties of Copper River salmon); Buy Copper River Salmon Online, http://www.fishermansexpress.com/shopping/copper-river-wild-salmon.html (last visited Aug. 14, 2007) (announcing that "it's not surprising that the whole Northwest celebrates every year as Copper River salmon are one of the first opening salmon fisheries in Alaska.").

147. *See, e.g.*, Fisherman's Express, http://www.fishermansexpress.com/shopping/product.html (last visited June 20, 2007) (asking $27.95 per pound for Copper River King salmon filets, $5.00 more per pound than the next most expensive type of Alaska salmon).

148. KNECHT, *supra* note 70, at 5-13, 29-31.

149. Brockaw explores the vanishing Chilean sea bass - - MSNBC.com, http://www.msnbc.msn.com/id/12939001/from/E7 (last visited Aug. 14, 2007).

150. *See generally* KNECHT, *supra* note 70 (discussing the saga of the Chilean sea bass). Black markets in fish of regulated species that remain in high consumer demand are common. 'Zero Tolerance' approach to seafood black market — NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/archive/news-releases/fishing-and-aquaculture/2006/seafood-black-market (last visited Aug. 14, 2007); Ministry of Fisheries, New Zealand, *Black Market Rock Lobster Operation Shut Down* (Dec. 20, 2004), http://www.fish.govt.nz/en-nz/Press/Press+Releases+2004/December+2004/Black+market+rock+lobster+operation+shut+down.htm; U.S. Fish & Wildlife Service, Department of Interior, *Agents Uncover Large-Scale Black Market in Illegal Salmon* (Jan. 22, 1982), http://www.fws.gov/news/historic/1982/19820122.pdf.

151. Monterey Bay Aquarium: Seafood Watch Program — Online Seafood Watch Guides for Sustainable Seafood Choices, http://www.mbayaq.org/cr/seafoodwatch/web/sfw_regional.aspx?region_id=0 (last visited Aug. 14, 2007).

152. *See* Buy Chilean Sea Bass from Gorton's Fresh Seafood, http://www.gortonsfreshseafood.com/product/9 (last visited Aug. 14, 2007) (charging $59.99 for two 8-ounce fillets).

public's perception of scarcity may well diverge from marine scientists', even with respect to ecosystem commodities with potential or actual economic markets. For example, abalone and conch remain biologically (absolutely) scarce, but unless there are buyers who continue to demand these species despite their long-term unavailability on the market, they may not remain economically (relatively) scarce. Consumers who have never known the pleasures on dining on these species simply may not care that they are no longer readily available in supermarkets. Conversely, regulatory restrictions on harvest can restore overfished species to ecological integrity (no absolute scarcity), while at the same time consumers continue to respond to perceived relative scarcity because the restrictions on harvest mean that the regulated species does not reach the market, or does so only for a few weeks.

This divergence between scientific and public perception is likely to be even more extreme with respect to marine resources amenities, for which there is no mechanism to translate absolute/ecological scarcity into relative/economic scarcity. Marine resources amenities thus present a classic case of the "tragedy of the commons" — except that participants in the traditional terrestrial commons would eventually notice that the commons had been destroyed. In contrast, perceptions that marine ecosystem commodities and amenities are subject to any kind of scarcity often must struggle to emerge through a lingering "paradigm of inexhaustibility" regarding marine resources — the belief that, given the oceans' vastness, humans were simply incapable of causing lasting damage to marine ecosystem function.[153] This belief was, until recently, the dominant paradigm for ocean policy and management.[154]

The question of how to make the ecologically documentable (or even suspected) absolute scarcity of marine resources perceivable and actionable in the political and economic realms is the core issue of marine policy and regulation in the United States.[155] One answer may be changes to the structure of competition for marine resources commodities and amenities.

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153. Craig, *Taking Steps*, *supra* note 11, at 159; Craig, *Oceans*, *supra* note 20, at 247.

154. Craig, *Taking Steps*, *supra* note 11, at 159; Craig, *Oceans*, *supra* note 20, at 247.

155. *See*, *e.g.*, Baumgärtner et al., *supra* note 114 (discussing the relative roles of economics and ecology in biodiversity preservation and sustainability, but also emphasizing that there is a philosophical dimension to biodiversity preservation that incorporates ethics as well as ecology and economics); Costanza, *supra* note 4, at 205-06 (describing the difficulties of "[c]oming to judgment" on ocean policy because "[t]he decisions we face today about the future of the oceans (and the planet as a whole) are by far the most complex we have ever faced, the technical information is daunting (even to the experts), and we have very little time to come to public judgment").

IV. COMPETITION AND THE POLITICS OF VALUING MARINE ECOSYSTEM SERVICES

Absolute and relative scarcity are not sufficient to explain the complex political dynamics that affect marine ecosystems and their services. Nor, given the complex and intermeshed public and private property and regulatory rights in the United States' coasts, are private property rights and market transactions sufficient either to explain or to properly value marine ecosystems and their services. Instead, the sometimes perverse relationships between absolute (biological) scarcity and market price have often combined with single-use structures of competition for marine resource commodities to create tunnel-visioned economic rather than biological agendas, often stymieing or undermining political efforts to address problems of absolute scarcity and the resulting ecosystem impairment and loss of marine resource amenities.

A. Competition and Marine Ecosystem Services

It is a commonplace that the problem of managing marine ecosystems and preserving their services can be viewed as problems of competition for common-pool resources[156] and of effectively regulating access to those resources.[157] However, an important qualifier to this view is the realization that demand competition for marine ecosystem goods and services comes in two forms, with potentially radically different outcomes for the popular and political valuation of the ecosystems themselves.

The more familiar kind of marine resource competition is competition among users of common-pool resources who want to extract *the same resource commodity* from the ecosystem. In Garret Hardin's classic essay on the tragedy of the commons, this was the competition among cow owners for the grass in the commons.[158] In marine ecosystems, this is classically the competition among fishers to capture the same commercially important fish, or the competition among multiple developers for coastal real estate, including the filling of coastal wetlands.[159] Such single-use competition of-

156. *See*, *e.g.*, Curran & Agardy, *supra* note 53, at 303-04; *see* Garrett Hardin, *Tragedy of the Commons*, 162 SCIENCE 1243 (1968).

157. *See* Costanza, *supra* note 4, at 205 ("The open access and common property characteristics of the oceans requires that special measures need to be taken to regulate access.").

158. Hardin, *supra* note 156, at 1244.

159. Of course, in property rights terms, there are significant differences between the competition for fish and the competition for coastal property. Fisheries generally remain public goods subject to either open access or common property regimes, despite the emergence of individual fishing quotas and other "privatized" rights in certain fisheries. *See*

ten works to elide perception of both the ecosystem itself and its proper functioning; instead, the ecosystem becomes the desired commodity — meadow or grassland reduced to hay; eastern Canadian oceans reduced to cod; Chesapeake Bay reduced to oysters; southern California reduced to city.[160] The early history of United States natural resource regulation displays the political end result of this contraction in popular perception: wetlands were unproductive swamps that stood in the way of human progress,[161] fisheries could be managed on a species-by-species basis without regard to habitat or bycatch.[162]

Single-use competition for marine resource commodities thus tends to reflect the "exclusion" problem typical of common-pool resources: "exclusive use of common-pool resources is very costly, and individual exploitation reduces resource availability for other users."[163] As a result, as in Hardin's "tragedy of the commons," single-commodity competition for natural resource commodities, if left unregulated, often will result in absolute scarcity — no grass, no fish, no wetlands. Absolute and relative scarcity can then become intertwined in the marketplace, increasing the value placed on the resource at issue. For example, while expansion of development to new areas of the coast remains possible in many areas of the country, coastal property in the United States is a finite resource. Given the increasing populations living near the coast, it is no surprise that coastal properties have generally increased in price throughout the country.[164]

Even in fisheries, absolute scarcity does occasionally send the

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generally RÖGNVALDUR HANNESSON, THE PRIVATIZATION OF THE OCEANS 43-84 (2004). Most coastal wetlands, in contrast, are found on private property. However, because this paper focuses on competition between forces to "use up" these natural resources commodities — extract the fish, fill the wetlands — and forces to preserve the relevant natural resources amenities, the private property aspects of wetlands in many ways exacerbate the "common-pool" resource problem of coastal wetlands by emphasizing a market regime that rewards "highest and best use" — i.e., development. In other words, even though any particular wetland is "protected" by a private property rights regime, there is still no economic impetus to leave the wetland intact.

160. *See* Krautkraemer, *supra* note 53, at 11 ("Commercial exploitation for natural resource commodities generally considers at most a few of the elements in the ecosystem.").

161. KIM DIANA CONNOLLY, STEPHEN M. JOHNSON, & DOUGLAS R. WILLIAMS, WETLANDS LAW AND POLICY: UNDERSTANDING SECTION 404, at 2-3 (2005) (describing the prevailing view that wetlands should be eliminated, even adopted by the Supreme Court in 1900); HALLOWELL, *supra* note 86, at 68-69 (describing the destruction of coastal wetlands in Louisiana as a result of the Swamp Lands Acts of 1849 and 1850 and to accommodate drilling for oil); NELSON MANFRED BLAKE, LAND INTO WATER — WATER INTO LAND: A HISTORY OF WATER MANAGEMENT IN FLORIDA 19-87 (1980) (describing the wetland- and swamp-destroying drive for "improvements" in Florida's early history).

162. Craig, *Taking the Long View*, *supra* note 11, at 666-71; Craig, *Oceans*, *supra* note 20, at 229, 238-42, 247-55.

163. Curran & Agardy, *supra* note 53, at 304.

164. Kriesel et al., *supra* note 79, § 2 .

right market signal. For example, the absolutely scarce bluefin tuna commands market prices of $80 per pound among sushi-loving Japanese purchasers, making some especially large individual fish worth almost $70,000.[165] Nevertheless, with fisheries, perception of absolute scarcity is usually more difficult than it is with coastal real estate, especially given the rise of "factory fishing," the general lack of scientific certainty about the status of any given species, and the fluidity of consumer demand among species with similar culinary properties.[166] As a result, markets for marine resource commodities — especially fish — usually do not adequately reflect increasing absolute scarcity. Indeed, "[t]he empirical evidence to date for natural resource commodities" indicates that "[t]he discovery and development of new reserves, the substitution of capital, and technological progress in resource extraction and commodity production have led to generally downward sloping price trends for many natural resource commodities," including fisheries.[167]

In the political realm, the paradox of single-commodity competition for marine resources is that, *regardless of market perception of scarcity*, such competition undermines any regulatory attempt to preserve the resource or the supporting ecosystem because there is insufficient economic — and hence political — opposition to the continuation of that use. Single-commodity competition tends to instruct policymakers that a particular marine ecosystem is valuable for only one (or a few) resources. Perhaps understandably, the existence of an increasingly relatively valuable (however increasingly absolutely scarce) resource commodity — blue fin tuna, coastal real estate — often unites the competitors against any regulatory effort to reduce access to or use of the ecosystem, each competitor assuming that he or she will be the one to benefit from

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165. EUGENE H. BUCK, ATLANTIC BLUEFIN TUNA: INTERNATIONAL MANAGEMENT OF A SHARED RESOURCE, CRS REPORT TO CONGRESS, 95-36 ENR (Mar. 8, 1995), *available at* http://www.ncseonline.org/NLE/CRSReports/Marine/mar-5.cfm ("In 1991, a Japanese importer paid a record price of $68,503 (or about $96.65 per pound) for a single giant bluefin tuna!").

166. While individual consumers shopping in a supermarket often seek particular species to eat — salmon, for example — in the larger world of commercial consumers, the exact species is often less important. Producers of fish-based fertilizer, pet food and livestock feed will often take whatever fish products are cheapest. Even commercial products for human consumption such as processed fish sticks can substitute a variety of species in their products. U.S. DEPT. OF AGRICULTURE, ITEM DESCRIPTION: FISH NUGGETS, PORTIONS, STICKS, STRIPS, BITE-SIZE PIECES, OVEN-READY, BREADED AND/OR BATTERED, FROZEN 1-4 (Mar. 12, 2001), *available at* http://www.ams.usda.gov/fqa/aa20325.pdf. Even individual consumers, moreover, may be willing to substitute species within the same general class (yellowfin for bluefin tuna, Atlantic for Alaskan salmon) or to substitute farm raised fish for wild-caught.

167. Krautkraemer, *supra* note 53, at 12.

the market rewards.[168] Even when market prices are falling, however, competitors will unite against regulation of the common resource, often denying that the resource commodity is in fact scarce[169] and arguing that unregulated access is necessary to make a living.[170]

In other words, single-commodity competition undermines the political will to create the acknowledged solution to the common-pool resource problem. Moreover, if there are no other politically motivated users of the same ecosystem, the united resource commodity competitors may well succeed in their opposition to regulation, at either the legislative (including rulemaking) or the enforcement levels.[171] In the United States, the histories of wetlands losses[172] and the many failures of the Magnuson-Stevens Fisheries

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168. *See*, *e.g.*, HALLOWELL, *supra* note 86, at 32-33 (describing oyster fishers' resistance to attempts to restore the marshes in Louisiana because of high valuation of the oyster beds that the resulting siltation and freshwater inundation was destroying); Scott Norris, *Thinking Like an Ocean: Ecological Lessons from Marine Bycatch*, CONSERVATION IN PRACTICE, Fall 2002, at 10, 11-12 (describing tuna fishers' resistance to regulations designed to protect dolphins).

169. Most commercially important fish species are indeed — or are becoming — absolutely scarce.

> Marine fishery production increased six-fold since 1950, primarily through extending fishing to relatively unexploited areas, although aquaculture has increased to more than 20% of the total fish harvest. But many older fisheries are producing much less as a result of overfishing; it is estimated that 75% of fisheries have been over-harvested. One sign of this is the increase in the catch of low-value species while the catch of some high-value species has declined. The prospects for increasing harvest from existing fisheries are not good. The harvest from capture fisheries has reached a peak, and growing production from aquaculture threatens capture fisheries as feedstocks are diverted from natural to commercial production.

Krautkraemer, *supra* note 53, at 29 (citations omitted).

170. *See*, *e.g*, HALLOWELL, *supra* note 86, at 103-113 (describing Gulf of Mexico shrimpers' united protest against regulations requiring the use of turtle excluder devices).

171. *See*, *e.g.*, SARA WARNER, DOWN TO THE WATERLINE: BOUNDARIES, NATURE, AND THE LAW IN FLORIDA 37-41 (2005) (describing the "explosion of bay fills" in Florida in the mid-20th century resulting from substantial economic pressures for coastal development and lax enforcement of laws intended to protect state lands and the public trust).

172. Wetlands covered 11 percent of the surface area of the lower 48 states 200 years ago; by 1997, they covered only 5 percent of the same area. In the 1950s until the early 1970s, the United States lost an average of 458,000 acres of wetlands per year, 87 percent because of agriculture. That loss slowed as Congress enacted regulations, but the nation still lost an average of 290,000 acres a year of wetlands in the 1970s and 1980s. USGCRP Seminar, Wetland Losses in the United States: Scope, Causes, Impacts, and Future Prospects, http://www.usgcrp.gov/usgcrp/seminars/9777DD.html (last visited Aug. 14, 2007). *See also* CONNOLLY ET AL., *supra* note 161, at 2-4 (describing a history of policies that encouraged the filling and destruction of wetlands); HALLOWELL, *supra* note 86, at 68-69 (describing the role of the Swamp Lands Acts of 1849 and 1850 on "reclamation" of Louisiana coastal marshes), 73-74 (describing how "[e]arly oil entrepeuners" altered the Gulf of Mexico coastline, noting that "[t]hey lay boards across sections of *flotant*, or floating marsh, which dominates the interior wetlands. They engineered marsh buggies to churn over the marsh

Conservation and Management Act[173] evidence this trend: concentrated attention on the value of one natural resource commodity results in a failure to acknowledge the other valuable goods and services that the relevant ecosystem provides — the natural resources amenities — and undervaluation of the ecosystem as a whole. In fact, many marine ecosystems suffer precisely because humans are interested in only one particular marine resource commodity and because exploitation of that resource commodity — generally, either through fishing or development,[174] — degrades the ecosystem itself.[175]

The resulting devastation to the resource, and the ecosystem that supports it, is predictable: "The 'tragedy of the commons' results, not from an inherent failure associated with a common pool resource, but from institutional failure to control access to the resource, and to make and enforce internal decisions for collective, long-term use."[176] In effect, therefore, single-use competition, especially consumptive exploitation of resource commodities, pits humans *against* the relevant ecosystem. As the National Research Council has noted, "Human activities often compete with ecosystem survival."[177] Moreover, single-use competition effectively obliterates human perception of the survival asymmetries — and

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with great round iron wheels and later, with treads. But most of all, they dredged channels through it. The marsh put up little resistance. It was surprisingly easy and quick work, one canal for every drill rig, dug wherever needed, spoil banks hurled up in all directions. No one cared about blocking the marsh's sheet flow; no [one] cared about ponding — the accumulation of trapped water inside the marsh that killed acres of vegetation. *This land was unfit for human habitation and there were absolutely no laws against the early oil industry's unpremeditated redesign of the marsh*.") (emphasis added).

173. *See* Donna R. Christie, *It Don't Come EEZ: The Failure and Future of Coastal Fisheries Management*, 14 J. TRANSNAT'L L. & POL'Y 1, 4-5 (2004); Coastal Conservation Association Florida, *Failures and Exploitation Bias in Federal Fishery Management Programs: Recommendations for Systemic Changes* (Oct. 2002); Associated Press, *Fisheries Management Called a Failure* (Mar. 10, 2000), *available at* http://www.californiafish.org/fisheryfailure2.htm.

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> When studying such population-environment interactions it is important to recognize that what matters for the environment is the sum of the activities of the members of the population with a given size and structure, and not the individual components of change directly. . . .In our case of coastal systems, this is mostly through changes in land use and land cover (e.g. mangrove deforestation), fishing or harvesting from the ecosystem, and pollution from other human activities.

Curran et al., *supra* note 22, at 267.

175. *See* Krautkraemer, *supra* note 53, at 11 (noting that "the extraction of one element [fish] or the addition of excessive amounts of another [fill in wetlands] can disrupt the entire balance of the ecosystem, with unforeseen consequences.").

176. Curran & Agardy, *supra* note 53, at 304 (citations omitted).

177. COMMITTEE ON ASSESSING AND VALUING THE SERVICES OF AQUATIC AND RELATED TERRESTRIAL ECOSYSTEMS, THE NATIONAL ACADEMIES, REPORT IN BRIEF, VALUING ECOSYSTEM SERVICES: TOWARD BETTER ENVIRONMENTAL DECISION-MAKING 1 (Nov. 2004).

human dependence on marine ecosystem services — that underlie all human interactions with coastal ecosystems. [178]

In contrast, a second kind of competition is emerging in some coastal ecosystems among users who want to make *different uses* of the same ecosystem, including uses that value marine resources amenities. In common-pool resource terminology, such multiple-use competitions underscore the "subtractability" problem: one "person's short-term interests in using the resources may not be in their or others' long-term interests."[179] While perhaps not providing comprehensive appreciation of all the ecosystem services that a marine ecosystem provides, multi-use competition adds important dimensions to the valuation of marine ecosystems because it forces policymakers and regulators to acknowledge that the relevant ecosystem serves multiple demands and that those demands tolerate different levels of ecosystem degradation, particularly when commodities and amenities users are in competition. Put another way, "[b]esides providing ecosystem services, coastal ecosystems as sites for human economic development put in sharp relief competing human demands for multiple, and not always compatible, uses, such as water for industrial purposes, space for shipping and ports, fishing, tourism, and salt, sand or coral for consumption and building."[180]

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178. As one team of researchers described this phenomenon:

> Generally speaking, coastal ecosystems can well exist in a sustainable manner without the existence of the human species. Human populations, on the other hand, are critically dependent on functioning ecosystems for their most basic life-support systems (i.e., food, clean air, and clean water), as well as many other environmental services that improve the quality of life. This asymmetry in mutual dependence makes the human population in principle more vulnerable than the ecosystem. Throughout the centuries humans have developed strategies, technologies, and institutions to diminish this vulnerability and improve their quality of life. Over most of human history these mechanisms have not significantly affected ecosystems. During recent decades, however, these influences have increased dramatically and now not only threaten the functioning of the ecosystems themselves but also may increase the vulnerability of the human population.

Curran et al., *supra* note 22, at 266.

179. Curran & Agardy, *supra* note 53, at 304 (citations omitted).

180. Curran et al., *supra* note 22, at 264.

B. The New Competition for the Lifestyle Values of Coastal Ecosystems

1. Ecosystem-Based Tourism and the Recreational Lifestyle Values of Marine Ecosystems

In general, "[t]ourism is increasingly built on the marketing of nature and natural resources, which have become its central elements."[181] While it is true that such tourism can "allow[] the use of natural areas which are otherwise of less economic value for these [developing] countries (such as remote beaches),"[182] it is also true that coastal ecotourism can create new competition between pre-existing commodities users and the new amenities-valuing tourists and tourism industry. For example, the most studied and increasingly common different-use competition for coastal ecosystems is that between fishers and ecotourism. The rise of coastal ecotourism, moreover, often leads to the creation of marine protected areas and reserves. It is no accident that, worldwide, creation of MPAs and the introduction of marine zoning tends to start with those places, such as coral reefs and beaches, that are valuable to ecotourism and recreation as well as for fishing.[183]

For example, coral reefs are almost always important fishing grounds, but the tourism values of coral reefs are also well known, creating an almost inevitable clash between the commodities users and the amenities promoters. With the decline of many coastal fisheries, however, coral reefs are often more valuable — to both the fishers and the tourist industry — when they are protected, intact, and functional. For example, the value of the Great Barrier Reef in Australia to the two million people who visit each year has been calculated to be US $350 to $800 per visit, making it "likely to be the most valuable coral reef in the world."[184] This and similar studies "suggest that healthy, intact coral reef systems can have very high values for both coral reef and distant nations," creating recreational demands — what might be called lifestyle values — and economic gain that often lead to political and regulatory protection of the reef ecosystem.[185] The Great Barrier Reef, for exam-

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181. Gössling, *supra* note 19, at 540 (citation omitted).

182. *Id.*

183. *See*, *e.g.*, *id.* at 547-49 (discussing the varying views of conservation in Zanzibar, with tourists most often pressing for preservation of the ecosystem), 552 (noting that tourism can foster local environmental awareness).

184. Carr & Mendelsohn, *supra* note 35, at 357. Coral reefs in Belize have been valued at US $367 per visitor. *Id.* (citing Robert Mendelsohn, E. Svendsen, & J. Davis, *Ecotourism and Conservation: A Study of Marine Ecosystems in Belize* (Master Thesis, Yale School of Forestry and Environmental Studies, 2004)).

185. *Id.*

ple, has been protected and zoned by law since 1975.[186]

Moreover, tourism competition can reshape the political agenda surrounding the relevant coral reef, reducing the political clout of fishers and resulting in marine zoning, MPAs, and marine reserves. This trend has become more pronounced as science increasingly documents the benefits of marine reserves to important fisheries as well as to tourists.[187] As an example of this dynamic, I have elsewhere compared the attempts to protect the Florida Keys' coral reef ecosystem with the ongoing efforts to establish the Northwest Hawaiian Islands National Marine Sanctuary.[188] While fishers in both places resisted the establishment of MPAs and marine reserves, the established marine tourism uses of the Florida Keys eventually allowed negotiation of the Dry Tortugas Ecological Reserve.[189] In contrast, in the absence of ecotourism (and of any real prospects for ecotourism), eight fishers, with occasional help from the State of Hawaii and sustained help from the Western Pacific Regional Fishery Management Council, effectively stymied and delayed the establishment of the Northwest Hawaiian Islands National Marine Sanctuary. Such delays occurred despite the ecological and scientific value of that coral reef ecosystem — perhaps the last "near natural" coral reef ecosystem in the world.[190] In the end, protection of the federal waters of this reef ecosystem has come only through presidential fiat: President Clinton's Executive Order in 2000, which established the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve,[191] and President George W. Bush's rather surprising decision in 2006 to set aside the ecosystem as a national monument.[192]

Beaches can also inspire ecotourism, either internationally or relatively locally, and such tourism reflects lifestyle values associated with intact and functional coastal ecosystems. The competition here is often between over-intensive coastal development and preservation of the beach ecosystem, including its associated dunes and wetlands.

Beach lovers often wax poetic about the beach lifestyle and its value to the human psyche:

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186. *Id*.

187. *See* Craig, *Taking the Long View*, *supra* note 11, at 681-89, and sources cited therein (discussing the benefits of MPAs and marine reserves to the fisheries themselves); *see also* Craig, *Taking Steps*, *supra* note 11, at 234-39 (discussing the promotion of fisheries restoration in the political process of establishing the Dry Tortugas Ecological Reserve).

188. Craig, *Taking Steps*, *supra* note 11, at 222-66.

189. *Id*. at 234-39.

190. *Id*. at 245-60.

191. Exec. Order No. 13178, 65 Fed. Reg. 76,903 (Dec. 4, 2000).

192. George W. Bush, Establishment of the Northwestern Hawaiian Islands Marine National Monument, 71 Fed. Reg. 36,443 (June 15, 2006).

> More directly than the written word or painted image, the sensations of the seashore travel with impunity to the heart and mind of the beast, collapsing past and present into a matrix of water, sand, space, and light. Few environments have been more inspirational in our leisure life. Nature's most potent antidepressant, the beach moves us with the power of a drug, the rhythm of its tides and shifting margins reorienting our sense of space and time, its aphrodisiacal cocktail of sun and water firing our slumbering hedonism. With its retina-searing vistas and erotic spectacles, it lies at the creamy center of American and European leisure destinations.[193]

More important to this paper, however, is the fact that those lifestyle values of beach ecosystems can be — and often are — marketed to potential tourists. For example,

> Zanzibar is marketed by tourism as a tropical paradise, a happier, "better" place characterized by individual freedom, peace, abundance of food, and free sex. Extensive white beaches, blue waters, green palm trees, fishermen at work, and topless or bikini-wearing women are the corresponding symbols, which are presented and marketed, for example, in photographs of travel catalogues in Italy, Germany, and Sweden.[194]

To be sure, the political response to beach tourism, as with all ecotourism, may depend in part on who is benefiting from the tourist trade. In Zanzibar, for example, the tourism market was developed mostly by foreign investors, and the tourism "industry itself has little interest in conservation, even though the existence of the hotels is ultimately based on the integrity of the environment," because if things become too uncomfortable, the foreign investors can simply pull up stakes and invest elsewhere.[195] Nevertheless, the existence of beach tourism that benefits locals can induce a political willingness to protect the beach ecosystem from destructive over-development, particularly when the local population also appreciates the lifestyle and more direct economic benefits to itself.

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193. LENA LENČEK & GIDEON BOSKER, THE BEACH: THE HISTORY OF PARADISE ON EARTH xix-xx (1999).

194. Gössling, *supra* note 19, at 540 (citations omitted).

195. *Id.* at 549 (citations omitted).

Such is the case in South Walton County in Florida, as Brad Pickel of the Beaches of South Walton Tourist Development Council explained at this Symposium. The Council promotes tourism to fourteen beaches in South Walton County, located along the Gulf coastal in the middle-western portion of Florida's panhandle, directly south of the Alabama border.[196] Its web site announces that "Beaches of South Walton is a proud recipient of the Blue Wave Flag — a prominent and highly celebrated certification that symbolizes clean, safe, and environmentally friendly beaches,"[197] emphasizing the County's promotion of ecotourism. More specifically, the Council and County exhort potential tourists to:

> Travel to Florida and experience Beaches of South Walton nestled along the Emerald Coast in the Florida Panhandle . . . . On your Beaches of South Walton, Florida beach vacation you'll find 26-miles of beaches, powdery-white dunes, vast stands of pine forests, cool underground springs, marshlands, bays, backwater bayous and crystalline Northwest Florida gulf waters. Plan your Florida beach vacation with this Official Beaches of South Walton, Florida Travel Guide. Travel to Florida today![198]

And, should any tourist still be in doubt of the lifestyle values these beaches offer, the web site also proclaims that, "If I could be anywhere, it'd be a place where wishes come true not in dreams, but on white sandy beaches."[199]

The County and its Tourist Development Council are intimately aware of the value of the beaches to the surrounding communities, and they act on the political will of those communities to protect and encourage beach tourism by protecting the beaches themselves. As Pickel emphasized at this Symposium, beach tourism is an important economic driver, both in South Walton and the nation generally. People spend more money visiting beaches in this country than they do visiting federal parks. The beaches of South Walton make that area of Florida a tourist destination, but "the attractiveness of the destination depends on pristine natural

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196. Beaches of South Walton, http://beachesofsouthwalton.com/interactive_map.asp (last visited Aug. 14, 2007).

197. *Id.*

198. Travel to Florida — Beaches of South Walton, Florida Beach Vacation Guide, http://www.beachesofsouthwalton.com (last visited Aug. 14, 2007).

199. Beaches of South Walton: Florida's Panhandle. Pure and Simple, http://www.beachesofsouthwalton.com/flashbits/center_homepage_wine_cuisine2.swf (last visited Aug. 14, 2007).

areas," such as beaches and lakes, for hiking, biking, and kayaking.[200] The county realizes that "[t]here is a huge economic benefit to [the] county" from preserving ecosystem services, especially the services of the dune system.[201] As a result, the county is investing in the management and preservation of those beaches and dunes, because maintenance of those ecosystems and their ecosystems services is vital to the county's tourist-based economy. Moreover, preservation of the beaches really is an investment, because the beach preservation funds come only from tourism, not taxes, and "those funds go right back into restoring and maintaining the beach system."[202]

To preserve this tourist attraction, the County engages in both proactive beach management and beach restoration. Proactive management includes requirements that new developments are built as far off the beach as possible. In addition, "[w]e're working on traditional neighborhood development, building living areas in conjunction with working areas, and all located well behind the dunes."[203] Building on top of the dunes is forbidden, and there is a regulatory framework that limits what can be done seaward of "a line in the sand."[204] As for restoration, the county engages in beach nourishment. Such nourishment seeks to mechnically reconstruct the beach and dune system that existed before degradation.

However, preservation of South Walton beaches is not just a matter of investing in tourism, and the County recognizes the other ecosystem services benefits of its beaches and dune system. For example, "the South Walton County beaches have the highest dunes on the Gulf of Mexico," which provide substantial protection to the infrastructure.[205] In particular, the dune system provides storm protection — the dunes are the first line of protection against storm surges from hurricanes. The County has found, as is true generally, that infrastructure behind non-restored beaches is much more likely to suffer structural loss in a hurricane.

Beach preservation and restoration provides other benefits. For example, preservation of the beach ecosystem maintains biodiversity, largely by providing habitat for endangered sea turtles and beach mice and numerous species of shorebirds. In addition,

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200. Bradley Pickel, Director of Beach Management, Beaches of South Walton Tourist Development Council, Speech at Florida State University Symposium on the Law and Policy of Ecosystem Services (Apr. 7, 2006).

201. *Id.*

202. *Id.*

203. *Id.*

204. *Id.*

205. *Id.*

preservation of the beach allows better delivery of emergency services for swimmers and shoreline establishments — "You can't drive on the beach where there is no beach!"[206]

In short, South Walton County, like the Great Barrier Reef and the Florida Keys, provides another example of how a marketable demand for coastal ecosystem amenities, in the form of beach tourism, can create a political will to protect and restore the ecosystem itself. Notably, as discussed, the County has enacted limitations on beach development, eliminating immediate beachfront access in favor of protecting the beach ecosystem itself. Moreover, the communities' political will to limit development apparently derives from at least two motivations — not just the direct economic benefits associated with beach tourism, but also the private property motivations of increasing protection from storm surge — signaling that these communities have begun to incorporate more general appreciation of ecosystem services into their political decision-making.

2. "Eco-Living" and the Lifestyle Valuation of Intact Coastal Ecosystems

Human ecology researchers have noted that human migration — defined broadly to include all human movements — into and out of the coastal zone is an important variable in the preservation or degradation of marine ecosystems. In particular, selective in and out migration can "change[] social relations and the value of ecosystem services to the local population" and "change consumption and investment decisions, with direct effects on the environment."[207]

As has been discussed, in the United States, coastal development since the nineteenth century has been considerable, with substantial numbers of people moving to coastal counties. In most areas, this development has also been intensive, resulting in the filling, building upon, paving, landscaping, and/or other alteration of most, if not all, of the land and the near complete destruction of many coastal ecosystems, particularly coastal wetlands. In many locations, coastal properties with both elbow room and a view are multi-million dollar investments, and even then the acreage is often far from natural, consisting of swimming pools, tennis courts, parking lots, and/or manicured lawns.

St. Joe's RiverCamps, as speaker Billy Buzzett discussed at

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206. *Id.*

207. Curran & Agardy, *supra* note 53, at 304 (citations omitted).

this Symposium, offer an alternative model of coastal development, one that both taps and promotes the lifestyle values of coastal ecosystems and creates demands for coastal resources amenities that can encourage more extensive preservation of coastal ecosystems, including coastal wetlands. Once a timber and paper company, the St. Joe Company — the largest landowner in Florida — has become a development company, engaged in marketing a number of different types of properties.

St. Joe's owns many miles of beaches in Florida and, as a corporation, has an obligation to provide shareholders with a return on their investment. However, the Company has discovered that "buyers like the ecosystems that are out there."[208] As observers have noted, there is "[d]eep consumer interest" in St. Joe's marketing of relatively undeveloped coastal properties along Florida's Gulf Coast, and the RiverCamps are intentionally some of the most lightly developed properties that St. Joe's markets.[209]

> [St. Joe CEO Peter] Rummell described RiverCamps as sets of "high-quality finished cabins" convenient to a variety of forms of outdoor recreation, from fishing and hunting to horseback riding. Company spokesmen [sic] Billy Buzzett described the idea as "Lewis and Clark meets Ralph Lauren." The first of the RiverCamps was slated for the tiny town of West Bay along St. Andrew Bay, and on the other, eastern side of Bay County, near Sandy Creek and Mexico Beach. Other potential locations for RiverCamps were near the St. Marks, Ochlockonee, and Chipola Rivers.[210]

As Buzzett explained at this Symposium, "we think that you can do quality development in natural areas."[211]

RiverCamps trade on the lifestyle values of living in comfort next to the wilderness. As St. Joe's web site for these developments advertises:

> RiverCamps will be located throughout Northwest Florida's Coastal Region. JOE's initial RiverCamps,

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208. Billy Buzzett, Director of Strategic Planning, The St. Joe Company, Speech at Florida State University Symposium on the Law and Policy of Ecosystem Services (Apr. 7, 2006).

209. *Id.*

210. KATHRYN ZIEWITZ & JUNE WIAZ, GREEN EMPIRE: THE ST. JOE COMPANY AND THE REMAKING OF FLORIDA'S PANHANDLE 159 (2004).

211. Buzzett, *supra* note 208.

> RiverCamps on Crooked Creek, is a 1,500 acre JOE community carefully nestled in a secluded woodland preserve along the sparkling waters of Crooked Creek and the spectacular 18,000 acre expanse of West Bay.
>
> RiverCamps' beautifully crafted homes are planned to embrace the outdoors, offering expansive views of surrounding marshes, creeks, savannas and the bay while offering a welcome sense of privacy. Linked by extensive trails and boardwalks, the RiverCamps communities will offer first-class amenities, such as a RiverHouse with swimming pool, grill and pavilion, fitness center, library, dining and lounging areas with kitchen and access to the Gulf of Mexico's pristine beaches and Fazio-designed Camp Creek 18-hole championship golf course.
>
> Visit the RiverCamps Preview Center and discover a rare opportunity to live close to nature and enjoy a simpler way of life in splendid seclusion from the cares of our modern day world.[212]

Trade on these lifestyle values, however, requires protection of the ecosystems themselves. Indeed, part of St Joe's intention in developing the Crooked Creek RiverCamp is to protect and restore West Bay. As Buzzett emphasized at this Symposium, St. Joe's enjoys considerable advantages in this regard because it owns all of the land in question, "has a 100-year planning horizon," and hence can control development for the foreseeable future.[213] Thus, although the Crooked Creek development includes 44 miles of bay frontage and 100 stream miles, there will be no development of these waterways, including no docks on the waterfront and no marina. The Company is committed to meeting Outstanding Florida Watershed standards and to restoring the longleaf pine ecosystem and the wetlands. Indeed, even more skeptical outside observers have postulated that "the extraordinary success of St. Joe's Land Company and the high interest in its 'RiverCamps' idea showed that direct consumer demand might cause the company to rethink its forest strategy," which had included logging of its lands and, according to ardent environmentalists, the avoidance of creation of

212. RiverCamps, http://joe.com/web/Land/LandTypes/RiverCamps.htm (last visited Aug. 14, 2007).

213. Buzzett, *supra* note 208.

habitat for endangered species such as the red-cockaded woodpecker.[214]

V. CONCLUSION

Jan Laitos and Rachel Reiss have argued that terrestrial public lands regulation and use has evolved through three progressive stages: (1) commodity use (timber, ranching); (2) multiple use regulation to protect environmental values as well as allow commodity use; and, most recently, (3) a drive for preservation and recreational use (with conflicts among consumptive and non-consumptive recreational users).[215] Regulation of the nation's oceans and coasts generally lags 10 to 30 years behind public lands regulation, and, under Laitos' and Reiss' typology, is still largely transitioning from stage (1) to stage (2), despite numerous calls for a jump to stage (3) and the implementation of a national system of marine protected areas and marine reserves.

The shift from marine resources commodities-based regulation (or, as I have argued, lack of effective regulation) to the effective preservation of marine resources amenities requires a change in both the popular and the political valuation of marine ecosystems. There is increasing recognition in the sociological, scientific, and economic literature that protection of marine ecosystem services is important. However, as social choice models of decision-making make clear, "[t]here is a critical connection between value formation and decision-making, but . . . [c]onventional social choice theory has, in general, . . . tended to avoid this issue of the connection between value formation and the decision-making process."[216]

Regulation of marine ecosystems gives ample evidence of the difficulty of translating changing values among the experts to in-the-legislature political will: How often is the value of commercial fishing, or of traditional coastal construction, ever *really* challenged? Policy makers, it is true, tinker with the notion of sustainable fishing and occasionally espouse commitment to wetlands preservation[217] or, often in the wake of devastating hurricanes or

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214. ZIEWITZ & WIAZ, *supra* note 210, at 281.

215. Jan G. Laitos & Rachel B. Reiss, *Recreation Wars for Our National Resources*, 34 ENVTL. L. 1091, 1092-1104 (2004). *See also* Jan G. Laitos & John A. Carver, *The Multiple to Dominant Use Paradigm Shift in Natural Resources Management*, 24 J. LAND RESOURCES & ENVTL. L. 221, 221-51 (2004).

216. Costanza, *supra* note 4, at 206 (quoting D. YANKELOVICH, COMING TO PUBLIC JUDGEMENT: MAKING DEMOCRACY WORK IN A COMPLEX WORLD (1991)).

217. *See* Hope Babcock, *Federal Wetlands Regulatory Policy: Up to Its Ears in Alligators*, 8 PACE ENVTL. L. REV. 307, 307-09 (1991). *See also* J.B. Ruhl, *Ecosystem Services and the Common Law of "The Fragile Land System"*, 20 NATURAL RESOURCES & ENVT. 3, 6-7 (2005) (noting the ineffectiveness of ecosystem legislation attempts generally).

other natural disasters made worse because of the degradation of coastal ecosystem services, better coastal zone management policies.[218] However, almost inevitably, when they try to enact a no-fishing marine reserve or a coastal building moratorium, the need for public "values education," political negotiation, and maybe even litigation generally becomes crystal clear.[219]

Changes in human consumption of natural resources "are not automatic but are the result of purposeful activity in response to signals of increased scarcity."[220] Naturally functioning marine ecosystems, especially coastal ecosystems, are becoming absolutely scarce. Moreover, the ecosystem services they provide serve elementary needs, suggesting that the public perception of scarcity — and hence the political will to protect those ecosystems and their services — should be pervasive.

In reality, of course, those scarcities generally are not (yet) perceived because the signals of scarcity either do not exist or are not effectively translated from particular disciplines into the public decision-making arena. For marine resources amenities in particular, increasing absolute scarcity has not resulted in a public shift in values in large part because markets to reflect those scarcities generally do not exist.[221]

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218. *See*, *e.g.*, Stephen Farber et al., *Linking Ecology and Economics for Ecosystem Management*, 56 BIOSCIENCE121, 121 (2006).

> The tragic consequences of Hurricane Katrina on the Gulf Coast, and in New Orleans in particular, have highlighted the importance of addressing ecosystem services — such as the storm protection that wetlands provide — in management decisions involving coastal settlement and infrastructure policies. . . . Also, evaluating trade-offs between coastal marsh area and fisheries requires an understanding of these ecosystem services and their values.

Id.

219. *See*, *e.g.*, Krautkraemer, *supra* note 53, at 31 (noting that developed countries' successful regulatory attempts to protect natural resources amenities "involve environmental factors that most directly affect human well being and are more visible than the loss of services from degraded ecosystems. Some natural environments have been better protected and preserved, but there are also reasons for alarm. A commitment to institutional innovation, not just technological innovation, will be crucial for the efficient management of environmental resources."); Paul R. Ehrlich, *Human Natures, Nature Conservation, and Environmental Ethics*, 52 BIOSCIENCE 31, 31 (2002) (noting that "the seriousness of the environmental dimensions of the human predicament is still unknown to the vast majority of the general public and decisionmakers worldwide. Although scientists understand the general directions in which humanity should be moving to solve its environmental problems, the policy response of society remains pathetic.").

220. Krautkraemer, *supra* note 53, at 5.

221.

> Increasing scarcity of a natural resource commodity generally triggers a variety of responses that, at least to some extent, ameliorate that scarcity. By their very nature, the same is not true for resource amenities — these goods and services are not generally traded in markets so there is

The problems of scarcity signals for marine resources commodities are more complex, given that markets for these commodities, by definition, do exist. Nevertheless, price signals often fail because of technological expansion of fishing capacity and effort in the face of dwindling stocks, lack of scientific information, delayed ecological responses to overfishing, non-linear responses to overfishing, and substitutability of a variety of species at both the production and the consumption ends.[222] Only when there is unflagging demand for a *particular* species that is *generally accepted* to be scarce, such as bluefin tuna, salmon, or grouper, are price signals likely to accurately reflect absolute scarcity.

Public valuation of marine resources faces other hurdles, as well. Even in the absence of private property rights and "takings" issues, articulating the values of intact and functional marine ecosystems is difficult,[223] as is overcoming the paradigm of inexhaustibility.[224] Full public debate over the value of marine ecosystem services would require extensive public education about sometimes highly technical scientific issues, at a time when much of the

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> no price signal to trigger a response. Detection of the problem is much more difficult and the response depends upon collective action.

Krautkraemer, *supra* note 53, at 34.

222. As evidence of the disjunction between absolute (ecological) scarcity and relative (market) scarcity in commercial fisheries, and the inadequacy of price as a signal of absolute scarcity, several environmental organizations have decided to provide consumers (including restaurants) with lists of "red" (imperiled), "yellow" (at risk), and "green" (okay in moderation) species of commercially available fish. BLUE OCEAN INSTITUTE, GUIDE TO OCEAN FRIENDLY SEAFOOD (2006), *available at* http://www.blueocean.org/pdfs/miniguide_color.pdf; Environmental Defense, *Pocket Seafood Selector* (2006), *available at* http://www.environmentaldefense.org/documents/1980_pocket_seafood_selector.pdf; Monterey Bay Aquarium: Seafood Watch Program — Online Seafood Watch Guides for Sustainable Seafood Choices, http://www.mbayaq.org/cr/seafoodwatch/web/sfw_regional.aspx?region_id=0 (last visited Aug. 14, 2007); Seafood Choices Alliance - Find Seafood, http://www.seafoodchoices.com/smartchoices/findseafood.php (last visited Aug. 14, 2007).

223. Indeed, the entire vocabulary of "environmental values" can disguise — and hence perpetuate — fundamental public policy disagreements.

> Confusions with respect to the nature, meaning, and status of "environmental values" in part reflect broader societal confusions with respect to many core environmental constructs, such as "sustainability", "natural", "environment", and "biodiversity", and problematic public understandings of science generally. The confusion also reflects pervasive disciplinary divides with respect to discipline and practice-specific conceptual and operational meanings of "values" and "environmental".

Joseph P. Reser & Joan M. Bentrupperbäumer, *What and Where are Environmental Values? Assessing the Impacts of Current Diversity of Use of 'Environmental' and 'World Heritage' Values*, 25 J. ENVTL. PSYCHOLOGY 125, 126 (2005).

224. *See* Krautkraemer, *supra* note 53, at 5 ("Because environmental resources — ecosystem services or 'resource amenities' — are not generally traded on markets, scarcity signals for these resources may be inadequate, and appropriate policy responses are difficult to implement and manage.").

basic research itself is incomplete and scientific understanding of most marine ecosystems is uncertain.[225] Finally, while a public commitment to "ecological sustainability" is important,[226] sustainable development is often too abstract a concept to determine the outcome of concrete political battles over marine resource consumption and ecosystem degradation. As Robert Costanza has noted, "[a]t present there is a pervasive lack of social mechanisms for dealing with changing environmental conditions"[227] and "a lack of a coherent, relatively detailed, shared vision of what a sustainable society would actually look like."[228]

Thus, for now, the creation of new markets for imaginary needs that depend upon intact and functional marine ecosystems offers real potential to change patterns of public consumption of marine resources even in the absence of wholehearted public commitment to sustainable development. Developments like St. Joe's RiverCamps, beach preservation in South Walton, and marine reserves that protect coral reefs and kelp forests for divers and snorkelers focus attention on the "lifestyle value" of intact and functional marine ecosystems and the amenities that they can provide.

The promotion of "lifestyle value" both creates and depends upon some public perception of scarcity, perhaps most obvious in

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225. For example, consider the educational and scientific optimism inherent in the following description of how to incorporate ecosystem services into natural resource management:

> Information about trade-offs that people are willing to make across alternative ecological services within the suite of feasible ecological services can be used to assess the desirability of different management outcomes. These trade-offs can be measured using both individual and collective values, and can be in monetary or nonmonetary units (scores, ratings, rankings). Evaluations of trade-offs are critical to finding management options that provide for the highest-value service flows from an ecosystem. For example, a management option that increases coastal wetlands are but reduces marsh-water edge would be evaluated by comparing the values for storm protection gained with the values for fishery habitat lost.
>
> Although a focus on trade-offs suggests that economic efficiency is an important criterion for measuring impacts on social welfare, other considerations — equity, sustainability, ecological stewardship, and cultural and ethical values — also provide important foundations for the decisionmaking process. Equity analyses require an estimation of who receives the service benefits or costs of management options, while sustainability and stewardship analyses focus on the intertemporal distribution of those services. Cultural and ethical considerations may place constraints on acceptable decisions.

Farber et al., *supra* note 218, at 122 (citations omitted).

226. *See* Costanza, *supra* note 4, at 206 (proceeding from the assumption that establishing the "goal of ecological sustainability" will be immediately implementable, politically).

227. *Id*. at 208.

228. *Id*. at 211.

the RiverCamp marketing: these lifestyle amenities are not available everywhere. As such, these developments offer the public concrete choices and create competition between traditional commodities users and the new amenities users, making increased preservation of marine ecosystems and their ecosystem services economically and politically viable.

WHAT *ARE* SLUGS GOOD FOR? ECOSYSTEM SERVICES AND THE CONSERVATION OF BIODIVERSITY

DALE D. GOBLE*

I. INTRODUCTION

The concept of "ecosystem services" was conceived as a tool for conserving biodiversity. Ecosystems, the argument goes, provide services that would be far more costly if we sought to provide them through engineered approaches; valuing the benefits that nature confers will help society more consciously evaluate the environmental tradeoffs between alternative actions. Given this objective, ecosystem services can be characterized as a "surrogate" for biodiversity—a step that makes explicit the assumption that, if we conserve ecosystem services, we will conserve biodiversity. It is this assumption that is the focus of this article. Surrogates are employed when it is difficult, expensive, or impossible to measure something. An examination of the concept of biodiversity demonstrates that it is such a something. Are ecosystem ser-

* Margaret Wilson Schimke Distinguished Professor of Law, University of Idaho. My thanks to Gretchen Daily, Holly Doremus, Bryan Norton, J.B. Ruhl, J. Michael Scott for their helpful comments, and the participants at the Symposium on The Law and Policy of Ecosystem Services organized by J.B and Jim Salzman at Florida State University College of Law -- it was a model of what such events should be. They all are, of course, absolved of any responsibility.

> *vices a suitable surrogate for biodiversity? A preliminary review suggests two problems. First, the spatial and temporal scales of biodiversity and ecosystem services differ substantially. Second, the utilitarian valuation that is implicit in the term "services" and explicit in the attempt to monetize that value also undercuts the usefulness of ecosystem services as a surrogate because it appears likely that there will always be a more "efficient" way to provide any specific service. Ultimately, whether ecosystem services are a suitable surrogate for biodiversity depends upon whether biodiversity has value beyond utility.*

What *are* slugs good for? They aren't tasty like cows or corn. They can't be bottled in garlic oil and sold as faux escargot. Slugs are neither charismatic[1] nor megafauna. Slugs are just icky.

Slugs do, however, serve a role in the ecosystems they inhabit. They are decomposers, chewing up leaves, feces, and other detritus and helping to recycle the nutrients back into the soil.[2] Slugs thus contribute to what has become known as "ecosystem services." In Gretchen Daily's frequently cited definition, ecosystem services are "the conditions and processes through which natural ecosystems . . . sustain and fulfill human life."[3] The service to which slugs contribute is replenishing soil fertility.

In defining ecosystem services, Daily noted that the concept had been born from the conclusion "that society is poorly equipped to evaluate environmental tradeoffs, and that the . . . continued resolution [of these tradeoffs] on the sole basis of the social, economic, and political forces prevailing today threatens environmental, economic, and political security."[4] The goal was to foster

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1. In the reverse psychology of such matters, the native slug of the Pacific Northwest, the banana slug, is the school mascot of the University of California, Santa Cruz. The species was not, however, chosen to grace the "tails" side of the new Washington state design for the quarter; the salmon was chosen instead. Richard Roessler, *In Search for Identity, Toss Goes to Fish,* THE SPOKESMAN-REVIEW, May 5, 2006, at 1A.

2. *See generally* ROBERT E. RICKLEFS, ECOLOGY 239-40 (3d ed. 1990).

3. Gretchen C. Daily, *Introduction: What are Ecosystem Services?, in* NATURE'S SERVICES 1, 3 (Gretchen C. Daily ed., 1997) [hereinafter NATURE'S SERVICES]. The same definition with a more expansive discussion can be found in Gretchen C. Daily et al., *Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems,* 2 ISSUES IN ECOLOGY 2 (1997), *available at* http://www.esa.org/science_resources/issues/FileEnglish/issue2.pdf; *see also* GEOFFREY HEAL, NATURE AND THE MARKETPLACE 1-3 (2000); Shahid Naeem, *Ecosystem Consequences of Biodiversity Loss: The Evolution of a Paradigm,* 83 ECOLOGY 1537, 1540 (2002); NATIONAL RESEARCH COUNCIL COMMITTEE ON ASSESSING AND VALUING THE SERVICES OF AQUATIC AND RELATED TERRESTRIAL ECOSYSTEMS, VALUING ECOSYSTEM SERVICES 1 (2005) [hereinafter cited as NRC AQUATIC COMMITTEE].

4. NATURE'S SERVICES, *supra* note 3, at 2. For an earlier statement of the problem, see Gretchen C. Daily et al., *Managing the Earth's Life Support Systems: The Game, the*

better understanding of the value of biodiversity by "characteriz[ing] the ways in which the earth's natural ecosystems confer benefits on humanity."[5] Ecosystem services are thus offered as a tool for conserving biodiversity. Specifically, valuing the benefits that nature confers will increase awareness and encourage conserving "natural ecosystems." As Geoff Heal noted, "Most of the services provided by natural ecosystems are dependent on adequate and appropriate biodiversity. So in selling any of these services we are obtaining an economic return on biodiversity."[6]

Since advocates of ecosystem services argue (at least in part) that the concept of ecosystem services will lead to the conservation of biodiversity, the concept can be characterized as a surrogate for biodiversity. Characterizing the relationship between ecosystem services and biodiversity as a surrogacy makes the conservation objective explicit, and it is the connection between ecosystem services and biodiversity that is the focus of this article. It is sufficient to note that, if the conservation of ecosystem services (the "surrogate") is to conserve biodiversity (the "target"), the services must be correlated to biodiversity so that changes in the services mirror changes in biodiversity. That is, if markets for ecosystem services are to conserve biodiversity then the service must be dependent upon biodiversity so that a reduction in biodiversity reduces the value of the service and thus provides a direct and immediate incentive to the decisionmaker to cease the destructive actions. Stated from the opposite perspective, if there is no necessary correlation between ecosystem services and biodiversity then there is no reason to assume that conserving ecosystem services will conserve biodiversity.

Examining the relationship between ecosystem services and biodiversity as a formal surrogacy relationship facilitates a more analytical examination and brings the issues into sharper relief. Does the concept of ecosystem services work as a surrogate for biodiversity? Can the concept be used to distinguish between good and bad policy choices? Will markets for these services provide incentives that foster choices that conserve biodiversity? Untangling these questions requires not only an examination of the concepts of biodiversity and ecosystem services, but also the idea of

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Players, and Getting Everyone to Play, 6 ECOLOGICAL APPLICATIONS 19 (1996). For amplification on the themes, see Gretchen C. Daily, *Countryside Biogeography and the Provisions of Ecosystem Services, in* NATURE AND HUMAN SOCIETY 104 (Peter H. Raven & Tania Williams eds., 1997).

5. NATURE'S SERVICES, *supra* note 3, at 2.

6. HEAL, *supra* note 3, at 106. Daily also makes the point implicitly. *See* Gretchen C. Daily, *Introduction: What are Ecosystem Services?, in* NATURE'S SERVICES 1, *supra* note 3, at 1-4.

surrogacy that ties them together.

II. THE CONCEPT OF BIODIVERSITY

Biodiversity has proven notoriously difficult to define or measure.[7] The National Research Council's Committee on the Noneconomic and Economic Value of Biodiversity began a chapter titled "What Is Biodiversity?" by noting that:

> The word *biodiversity* is used in many ways. Economists and ecologists, ranchers and gardeners, mayors and miners all view biodiversity from different perspectives. When people discuss biodiversity, they often use it as a surrogate for "wild places" or "abundance of species" or even "large, furry mammals." Yet from the viewpoint of those engaged in biodiversity-related sciences—such as population biology, ecology, systematics, evolution, and genetics—biodiversity has a specific meaning: "the variety and variability of biological organisms."[8]

Although the variety-and-variability definition is more specific than "wild places," it is only slightly so—the Committee itself spent twenty-three more pages amplifying the definition.[9] A con-

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7. This term was coined in the run-up to the National Forum on BioDiversity that was held in Washington, D.C. at the end of September 1986. Walter G. Rosen created the neologism by compressing the term "biological diversity." *See* DAVID TAKACS, THE IDEA OF BIODIVERSITY 34-40 (1996). The term quickly assumed an independent identity: "In 1988, *biodiversity* did not appear as a keyword in *Biological Abstracts,* and *biological diversity* appeared once. In 1993, *biodiversity* appeared seventy-two times, and *biological diversity* nineteen times." *Id.* at 39 (citation omitted) (emphasis in original). *See generally* Bryan Norton, *Toward a Policy-Relevant Definition of Biodiversity, in* 2 THE ENDANGERED SPECIES ACT AT THIRTY: CONSERVING BIODIVERSITY IN HUMAN-DOMINATED LANDSCAPES 49 (J. Michael Scott, et al. eds., 2006).

8. NATIONAL RESEARCH COUNCIL COMMITTEE ON NONECONOMIC AND ECONOMIC VALUE OF BIODIVERSITY, PERSPECTIVES ON BIODIVERSITY 20 (1999) [hereinafter cited as NRC BIODIVERSITY COMMITTEE]. The Committee's definition tracks the definition given by the congressional Office of Technology Assessment:

> Biological diversity refers to the variety and variability among living organisms and the ecological complexes in which they occur. Diversity can be defined as the number of different items and their relative frequency. For biological diversity, these items are organized at many levels, ranging from complete ecosystems to the chemical structures that are the molecular basis of heredity. Thus, the term encompasses different ecosystems, species, genes, and their relative abundance.

U.S. CONGRESS, OFF. OF TECH. ASSESSMENT, TECHNOLOGIES TO MAINTAIN BIOLOGICAL DIVERSITY box I-A, at 3 (1987) [hereinafter OTA].

9. NRC BIODIVERSITY COMMITTEE, *supra* note 8, at 20-42.

temporaneous discussion compiled nine additional variations on the variety-and-variability definition[10] and more continue to be drafted:

> Biodiversity is the variety of life. The concept of biodiversity includes the entire biological hierarchy from molecules to ecosystems, or the entire taxonomic hierarchy from alleles to kingdoms, all the logical classes in between (individuals, genotypes, populations, species, etc.), and all of the different members of all those classes. It also includes the diversity of living interactions and processes at all these levels of organization.[11]

E.O. Wilson captured the difficulty when he commented "it is, in one sense, everything."[12]

These variations on the theme of variety are descriptively powerful because they share a pervasive, intuitive understanding that nature is diverse. But this intuitive understanding masks complex questions concerning what variety and variability is crucial. Is it the uniqueness of each specimen or the variety and variability of a population, a subspecies, or a species? Should the focus instead be on assemblages of species such as communities, ecosystems, and landscapes? If answers to these questions are forthcoming they only produce more questions. For example, how is the variety and variability to be measured? Is it even measurable? As one mathematical ecologist has noted, "diversity is rather like an optical illusion. The more it is looked at, the less clearly defined it appears to be and viewing it from different angles can lead to different perceptions of what is involved."[13]

The lack of clarity substantiates Bryan Norton's conclusion that there can be no single "objective scientific definition" of biodiversity in the sense that there is a standard for measuring it.[14]

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10. Kevin J. Gaston, *What Is Biodiversity?, in* BIODIVERSITY 1, 1-2 & table 1.1 (1996).

11. Sahotra Sarkar & Chris Margules, *Operationalizing Biodiversity for Conservation Planning,* 27 J. BIOSCIENCE 299, 299 (2002). *See also, e.g.,* Kent H. Redford & Brian D. Richter, *Conservation of Biodiversity in a World of Use,* 13 CONSERVATION BIOLOGY 1246, 1247 (1999) ("the natural variety and variability among living organisms, the ecological complexes in which they naturally occur, and the ways in which they interact with each other and with the physical environment.").

12. E.O. Wilson, *Introduction, in* BIODIVERSITY II at 1, 1 (Marjorie L. Reaka-Kudla et al. eds. 1988).

13. ANNE E. MAGURRAN, ECOLOGICAL DIVERSITY AND ITS MEASUREMENT 1 (1988).

14. Bryan G. Norton, *On What We Should Save: The Role of Culture in Determining Conservation Targets, in* SYSTEMATICS AND CONSERVATION EVALUATION 23, 25-29 (P. Forey et al. eds. 1994).

Definitions and measures are tools that have utility to the extent that they help us navigate the world and not because they result from any "correspondence to prior realities."[15] The difficulty with the consensus, variety-and-variability definition is that it cannot be applied in the day-to-day universe where choices are constrained by limited resources. Since we can't protect every specimen—or even every place of biological interest—how can we decide what should be conserved?[16] There have been several suggestions for clarifying the concept of biodiversity so that it can be used as a guide for conservation decisions by focusing on either three hierarchical levels (genes, species, and ecosystems),[17] five biospatial levels (genes, populations, species, assemblages such as communities, and landscapes or ecosystems),[18] three nested scales (alpha, beta, and gamma diversity),[19] or three ecosystem attributes (composition, structure, and functions).[20] These approaches not only raise their own concerns,[21] but also demonstrate the importance of context. Michael Soule, for example, offered the five biospatial levels to call attention to "the biological and social contexts of conservation actions, particularly how both biogeography and political geography dictate different conservation tactics."[22] Reed Noss, on the other hand, focused on the three ecosystem attributes because he was seeking a method for selecting "indicators of biodiversity

15. Norton, *supra* note 7.

16. *See, e.g.,* Justin Garson et al., *Birds as Surrogates for Biodiversity: An Analysis of a Data Set from Southern Quebec,* 27 J. BIOSCIENCE 347 (2002). This issue is often discussed as a question of reserve planning. *See, e.g.,* Craig R. Groves et al., *Planning for Biodiversity Conservation: Putting Conservation Science into Practice,* 52 BIOSCI. 499 (2002); C.R. Margules & R.L. Pressey, *Systematic Conservation Planning,* 405 NATURE 243 (2000); Mark W. Schwartz, *Choosing the Appropriate Scale of Reserves for Conservation,* 30 ANNUAL REV. ECOLOGY & SYSTEMATICS 83 (1999).

17. ELLIOTT A. NORSE ET AL., CONSERVING BIOLOGICAL DIVERSITY IN OUR NATIONAL FORESTS 2-3 (1986); OTA, *supra* note 8, box I-A, at 3; NRC BIODIVERSITY COMMITTEE, *supra* note 8, at 2-3; ORGANISATION FOR ECONOMIC CO-OPERATION & DEVELOPMENT, SAVING BIOLOGICAL DIVERSITY 19-23 (1996) [hereinafter OECD].

18. Michael E. Soule, *Conservation: Tactics for a Constant Crisis,* 253 SCI. 744 (1991).

19. *See* NRC BIODIVERSITY COMMITTEE, *supra* note 8, at 23-24, 26-30; BRYAN G. NORTON, WHY PRESERVE NATURAL VARIETY? 31-34 (1987); R.H. MacArthur, *Patterns of Species Diversity*, 40 BIOLOGICAL REV. 510 (1965); ROBERT H. WHITTAKER, COMMUNITIES AND ECOSYSTEMS (1970); R.H. Whittaker, *Evolution and Measurement of Species Diversity*, 21 TAXON 213 (1972).

20. Reed F. Noss, *Indicators for Monitoring Biodiversity: A Hierarchical Approach*, 4 CONSERVATION BIOLOGY 355 (1990).

21. One difficulty that these approaches share is that many of the categories they employ are characterized by very blurry edges. Even the concept of "species"—the fundamental taxonomic unit of all biological classification—has proved remarkably resistant to clarity and unanimity. As the twentieth century's leading taxonomist and historian of biology noted, "There is probably no other concept in biology that has remained so consistently controversial as the species concept." ERNST MAYER, THE GROWTH OF BIOLOGICAL THOUGHT 251 (1982). This is perhaps less surprising when it is recalled that evolution is, after all, about continuums.

22. Soule, *supra* note 18, at 744.

for use in environmental inventory, monitoring, and assessment programs."[23] The difference between Soule's and Noss's approach reflects not only their differing objectives but also the impossibility of using a single metric to measure something that is "everything"—we can at best measure only parts of the irreducibly complex whole that we call biodiversity.[24]

The lack of clarity on what we mean by biodiversity is important not because there is some true definition waiting to be discovered, but because it reveals substantial uncertainties in our understanding of an important conservation objective. Our inability to define biodiversity means we cannot be sure that our conservation management is effective at conserving what we need to conserve to conserve biodiversity. In a political universe of constrained choices and the competing interest of the moment, such concerns quickly become political liabilities.[25] This difficulty reflects recurrent problems associated with attempting to measure and describe complex systems—a difficulty that has elsewhere led to the use of surrogates that can be measured.

III. ECOSYSTEMS, THEIR COMPOSITION, STRUCTURE, AND FUNCTION

Ecosystem services is neither a scientific concept nor something that is (at least in theory) measurable, like the number of species in an ecosystem or the pathways that carbon moves through that ecosystem, because the term "services" brings values into the question. Therefore, before examining the concept of ecosystem services, it is useful to examine the science behind the concept.

Ecosystems are generally described as an assemblage of organisms and the abiotic environment with which and within which the organisms interact:

> [a] community has a close-linked, interacting relation to environment, as climate and soil affect the

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23. Noss, *supra* note 20, at 356.

24. For example, Landres and his colleagues note in their discussion of indicator species that ecological criteria for selecting indicators may be either species-based or community-based depending upon whether a particular species or the quality of the community is of concern. The "types of data needed under each approach are different and, generally, cannot be substituted for one another." Peter B. Landres et al., *Ecological Uses of Vertebrate Indicator Species: A Critique*, 2 CONSERVATION BIOLOGY 316, 320 (1988).

25. For a description of how real-world complexity can be translated into ideological warfare see Joel Achenbach, *The Tempest*, WASH. POST, May 28, 2006, at W8, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2006/05/23/AR2006052301305_5.html (describing how the ambiguities of global climate change are manipulated by skeptics to undermine science).

> community and the community affects the soil and its own internal climate or microclimate, as energy and matter are taken from [the] environment to run the community's living function and form its substance, transferred from one organism to another in the community, and released back to [the] environment. A community and its environment treated together as a functional system of complementary relationships, and transfer and circulation of energy and matter, is an *ecosystem*.[26]

Ecologists who study ecosystems generally focus on the contributions of the interdependent parts of the system to its overall function by examining interactions such as the transformation of energy and the cycling of elements within an ecosystem.[27]

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26. WHITTAKER, *supra* note 19, at 1. *See also* NATURE'S SERVICES, *supra* note 3, at 2 ("An ecosystem is the set of organisms living in an area, their physical environment, and the interactions between them."); GENE E. LIKENS, THE ECOSYSTEM APPROACH: ITS USE AND ABUSE 9 (1992) ("a spatially explicit unit of the Earth that includes all of the organisms, along with all components of the abiotic environment within its boundaries"); NRC AQUATIC COMMITTEE, *supra* note 3, at 7; OECD, *supra* note 17, box 2, at 23 ("the plants, animals, microorganisms and physical environment of any given place, and the complex relationships linking them into a functional system"); ROBERT E. RICKLEFS, THE ECONOMY OF NATURE 3 (4th ed. 1997) ("Assemblages of organisms together with their physical and chemical environments"). From its inception, the concept has been focused on the interaction between the living and nonliving components of the biosphere. *See* A.G. Tansley, *The Use and Abuse of Vegetational Concepts and Terms,* 16 ECOLOGY 284, 299 (1935) ("Though the organisms may claim our primary interest, when we are trying to think fundamentally we cannot separate them from their special environment, with which they form one physical system.").

Our understanding of these interactions has changed as it has become increasingly apparent that ecosystems are not equilibrium systems - there is no "balance of nature." That is, ecosystems are not "static entities in equilibrium," but rather "complex systems that are dynamic and unpredictable across time and space." Tabatha J. Wallington et al., *Implications of Current Ecological Thinking for Biodiversity Conservation: A Review of the Salient Issues*, 10 ECOLOGY & SOC'Y (2005), *available at* http://www.ecologyandsociety.org/vol10/iss1/art15. Ecosystems, in other words, are historically contingent: they evolve over time as the biotic alters the abiotic and is in turn altered by the new environment. LIKENS, *supra*, at 10. At a global scale, for example, life has transformed this planet into a place that is hospitable to the life that has co-evolved with the changing abiotic environment that life itself has modified. One example is oxygen. Although early life was anaerobic, it produced oxygen as a waste product which (as the amount of oxygen in the atmosphere increased) provided a competitive advantage for organisms that could tolerate oxygen. *E.g.,* VLADIMIR N. BASHKIN, MODERN BIOGEOCHEMISTRY 24-27 (2002); RICKLEFS, ECOLOGY, *supra* note 2, at 33; *see generally* PETER WESTBROEK, LIFE AS A GEOLOGICAL FORCE (1991); Naeem, *supra* note 3, at 1540. Human impacts have come to play an increasingly dominant role. *See, e.g.,* Peter M. Vitousek et al., *Human Domination of Earth's Ecosystems,* 277 SCI. 494 (1997). Ecologists have come to recognize that current "natural" ecosystems are at least human-influenced. *See, e.g.,* Jesse Bellemare et al., *Legacies of the Agricultural Past in the Forested Present: An Assessment of Historical Land-Use Effects on Rich Mesic Forests*, 29 J. BIOGEOGRAPHY 1401 (2002); David Foster et al., *The Importance of Land-Use Legacies to Ecology and Conservation*, 53 BIOSCI. 77 (2003); Tansley, *supra* note 26, at 303-04. Simply removing the disturbance is thus no guarantee that the system will return to its previous status.

27. *E.g.,* RICKLEFS, ECONOMY OF NATURE, *supra* note 26, at 190-94.

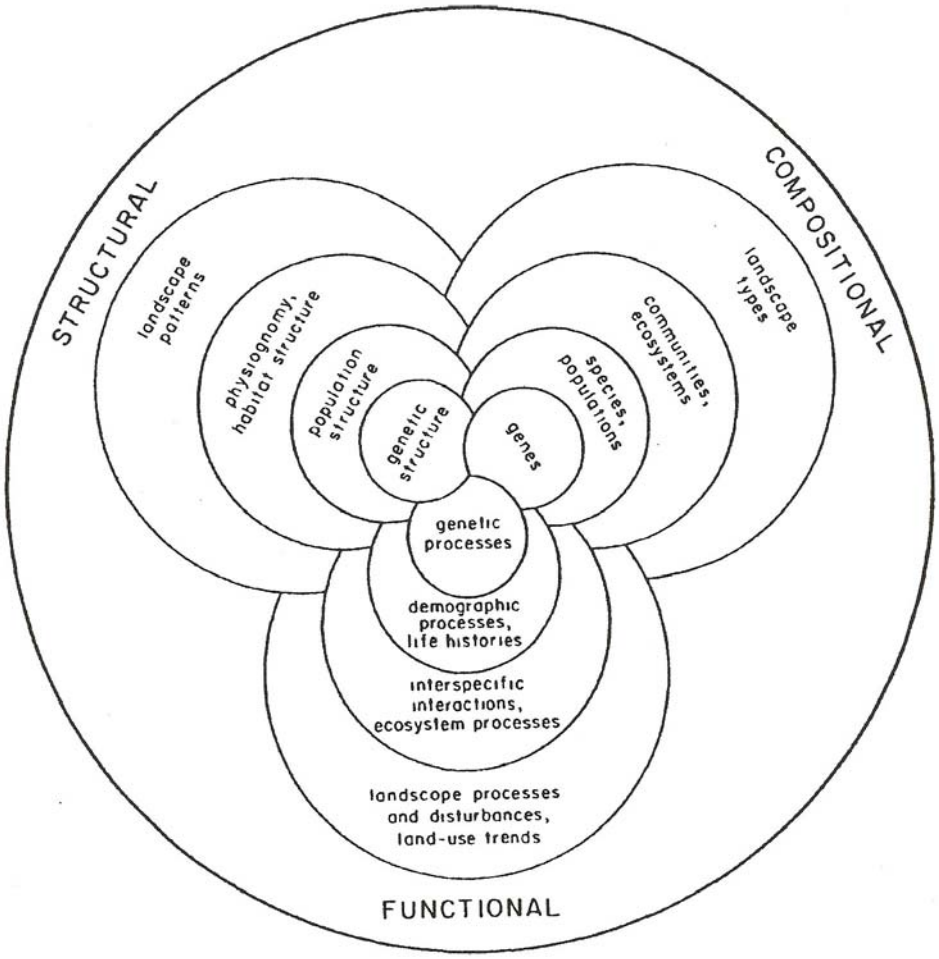

Figure 1.

Ecosystems are characterized by their *composition*, *structure*, and *function* (see figure 1).[28] Ecosystem *composition* refers to the array of organisms in the ecosystem. It includes not only lists of species, but also their relative abundance. The composition of the Pacific Northwest rainforest, for example, includes both banana slugs and Pacific yew.

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28. JERRY F. FRANKLIN ET AL., ECOLOGICAL CHARACTERISTICS OF OLD-GROWTH DOUGLAS-FIR FORESTS 2 (
1981); Jerry F. Franklin, *Structural and Functional Diversity in Temperate Forests*, *in* BIODIVERSITY 166, 169-71 (E.O. Wilson & Frances M. Peter eds., 1988); Noss, *supra* note 20, at 356-57. The NRC Aquatic Committee disregards the compositional component, presumably because it is focused on ecosystem services, which are tied to the other two characteristics. NRC AQUATIC COMMITTEE, *supra* note 3, box 3-1, at 60.

Ecosystem *structure* refers to the physical organization or spatial arrangement of the components of the system. Structure thus encompasses both the physical organization (standing dead trees and fallen logs, for example) and biological principles (the relationship between a primary producer, such as the yew, and a decomposer, such as the slug) that organize the relationships among these components.

Ecosystem *function* is the ecological and evolutionary processes that take place as a result of the interactions among the biotic and abiotic components of the ecosystem.[29] For example, primary production and decomposition are ecosystem functions. The yew demonstrates this interaction with the abiotic environment: as a primary producer, the plant relies upon solar energy to fuel photosynthesis that combines atmospheric carbon with water and a wide variety of other chemical elements (e.g., nitrogen, potassium, and sulphur) from the environment (often dissolved in water) that allows the plant to produce new compounds such as amino acids, proteins and the carbohydrate glucose. Primary producers are resources for herbivores, predators, parasites, bacteria, and (ultimately) decomposers such as the banana slug.[30]

Describing the *composition* and *structure* of an ecosystem is complex, but relatively straightforward; describing ecosystem *function* is more difficult because it must be inferred from the observed structure and "there is no explicit and invariant link between structure and function."[31] The problem is further complicated by the fact that the function of any specific ecosystem "is dependent not only on its composition, but also on linkages to surrounding systems and the impact of stressors."[32] For example, two wetlands with the same potential to sequester pollutants, modify nutrient loads, etc., are not identical if one is in an urban setting and the

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29. There is some linguistic ambiguity on the term "ecosystem function." de Groot, for example, separates ecosystem composition into ecosystem structures and ecosystem processes; the structures and processes in turn give rise to ecosystem functions, defined as "the capacity of natural processes and components to provide goods and services that satisfy human needs, directly or indirectly." (citation omitted). Ecosystem functions, in turn, produce goods and services. Rudolf S. de Groot et al., *A Typology for the Classification, Description and Valuation of Ecosystem Functions, Goods and Services,* 41 ECOLOGICAL ECON. 393, 394 (2002). It is not clear that the additional layer of complexity brings additional clarity. This Article follows the NRC Aquatic Committee and uses the terms as defined in the text: ecosystem structure means components, while ecosystem function means processes. The interaction of structure and function produce both goods (ecosystem structural components that are tangible commodities) and services (structural components and functions that are useful but not tangible commodities).

30. *E.g.,* RICKLEFS, ECOLOGY *supra* note 2, at 53-57; *see also* A.R. Main, *The Role of Diversity in Ecosystem Function: An Overview, in* BIODIVERSITY IN MEDITERRANEAN ECOSYSTEMS IN AUSTRALIA 77, 78-79 (Richard J. Hobbs ed., 1992).

31. NRC AQUATIC COMMITTEE, *supra* note 3, at 76.

32. *Id.*

other in a wilderness area because different surroundings create different opportunities.[33]

Much of the conservation effort over the past several decades has focused on ecosystem composition. Implementation of the Endangered Species Act,[34] for example, at least initially emphasized species. Conservation of structural and functional diversity has lagged because it runs counter to our culture's drive to reap the economic benefits that flow from simplifying ecosystems.[35] Ecosystem services, as you will recall, is an attempt to change the dynamics of such decision-making by valuing unaltered ecosystems.

IV. ECOSYSTEM GOODS AND SERVICES

Ecosystem composition and function are scientific descriptions of the relationships that operate within ecosystems. As such, they are (as far as is possible) value-free. Ecosystems can also be described in utilitarian, value-laden terms as providing *goods* and *services*. The relation between ecosystem composition and function, on the one hand, and ecosystem goods and services, on the other, is complicated at least in part because of this shift from description to prescription. There is no simple correlation between ecosystem composition and function, on the one hand, and ecosystem goods and services, on the other hand. Furthermore, the goods produced by an ecosystem are also dependent upon the services provided by that ecosystem. The yew that produces Taxol®,[36] for example, is dependent upon the banana slug for nutrient recycling.[37]

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33. *Id.* at 59; *see also id.* at 76-77.

34. 16 U.S.C. §§ 1531-44 (2000). If the ESA were only a species act, zoos and seed banks would be sufficient to satisfy its goals. Thus, the importance of the Act's statement of purpose: "The purposes of this Act are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved." § 1531(b). *See also* § 1532(16) (expansive definition of "species").

35. *See* Franklin, *supra* note 28, at 169-71. For an examination of the most common simplification see Donald Worster, *Transformations of the Earth: Toward an Agroecological Perspective in History,* 76 J. AM. HIST. 1087 (1990).

36. "Taxol" is the trade name for an anticancer agent synthesized from the Pacific yew. *See* American Chemical Society, The Pacific Yew, http://acswebcontent.acs.org/landmarks/landmarks/taxol/yew.html (last visited June 23, 2007); Sarah A. Laird & Kerry ten Kate, *Linking Biodiversity Prospecting and Forest Conservation, in* SELLING FOREST ENVIRONMENTAL SERVICES 151, 164 box 9.3 (Stefano Pagiola et al. eds., 2002); *New Source of Cancer Drug Spares Yew Tree,* N.Y. TIMES, Jan. 31, 1993, *available at* http://query.nytimes.com/gst/fullpage.html?sec=health&res=9F0CE7DE1331F932A05752C0A965958260.

37. This may be the meaning of a curious aspect of Daily's definition of ecosystem services. She begins with the statements that ecosystems provide three types of services: (1) maintenance of biodiversity and the output of ecosystem goods, (2) provision of basic life-support functions, and (3) provision of intangible aesthetic and cultural benefits. NATURE'S SERVICES, *supra* note 3, at 3. The first item on this list raises questions about the relation-

Ecosystem goods are familiar. They are the tangible bits of ecosystem composition that are commodities—the bauxite, timber, fish, Taxol®, and all the other "natural resources."[38] Although banana slugs are structural components of the Pacific rainforest ecosystem, they are not goods—at least until someone can re-conceive and package them as marketable commodities. In other words, goods are compositional elements of ecosystems, but not all compositional components are goods.

Ecosystem services, on the other hand, are less familiar—in part—because Daily and her colleagues have only recently crafted the concept. Ecosystem services are also less familiar because the physical, biological, and chemical processes at work in ecosystems (the ecosystem functions) are seldom experienced directly (or even seen) by those who benefit from those functions. As processes, they are simply part of the background that is the taken-for-granted world. The decomposition services provided by slugs, for example, is invisible to most people—and when it isn't, it's because slugs are decomposing something of value to humans.[39] Although some services are provided by structural components of ecosys-

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ship of biodiversity to ecosystem services: does biodiversity interact with the abiotic environment to produce the flow of goods and services, or do ecosystem services include biodiversity? That is, is biodiversity a producer of goods and a provider of services or is it an output of ecosystem services? Daily appears to argue that it is an output rather than the provider. What she may mean is suggested in a subsequent discussion of the dynamic, interactive relationship among the parts of ecosystems. Daily and her colleagues wrote, "Biodiversity is generated and maintained in natural ecosystems, where organisms encounter a wide variety of living conditions and chance events that shape their evolution in unique ways." NATURE'S SERVICES, *supra* note 3, at 5. The fact that the biotic and abiotic components of ecosystems are dynamic and interactive does not, however, render biodiversity an ecosystem service; nor does the fact that biodiversity creates biodiversity by rendering services to other species. Rather, it is the interaction of the biotic and abiotic environment that produces not only goods but also the physically observable manifestations of ecosystem functions that have been labeled ecosystem services. If these services are to serve as a surrogate for biodiversity, it seems important to keep the two distinct.

38. Categorizing something as a "resource" is a complex act of social definition that varies among cultures and over time. The anthropologist Eugene Hunn provides a simple example: suckers are a highly valued resource for the indigenous peoples of the Pacific Northwest because the species spawn two months prior to the earliest salmon runs into the basin; they are not, however, resources for Euro-Americans in the region and agencies nominally acting under "multiple-use resource management" systematically extirpate suckers from trout streams. Eugene S. Hunn, *Mobility as a Factor Limiting Resource Use in the Columbia Plateau of North America, in* NORTHWEST LANDS, NORTHWEST PEOPLES 156, 161 (Dale D. Goble & Paul W. Hirt eds., 1999). Bill Cronon's study of New England similarly demonstrates how the Indians and the English perceived the same habitat in dramatically different ways. WILLIAM CRONON, CHANGES IN THE LAND (1983). On the more general question of how societies create "natural resources" by valuing certain elements of their habitat, see WALTER FIREY, MAN, MIND AND LAND 27 (1960); Alexander Spoehr, *Cultural Differences in the Interpretation of Natural Resources, in* MAN'S ROLE IN CHANGING THE FACE OF THE EARTH 93 (William L. Thomas, Jr. ed., 1956); Carolyn Merchant, *The Theoretical Structure of Ecological Revolutions,* 11 ENVTL. REV. 265 (1987); Worster, *supra* note 35.

39. M.L. FLINT, UNIV. OF CAL., PEST NOTES: SNAILS & SLUGS (2003), *available at* http://www.ipm.ucdavis.edu/PDF/PESTNOTES/pnsnailsslugs.pdf.

tems, such as the pollination by animals, the tsunami protection afforded by coral reefs, and the flood risk reduction by wetlands, most ecosystem services are provided by ecosystem functions rather than structure. This array of "services" include:

* purification of air and water
* mitigation of droughts and floods
* generation and preservation of soils and renewal of their fertility
* detoxification and decomposition of wastes
* pollination of crops and natural vegetation
* dispersal of seeds
* cycling and movement of nutrients
* control of the vast majority of potential agricultural pests
* protection of coastal shores from erosion by waves
* protection from the sun's harmful ultraviolet rays
* stabilization of the climate
* moderation of weather extremes and their impacts
* provision of aesthetic beauty and intellectual stimulation that life the human spirit.[40]

Beyond this, and other similar[41] lists, definitions of ecosystem services tend to be overly general. The most frequently cited definition is that provided by Daily: ecosystem services are "the conditions and processes through which natural ecosystems ... sustain and fulfill human life."[42] The authors of the National Research Council report *Valuing Ecosystem Services* note that "the physical, biological, and chemical processes at work in natural ecosystems . . . are seldom experienced directly by users . . . Rather, it is the services provided by ecosystems, such as flood risk reduction and water supply . . . that create value for human users . . . ."[43] The *Millennium Ecosystem Assessment* defined ecosystem services even more generally as "the benefits provided by ecosystems" and lumped goods and services together.[44]

As noted, "ecosystem services" is not a scientific term, but

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40. NATURE'S SERVICES, *supra* note 3, at 3-4.

41. The National Research Council Committee's report offers two tables with five different lists. NRC AQUATIC COMMITTEE, *supra* note 3, at 80-81 tbl. 3-2. *See also* Claire Kremen, *Managing Ecosystem Services: What Do We Need to Know about Their Ecology?,* 8 ECOLOGY LETTERS 468, 470 (2005).

42. NATURE'S SERVICES, *supra* note 3, at 3. For the same definition with a more expansive discussion, see id. at 2.

43. NRC AQUATIC COMMITTEE, *supra* note 3, at 1.

44. MILLENNIUM ECOSYSTEM ASSESSMENT, ECOSYSTEMS AND HUMAN WELL-BEING: SYNTHESIS 39 (2005), *available at* http://www.maweb.org/proxy/document.356.aspx; *see also id.* at 40, Box 2.1.

rather a rhetorical approach that draws attention to the value of biodiversity to the public.[45] As such, the value-laden term "services" and the additional, utilitarian definitions perform satisfactorily because they draw attention to a previously little-noted group of benefits that nature provides our species. Ecosystem services thus provide a rhetorical tool for the conservation of nature. The question is whether the concept can provide more than rhetoric.

V. SURROGACY

It is not possible to measure everything. In many situations where it is too difficult or expensive to measure something directly, surrogates are used to provide the missing information.[46] A surrogate (or indicator) is a miners' canary—"an organism whose characteristics (*e.g.,* presence or absence, population density, dispersion, reproductive success) are used as an index of attributes too difficult, inconvenient, or expensive to measure for other species or environmental conditions of interest."[47] Monitoring water quality in drinking water systems, for example, is based in part on the presence of *Escherichia coli* (*E. coli*), a bacteria that is not harmful in itself but which is used to indicate the presence of other potentially harmful organisms because it is found only in human and animal fecal waste.[48] This is the first of two different contexts in which organisms have been used as surrogates: they are used to monitor the presence and effects of pollution.[49]

Organisms are also used as surrogates for changes in ecological factors such as population trends and habitat suitability. Surrogates have a long history in this field, beginning at least with C. Hart Merriam's use of vertebrates to define life zones in 1898.[50]

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45. *See supra* notes 5-6 and accompanying text.

46. Landres et al., *supra* note 24, at 317.

47. *Id. See generally* William A. Thomas, *Indicators of Environmental Quality: An Overview*, *in* INDICATORS OF ENVIRONMENTAL QUALITY 1 (William A. Thomas ed., 1972).

48. *See* Drinking Water Contaminants: Microorganisms, http://www.epa.gov/safewater/contaminants/index.html#micro (last visited June 23, 2007).

49. *See generally* NATIONAL RESEARCH COUNCIL COMMITTEE ON THE APPLICATIONS OF ECOLOGICAL THEORY TO ENVIRONMENTAL PROBLEMS, ECOLOGICAL KNOWLEDGE AND ENVIRONMENTAL. PROBLEM-SOLVING 81 (1986). This use of organisms is well developed. *See, e.g.,* A. JAMES & LILIAN EVISON, BIOLOGICAL INDICATORS OF WATER QUALITY (1979); MARGIT KOVACS, BIOLOGICAL INDICATORS IN ENVIRONMENTAL PROTECTION (1992); WAYNE R. OTT, ENVIRONMENTAL INDICES (1978); L. ELLIOT SHUBERT ED., ALGAE AS ECOLOGICAL INDICATORS (1984); IAN F. SPELLERBERG, MONITORING ECOLOGICAL CHANGE (1991); James R. Newman & R. Kent Schreiber, *Animals as Indicators of Ecosystem Responses to Air Emissions,* 8 ENVTL. MANAGEMENT 309 (1984).

50. C. Hart Merriam, Life Zones and Crop Zones of the United States (1898) (USDA, Division of Biological Survey Bulletin 10). *See also* VICTOR E. SHELFORD, THE ECOLOGY OF NORTH AMERICA (1963).

The use of surrogates has expanded significantly since the enactment of the numerous federal environmental and land-use management statutes of the 1970s. One widely known example is the U.S. Forest Service's reliance upon "management indicator species" to meet its statutory obligation to "provide for diversity of plant and animal communities."[51] Similarly, when the National Research Council sought to assess the U.S. Fish and Wildlife Service's management of listed species in the Klamath River Basin, it relied upon measurements of annual chlorophyll *a* concentrations as a surrogate for algal density during the annual algal blossom.[52]

The most common proposals for reducing the intractable complexity of biodiversity are three potential surrogates:

* *Genetic diversity:* the arguments in support of this alternative focus on the genetic basis of both intra- and inter-specific differences, as well as the fact that this is also the level at which evolutionary pressures operate.[53]
* *Species diversity:* this alternative has been the most common choice—which probably reflects the familiarity of "species" as the fundamental taxonomic unit as well as the relatively more complete documentation of the diversity and distribution of species.[54]
* *Landscape or ecosystem diversity:* those who favor this approach argue that the other alternatives fail to capture the dynamic interactions of communities and thus fail to conserve ecosystem functions. Furthermore, they argue, protecting landscapes will conserve species since landscapes are composed of species.[55]

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51. 16 U.S.C. § 1604(g)(3)(B) (2000). *See generally* Charles F. Wilkinson & H. Michael Anderson, *Land and Resource Planning in the National Forests,* 64 OR. L. REV. 1, 290-309 (1985). The agency's management approach was scientifically controversial. The approach assumed, first, that the surrogates provide a reliable assessment of habitat conditions and, second, that maintaining habitat for the indicator would ensure conditions suitable for other species. Both assumptions are open to dispute. *See* Landres et al., *supra* note 24.

52. *See* NATIONAL RESEARCH COUNCIL COMMITTEE ON ENDANGERED AND THREATENED FISHES IN THE KLAMATH RIVER BASIN, ENDANGERED AND THREATENED FISHES IN THE KLAMATH RIVER BASIN 110-16 (2004).

53. Terry L. Erwin, *An Evolutionary Basis for Conservation Strategies,* 253 SCI. 750 (1991); Daniel P. Faith, *Conservation Evaluation and Phylogenetic Diversity,* 61 BIOLOGICAL CONSERVATION 1 (1992); R.I. Vane-Wright et al., *What to Protect? Systematics and the Agony of Choice,* 55 BIOLOGICAL CONSERVATION 235 (1991); Paul H. Williams et al., *Do Conservationists and Molecular Biologists Value Differences Between Organisms in the Same Way?,* 2 BIODIVERSITY LETTERS 67 (1994).

54. *See, e.g.,* M. Philip Nott & Stuart L. Pimm, *The Evaluation of Biodiversity as a Target for Conservation, in* THE ECOLOGICAL BASIS OF CONSERVATION 125 (S.T.A. Pickett et al. eds., 1997).

55. *E.g.,* J. Michael Scott et al., *Species Richness: A Geographic Approach to Protecting*

Each proposal has its own shortcomings. Advocates for species diversity, for example, assume that conservation management actions targeted at species will conserve other taxa (such as subspecies and populations) as well as genetic diversity and ecosystem diversity—a claim that continues to be contested.[56]

To restate this more formally, surrogacy is a relationship between two variables, the surrogate (or indicator) and the target (or objective).[57] When the target (something of interest, such as biodiversity) either cannot be measured directly or economically, measurement of a surrogate may be substituted. The surrogate should meet two criteria: first, it should be relatively simple and economical to measure; and second, it should be correlated to the target so that changes in the surrogate track changes in the target. For our purposes, the issue is the degree of correlation between the proposed surrogate (ecosystem services) and target (biodiversity). Specifically, do changes in an ecosystem's output of services track changes in that ecosystem's diversity?[58]

It is helpful to distinguish between three degrees of correlation.[59] For example, the use of *E. coli* as a surrogate for water quality is a "first-order surrogate." Because it is found only in fecal material, the presence of *E. coli* in a drinking water system indicates that there is substantial probability that the water supply has been contaminated. The proposed genes, species, and landscape surrogates are similar to *E. coli*: measuring the variability of the chosen metric is claimed to be sufficiently correlated to biodiversity-in-general that changes in the surrogate track changes in biodiversity. Translated into a management context, the claim is that management actions that conserve genes or species or landscapes will conserve biodiversity. Although these are disputed correlations, they are nonetheless offered as factual (*i.e.,* measurable)

Future Biological Diversity, 37 BIOSCI. 782 (1987); *see generally* JAREN VERNER ET AL., WILDLIFE 2000 (1986).

56. *E.g.,* Sandy J. Andelman & William F. Fagan, *Umbrellas and Flagships: Efficient Conservation Surrogates or Expensive Mistakes?,* 97 PROC. NAT'L ACAD. SCI. 5954 (2000); D.B. Lindenmayer et al., *The Focal-Species Approach and Landscape Restoration: A Critique,* 16 CONSERVATION BIOLOGY 338, 340 (2002).

57. *See, e.g.,* Sarkar & Margules, *supra* note 11, at 304.

58. Advocates of ecosystem services such as Daily and Heal have not argued that services are a *formal* surrogate for biodiversity. My argument, however, is that, if ecosystem services are to be of value in conserving biodiversity, they must be correlated with that diversity—which is the role of a surrogate. The objective in examining the surrogacy relationship as a formal relationship thus is to expose the implicit issues in whether the ecosystem services can be used to conserve biodiversity.

59. What are here labeled first-order and second-order surrogates, Sarkar and Margules call "true surrogates" (surrogates that represent the target variable) and "estimator surrogates" (surrogates that have true surrogates as their target variable). Sarkar & Margules, *supra* note 11, at 304-05. Sarkar and Margules do not consider what I have denominated "third-order surrogates."

relationships that can in principle be verified or refuted.

A second-order surrogate is offered not as a measure of biodiversity (as is the case with a first-order surrogate) but rather as a measure of a first-order surrogate. Examples are the variety of proposals that rely upon different subsets of species composition such as flagship,[60] umbrella,[61] focal,[62] and keystone[63] species. Proponents of such categories of species have argued that they can be used as a measure of species diversity (the first-order surrogate) and, hence, as conservation management indicators because actions targeted at the subset will meet the conservation needs of other species (and thus of biodiversity-in-general).[64] These proposals are second-order surrogates because they would replace

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60. These are charismatic species that often have become the symbol for an entire conservation agenda. The northern spotted owl and the Florida panther are examples. Daniel Simberloff, *Flagships, Umbrellas, and Keystones: Is Single-Species Management Passé in the Landscape Era?,* 83 BIOLOGICAL CONSERVATION 247, 248-50 (1998). *See also* Andelman & Fagan, *supra* note 56.

61. Umbrella species require such large habitat blocks that they are thought likely to shelter other at-risk species as well. Spotted owls and Florida panthers are also umbrella species. *See* Simberloff, *supra* note 60, at 249-50; David Wilcove, *Getting Ahead of the Extinction Curve,* 3 ECOLOGICAL APPLICATIONS 218 (1993).

62. Andelman & Fagan, *supra* note 56; Robert J. Lambeck, *Focal Species: A Multi-Species Umbrella for Nature Conservation,* 11 CONSERVATION BIOLOGY 849 (1997); Lindenmayer et al., *supra* note 56.

63. Keystone species play a disproportionately significant role in shaping the ecosystems in which they are found. Robert T. Paine, *Food Web Complexity and Species Diversity,* 100 AM. NATURALIST 65 (1966). For example, sea otters are keystone species in the nearshore rocky ecosystem of the Pacific coast. The otter preys upon sea urchins, the primary herbivore in the ecosystem. Removal of otters leads to a population explosion of urchins that turn the kelp forests into "deserts" that support far fewer species. *See generally* Paul K. Dayton, *Experimental Studies of Algal Canopy Interactions in a Sea Otter-Dominated Kelp Community at Amchitka Island, Alaska,* 73 FISHERY BULL. 230 (1975); James A. Estes et al., *Sea Otter Predation and Community Organization in the Western Aleutian Islands, Alaska,* 59 ECOLOGY 822 (1978); James A. Estes & John F. Palmisano, *Sea Otters: Their Role in Structuring Nearshore Communities,* 185 SCI. 1058 (1974); L.F. Lowry & J.S. Pearse, *Abalones and Sea Urchins in an Area Inhabited by Sea Otters,* 23 MARINE BIOLOGY 213 (1973); Charles A. Simenstad et al., *Aleuts, Sea Otters, and Alternate Stable-State Communities,* 200 SCI. 403 (1978). Similarly, the foraging behavior of a guild of three desert-dwelling, seed-eating kangaroo rats prevents the establishment of tall perennial and annual grasses but increases the number of seed-eating birds: exclusion of the rats leads to the replacement of desert shrubs and animal species by grassland plants and animals. James H. Brown & Edward J. Teske, *Control of a Desert-Grassland Transition by a Keystone Rodent Guild,* 250 SCI. 1705, 1705 (1990). *See also* J.C. Castilla & L.R. Duran, *Human Exclusion from the Rocky Intertidal Zone of Central Chile: The Effects on Concholepas concholepas (Gastropoda),* 45 OIKOS 391 (1985) (removal of top predator, humans, increased species diversity); John Pastor, et al., *Moose, Microbes, and the Boreal Forest,* 38 BIOSCI. 770 (1988) (moose browsing changes plant community composition and soil microbial processes in boreal forests); W.G. Wharton & K.H. Mann, *Relationship Between Destructive Grazing by the Sea Urchin, Strongylocentrotus droebachiensis, and the Abundance of American Lobster, Homarus americanus, on the Atlantic Coast of Nova Scotia,* 38 CANADIAN J. FISHERIES & AQUATIC SCI. 1339 (1981) (overfishing of lobsters in the northwestern Atlantic altered balance among urchins, kelp, and other marine species).

64. *E.g.,* Andelman & Fagan, *supra* note 56, at 5954; Lindenmayer et al., *supra* note 56, at 340.

measurement of species diversity (the first-order surrogate) with measurement of one or a subset of species.

Other second-order surrogates rely upon vegetation types. The Gap Analysis Program, for example, seeks to conserve biodiversity by mapping land cover (vegetation types) based on satellite imagery.[65] Vegetation is the dominant structural component of ecosystems, providing not only habitat but food for a large variety of animal species—including many inconspicuous (and thus easily overlooked) species. It is, however, a second-order surrogate because the assumption is that land-cover is a reasonably accurate measure of species or landscape diversity (the first order surrogates).

Given the difficulty (if not impossibility) of monitoring and managing biodiversity-in-general, some simplifying measure is necessary—but all of the choices are by definition imperfect. It is the overwhelming complexity of biodiversity that necessitates the reductionistic use of a surrogate to begin with, and because all reductionistic decisions are choices, they pose risks.[66]

Ecosystem services *are* correlated with biodiversity—if only to

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65. *See generally* J. MICHAEL SCOTT ET AL., GAP ANALYSIS: A GEOGRAPHIC APPROACH TO PROTECTION OF BIOLOGICAL DIVERSITY (1993) (Wildlife Monographs No. 123); U.S GEOLOGICAL SURVEY, GAP ANALYSIS PROGRAM HISTORY AND OVERVIEW (2003), *available at* http://www.gap.uidaho.edu/portal/gap_fs2004.pdf; Official Description, http://gapanalysis.nbii.gov/portal/server.pt (follow "About GAP" hyperlink; then follow "official description" hyperlink) (last visited June 23, 2007) (describing the GAP Analysis Program).

66. Reed Noss, for example, offered a possible approach that began with the primary attributes of ecosystems—composition, structure, and function—and crafted a nested, hierarchical scheme that included each element at increasing geographic scales (*see* figure 1). Noss, *supra* note 20. Simberloff's response was that the proposal was "the *reductio ad absurdum* of th[e] confusion of goals" because it required monitoring "virtually *everything*." Simberloff, *supra* note 60, at 248. On the other hand, Peter Landres and his colleagues concluded that most of the ecological criteria that had been suggested for selecting surrogates lacked scientific rigor. As a result, "[u]sing indicators to assess population trends and habitat suitability for other species is inappropriate without confirmatory research"—which they acknowledged was prohibitively expensive. Landres et al., *supra* note 24, at 323.

The question of correlation thus becomes a question of risk: do you prefer Type I or Type II errors? Type I errors are false negatives; that is, a failure to detect a significant effect (*e.g.,* a correlation between two events); Type II errors, on the other hand, are false positives, incorrect claims that there is a significant effect. Scientists generally assume that Type I errors are less significant than Type II errors. This preference reflects the standard of lab-bench science where experiments are reproducible: a Type I, false-positive error is likely to lead future research astray, wasting resources; a Type II, false-negative error, on the other hand, may only result in delay. Where experiments can be duplicated, this is a prudent institutional preference. It is, however, a normative choice—both Type I and Type II errors *are* errors and there is no intrinsic reason to prefer one type to the other. Furthermore, in situations where there is more than epistemological risk—in the conservation of biodiversity or at-risk species, for example—the lab-bench preference may be imprudent since Type II errors generally will lead to failing to provide protection—and extinction is irreversible. K.S. Shrader-Frechette & E.D. McCoy, *Statistics, Costs and Rationality in Ecological Inference,* 7 TRENDS IN ECOLOGY & EVOLUTION 96 (1992); Daniel J. McGavey, *Making the Most of the "Best Data Available" in Endangered Species Act Science,* BIOSCI. (forthcoming).

the extent that the services are the product of some aspect of the biodiversity of a parcel. The proposed surrogacy relationship, however, is an unusual one. Proponents of the concept might be understood to be assuming that ecosystem services is a second-order surrogate that provides a measure of a first-order surrogate, ecosystem or landscape diversity. To the extent that ecosystem services depend upon ecosystem composition, structure, and function, it seems analogous to claims that umbrella or keystone species can serve as a second-order surrogate for species diversity. There is, however, a fundamental difference. Ecosystem services, unlike other second-order surrogates such as keystone species or landcover, changes the metric employed in measuring the surrogate: rather than employing a biological measurement (*e.g.,* populations of grizzly bears or old-growth rain forest), ecosystem services employs a utilitarian valuation (value to humans) that is further translated into dollars (*e.g.,* dollars per ton of carbon). That is, the translation of ecosystem function into services and then into dollars involves two value-laden transformations: from a biological function into a claim that something has value to humans and then into a monetization of that value. My concern is not with the *ability* to monetize the "services"—a topic that has attracted significant attention[67]—but rather with the shift between a biological and a non-biological metric to measure the surrogate.

To return to our question: is the concept of ecosystem services sufficiently correlated to biodiversity to serve usefully as a surrogate for biodiversity? There are two types of problems with the surrogacy relationship between ecosystem services and biodiversity. First, the scales (both spatial and temporal) of biodiversity and ecosystem services not only differ substantially but also do so in a consistent pattern that undercuts the surrogacy relationship. Second, the utilitarian valuation that is implicit in the term "services" and explicit in the attempt to monetize that value also militates against the usefulness of ecosystem services as a surrogate: it seems likely that there will always be a more "efficient" way to

67. Much of the work on ecosystem services has focused on developing methods for determining the economic value of ecosystem services. Daily, for example, has argued that the lack of markets for ecosystem services means that there are no price signals to reflect changes in supply or condition. "This is a major factor driving the . . . conversion [of natural ecosystems] to human-dominated systems . . . ." NATURE'S SERVICES, *supra* note 3, at 2. Several of the chapters in Daily's book address the valuation issue. *See, e.g.,* Lawrence H. Goulder & Donald Kennedy, *Valuing Ecosystem Services: Philosophical Bases and Empirical Methods, in* NATURE'S SERVICES 23 (Gretchen C. Daily ed., 1997); Robert Costanza & Carl Folke, *Valuing Ecosystem Services with Efficiency, Fairness, and Sustainability as Goals, in* NATURE'S SERVICES 49. *See also* NRC AQUATIC COMMITTEE, *supra* note 3; *Symposium,* 20 STAN. ENVTL. L.J. 309-536 (2001); James Salzman, *Creating Markets for Ecosystem Services: Notes from the Field,* 80 N.Y.U. L. REV. 870 (2005).

provide the specific service in question. This limitation is also a consistent problem since there does not appear to be a necessary correlation between services and diversity. Although marketing ecosystem services may benefit some of the biological diversity on a parcel of land, the absence of a necessary correlation between ecosystem services and biodiversity means that the marketing of ecosystem services cannot be expected to conserve all of the biodiversity associated with that parcel—particularly because much of the diversity associated with a parcel surrounds that parcel.

VI. *ECOSYSTEM* SERVICES AND SCALE

Biodiversity varies at both spatial and temporal scales: "patterns of diversity are caused by a variety of ecological and evolutionary processes, historical events, and geographical circumstances."[68] Although these scales are interrelated—increasing the spatial scale, for example, tends to increase the temporal scale of ecological processes (*i.e.,* bigger ecosystems generally change more slowly)—it is useful to examine them separately.

A. Spatial Scale

Spatial scale is a continuum that ranges from the dimensions of subatomic particles to the expanding universe. The spatial scale of biodiversity is more restricted, but still staggering as it ranges from the area used by a single microbe to the biosphere.

Scale plays a fundamental role in ecology because different aspects of biodiversity are present at different scales. Biodiversity, in other words, is nonlinear: it does not vary uniformly with varying scales. The diversity of local ecosystems, for example, is a dynamic interaction between local and regional processes. Local processes such as predation, competitive exclusion, and stochastic events tend to promote local extinction while regional processes such as species formation and dispersal add species to local assemblages. Species diversity at a small scale, in short, is influenced by events at much broader scales.[69] From the opposite perspective, local heterogeneity is generally averaged out at broader scales.[70] Similarly, although manipulation of a few hectares[71] is sufficient

68. Dolph Schluter & Robert E. Ricklefs, *Species Diversity: An Introduction to the Problem, in* SPECIES DIVERSITY IN ECOLOGICAL COMMUNITIES 1, 1 (1993).

69. *E.g.,* Robert E. Ricklefs, *Community Diversity: Relative Roles of Local and Regional Processes,* 235 SCI. 167, 167 (1987).

70. *See generally* J.A. Wiens, *Spatial Scaling in Ecology,* 3 FUNCTIONAL ECOLOGY 385 (1989).

71. A hectare is a unit of area equal to 2.47 acres.

to address questions of how individual shrubsteppe birds utilize habitat, addressing the same questions at a population level would require the manipulation of several square kilometers.[72] Furthermore, different types of processes seem to be dominant at different scales: mechanistic relationships between climate and vegetation that are present at broad scales are overwhelmed by biological processes at finer scales.[73] In part, this reflects the discontinuous, patchiness of habitats at finer scales: the remaining Pacific Northwest rainforest, for example, appears relatively uniform from the window of an airplane, but very patchy when one is trying to navigate off-trail.[74]

The crucial point is that ecosystems are dynamic and contingent upon their spatial context: they are both internally variable as well as open to interactions with other ecosystems across the range of spatial scales.[75] These variations are often nonlinear.

If ecosystem services are to operate as a surrogate for biodiversity, the services must be acquired/managed at biologically relevant spatial scales. This raises questions about the correlation of the scale of land ownership (since legal control will be necessary for market transactions) to the scale at which the desired service is produced. Buying half a wetland, for example, may provide the desired water purification services but fail to protect the biodiversity of the full wetland because it is now an "island" only half its previous size. Furthermore, even purchasing the entire wetland may be insufficient if its context is transformed by residential development.[76] Given the nonlinear variations in biodiversity, our boundaries—be they the Euclidean boundaries of township and section or the explanatory boundaries of patch and ecosystem—

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72. *See* John A. Wiens et al., *A Lesson in the Limitations of Field Experiments: Shrubsteppe Birds and Habitat Alteration,* 67 ECOLOGY 365, 374 (1986). A square kilometer is 100 hectares.

73. *See generally id.* at 386.

74. *See generally* CHRIS MASER, FOREST PRIMEVAL (Oregon State University Press 2001).

75. *See generally* Wallington et al., *supra* note 26.

76. *E.g.*, Larry D. Harris, *Edge Effects and Conservation of Biotic Diversity,* 2 CONSERVATION BIOLOGY 330 (1988); Janice M. Lord & David A. Norton, *Scale and the Spatial Concept of Fragmentation,* 4 CONSERVATION BIOLOGY 197 (1990); William D. Newmark, *Legal and Biotic Boundaries of Western North America National Parks: A Problem of Congruence*, 33 BIOLOGICAL CONSERVATION 197 (1985); William D. Newmark, *Extinction of Mammal Populations in Western North American National Parks*, 9 CONSERVATION BIOLOGY 512 (1995); Michael E. Soule & L. Scott Mills, *No Need to Isolate Genetics,* 282 SCI. 1658 (1998); Stanley A. Temple & John R. Cary, *Modeling Dynamics of Habitat-Interior Bird Populations in Fragmented Landscapes,* 2 CONSERVATION BIOLOGY 340 (1988); Ronald L. Westmeier et al., *Tracking the Long-Term Decline and Recovery of an Isolated Population*, 282 SCI. 1695 (1998); Richard Yahner, *Changes in Wildlife Communities Near Edges,* 2 CONSERVATION BIOLOGY 333 (1988). For a popular explanation see DAVID QUAMMEN, THE SONG OF THE DODO (1996).

frequently are not large enough to encompass the necessary spatial scales.[77]

B. Temporal Scale

As with spatial scale, temporal scale of biodiversity is a continuum that ranges from the very brief (the life span of a single microbe) to the all-but inconceivably long (the billions of years since life emerged on the planet). The organisms that are present at any given time at any particular place are a result of processes operating at all of these time scales.[78] Individual Douglas firs in the old-growth Pacific rainforest may be a millennium old having persisted through climatic fluctuations such as the Little Ice Age that contributed to the extinction of the Greenland Norse.[79] They structure a forest that includes many organisms whose lives are measured in hours or days at most.[80] Although individual trees may be ancient, they are part of a dynamic spatially and temporally patchy system: "The landscape consists of a continually changing mosaic of patches in different stages of succession . . . ."[81] As long as disturbances are small relative to the landscape and infrequent relative to recovery times, the landscape will be a shifting mosaic that maintains a relatively stable distribution of organisms.[82] As with spatial scale, however, temporal scale can involve nonlinear changes, particularly when disturbances are too large or too frequent. Ecosystems can flip between multiple, relatively stable conditions.[83]

Stated more generally, ecology is an historical science in which events play out over varying lengths of time and the outcome of random events, resource exploitation, and other disturbances may

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77. *See, e.g.,* Dale D. Goble, *The Property Clause - as if Biodiversity Mattered,* 75 U. COLO. L REV. 1195 (2004); Richard J. Hobbs, *Managing Ecological Systems and Processes, in* ECOLOGICAL SCALE 459, 467-80 (David L. Peterson & V. Thomas Parker eds. 1998).

78. Hobbs, *supra* note 77, at 472.

79. *E.g.,* JARED DIAMOND, COLLAPSE 219-20 (2005); EUGENE LINDEN, THE WINDS OF CHANGE 1-33 (2006).

80. *See generally* MASER, *supra* note 74.

81. Wallington et al., *supra* note 26. *See generally* DANIEL B. BOTKIN, DISCORDANT HARMONIES (1990); MASER, *supra* note 74.

82. *See* Monica G. Turner, *Landscape Ecology: Living in a Mosaic, in* ECOLOGY 77, 104-06 (Stanley I. Dodson et al. eds., 1998).

83. *See* C.S. Holling et al., *Biodiversity in the Functioning of Ecosystems: An Ecological Synthesis, in* BIODIVERSITY LOSS 44, 48-60 (Charles Perrings et al. eds. 1995); Robert M. May, *Thresholds and Breakpoints in Ecosystems with a Multiplicity of Stable States,* 269 NATURE 471 (1977); Marten Scheffer & Stephen R. Carpenter, *Catastrophic Regime Shifts in Ecosystems: Linking Theory to Observation,* 18 TRENDS ECOLOGY & EVOLUTION 648 (2003). *See also supra* note 63 (discussing the role of keystone species in maintaining alternative stable states)..

be unpredictable.[84] For example, a recent study of the seabed at the North Pole indicated that 55 million years ago the temperature was a balmy seventy-four degrees Fahrenheit—much warmer than climate models had suggested.[85] As one of the lead authors noted, "Something extra happens when you push the world into a warmer world, and we just don't understand what it is."[86] The Arctic Ocean reveals a pervasive—and often incorrect—assumption with which our species views the world: the future will be smooth curve from the present.

As with spatial scale, ecosystem services can operate as a surrogate for biodiversity only if the services are acquired and managed at biologically relevant temporal scales. Natural resource management, however, is dominated by economic and political time scales that are significantly shorter than an ancient Douglas fir. In the United States, for example, politics operates on election cycles of two to six years. As the last dozen presidential elections have demonstrated, it is difficult to maintain a consistent management approach for longer than two to three cycles.[87] Even when a general policy is maintained over lengthy periods from the human perspective, they are frequently too short to conserve biodiversity. For example, the temporal component of *sustained* yield in the multiple-use, sustained-yield paradigm that dominated the twentieth century resource management failed because it approached ecosystems from an engineering perspective that sought to reduce variability (in runs of salmon, for example) and ultimately reduced complexity and resilience of the system, contributing to its collapse.[88] Global climate change offers another obvious

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84. *See, e.g.*, Bellemare et al., *supra* note 26; Foster et al., *supra* note 26; Ricard V. Sole et al., *Self-Similarity of Extinction Statistics in the Fossil Record,* 388 NATURE 764 (1997).

85. Appy Sluijs et al., *Subtropical Arctic Ocean Temperatures during the Palaeocene/Eocene Thermal Maximum,* 441 NATURE 610 (2006); *see also* Kathryn Moran et al., *The Cenozoic Palaeoenvironment of the Arctic Ocean,* 441 NATURE 601 (2006); Henk Brinkhuis et al., *Episodic Fresh Surface Waters in the Eocene Arctic Ocean,* 441 NATURE 606 (2006).

86. Andrew C. Revkin, *Studies Portray Arctic as Sultry in Distant Past,* N.Y. TIMES, June 1, 2006, at A1 (quoting Henk Brinkhuis).

87. *Compare* NRDC: The National Forest Roadless Area Rule, http://www.nrdc.org/land/forests/qroadless.asp (last visited June 23, 2007), *with* Lost in the Woods: Bad Forest Policy Left and Right, http://www.cato.org/dailys/07-21-04.html (last visited June 23, 2007).

88. *See* C.S. Holling, *What Barriers? What Bridges?, in* BARRIERS AND BRIDGES TO THE RENEWAL OF ECOSYSTEMS AND INSTITUTIONS 3, 6-10 (Lance H. Gunderson et al. eds., 1995); C.S. Holling & Gary K. Meffe, *Command and Control and the Pathology of Natural Resource Management,* 10 CONSERVATION BIOLOGY 328 (1996); Gary K. Meffe, *Techno-Arrogance and Halfway Technologies: Salmon Hatcheries on the Pacific Coast of North America,* 6 CONSERVATION BIOLOGY 351 (1992). *See generally* Dale D. Goble, *Salmon in the Columbia Basin: From Abundance to Extinction, in* NORTHWEST LANDS, NORTHWEST PEOPLES 229 (Dale D. Goble & Paul W. Hirt eds. 1999).

example.

The focus on present value and the concomitant discounting of the future that is central to most economic theory also produces a short temporal scale. As Colin Clark argued—and the colloquial "shoot, shovel, and shut-up" demonstrates—the extinction of a species will often be the economically rational choice.[89] Furthermore, the economic perspective informs us that we should not worry about such irreversible events: since resources are fungible (that is, there is always some other resource that can meet the desire) and man-made capital can be substituted for natural capital so there is no absolute scarcity.[90] Stated differently, irreversible changes to ecosystems such as extinction do not prejudice the future because of the substitutability of one resource for another.[91]

The crucial point is that our resource management and market allocation systems have histories measured at most in decades—a period that is far too short to assess their impacts when the systems of concern cycle on centuries and millennia. Given the lag times in such systems our species is likely to ignore or discount gradual changes (such as global climate change) and then be surprised by the major shift that occurs when an unrecognized threshold is crossed.

C. Scale Redux

Ecosystem services thus correlate poorly with both the spatial

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89. Colin W. Clark, *Profit Maximization and the Extinction of Animal Species,* 81 J. POL. ECON. 950 (1973). *See also* Jon H. Goldstein, *The Prospects for Using Market Incentives for Conservation of Biological Diversity, in* THE PRESERVATION AND VALUATION OF BIOLOGICAL RESOURCES 246 (Gordon H. Orians et al. eds., 1990); Roger G. Noll, *Commentary, in* THE PRESERVATION AND VALUATION OF BIOLOGICAL RESOURCES 269 (Gordon H. Orians et al. eds., 1990). As the editor of a collection of essays on conservation through use commented, "[t]he attempt to derive conservation advantage from using wildlife should not be seen as a bold new conservation initiative for it is not proactive at all; it is a concerned response to an existing, and worsening, situation." Melvin Bolton, *Synthesis and Conclusions, in* CONSERVATION AND THE USE OF WILDLIFE RESOURCES 253, 266 (M. Bolton ed. 1997).

90. *E.g.,* Stefan Baumgartner et al., *Relative and Absolute Scarcity of Nature: Assessing the Roles of Economics and Ecology for Biodiversity Conservation,* 59 ECOLOGICAL ECON. 487 (2006); Bryan G. Norton, *Evaluating Ecosystem States: Two Competing Paradigms,* 14 ECOLOGICAL ECON. 113 (1995); Robert M. Solow, *The Economics of Resources or the Resources of Economics,* 64 AM. ECON. REV. PROC. 1 (1974).

91. *E.g.,* Baumgartner, *supra* note 90; Norton, *supra* note 90. Economics is simply irrelevant in realms where such substitutability does not exist. Economists do recognize that some things should be preserved for their "amenity value" -- "It is perfectly okay, it is perfectly logical and rational, to argue for the preservation of a particular species or the preservation of a particular landscape. But it has to be done on its own, for its own sake, because this landscape is intrinsically what we want." Robert M. Solow, *Sustainability: An Economist's Perspective, in* ECONOMICS OF THE ENVIRONMENT 179, 181 (Robert Dorfman & Nancy S. Dorfman eds, 4th ed. 1993). *See also* Robert M. Solow, *On the Intergenerational Allocation of Natural Resources,* 88 SCANDINAVIAN J. ECON. 141 (1986).

and temporal scale of biodiversity. On the one hand, the spatial scale at which the desired service is produced is unlikely to correspond to the scale of land ownership which is both highly fragmented (thus too small) and Euclidean (thus too rectangular). Both characteristics suggest that our boundaries seldom will be large enough or fluid enough to encompass the appropriate scales. Similarly, the temporal scale of ecosystem functions is orders of magnitude greater than the temporal scale of the political and valuation systems that guide natural resource management decision making. Both shortcomings are compounded by the often-nonlinear nature of ecosystem functions at both scales: the history of resource management has been a series of surprises—that there were no more buffalo, passenger pigeons, or salmon.[92]

VII. ECOSYSTEM *SERVICES* AND UTILITY

The description of ecosystem structure and function as goods and services is intrinsically a value statement. To label some elements of an ecosystem a good or a service—the shift from trees to timber and from decomposition to soil fertility—is only to say that some bit of nature is a "resource" because it has utility to our species.

Daily, Heal, and other advocates of ecosystem services frequently refer to the ecosystems that provide the desired services as "natural." In the recurrently cited definition of the concept, Daily wrote that ecosystem services are "the conditions and process through which *natural* ecosystems . . . sustain and fulfill human life."[93] She also is careful to distinguish between natural and human-dominated ecosystems.[94] The biology, however, is less conclusive on this rhetorical dichotomy between natural and human-dominated landscapes—in a world of global climate change where the flesh of polar bears is laced with PCBs, dichotomies dissolve into continuous shades of gray.

Human-dominated ecosystems produce not only "human" goods and services—cows and corn, for example—they also produce "natural" ecosystem services such as carbon sequestration. Although much of the human-dominated landscape is engineered, it nonetheless retains "natural" constituents and functions; the car-

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92. Dale D. Goble, *Three Cases / Four Tales: Commons, Capture, the Public Trust, and Property in Land,* 35 ENVTL. L. 807 (2006).

93. NATURE'S SERVICES, *supra* note 3, at 3 (emphasis added). Similarly, Heal writes: "*Natural* ecosystems are the essential, low-level infrastructure upon which human activities and built systems rest." HEAL, *supra* note 3, at 3 (emphasis added).

94. NATURE'S SERVICES, *supra* note 3, at 2-3. *See also* HEAL, *supra* note 3, at 3-4.

bon sequestration in a suburban ecosystem may be less than in a forest, but the suburb's trees and shrubs also provides this service. Although it is doubtless true that at some point the degradation reaches a point at which the service provided by the ecosystem is so trivial as to be irrelevant (see cartoon), the point is that we face a continuum rather than a dichotomy.

Furthermore, the utility of ecosystem function and process is captured (to the extent that it is captured) only in the output of services. The focus on market-driven services means that only the biodiversity needed to produce the specific service will be valued in transactions for that service. Carbon sequestration is currently a hot market—the 2006 Super Bowl, for example, proudly claimed to be "carbon neutral."[95] There are several non-profit and for-profit companies currently offering carbon neutrality generally as a mix of sources such as fuel efficiency, alternative energy sources, and carbon sequestration through planting trees.[96] The website for one of the non-profit organizations captures the crucial point when it when it quotes an attorney for the Natural Resources Defense Council: "the [Climate] Trust is the largest buyer [of offsets] with an environmental . . . as opposed to corporate cost minimization."[97] The attorney's point, of course, is that cost-minimization comes at an environmental cost.

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95. Marc C. Trexler & Laura H. Kosloff, *Selling Carbon Neutrality,* 23 ENVTL. F. 34, 35 (2006). If recycling is too complex or you can't imagine giving up your Hummer, then you can buy an environmental indulgence in the form of trees in Kentucky or wind energy in Washington. *E.g.,* Christine Larson, *A New Way to Ask, "How Green Is my Conscience?,"* N.Y. TIMES, June 25, 2006, at 3.6; Anthony DePalma, *Gas Guzzlers Find the Price of Forgiveness,* N.Y. TIMES, Apr. 22, 2006, at A1.

96. *See, e.g.,* The Climate Trust, http://www.climatetrust.org/index.php (last visited June 23, 2007); Carbonfund, http://www.carbonfund.org/site/ (last visited June 23, 2007); The CarbonNeutral Company, http://www.carbonneutral.com (last visited June 23, 2007).

97. About the Climate Trust, http://www.climatetrust.org/about_us.php (visited June 23, 2007). For discussions of individual sequestration projects see Climate Trust Projects: Deschutes Riparian Restoration, http://www.climatetrust.org/offset_deschutes.php (last visited June 23, 2007); Climate Trust Projects: Preservation of a Native Northwest Forest, http://www.climatetrust.org/offset_native.php (last visited June 23, 2007); Climate Care, Uganda: Helping Climate and Primate, http://www.climatecare.org/projects/countries/uganda (last visited June 23, 2007).

The limited data available suggests that this is what is occurring. As a group of advocates noted in an editorial in *Science*, the degree to which biodiversity and ecosystem services coincide "depend[s] on complex, and at present little-understood, interactions between biodiversity and resultant ecosystem services."[98] The most detailed examination of these interactions is a study that examined six ecosystem services in the central coast ecoregion of California.[99] Chan and his colleagues concluded that "[t]he average correlation between biodiversity and [ecosystem] services is low."[100]

A similar conclusion was reached in an examination of the

98. Patricia Balvanera et al., *Conserving Biodiversity and Ecosystem Services,* 291 SCI. 2047 (2001).

99. Kai M. Chan et al., *Conservation Planning for Ecosystem Services,* 4 PLOS BIOLOGY 2138, 2138 (2006), *available at* http://www.plosbiology.org. The services evaluated in the study were carbon sequestration, crop pollination, flood control, forage production, outdoor recreation, and water provision. *Id.* at 2139.

100. *Id.* at 2144-45.

common approach to carbon sequestration, monoculture tree plantations.[101] A review of some 504 plantations revealed that the higher productivity and biomass of these plantations in relation to diverse forests generally required additional water and fertilizers and produced increased soil acidity.[102] The authors of the article urged greater regulation of carbon sequestration services to protect ecosystem functions—hardly a promising conclusion given the touted benefits of market-based approaches. Although they did not examine biological diversity, it seems probable that biodiversity also was reduced in plantation forests (even ignoring the loss of plant diversity).

Ultimately, the utilitarianism that dominates the services discourse undercuts the claim that it will preserve natural ecosystems. If the value of nature is that it has utility as a source of services, then it can almost certainly be improved upon. It should hardly be surprising that there is little correlation between services and diversity since ecosystem services mimic other resource management strategies that have sought to implement the utilitarian vision—genetically modified poplars sequester far more carbon far more rapidly than diverse, non-engineered forests.[103] Strategies such as multiple-use, sustained-yield have also generally resulted in simplified ecosystems and a loss of biodiversity.[104] There is no apparent reason to assume that the utilitarian perspective embedded in ecosystem services will yield different results—with utility as our guide ecosystem services becomes multiple-use, sustained-yield (version 2.0).

At bottom, this should not be unexpected. Economics and ecology embody strikingly different understandings of nature. Economists view nature (and hence biodiversity) as a storehouse of products (resources). This reflects an axiomatic proposition of economic theory: no resource (product) is irreplaceable because a variety of products can satisfy any desire. Scarcity, on this view, is relative (some products are more expensive because they are scarcer), linear (the transition between sources of satisfaction will be smooth[105]), and choice-based. Ecologists, on the other hand, are

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101. *E.g.,* Robert B. Jackson et al., *Trading Water for Carbon with Biological Carbon Sequestration,* 310 SCI. 1944, 1944 (2005); Jeffery A. Wright et al., *Latin American Forest Plantations: Opportunities for Carbon Sequestration, Economic Development, and Financial Returns,* J. FORESTRY, Sept. 2000, at 20, 21-23. *See also* S. Pacala & R. Socolow, *Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies,* 305 SCI. 968, 970 table 1 (2004).

102. Jackson et al., *supra* note 101.

103. *See* Jackson et al., *supra* note 101; Wright et al., *supra* note 101, at 22.

104. *See, e.g.,* Dale D. Goble, *Salmon in the Columbia Basin: From Abundance to Extinction, in* NORTHWEST LANDS, *supra* note 88, at 243-52; Worster, *supra* note 35.

105. *E.g.,* Robert M. Solow, *The Economics of Resources or the Resources of Economics*,

concerned with the function and integrity of the ecosystem which is often absolute (extinction is not reversible), nonlinear (recall the multiple relatively stable points[106]), and unconcerned with human desires.[107]

VIII. SOME CAUTIONARY CONCLUSIONS

My argument has been that, if markets for ecosystem services are to conserve biodiversity-in-general then ecosystem services must coincide with biodiversity. One way to evaluate this coincidence is to examine the fidelity of ecosystem services as a surrogate for biodiversity. That is: ecosystem services must be correlated to biodiversity so that marketing an ecosystem's services *necessarily* conserves that ecosystem's diversity. The evidence suggests two problems that make this correlation unlikely. The first is the differing spatial and temporal scales of services and biodiversity. The second is the utilitarianism embedded in the concept of services. The combination of the two make the necessary correlation between services and the full complement of diversity unlikely.

The problem is that many ecosystem structural components—such as banana slugs—have no apparent utility to our species. Thus, there is no reason not to simplify ecosystems—and thus to reduce biodiversity—as long as the total output of goods and services from that ecosystem at the present moment is maximized.[108] As Aldo Leopold wrote in *The Land Ethic*, "One basic weakness in a conservation system based wholly on economic motives is that most members of the land community have no economic value."[109]

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supra note 90, at 3.

106. *See supra* note 82.

107. As one overview noted:

> It may well be that natural systems are not so very fragile: they are, after all, complex adaptive systems that will probably change and become new systems in the face of environmental stresses. What *is* fragile, however, is the maintenance of the services on which humans depend. There is no reason to expect systems to be robust in protecting those services—recall that they permit our survival but do not exist by virtue of permitting it.

SIMON A. LEVIN, FRAGILE DOMINION 15 (1999).

108. The posited correlation between stability and diversity remains contested and uncertain. *See, e.g.,* F. Stuart Chapin III et al., *Consequences of Changing Biodiversity,* 405 NATURE 234 (2000); C.S. Holling et al., *Biodiversity in the Functioning of Ecosystems: An Ecological Synthesis, in* BIODIVERSITY LOSS 44, 48-54 (Charles Perrings et al. eds. 1995); Naeem, *supra* note 3; Garry Peterson et al., *Ecological Resilience, Biodiversity, and Scale,* 1 ECOSYSTEMS 6 (1998); Wallington et al., *supra* note 26.

109. ALDO LEOPOLD, *The Land Ethic, in* A SAND COUNTY ALMANAC AND SKETCHES HERE AND THERE 201, 210 (1949). As Harold Morowitz noted, "The answer to 'How much is

As a result, what we value as a good or service is less than the whole diversity of any place.

Ultimately, the issue is one of value—that slippery term that is central to both economics and ethics. If we value biodiversity only for its utility, then parts of the whole are without value; the banana slug is good for nothing. On such a view, ecosystem services are a good surrogate to the extent that they can be easily observed. If, however, biodiversity is or should be valued for reasons that go beyond utility—if "[a] thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community," in Leopold's phrase[110]—then the concept of ecosystem services is a surrogate that is potentially dangerously misleading.

My argument might seem to demand too much, to be jousting with a straw man. After all, ecosystem services have been offered as a tool to facilitate the conservation of biological diversity, not as a surrogate for that diversity. My purpose, however, is to introduce a note of caution: by itself, the conservation of ecosystem services is unlikely to conserve biodiversity writ large.[111] This is not to say that ecosystem services may not be beneficial in conserving some of the biodiversity on a particular parcel—only that it is unlikely to be a magic bullet in conserving biological diversity.[112] As is often the case, win-win scenarios are broadly appealing but often involve self-deception.[113] Although the relationship between ecosystem services and biodiversity is biologically attenuated, the concept has always owed more to rhetoric than to biology. As Bryan Norton has noted, communicating in the political and social arenas to politicians and the public requires attention to rhetoric.[114] To the extent that it has rhetorical power in convincing the public that biodiversity should be conserved because it has value to out species, the concept itself has utility.

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a species worth?' is 'What kind of world do you want to live in?'" Harold J. Morowitz, *Balancing Species Preservation and Economic Considerations,* 253 SCI. 752, 754 (1991). *See also* David Ehrenfeld, *The Conservation Dilemma, in* THE ARROGANCE OF HUMANISM 176 (1978).

110. LEOPOLD, *supra* note 109, at 224-25.

111. Chan et al., *supra* note 99, at 2148, 2150.

112. *Id.* at 2150.

113. William H. Rodgers, Jr., *The Myth of Win-Win: Misdiagnosis in the Business of Reassembling Nature,* 42 ARIZ. L. REV. 297 (2000). *See generally* KAREN A. CERULO, NEVER SAW IT COMING (2006); DOMINIC D.P. JOHNSON, OVERCONFIDENCE AND WAR (2004). *Cf.*Andrew C. Revkin, *Carbon Neutral is Hip, But Is It Green?,* N.Y. TIMES, Apr. 29, 2007, § 4 (Week in Review), at 1 ("An environmental movement that's just about perfect for consumers").

114. Norton, *supra* note 7, at 57-58.

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THE STRUCTURE OF THE LAND USE REGULATORY SYSTEM IN THE UNITED STATES

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I. INTRODUCTION

Land use regulation is one of the most poorly understood areas of law and public policy in the United States. At the same time, land use regulation is one of the most pervasively influential, and therefore important, areas of law and public policy in the United States. Through land use regulation, we shape the communities and environments in which we live, work, and play.

Land use law and policy are blamed for many social problems, such as urban sprawl,[1] racial segregation,[2] environmental injus-

1. Philip J. Tierney, *Bold Promises but Baby Steps: Maryland's Growth Policy to the Year 2020*, 23 U. BALT. L. REV. 461, 462—63 (1994) (noting that the lax regulatory patterns generated by local governments have caused unplanned sprawl). *See generally* JONATHAN LEVINE, ZONED OUT: REGULATION, MARKETS, AND CHOICES IN TRANSPORTATION AND METROPOLITAN LAND-USE 86-108 (2006) (examining whether zoning is a state regulation or a local property right); Henry R. Richmond, *Sprawl and Its Enemies: Why the Enemies are Losing*, 34 CONN. L. REV. 539 (2002) (discussing the failure and inability of sprawl opponents to adapt land use policy to consensus values and social change).

2. *See* Spencer v. Kugler, 404 U.S. 1027, 1029 (1971) (Douglas, J., dissenting) (describing the use of zoning and land use regulation to segregate and discriminate by race); Bradley C. Karkkainen, *Zoning: A Reply to the Critics*, 10 J. LAND USE & ENVTL. L. 45, 54 (1994); Joel Kosman, *Toward an Inclusionary Jurisprudence: A Reconceptualization of Zoning*, 43 CATH. U. L. REV. 59, 59—62 (1993) (arguing that zoning is based on racist and classist origins that have been legitimized by the police power of local governments).

tice,[3] degraded water quality and watershed health,[4] loss of biodiversity and natural habitat for imperiled species,[5] poor air quality,[6] and inadequate supplies of affordable housing.[7] In addition, the land use regulatory system has been characterized as wasteful or inefficient,[8] captured by self-seeking private interests,[9] abusive of individual rights,[10] fragmented and chaotic,[11] ill-informed,[12] rac-

3. *See* Robert D. Bullard, *Environmental Justice in the Twenty-first Century*, *in* THE QUEST FOR ENVIRONMENTAL JUSTICE: HUMAN RIGHTS AND THE POLITICS OF POLLUTION 19, 32-33 (Robert D. Bullard, ed. 2005); Craig Anthony (Tony) Arnold, *Planning Milagros: Environmental Justice and Land Use Regulation*, 76 DENV. U. L. REV. 1 (1998) [hereinafter Arnold, *Planning Milagros]*.

4. DEV., CMTY., & ENV'T DIV., U.S. ENVTL. PROT. AGENCY, EPA-231-R-01-002, OUR BUILT AND NATURAL ENVIRONMENTS: A TECHNICAL REVIEW OF THE INTERACTIONS BETWEEN LAND USE, TRANSPORTATION, AND ENVIRONMENTAL QUALITY 15—19 (2001), *available at* http://www.epa.gov/dced/pdf/built.pdf [hereinafter BUILT AND NATURAL ENVIRONMENTS REPORT] (discussing the adverse impacts on water quality and watershed health caused by development); Tierney, *supra* note 1, at 461 (arguing that inadequate land use regulations have contributed to the degradation of the Chesapeake Bay).

5. BUILT AND NATURAL ENVIRONMENTS REPORT, *supra* note 4, at 12 ("Habitat loss and fragmentation are two of the most direct impacts of development on previously undeveloped land.").

6. *See* Amanda Siek, Comment, *Smart Cities: A Detailed Look at Land Use Planning Techniques That Are Aimed at Promoting Both Energy and Environmental Conservation*, 7 ALB. L. ENVTL. OUTLOOK 45, 46 (2002) (faulting zoning for causing sprawl and increased traffic congestion, which leads to air pollution).

7. Jonathan Douglas Witten, *The Cost of Developing Affordable Housing: At What Price?*, 30 B.C. ENVTL. AFF. L. REV. 509, 524 (2003). *See also* A. Dan Tarlock, *Consistency with Adopted Land Use Plans as a Standard of Judicial Review: The Case Against*, 9 URB. L. ANN. 69, 71 (1975) [hereinafter Tarlock, *Consistency*] (arguing that a broad discretionary zoning system resulting in zoning changes fails to ensure adequate and affordable housing).

8. *See* Robert C. Ellickson, *Alternatives to Zoning: Covenants, Nuisance Rules, and Fines as Land Use Controls*, 40 U. CHI. L. REV. 681, 682—87 (1973) [hereinafter Ellickson, *Alternatives to Zoning*]; Karkkanian, *supra* note 2, at 61—64; Douglas W. Kmiec, *Deregulating Land Use: An Alternative Free Enterprise Development System*, 130 U. PA. L. REV. 28, 30—31 (1981); Tarlock, *Consistency, supra* note 7, at 72 (contending that a system characterized by a sequence of zoning changes results in "inefficient land resource allocations").

9. *See* RICHARD A. EPSTEIN, TAKINGS: PRIVATE PROPERTY AND THE POWER OF EMINENT DOMAIN 263—73 (1985); JOE R. FEAGIN & ROBERT PARKER, BUILDING AMERICAN CITIES: THE URBAN REAL ESTATE GAME 2 (2d ed. 1990); DENNIS R. JUDD, THE POLITICS OF AMERICAN CITIES: PRIVATE POWER AND PUBLIC POLICY 1-9 (3d ed. 1988); ROBIN PAUL MALLOY, PLANNING FOR SERFDOM: LEGAL ECONOMIC DISCOURSE AND DOWNTOWN DEVELOPMENT 140 (1991); BERNARD H. SIEGAN, PROPERTY AND FREEDOM: THE CONSTITUTION, THE COURTS, AND LAND-USE REGULATION 179—201 (1997); Richard Briffault, *Our Localism: Part I—The Structure of Local Government Law*, 90 COLUM. L. REV. 1, 3—5 (1990); Robert C. Ellickson, *Suburban Growth Controls: An Economic and Legal Analysis*, 86 YALE L.J. 385, 407—08 (1977) [hereinafter Ellickson, *Suburban Growth Controls*] (arguing that officials in large, centrally located cities are more vulnerable to capture by self-seeking private interests since officials in these communities are in greater need of campaign contributions than those in smaller suburbs, where the main concern is exclusionary zoning); Jerry Frug, *The Geography of Community*, 48 STAN. L. REV. 1047, 1047—48 (1996); Karkkanian, *supra* note 2, at 59 (noting that substantial evidence supports the proposition that some zoning officials will approve development proposals only in exchange for campaign contributions, patronage jobs, bribes, and other subsidies).

10. *See* Karkkanian, *supra* note 2, at 52 (observing that some critics find zoning fundamentally unfair because it bestows benefits on some property owners, while declining those same benefits to other property owners). *See also* MIKE DAVIS, CITY OF QUARTZ: EXCAVATING THE FUTURE IN LOS ANGELES 151—219 (1992); EPSTEIN, *supra* note 9, at 263—73;

ist,[13] class-biased,[14] undisciplined,[15] and environmentally destructive.[16]

The land use regulatory system is frequently expected to solve complex public policy problems (e.g., degraded watersheds and other degraded ecological conditions, regional housing needs, limited local government revenues, under-producing economic conditions locally) and then criticized for its failure to do so.[17] Critics may contend that the land use regulatory system inherently or structurally lacks the capacity to address the particular identified problem, or may even cause or contribute to the problem.[18]

FEAGIN & PARKER, *supra* note 9, at 2; JUDD, *supra* note 9, at 1—9; MALLOY, *supra* note 9, at 140; SIEGAN, *supra* note 9, at 179—201; Joe R. Feagin, *Arenas of Conflict: Zoning and Land Use Reform in Critical Political-Economic Perspective*, *in* ZONING AND THE AMERICAN DREAM 73, 84 (Charles M. Haar & Jerold S. Kayden eds., 1990);.

11. *See* Carol M. Rose, *Planning and Dealing: Piecemeal Land Controls as a Problem of Local Legitimacy*, 71 CAL. L. REV. 837 (1983); A. Dan Tarlock, *The Potential Role of Local Governments in Watershed Management*, 20 PACE ENVTL. L. REV. 149, 157-58, 166-68 (2002) [hereinafter Tarlock, *Watershed*]; Michael R. Yarne, Note, *Conformity as Catalyst:* Environmental Defense Fund v. Environmental Protection Agency, 27 ECOLOGY L.Q. 841, 850 (2000) (noting that the land use system is fragmented among county governments, municipalities, and state transportation agencies, which causes a deficiency in policy and institutional systems in addressing regional issues such as air pollution).

12. *See, e.g.*, David W. Owens, *The Zoning Variance:Reappraisal and Recommendations for Reform of a Much—Maligned Tool*, 29 COLUM. J. ENVTL. L. 279, 280 (2004) ("A conventional wisdom has developed that . . . uneducated lay boards apply their peculiar notion of justice rather than judiciously applying narrowly defined legal standards . . . .").

13. *See* FEAGIN & PARKER, *supra* note 9, at 2; JUDD, *supra* note 9, at 1—9; Bullard, *supra* note 3, at 32-33; Jon C. Dubin, *From Junkyards to Gentrification: Explicating a Right to Protective Zoning in Low-Income Communities of Color*, 77 MINN. L. REV. 739, 740—44 (1993); Feagin, *supra* note 10, at 84; Karkkanian, *supra* note 2, at 54 (citing Kosman, *supra* note 2, at 71-77); Yale Rabin, *Expulsive Zoning: The Inequitable Legacy of Euclid*, *in* ZONING AND THE AMERICAN DREAM, *supra* note 10, at 101.

14. *See* sources cited *supra* note 12.

15. *See, e.g.*, Owens, *supra* note 12, at 280 (observing that the administration of variances is undisciplined in that they tend to be arbitrarily given). *See also* Rose, *supra* note 11.

16. BRUCE BABBITT, CITIES IN THE WILDERNESS: A NEW VISION OF LAND USE IN AMERICA 4-5, 70-71 (2005); Craig Anthony (Tony) Arnold, *Is Wet Growth Smarter Than Smart Growth?: The Fragmentation and Integration of Land Use and Water*, 35 ENVTL. L. REP. 10152 (2005) [hereinafter Arnold, *Is Wet Growth Smarter?*] (summarizing smart growth literature demonstrating the impact of land use on the environment and analyzing the impact of land use on waters and watersheds); John Harte, *Land Use, Biodiversity, and Ecosystem Integrity: The Challenge of Preserving Earth's Life Support System*, 27 ECOLOGY L.Q. 929, 947 (2001); Tarlock, *Watershed, supra* note 11, at 157-58, 166-68; Tarlock, *Consistency, supra* note 7, at 71 (noting that land use policies that allow for discretionary zoning changes fail to provide environmental protection).

17. *See* Karkkanian, *supra* note 2, at 47 n.8 (explaining that zoning has a "'vital social function' it is thought to perform, even though in many instances actual performance falls short of the perceived ideal."). *See also* Briffault, *supra* note 9, at 3—5; Frug, *supra* note 9, at 1047—48.

18. Daniel R. Mandelker, *Controlling Nonpoint Source Water Pollution: Can It Be Done?*, 65 CHI.-KENT L. REV. 479, 489 (1989); J.B. Ruhl et al., *Proposal for a Model State Watershed Management Act*, 33 ENVTL. L. 929 (2003); Tarlock, *Watershed, supra* note 11, at 157-58, 166-68; James C. Buresh, Note, *State and Federal Land Use Regulation: An Application to Groundwater and Nonpoint Source Pollution Control*, 95 YALE L.J. 1433, 1439-41

These criticisms reflect misunderstandings of land use law and policy. The analytical starting point of these critical assessments is a set of theoretical and arguably misplaced assumptions about how land use regulation is or ought to be structured, instead of how land use regulation actually operates in the United States.

If we are to improve our land use practices in the United States, land use law and policy should be studied and understood as a system with its own distinctive characteristics and functions. Understanding any system requires studying its structure on its own terms, instead of imposing a set of expectations on it. Land use planning, regulation, and law form a system of institutions and processes. The system has functions, scale, components, processes, and values. The system is dynamic, adaptive, and functional. This article serves, in part, to describe this system from a broad perspective. In this respect, this article is part of a general body of scholarship on land use regulation.

In addition, the structure of the land use regulatory system can tell us quite a bit about the role that land use regulation, especially local land use regulation, can play in addressing specific public policy problems. This symposium issue of the *Journal of Land Use and Environmental Law* examines the law and policy of ecosystem services. There is little doubt that we should be giving attention to the relationship between land use and ecosystem management and conservation. Land use patterns and practices harm ecosystems and the services that ecosystems provide nature and society.[19] In addition, local governments face substantial obstacles to using land use regulatory powers to protect ecosystems.[20] At the same time, some of the most impressive legal and policy developments in ecosystem protection in recent years have

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(1986); Barry T. Woods, Comment, *Environmental Land Use, Indirect Source Controls and California's South Coast Plan; Is the Day of Attainment Coming?*, 23 ENVTL. L. 1273, 1277-82 (1993).

19. Harte, *supra* note 16, at 947 ("[T]he effects of most environmental threats to humanity are greatly exacerbated by land use practices that destroy habitat and degrade ecosystem processes that provide ecological services to humankind.").

20. *See id.* at 955, 959—65 (recognizing the challenge of implementing pro-environment land use practices in the face of the overwhelming sentiment that private property rights allow landowners to do what they want on their land and further arguing that the legal instruments currently used to solve environmental problems might be inadequate to address the protection of biodiversity); Francesca Ortiz, *Biodiversity, the City, and Sprawl*, 82 B.U. L. REV. 145, 169—72 (2002) (citing various challenges to biodiversity protection including the presence of non-native species, the imbedded notion of private property rights in citizens, and the already wounded ecosystems in suburban and urban developments); A. Dan Tarlock, *Local Government Protection of Biodiversity: What is Its Niche?*, 60 U. CHI. L. REV. 555, 557—58 (1993) [hereinafter Tarlock, *Niche*] (observing the problem that jurisdictional boundaries pose for local governments and land use planners since these boundaries often do not match the habitat of the species).

occurred in the land use regulatory system.[21] Scholars vigorously debate the potential role of local land use regulation in protecting ecosystems.[22] The concept of ecosystem services is that nature provides society certain highly valuable services —natural capital— that should be valued and conserved like any productive capital.[23]

Thus, this article serves a second purpose: to analyze whether the land use regulatory structure can value and conserve ecosystem services. It argues that the land use regulatory system has great potential for incorporating concepts and considerations of ecosystem services into land use actions and decisions. However, the land use regulatory system cannot and will not serve as an entire ecosystem protection system or as an entire market for valuing and investing in nature's services.

Section II of this article describes three misunderstandings of the land use regulatory system as diminutive, venal, and inadequate, and calls for understanding land use regulation as a functional system.

Sections III through VII of the article describe the structure of the land use regulatory system, a structure that may underlie the surface of land use regulation. First, the system serves primarily to mediate between physical and social environments—between people and places and between human communities and nature's communities. In doing so, the land use regulatory system also mediates between power and community and between freedom and boundaries. Second, the land use regulatory system is a system of "regulatory patches" that are located in the United States primar-

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21. *See* JOHN R. NOLON, OPEN GROUND: EFFECTIVE LOCAL STRATEGIES FOR PROTECTING NATURAL RESOURCES (2002) [hereinafter NOLON, OPEN GROUND]; JOHN R. NOLON, WELL GROUNDED: USING LOCAL LAND USE AUTHORITY TO ACHIEVE SMART GROWTH (2001) [hereinafter NOLON, WELL GROUNDED]; John R. Nolon, *In Praise of Parochialism: The Advent of Local Environmental Law*, 26 HARV. ENVTL. L. REV. 365 (2002) [hereinafter Nolon, *In Praise of Parochialism*]. *See also* Ortiz, *supra* note 20, at 172—81 (noting that land use systems, such as conservation easements, land trusts, controlled growth, and smart growth, have been recently used to limit the impact of urbanization and can contribute to biodiversity protection).

22. *See, e.g.*, Craig Anthony (Tony) Arnold, *Clean-Water Land Use: Connecting Scale and Function*, 23 PACE ENVTL. L. REV. 291 (2006) [hereinafter Arnold, *Clean-Water Land Use*]; Buresh, *supra* note 18 (arguing that the federal government should intervene in the local land use regulatory scheme to remedy the deficits of the system in addressing groundwater and nonpoint source pollution).

23. James Salzman, *A Field of Green? The Past and Future of Ecosystem Services*, 21 J. LAND USE & ENVTL. LAW 133, 134 (2006) [hereinafter Salzman, *A Field of Green?*] ("[E]cosystem services provide both the conditions and processes that sustain human life," but these services are rarely given value in the marketplace). *See generally* James Salzman, *Valuing Ecosystem Services*, 24 ECOLOGY L.Q. 887 (1997) [hereinafter Salzman, *Valuing Ecosystem Services*] (discussing the services provided by ecosystems, the problem of valuing these services, and the role of environmental law in promoting widespread comprehension of ecosystem services).

ily at the local level of governance and decision making, but operate in the shadows of: a) the super-dominance of private control of land, and b) overlays of federal and state land use regulations. The land use regulatory system is not one of nested regulatory hierarchies, as it is sometimes misperceived. Third, the land use regulatory system is composed of numerous component parts and processes. It is not adequate to speak of the land use regulatory system merely in terms of land, legal principles and rules, the activities of planning and regulating, or even all three of these. The system is shaped by strong influences of social, political, economic, psychological, cultural, and ethical forces and encompasses a wide variety of activities, including deliberation and decision, problem solving, operation and maintenance of land activities, and study and assessment, among others. Moreover, the land use regulatory system is "thin" on law and "thick" on policy, with its legal content being far more about tools, authority, and discretionary choice than about rules, limits, and remedies (although these do exist within the system). Finally, even though the land use regulatory system has values, norms, and ethical choices, it is not characterized by a single "land use ethic" or "land ethic." As a mediating system—as opposed to a constitutive, distributive, or protective system—land use regulation can facilitate or implement the ethical understandings that people develop about their relationships with their natural and social environments.

Section VIII of this article discusses what the underlying structure of the land use regulatory system means for incorporating considerations of ecosystem services into land use in the United States. In several respects, the land use regulatory system will not and cannot meet the demands for land uses to account for and protect ecosystem services. At its core, the land use regulatory system is not an ecosystem protection system. It is concerned with many aspects of human-environment relationships, some of which have very little to do with natural ecosystems. Social forces that have very little to do with ecosystem services often operate on the land use regulatory system, and the system functions at scales that typically do not correspond to the natural scales of ecosystems.

On the other hand, several aspects of the land use regulatory system offer great potential for incorporating considerations of nature's services into how land is used in the United States. These include the obvious relationship between land use and the healthy functioning of ecosystems, the role of the land use regulatory system as a mediator between people and their environments (including facilitating their understanding and valuing of ecosystem services), the system's alternative to traditional markets, and the

demonstrated capacity of local land use regulators to address the specific ecosystem impacts of land use and land development activity. It is likely that the land use regulatory system will continue to adapt to value and conserve ecosystem services, and more generally to protect certain aspects of ecosystems that are increasingly valued in society.

II. MISUNDERSTANDING LAND USE REGULATION

One common misunderstanding of land use regulation is to think of it as a sub-field of another area of law. Another is to use selected theories and examples of land use policy failure to formulate a structural model of land use regulation as inherently inefficient, unfair, or destructive. A third is to expect land use regulation to produce particular substantive results or to function as a model for public problem solving.

A. The Diminutive Land Use System

As an area of study, land use regulation is typically treated as a sub-category of another area of law, such as property, constitutional law, environmental law, administrative law, or local government law.[24] This treatment can result not so much from an explicit categorization process as from the ways by which scholars study land use regulation. For example, many scholarly articles address the constitutional issues that arise in government regulation of land use.[25] The issues receiving the greatest attention include takings (especially regulatory takings and exactions), due process, equal protection, free speech protections, the free exercise

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24. *See, e.g.*, DANIEL R. MANDELKER, LAND USE LAW 1-1 to 1-3 (5th ed. 2003) (arguing that a constitutional law framework "provides a unifying structure for land use law"); Karkkanian, *supra* note 2, at 65 (noting that zoning operates similarly to a "property rule," although the analogy is somewhat imperfect); Michael Allan Wolf, *Fruits of the "Impenetrable Jungle": Navigating the Boundary Between Land-Use Planning and Environmental Law*, 50 WASH. U. J. URB. & CONTEMP. L. 5 (1996) (discussing the unclear boundaries between land use and environmental law).

25. *See, e.g.*, Vicki Been, *"Exit" as a Constraint on Land Use Exactions: Rethinking the Unconstitutional Conditions Doctrine*, 91 COLUM. L. REV. 473 (1991); James H. Freis, Jr. & Stefan V. Reyniak, *Putting Takings Back Into the Fifth Amendment: Land Use Planning After* Dolan v. City of Tigard, 21 COLUM. J. ENVTL. L. 103 (1996); Michael S. Giaimo, *Challenging Improper Land Use Decision-Making Under the Equal Protection Clause*, 15 FORDHAM ENVTL. L. REV. 335 (2004); R.S. Radford, Of Course *a Land Use Regulation that Fails to Substantially Advance Legitimate State Interests Results in a Regulatory Taking*, 15 FORDHAM ENVTL. L. REV. 353 (2004); Shelley Ross Saxer, *When Religion Becomes a Nuisance: Balancing Land Use and Religious Freedom When Activities of Religious Institutions Bring Outsiders into the Neighborhood*, 84 KY. L.J. 507 (1995—96); Parna A. Mehrbani, Comment, *Substantive Due Process Claims in the Land-Use Context: The Need for a Simple and Intelligent Standard of Review*, 35 ENVTL. L. 209 (2005).

of religion, federalism and the Commerce Clause, and federal supremacy/preemption issues. To be sure, many important constitutional issues arise in the context of land use regulation. However, thinking of land use as largely a set of issues about constitutional constraints on government regulation is terribly misguided. While constitutional rights and structural provisions provide some very broad parameters for land use regulators (mostly local government officials), state statutes and provisions in local city codes and charters provide legal parameters that are more numerous, more frequently applicable, and more constraining than are constitutional doctrines.[26] The most significant limits to local land use regulation, though, are not legal at all, but instead are physical, political, socio-cultural, psychological, financial, and economic constraints.[27] Many aspects of land use regulation do not raise constitutional issues in any meaningful way. Those land use issues involving constitutional questions typically arise from fact patterns and institutional contexts that do not fit neatly into elegant theories of constitutional law. It is no wonder that those studying land use from a constitutional perspective seem to dwell on a perceived intellectual bankruptcy of constitutional doctrines as applied to land use matters.[28]

The same type of problems arise from the treatment of land use regulation as essentially a field of property law, environmental law, administrative law, or local government law. For example, many aspects of land use regulation—such as the role of comprehensive planning or the types of landscape buffering that are appropriate to particular types of development—do not fit neatly into the "what is property?" question, whether analyzed from a "bundle of rights" or a "web of interests" perspective.[29] A property analysis treats the vast array of land use regulatory activities and functions

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26. *See* Melvyn R. Durchslag, *Forgotten Federalism: The Takings Clause and Local Land Use Decisions*, 59 MD. L. REV. 464, 465 (2000) (noting that it is far more probable that land use regulations will be enacted by local governments, rather than state or federal governments).

27. *See* Arnold, *Clean-Water Land Use, supra* note 22 (noting that the difficulty in regulating land use to maintain water quality stems in part from the reality that watersheds often cross political boundaries); Ruhl et al., *supra* note 18 (noting the economic, geographical, and political constraints inherent in watershed management).

28. *See, e.g.*, Been, *supra* note 25; J. Peter Byrne, *Ten Arguments for the Abolition of the Regulatory Takings Doctrine*, 22 ECOLOGY L.Q. 89 (1995); Dubin, *supra* note 13; Jeanne L. Schroeder, *Never Jam To-day: On the Impossibility of Takings Jurisprudence*, 84 GEO. L.J. 1531 (1996).

29. *See* Craig Anthony (Tony) Arnold, *The Reconstitution of Property: Property as a Web of Interests*, 26 HARV. ENVTL. L. REV. 281, 345—50 (2002) [hereinafter Arnold, *Reconstitution of Property*](describing the "bundle of rights" and "web of interests" concepts as applied to land use and regulatory takings and noting the limitations of each).

as a subset of public property rights,[30] a type of commons,[31] or part of the boundaries or limits on private property rights and interests.[32] This analysis is only helpful at the most general level, though. It fails to inform our understanding of land use in any meaningful and deep way because it does not tell us very much about: 1) how land use regulation differs from other limits on private property, other types of public property, or other commons; 2) why different substantive choices about land uses are made by different decision makers; and 3) whether the land use regulatory system serves different functions and uses different methods and processes than the system of private property rights in the United States. Private arrangements, community custom and practices, and judge-created common law define property, whereas government policy—more than any other source—defines land use regulation. There is also an intellectual asymmetry to treating land use regulation as a subset of property because property rights serve as limits on the land use regulatory system, just as much as land use regulations serve as limits on the system of private property. Land use regulation and property rights are related, yet coequal areas of legal analysis.

Likewise, the questions asked by environmental law, administrative law, and local government law differ from those asked by land use regulation, even though the fields are related. Some, perhaps even many, land use decisions have impacts on the natural environment and human health,[33] are made by administrative bodies,[34] and/or are exercises of local government authority,[35] yet

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30. *See, e.g.*, WILLIAM A. FISCHEL, THE ECONOMICS OF ZONING LAWS: A PROPERTY RIGHTS APPROACH TO AMERICAN LAND USE CONTROLS (1985); LEVINE, *supra* note 1, at 86-108.

31. *See, e.g.*, Karkkainen, *supra* note 2, at 65-78 (arguing that zoning serves to protect property owners' interest in "the neighborhood commons").

32. *See, e.g.*, ERIC T. FREYFOGLE, BOUNDED PEOPLE, BOUNDLESS LANDS: ENVISIONING A NEW LAND ETHIC 46 (1998) [hereinafter FREYFOGLE,BOUNDED PEOPLE] ("In urban settings, landowner autonomy has diminished under an outpouring of zoning ordinances and health and safety rules."); ROBERT H. NELSON, ZONING AND PROPERTY RIGHTS: AN ANALYSIS OF THE AMERICAN SYSTEM OF LAND-USE REGULATION 7-10 (1977) (tracing the basis for zoning to nuisance law); Mark W. Cordes, *Property Rights and Land Use Controls: Balancing Private and Public Interest*, 19 N. ILL. U. L. REV. 629 (1999) (discussing how land use controls are limits on property rights).

33. *See generally* NEW GROUND: THE ADVENT OF LOCAL ENVIRONMENTAL LAW (John R. Nolon ed., 2002); JOHN RANDOLPH, ENVIRONMENTAL LAND USE PLANNING AND MANAGEMENT (2004); LINDA A. MALONE, ENVIRONMENTAL REGULATION OF LAND USE (1990 & Supp. 2006).

34. *See* DANIEL P. SELMI & JAMES A. KUSHNER, LAND USE REGULATION: CASES AND MATERIALS 29—33 (2d ed. 2004) (citing Ann O'Malley Bowman & Michael Pagano, *Imagining Cityscapes: The Politics of Urban Development*, 8 LAND LINES 1, 4-5 (1996); ERIC DAMIAN KELLY, MANAGING COMMUNITY GROWTH: POLICIES, TECHNIQUES AND IMPACTS 8—11 (1994); THE PRACTICE OF LOCAL GOVERNMENT PLANNING 43, 422—24 (Frank S. So & Judith Getzels eds., 2d ed. 1988).

many land use decisions do not involve one or more of these dimensions of environmental, administrative, or local government law. An example of a land use decision that is not environmental, administrative, or local in nature is the congressional enactment of the Religious Land Use and Institutionalized Persons Act (RLUIPA), which prohibits certain types of facially neutral land use regulations that substantially burden the exercise of religion.[36] In addition, the ways by which local governments protect the environment through land use controls and make administrative decisions on land use permits differ considerably from the methods used by federal and state administrative agencies, including environmental agencies.[37]

Experts in land use law concern themselves not only with areas of constitutional, property, environmental, administrative, and local government law that relate to the land use regulatory system, but also with areas that are particular to land use law as a distinct category of law. Examples of the former include regulatory takings and due process;[38] the right to exclude and the implications of possession;[39] protection of biodiversity;[40] judicial review of administrative agency actions;[41] and Dillon's Rule.[42] Examples of the

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35. *See id*.

36. 42 U.S.C. § 2000cc (2000).

37. *See* HERMAN L. BOSCHKEN, LAND USE CONFLICTS: ORGANIZATIONAL DESIGN AND RESOURCE MANAGEMENT 171-98 (1982). *See generally* Nancy Perkins Spyke, *The Land Use-Environmental Law Distinction: A Geo-Feminist Critique*, 13 DUKE ENVTL. L. & POL'Y F. 55, 57-76 (2002) [hereinafter Spyke, *Land Use-Environmental Law Distinction*]; Wolf, *supra* note 24, at 5.

38. *See, e.g.*, Ann E. Carlson & Daniel Pollak, *Takings on the Ground: How the Supreme Court's Takings Jurisprudence Affects Local Land Use Decisions*, 35 U.C. DAVIS L. REV. 103 (2001); Durchslag, *supra* note 26; Freis, Jr. & Reyniak, *supra* note 25; Daniel R. Mandelker, *Entitlement to Substantive Due Process: Old Versus New Property in Land Use Regulation*, 3 WASH. U. J. L. & POL'Y 61 (2000); A. Dan Tarlock, *Regulatory Takings*, 60 CHI.-KENT L. REV. 23 (1984).

39. *See, e.g.*, David L. Callies & J. David Breemer, *The Right to Exclude Others From Private Property: A Fundamental Constitutional Right*, 3 WASH. U. J.L. & POL'Y 39 (2000).

40. *See, e.g.*, Harte, *supra* note 16; J.B. Ruhl, *Biodiversity Conservation and the Ever-Expanding Web of Federal Laws Regulating Nonfederal Lands: Time for Something Completely Different?*, 66 U. COLO. L. REV. 555 (1995).

41. *See, e.g.*, Daniel R. Mandelker & A. Dan Tarlock, *Shifting the Presumption of Constitutionality in Land-Use Law*, 24 URB. LAW. 1 (1992); Robert J. Hopperton, *The Presumption of Validity in American Land Use Law: A Substitute for Analysis, A Source of Significant Confusion*, 23 B.C. ENVTL. AFF. L. REV. 301 (1996); Daniel R. Mandelker & A. Dan Tarlock, *Two Cheers for Shifting the Presumption of Validity: A Reply to Professor Hopperton*, 24 B.C. ENVTL. AFF. L. REV. 103 (1996); Robert J. Hopperton, *Majoritarian and Counter-Majoritarian Difficulties: Democracy, Distrust, and Disclosure in American Land-Use Jurisprudence—A Response to Professors Mandelker and Tarlock's Reply*, 24 B.C. ENVTL. AFF. L. REV. 541 (1997).

42. *See generally* Witten, *supra* note 7, at 520—21 (comparing Dillon's Rule to home rule jurisdictions); Brad K. Schwartz, Note, *Development Agreements: Contracting for Vested Rights*, 28 B.C. ENVTL. AFF. L. REV. 719, 733 n.114 (2001) (outlining the authority of municipalities under Dillon's Rule).

latter include the appropriate procedures for planning commission hearings;[43] the authority for, and limits to, the use of negotiated land use controls;[44] advanced zoning techniques like overlay zones and performance zoning;[45] conditions of land use approvals for new subdivisions or mixed-use developments;[46] the scope of sign ordinances;[47] the impacts of land development that require street widening and improvements;[48] and whether a church-operated day care facility is ancillary to a use of the property as a house of worship.[49] Moreover, experts in land use law tend to share particular ways of looking at the issues they address, which differs from the ways that experts in other areas of law tend to look at their issues. Geo-spatial arrangements, form and function, design, and context-

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43. *See, e.g.*, Frito-Lay, Inc. v. Planning & Zoning Comm'n of Killingly, 538 A.2d 1039 (Conn. 1998) (legal challenge to a planning and zoning commission's procedures in denying an application for a special permit and site plan approval for a wood chip burning electric co-generation plant).

44. *See, e.g.*, Alejandro Esteban Camacho, *Mustering the Missing Voices: A Collaborative Model for Fostering Equality, Community Involvement and Adaptive Planning in Land Use Decisions, Installment One*, 24 STAN. ENVTL. L.J. 3 (2005) [hereinafter Camacho, *Installment One*] (illustrating how bilateral negotiated land use decisions foster a public perception of illegitimacy and hinder community based decisionmaking); Alejandro Esteban Camacho, *Mustering the Missing Voices: A Collaborative Model for Fostering Equality, Community Involvement and Adaptive Planning in Land Use Decisions, Installment Two*, 24 STAN. ENVTL. L.J. 269 (2005) [hereinafter Camacho, *Installment Two*] (outlining a model of negotiated land use planning utilizing multi-disciplinary ideals); Shelby D. Green, *Development Agreements: Bargained-for Zoning That is Neither Illegal Contract Nor Conditional Zoning*, 33 CAP. U. L. REV. 383 (2004) (exploring development agreements as a new model of decisionmaking authority based on agreements between the municipality and the developer); Karkkainen, *supra* note 2, at 81-83 (positing that zoning is functional in part because it facilitates bargaining over land use outcomes).

45. *See, e.g.*, Arnold, *Planning Milagros, supra* note 3, at 114—21 (addressing various types of flexible zoning, including performance and overlay zoning, as applicable to the environmental justice context); Frederick W. Acker, Note, *Performance Zoning*, 67 NOTRE DAME L. REV. 363 (1991); Robert J. Blackwell, Comment, *Overlay Zoning, Performance Standards, and Environmental Protection After* Nollan, 16 B.C. ENVTL. AFF. L. REV. 615 (1989).

46. *See, e.g.*, Giger v. City of Omaha, 442 N.W.2d 182 (Neb. 1989) (approving conditional rezoning of property for mixed-use development of retail, office, and residential uses); Laurie Reynolds, *Local Subdivision Regulation: Formulaic Constraints in an Age of Discretion*, 24 GA. L. REV. 525 (1990) (providing an overview of subdivision regulation and discussing discretion in ordinance application).

47. *See generally* SELMI & KUSHNER, *supra* note 34, at 729—35 (discussing and reviewing case law concerning aesthetics, the police power, constitutional issues, and judicial attitudes toward sign ordinances); William R. Ewald, Jr., *Street Graphics and the Law*, 3 WASH. U. J.L. & POL'Y 397 (2000) (relating the author's experiences and involvement in drafting sign ordinances for several cities and specifically discussing the "street graphics" approach).

48. *See* DAVID L. CALLIES ET AL., BARGAINING FOR DEVELOPMENT 42-55 (2003) (cataloging cases reviewing local development conditions that developers improve roads to accommodate increased traffic caused by new development).

49. *See, e.g.*, Helen M. Maher, *Religious Freedom and Zoning*, 5 BUFF. ENVTL L.J. 309, 350 (1998) (noting that day care facilities can be considered religious uses of property if the property on which the center is located is regularly used for religious purposes). *Cf.* Henley v. City of Youngstown Bd. of Zoning Appeals, 735 N.E.2d 433 (Ohio 2000) (stating that housing for homeless was an accessory use to church).

specific characteristics of land and structures dominate the perspectives of experts in land use law, regulation, and policy.[50] Likewise, experts look at the issues through the lenses of community participation in governance and self-definition, local structures of power and socioeconomic status, and planning goals, processes, benefits, and constraints.[51]

For example, the U.S. Supreme Court regulatory takings case of *City of Monterey v. Del Monte Dunes at Monterey, Ltd.*[52] illustrates the differences in perspective arising out of different areas of law. The case involved the Court's review of a $1.5 million verdict for a developer that had repeatedly been denied permits for decreasingly intensive development projects on an ocean-front parcel of land in Monterey, California.[53] The constitutional law perspective focuses on whether the Seventh Amendment provides for a right to a jury trial, whether the plaintiff's claim for just compensation was ripe, and whether the local government's denial of the permit fails to substantially advance its stated purpose.[54] The environmental law perspective focuses on the inadequacies of the Endangered Species Act to remedy past degradation of endangered species' habitat through invasive plant species.[55] The administra-

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50. *See, e.g.*, MIKE GREENBERG, THE POETICS OF CITIES: DESIGNING NEIGHBORHOODS THAT WORK (1995); KEVIN LYNCH, THE IMAGE OF THE CITY (1960); RICHARD SENNETT, THE CONSCIENCE OF THE EYE: THE DESIGN AND SOCIAL LIFE OF CITIES (1990); Nancy Perkins Spyke, *Charm in the City: Thoughts on Urban Ecosystem Management*, 16 J. LAND USE & ENVTL. L. 153 (2001) [hereinafter Spyke, *Charm in the City*]; Spyke, *Land Use-Environmental Law Distinction, supra* note 37, at 89-94.

51. *See* EDMUND M. BURKE, A PARTICIPATORY APPROACH TO URBAN PLANNING (1979); MICHAEL FAGENCE, CITIZEN PARTICIPATION IN PLANNING (1977); JOHN FORESTER, THE DELIBERATIVE PRACTITIONER: ENCOURAGING PARTICIPATORY PLANNING PROCESSES (1999); RANDOLPH, *supra* note 33, at 47, 55-74; Sherry R. Arnstein, *A Ladder of Citizen Participation*, 35 J. AM. INST. PLANNERS 216 (1969); Camacho, *Installment One*, *supra* note 44; Camacho, *Installment Two*, *supra* note 44; Paul Davidoff, *Advocacy and Pluralism in Planning*, 31 J. AM. INST. PLANNING 331 (1965); Karkkainen, *supra* note 2, at 83-85 (extolling the virtues of zoning as a decentralized, participatory system in which local residents can participate actively); Audrey G. McFarlane, *When Inclusion Leads to Exclusion: The Uncharted Terrain of Community Participation in Economic Development*, 66 BROOK. L. REV. 861 (2000) (discussing federal participation mandates for public participation in urban development initiatives and arguing that empowerment theories are key in recognizing the importance of community participation); AM. PLANNING ASS'N, POLICY GUIDE ON NEIGHBORHOOD COLLABORATIVE PLANNING (1998), *available at* http://www.planning.org/policyguides/neighborhood.htm?project.

52. City of Monterey v. Del Monte Dunes at Monterey, Ltd., 526 U.S. 687 (1999).

53. *Id.*

54. The majority held in the affirmative on all three points. *Id*. However, the Court recently rejected the "substantially advances" formula as a regulatory taking standard in *Lingle v. Chevron U.S.A. Inc.*, 544 U.S. 528, 548 (2005).

55. The site had at one time supported the endangered Smith's Blue Butterfly, but non-native ice plant, which had been planted to prevent soil erosion, had replaced the native buckwheat on which the butterfly depends; in the years prior to the development proposal and litigation, no live species of the butterfly had been found on the property. *Del Monte Dunes*, 526 U.S. at 695.

tive law perspective focuses on the degree of deference the courts should give to the determinations of the city council and planning commission that the project posed adverse impacts on the environment and public infrastructure.[56] The land use regulatory perspective, however, highlights the specific characteristics and physical and social context of the land—including the land's potential to support an endangered butterfly and its habitat; the development and highway traffic pressing the property on two sides with a state park and the Pacific Ocean on the other two sides; and the environmentally degraded conditions of the property that had been used for oil drilling—as relevant to whether the developer's proposed uses are appropriate for a permitted development.[57] Also, the land use regulatory perspective sees the pervasive use of discretionary land use permits, such as conditional use permits, subdivision maps, and site plan reviews, as a basis of negotiated land use regulation, with both benefits from flexibility and tailored terms and dangers from ill-defined standards and abuse of discretion.[58] From a land use regulatory perspective, the case illustrates the difficulties of local governments in addressing and controlling cumulative impacts, as well as mediating between the exponentially heightened pro-development and anti-development pressures that arise on undeveloped lands located within highly developed areas.[59] More broadly, though, the *Del Monte Dunes* case demonstrates that the land use regulatory system has its own principles and functions that make it a distinct category of law and public policy.

B. The Venal Land Use System

Critics of the land use regulatory system mistakenly label it as inherently pathological, inevitably producing inefficient, unjust, or harmful results. Criticisms of specific land use practices and decisions, as well as discussions of the limits and weaknesses of the land use regulatory system, are often justified. However, they lose much of their credibility and their practical utility when they become theory-driven indictments of the system as a whole.

The arguments that land use regulation in the United States is inefficient fall into three general categories. First, critics contend that land use regulation distorts the uses of land that would result from free market transactions, thus producing sub-optimal levels

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56 Id. at 703—07.

57. *Id.* at 694—98.

58. *See id.* at 695—700.

59. *See id.*

of economic welfare in society.[60] Although these critics acknowledge the need to prevent or remedy negative externalities from private land use choices, they characterize the land use regulatory system as dominated by: 1) special interests using land use regulation to secure wealth transfers and uncompensated benefits; and 2) cognitively limited or biased decision makers who misperceive the nature and scope of the negative externalities at issue.[61]

Second, efficiency mavens point out the high transaction costs of the land use regulatory system.[62] The processes of permit applications, refinement of plans, public hearings, and decision making often at multiple levels—sometimes characterized by conflict and/or delay—add costs to land development, which result in higher consumer costs.[63] Planning, zoning, permitting, and infrastructure development are highly public, participatory, and time-consuming processes, according to those who seek systems that minimize transaction costs.

Third, according to some critics, the worst inefficiencies lie in the fragmented, piecemeal nature of land use regulation in the United States.[64] This critique observes that most land use decisions are made on an ad hoc project-by-project basis, with only the most general standards, inconsistently exercised discretion, and very little comprehensive advanced planning.[65] The fragmentation of land use regulatory powers across tens of thousands of municipalities and other local units of government results in unproductive land use policies and barriers to regional planning that could produce rational plans for region-wide land use impacts at appropriate economies of scale.[66] According to critics, a regulatory process built primarily on reaction to proposed land use projects renders local officials unable to achieve area-wide plans.

The charges of unfairness in the land use regulatory system

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60. *See generally* Ellickson, *Alternatives to Zoning, supra* note 8. *See also* Karkkainen, *supra* note 2, at 61-65; Bernard H. Siegan, *Non-Zoning in Houston*, 13 J.L. & ECON. 71, 142-43 (1970).

61. *See generally* Ellickson, *Suburban Growth Controls, supra* note 9.

62. Ellickson, *Alternatives to Zoning*, *supra* note 8, at 697-98; Karkkainen, *supra* note 2, at 60-61; Kmiec, *supra* note 8, at 46-49; Jan Z. Krasnowiecki, *Abolish Zoning*, 31 SYRACUSE L. REV. 719, 727-44 (1980).

63. *See supra* note 62.

64. Rose, *supra* note 11; Yarne, *supra* note 11, at 850; Tarlock, *Watershed, supra* note 11, at 157-58, 166-68; Owens, *supra* note 12.

65. *See supra* note 64.

66. *See, e.g.*, Sheryll D. Cashin, *Localism, Self-Interest, and the Tyranny of the Favored Quarter: Addressing the Barriers to New Regionalism*, 88 GEO. L.J. 1985 (2000); Janice C. Griffith, *Regional Governance Reconsidered*, 21 J.L. & POL. 505 (2005); Rutherford H. Platt, *Crosscutting Themes and Recommendations*, *in* THE ECOLOGICAL CITY: PRESERVING AND RESTORING URBAN BIODIVERSITY 277, 280-81 (Rutherford H. Platt et al. eds., 1994); Shelley Ross Saxer, *Local Autonomy or Regionalism?: Sharing the Benefits and Burdens of Suburban Commercial Development*, 30 IND. L. REV. 659 (1997).

also fall into three broad categories. One is that the systems' segregation of land use and exclusion of inappropriate land uses from certain areas of the community reflect an inherently segregationist, exclusionary nature of the system that segregates and excludes classes of people, not just classes of structures and land uses.[67] This particular point emphasizes the system's inherent use for "in-groups" to use land use regulation to exclude "out-groups."[68] A second category of criticism focuses on specific patterns of power allocation and prejudice in U.S. society. These critics argue that the land use regulatory system is controlled by dominant groups in society, especially non-Hispanic whites, wealthy development and business interests, and high-income communities.[69] These structural critics point to examples of racism, class bias, and exercise of power by elites in land use policies and patterns.[70] A third category is that land use regulation "is fundamentally unfair because it grants special privileges to some property owners (typically, current owners/occupants of single-family homes) at the expense of others, including principally those (usually non-resident) owners who wish to develop their property for non-residential purposes."[71]

The last type of indictment against the land use regulatory system is that it is inherently anti-environmental. This criticism argues that land use regulation in the United States is imbedded with norms and methods that promote consumptive, environmentally degrading uses of land.[72] The focus, after all, is on the use of

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67. *See, e.g.*, SELMI & KUSHNER, *supra* note 34, at 370-71; Dubin, *supra* note 13, at 740—44; Karkkainen, *supra* note 2, at 54-60; Janai S. Nelson, *Residential Zoning Regulations and the Perpetuation of Apartheid*, 43 UCLA L. REV. 1689 (1996); Marc Seitles, *The Perpetuation of Residential Racial Segregation in America: Historical Discrimination, Modern Forms of Exclusion, and Inclusionary Remedies*, 14 J. LAND USE & ENVTL. L. 89 (1999).

68. For descriptions of ingroup and outgroup dynamics, *see* M.B. Brewer, *Ingroups/Outgroups*, *in* 2 THE CORSINI ENCYCLOPEDIA OF PYSCHOLOGY AND BEHAVIORAL SCIENCE 762-65 (W. Edward Craighead & Charles B. Nemeroff eds., 3d ed. 2001); Fathali M. Moghaddam, *Intergroup Relations*, *in* 2 MAGILL'S ENCYCLOPEDIA OF SOCIAL SCIENCE: PSYCHOLOGY 842-47 (Nancy A. Piotrowski ed., 2003); H. Tajfel, *Interindividual Behaviour and Intergroup Behaviour*, *in* DIFFERENTIATION BETWEEN SOCIAL GROUPS: STUDIES IN THE SOCIAL PSYCHOLOGY OF INTERGROUP RELATIONS 27 (Henri Tajfel ed., 1978).

69. *See* FEAGIN & PARKER, *supra* note 9, at 2; Bullard, *supra* note 3, at 32-33; Feagin, *supra* note 10, at 31-54; Frug, *supra* note 9, at 1047-48.

70. *See supra* note 69.

71. Karkkainen, *supra* note 2, at 52.

72. *See generally* BABBITT, *supra* note 16, at 4-5, 70-71 (asserting that the land use regulatory system is systematically biased towards development with resulting environmental harms and losses); BOSCHKEN, *supra* note 37 (identifying inherent structural weaknesses in the land use regulatory system that cause environmental degradation and ecologically harmful over-development); RICHARD REGISTER, ECOCITIES: BUILDING CITIES IN BALANCE WITH NATURE 229-30 (2002) (describing criticisms of zoning as inherently environmentally destructive due to its segregating effects but disagreeing that such uses of zoning are inevitable); Lynda L. Butler, *The Pathology of Property Norms: Living Within Nature's Boundaries*, 73 S. CAL. L. REV. 927 (2000) (analyzing the environmental pathologies of American norms regarding the use of land).

land as defined by humans. According to these critics, the natural uses of land—and the human non-uses of land—receive very little attention or protection.[73] In addition, the system decentralizes regulatory authority, relies on permits essentially negotiated between developers and regulators, and protects private property rights to develop and use land in economically productive ways, all of which predictably harbor environmentally destructive land practices.[74]

Criticisms of the inefficiencies, injustices, and environmental harms of land use policies and practices have merit as calls for improvements in the system. However, as indictments of the system's inherent structure, they are misguided. Each type of criticism assumes a particular single criterion—efficiency, fairness, or environmental protection—by which land use regulation should be structured and governed. There is little room in any of these theoretical constructs for a system that accommodates, balances, or merges multiple principles in messy, pragmatic "second-best" ways.[75] Moreover, to the extent that these criticisms single out the land use regulatory system, they fail to give sufficient attention to the inefficiencies, injustices, and environmental harms in any regulatory system or even in any social system. It is hard to imagine a system that affords political participation and democratic governance meaningful value, while also achieving optimally efficient outcomes with few transaction costs. Public decision making involves significant transaction costs. It is hard to imagine how land use law and planning will single-handedly overcome racial and class prejudices in society that are apparent in so many forms, including private market transactions.[76] It is hard to imagine a

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73. *See generally* ERIC T. FREYFOGLE, JUSTICE AND THE EARTH: IMAGES FOR OUR PLANETARY SURVIVAL (1995) [hereinafter FREYFOGLE, JUSTICE AND THE EARTH]; FREYFOGLE, BOUNDED PEOPLE, *supra* note 32; ERIC T. FREYFOGLE, THE LAND WE SHARE: PRIVATE PROPERTY AND THE COMMON GOOD (2003) [hereinafter FREYFOGLE, THE LAND WE SHARE]; Joseph L. Sax, *Property Rights and the Economy of Nature: Understanding* Lucas v. South Carolina Coastal Council, 45 STAN. L. REV. 1433 (1993).

74. *See* BABBITT, *supra* note 16, at 4-5, 70-71.

75. *See* MARGARET JANE RADIN, REINTERPRETING PROPERTY 1 (1993).

76. *See* DOUGLAS S. MASSEY & NANCY A. DENTON, AMERICAN APARTHEID: SEGREGATION AND THE MAKING OF THE UNDERCLASS (1993) (describing practices of redlining, racial steering, and failure of institutions to support recently integrated neighborhoods with credit as parts of structural racism in society); Ian Ayres, *Fair Driving: Gender and Race Discrimination in Retail Car Negotiations*, 104 HARV. L. REV. 817, 818—20 (1991) (presenting empirical evidence of irrational racial prejudices in car sales); Vicki Been, *Locally Undesirable Land Uses in Minority Neighborhoods: Disproportionate Siting or Market Dynamics?*, 103 YALE L.J. 1383, 1390—92 (1994) (explaining that the market disfavors the poor by favoring existing distribution of economic resources and disfavors people of color through racial discrimination in residential markets);

Many powers and institutions of local government, including public

legal or regulatory system that can sharply curtail environmental degradation within a culture that persists in patterns of thinking and action about nature as something to be consumed, developed, and exploited. Finally, the critics of theoretical pathologies in the land use regulatory system fail to give adequate attention to examples of land use plans, regulations, decisions, and even patterns that are efficient, fair, or environmentally sustainable.[77] If the system is inherently defective, how can it produce any good results?

C. The Inadequate Land Use System

A third way that the land use regulatory system is misunderstood is its characterization as failing to measure up to certain public policy challenges. Critics may point out all the ways that land use planning, regulation, and decision making will not adequately manage watersheds and prevent watershed degradation,[78] protect biodiversity,[79] ensure an adequate supply of affordable housing,[80] stimulate economic development,[81] or prevent sprawl,[82] among many other such problems. These criticisms are not concerned as much with theoretical limits in the system as they are with practical limits that preclude effective solutions to specific policy problems. Criticisms of this sort refer to inadequacies that are inherent in the land use regulatory system, such as its decentralization, lack of scientific expertise among local officials, and inevitable political and economic pressures. In some ways, these criticisms may helpfully communicate the idea that the land use

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> schools, police functions, criminal sentencing, the taxing power, various licensing powers, and powers to hire public employees, grant government contracts, and award public services have been used in unlawfully discriminatory ways. Yet this does not lead to the conclusion that all those powers and institutions should be scrapped.

Karkkainen, *supra* note 2, at 54-55.

77. *See, e.g.*, *infra* notes 117, 134, 274-76, 288, 311.

78. *See* Ruhl et al., *supra* note 18, at 933; Tarlock, *Watershed, supra* note 11, at 149.

79. *See* BABBITT, *supra* note 16, at 4-5, 70-71; Tarlock, *Niche, supra* note 20, at 557—58.

80. *See* SELMI & KUSHNER, *supra* note 34, at 519-23.

81. *See, e.g.*, Audrey G. McFarlane, *Race, Space, and Place: The Geography of Economic Development*, 36 SAN DIEGO L. REV. 295 (1999).

82. *See, e.g.*, BABBITT, *supra* note 16, at 4-5, 70-71; ANDRES DUANY ET AL., SUBURBAN NATION: THE RISE OF SPRAWL AND THE DECLINE OF THE AMERICAN DREAM (2000); LEVINE, *supra* note 1, at 86-108; Frug, *supra* note 9; Tierney, *supra* note 1, at 462—63. *But see* ROBERT BRUEGMANN, SPRAWL: A COMPACT HISTORY 105-07 (2005) (studying the decentralization of cities and evolution of land use patterns to show that decreased population densities, whether through outward sprawl or through gentrification of central cities, are the result of human desires for less crowded living conditions, not the result of land use regulatory policies).

regulatory system is not designed to serve as another kind of system, such as an environmental protection system, watershed management system, or housing provision system. However, all too often the land use regulatory system is underestimated for its potential to contribute to solutions in these policy areas. The critics do not sufficiently account for the land use regulatory system's capacity to adapt and produce innovations to address changing conditions and demands on the system. While this change may be slower, less complete, and less pervasive than the experts' minds can imagine an ideal system producing, it would be a gross understatement to say that all changes in land use regulation to address social and environmental needs are wholly inadequate.

D. Understanding Land Use as a Functional System

If we are to improve our land use practices in the United States, we must first understand land use regulation and decision making as a system,[83] not merely make assumptions about the methods and outcomes of regulatory and decision making processes. Understanding the land use regulatory system requires studying it on its own terms, instead of imposing a set of expectations on it. The task is to look beyond specific issues and problems to the underlying structure of the system. Like any system, the land use regulatory system has functions, scale, components, processes, and values. The system is functional and adaptive, serving primarily to mediate among social space, physical space, and the forces that shape them.

This article analyzes the functions, scale, components, processes, and values of the land use regulatory system. Instead of fo-

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83. For a systems approach to studying the intersection of natural, physical, and social environments, see, e.g., ERIC DAMIAN KELLY & BARBARA BECKER, COMMUNITY PLANNING: AN INTRODUCTION TO THE COMPREHENSIVE PLAN 23 (2000) (understanding land use planning from a systems perspective); Nancy B. Grimm et al., *An Ecosystem Approach to Understanding Cities: Familiar Foundations and Uncharted Frontiers*, *in* UNDERSTANDING URBAN ECOSYSTEMS: A NEW FRONTIER FOR SCIENCE AND EDUCATION 95, 97-99 (Alan R. Berkowitz et al. eds., 2003) (studying ecosystems by defining the boundaries, structure, and function of dynamic systems); Kathleen Hogan & Kathleen C. Weathers, *Psychological and Ecological Perspectives on the Development of Systems Thinking*, *in* UNDERSTANDING URBAN ECOSYSTEMS, *supra*, at 233, 234 ("Systems thinking comprises skills that allow a person to analyze open systems (i.e., those that exchange matter and energy with a surrounding environment) by recognizing how multiple factors interact, and by seeing and predicting patterns of change over time."); Lynn M. LoPucki, *The Systems Approach to Law*, 82 CORNELL L. REV. 479 (1997) (using a systems approach to understand law); Charles H. Nilon et al., *Introduction: Ecosystem Understanding Is a Key to Understanding Cities*, *in* UNDERSTANDING URBAN ECOSYSTEMS, *supra*, at 1, 2-4 (describing urban environments as systems of biological, psychological, and social dynamics); J.B. Ruhl, *The Fitness of Law: Using Complexity Theory to Describe the Evolution of Law and Society and Its Practical Meaning for Democracy*, 49 VAND. L. REV. 1407 (1996) (using a systems approach to understand law).

cusing on narrow and specific legal issues or deconstructing a particular line of cases, the article takes a view of the system that is both broad and deep. The perspective is broad in that it is a bird's-eye overview of the entire system. It is deep in that it seeks to identify the underlying structure of the system. The article is merely an initial step towards a systemic understanding of land use regulation in the United States, an approach that deserves further development in subsequent works on the topic. Those readers who may be seeking dozens of concrete examples or the application of the article's insights to today's hot topics in land use may be disappointed. For those readers who want to take thought-provoking "steps to an ecology of" the land use regulatory system,[84] this article may offer the modest beginnings of a pathway.

III. THE FUNCTIONS OF THE LAND USE REGULATORY SYSTEM

Legal systems (including subsystems) can be thought of as mediating, constitutive, distributive, or protective.[85] A ***mediating system*** serves to facilitate relationships among the participants in the system and/or among institutions, forces, and processes in society.[86] It does not necessarily mean that a third-party neutral facilitates a negotiated outcome to a dispute (mediation) or that methods of alternative dispute resolution are preferred. In fact, cooperation is not a necessary component of a mediating system. The core concept behind the mediating system is that the law itself does not define social outcomes. Instead, the law is the vehicle by which social forces define social outcomes.

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84. *See* GREGORY BATESON, STEPS TO AN ECOLOGY OF MIND (1972); J.B. Ruhl, *Complexity Theory as a Paradigm for the Dynamical Law-and-Society System: A Wake-up Call for Legal Reductionism and the Modern Administrative State*, 45 DUKE L.J. 849 (1996).

85. *See supra* notes 72—75.

86. Rose, *supra* note 11, at 894 ("A **mediation** model . . . attempts to assure due consideration through a pattern of voice--through hearing from interested parties and attempting to arrive at an accommodation acceptable to them within the framework of larger community norms."); Carol M. Rose, *New Models for Local Land Use Decisions*, 79 NW. U.L. REV. 1155, 1155 (1984-1985) (describing "the whole field of local land use processes as a series of variations on a theme of dispute resolution"). The mediating functions of social institutions are discussed in a wide range of literature. *See, e.g.*, STEPHEN WEBB, SOCIAL WORK IN A RISK SOCIETY: SOCIAL AND CULTURAL PERSPECTIVES 23-48 (2005); Theodore M. Kerrine & Richard John Neuhaus*, Mediating Structures: A Paradigm for Democratic Pluralism*, 446 ANNALS AM. ACAD. POL. & SOC. SCI. 10 (1979); Jurgen Habermas, *From Kant to Hegel and Back Again—The Move Towards Detranscendentalization*, 7 EUR. J. PHIL. 129 (1999); Christine I. Baxter, *Canals Where Rivers Used to Flow: The Role of Mediating Structures and Partnerships in Community Lending*, 10 ECON. DEV. Q. 44 (1996); F. Xavier Molina-Morales et al., *The Role of Local Institutions as Intermediary Agents in the Industrial Distric*t, 9 EUR. URB. & REGIONAL STUD. 315 (2002); Roberta Kevelson, *Property as Rhetoric in Law*, 4 CARDOZO STUD. L. & LITERATURE 189 (1992). *But see* PATRICIA EWICK & SUSAN S. SILBEY, THE COMMON PLACE OF LAW: STORIES FROM EVERYDAY LIFE 132-36 (1998) (criticizing the perspective of law as a tool or instrument).

In contrast, the ***constitutive system*** is a legal system that shapes or defines society.[87] A ***distributive system*** primarily distributes goods, benefits, rights, powers, harms, costs, responsibilities, and limits.[88] A ***protective system*** functions primarily to protect particular groups of people or particular resources.[89] Many legal systems serve a mix of functions but are characterized by one of the functions more than the others.

A. Mediating Functions

At its core, the land use regulatory system functions primarily as a mediating system. It facilitates and mediates relationships between the social environment and the physical environment, between people and places, and between human communities and nature's communities. In doing so, the land use regulatory system also mediates between power and community and between freedom and boundaries. The land use regulatory system also serves some of the functions of each of the other types of systems: 1) constitutive functions—shaping social norms, values, and institutions; 2) distributive functions—distributing power and resources; and 3) protective functions—protecting certain people and things. However, these three additional functions are ancillary or incidental to the primary function of the system as a mediator—a facilitator of relationships—between the social environment and the physical environment. Thus, the ways in which the system shapes public norms and values, distributes resources, and protects certain groups and resources arise out of the relationships that people form with their social, built, and natural environments. The mediating nature of the land use regulatory system will be discussed first, followed by a discussion of why the constitutive, distributive,

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87. *See* Holly Doremus, *Constitutive Law and Environmental Policy*, 22 STAN. ENVTL L.J. 295 (2003) (analyzing environmental law as a constitutive system); Mark C. Suchman, *On Beyond Interest: Rational, Normative and Cognitive Perspectives in the Social Scientific Study of Law*, 1997 WIS. L. REV. 475, 476 (defining a constitutive approach as implying "that responses to law reflect the ability of legal rules to define, constitute and construct a shared reality in which certain behaviors become socially nonsensical").

88. *See, e.g.*, JOHN RAWLS, A THEORY OF JUSTICE (1971) (arguing for a system that distributes more services and benefits to those people in greater need); David Gray Carlson, *Bankruptcy Theory and the Creditors' Bargain*, 61 U. CIN. L. REV. 453, 465 (1992) (defining bankruptcy as a distributive system); Mark Kelman, *The Necessary Myth of Objective Causation Judgments in Liberal Political Theory*, 63 CHI.-KENT L. REV. 579, 600 (1987) (implying that the modern welfare state is a distributive system).

89. For example, the United States' child protective system seeks to look after the health and safety of children within the child welfare system. 42 U.S.C. § 671(a)(15) (2000). The wildlife management requirements on public lands, including such federal laws as the Endangered Species Act and the Sikes Act, can also be seen as a protective system. George Cameron Coggins, *The Law of Public Rangeland Management III: A Survey of Creeping Regulation at the Periphery, 1934—1982*, 13 ENVTL. L. 295, 326—27 (1983).

and protective functions of the land use regulatory system are subsumed under the system's mediating functions.

1. People and Places

How land is used in the United States is the result of countless decisions by individuals, entities, communities, and governmental bodies, as well as the operation of complex, multi-faceted social forces.[90] The land use regulatory system has developed to give order to and create processes for making and implementing these decisions and for resolving conflicts among goals and ideas about how land should be used. More broadly, the land use regulatory system aims to facilitate deliberations and decisions about what an ideal society looks like, situated geographically. The land use regulatory system is the intermediary between our aspirations and our environment.

Most essentially, the land use regulatory system is a mediator between people and places. These relationships include relationships between social environments and physical environments, and between the built environment and the natural environment.[91]

First, the system mediates between the natural meanings and social meanings of land. Land has both natural meaning and social meaning. Land has natural meaning defined by its place in nature. Any given area of land exists as an integral, interconnected part of nature, a component of ecosystems, a participant in ecological processes, and a performer of ecological functions.[92] Land had an existence and a set of characteristics before any hu-

90. *See* SELMI & KUSHNER, *supra* note 34, at xxvii, 3. For a similar point in environmental and natural resources law, see Errol E. Meidinger, *Law and Institutions in Cross-Boundary Stewardship*, *in* STEWARDSHIP ACROSS BOUNDARIES 87-110 (Richard L. Knight & Peter B. Landres eds., 1998); Zygmunt J.B. Plater, *Environmental Law and the Three Economies: Navigating a Sprawling Field of Study, Practice, and Societal Governance in Which Everything Is Connected to Everything Else*, 23 HARV. ENVTL. L. REV. 359 (1999).

91. *See* STEPHEN R. KELLERT, BUILDING FOR LIFE: DESIGNING AND UNDERSTANDING THE HUMAN-NATURE CONNECTION 58 (2005) ("When examined closely, cherished places are not just social and cultural settings but also physical and ecological environments endowed with characteristics people associate with the place's distinctive identity. What makes a place special is the unique integration of culture with nature."); Spyke, *Charm in the City, supra* note 50, at 155 (asserting that ecosystem management in urban areas should link the ecological and social characteristics of cities). *See also* GREENBERG, *supra* note 50 (asserting as a basic thesis that cities and neighborhoods are ideally places of economic, social, and intellectual exchange).

92. *See* ALDO LEOPOLD, A SAND COUNTY ALMANAC 214—20 (1949) (discussing basic ecological processes); James Salzman, et al., *Protecting Ecosystem Services: Science, Economics, and Law*, 20 STAN. ENVTL. L. J. 309, 310 (2001) (noting that healthy ecosystems aid in air and water purification, decomposition of waste, climate regulation, renewal of soil fertility, the control of floods, droughts, and pests, and the pollination of plants).

mans interacted with it.[93] Humans may modify, affect, alter, and even destroy the characteristics of land and the physical, biological, and chemical environment in which it exists, but these changes are in relation to natural conditions and characteristics.[94] Thus, even though the post-modernist would contend that our knowledge or understanding of land and nature and any references to a "natural meaning" of land are inherently human constructs,[95] there is relatively widespread acceptance that land has existence and characteristics that do not depend on human definition.[96]

Land also has social meanings. Land may be considered sacred or holy. Thus, issues over road development in a forest area sacred to Native American tribes,[97] prayer meetings in homes,[98] or the permissibility of faith-mandated shelters for the homeless[99] involve faith-based meanings of land. Whether land or nature has inherent value, or merely utilitarian value, is an issue of human ethics.[100] Thus, decisions about whether or not to protect the Delhi Sands from development in growth-pressured Southern California[101] or to modify land use practices that are degrading the Mackinaw River in Illinois[102] depend on the ethical choices or

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93. R. EDWARD GRUMBINE, GHOST BEARS: EXPLORING THE BIODIVERSITY CRISIS 239-40 (1992); O.J. REICHMAN, KONZA PRAIRIE: A TALLGRASS NATURAL HISTORY (1987).

94. DEBRA L. DONAHUE, THE WESTERN RANGE REVISITED: REMOVING LIVESTOCK FROM PUBLIC LANDS TO CONSERVE NATIVE BIODIVERSITY 176-77 (1999). *See also* BABBITT, *supra* note 16, at 13 ("In south Florida, hurricanes are the prime movers of land use planning.").

95. *See generally* PETER H. KAHN, JR., THE HUMAN RELATIONSHIP WITH NATURE: DEVELOPMENT AND CULTURE (1999); MAX OELSCHLAEGER, THE IDEA OF WILDERNESS: FROM PREHISTORY TO THE AGE OF ECOLOGY (1991); POSTMODERN ENVIRONMENTAL ETHICS (Max Oelschlaeger ed., 1995); RESTORING NATURE: PERSPECTIVES FROM THE SOCIAL SCIENCES AND HUMANITIES (Paul H. Gobster & R. Bruce Hull eds., 2000).

96. *See generally* J. BAIRD CALLICOTT, EARTH'S INSIGHTS: A SURVEY OF ECOLOGICAL ETHICS FROM THE MEDITERRANEAN BASIN TO THE AUSTRALIAN OUTBACK (1994) (showing that various cultures around the globe depend on an ecocentric environmental ethics).

97. *See, e.g.*, Lyng v. Nw. Indian Cemetery Protective Ass'n, 485 U.S. 439 (1988).

98. *See, e.g.*, COLO. REV. STAT. § 29-1-1201 (2006); Farhi v. Comm'rs of Deal, 499 A.2d 559 (N.J. Super. Ct. Law Div. 1985).

99. *See e.g.*, Fifth Ave. Presbyterian Church v. City of New York, 293 F.3d 570 (2d Cir. 2002).

100. *See* CALLICOTT, *supra* note 96, at 7-11 (outlining the origins and distinctions between anthropocentric and ecocentric environmental ethics).

101. *See* JOHN COPELAND NAGLE & J.B. RUHL, THE LAW OF BIODIVERSITY AND ECOSYSTEM MANAGEMENT 2-12 (2002). *See, e.g.*, Notice of Availability of an Environmental Assessment and Receipt of an Application for an Incidental Take Permit for the Oakmont Industrial Group Development, City of Ontario, San Bernardino County, CA, 71 Fed. Reg. 69,215, 69,215—16 (Nov. 30, 2006); Receipt of Applications for Incidental Take Permits for the **Delhi Sands** Flower-Loving Fly and Availability of an Environmental Assessment Associated With the Development of Five Sites in the Cities of Rialto and Colton, San Bernardino County, CA, 65 Fed. Reg. 65,877, 65,877—78 (Nov. 2, 2000).

102. *See* FREYFOGLE, BOUNDED PEOPLE, *supra* note 32, at 151-70. The Nature Conservancy notes that the intensification of urban development and modifications in agricultural structures have resulted in habitat loss and increased pollution in the Mackinaw River. The Nature Conservancy in Illinois — The Mackinaw River Watershed,

frameworks in the communities making those decisions. Land is a means of defining community, and therefore land becomes infused with community meanings.[103] The island of Puerto Rico has a particular social, political, and cultural meaning, for example.[104] Land often has personal meaning, such as the personhood-shaping meanings of the old farmstead, our home, the store where we had our first job, or that riverbank where we used to meet.[105] Land has economic value, with this parcel being valued at $345,000 and that parcel, of different size, location, and characteristics, being valued at $270,000.

The land use regulatory system is an intermediary between the natural and social meanings of land, with the social meanings of land being shaped, in part, by the land's physical and natural characteristics,[106] and the land's physical and natural characteristics being altered by social determinations about its meaning and functions.[107] For example, whether to develop a hillside meadow overlooking a river to be used for offices and condominiums or whether to maintain it as a park is a choice that will be made within the land use regulatory system. The local community and its decision makers consider and define the community's relationships with the views of the river, the butterfly-filled meadow, the flow of runoff from the hillside into the river, the growth and development of nearby office parks and residences, and the potential for riverfront land as a place to do business, a place to live, or a place to play and relax.

Second, land use planning—a significant component of the land use regulatory system[108]— creates, enhances, and protects a

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http://www.nature.org/wherewework/northamerica/states/illinois/preserves/art7559.html (last visited Aug. 13, 2007).

103. Sandra Hill, *Drawing Strength From Diversity--Defining Community in Our Cities*, AMERICAN FORESTS (Winter 1998), *available at* http://www.findarticles.com/p/articles/mi_m1016/is_n4_v103/ai_20208774.

104. *See* JOSE TRIAS MONGE, PUERTO RICO: THE TRIALS OF THE OLDEST COLONY IN THE WORLD (1997); NANCY MORRIS, PUERTO RICO: CULTURE, POLITICS, AND IDENTITY (1995); Blanca G. Silvestrini, *Contemporary Puerto Rico: A Society of Contrasts*, *in* THE MODERN CARIBBEAN 147 (Franklin W. Knight & Colin A. Palmer eds., 1989).

105. *See* Margaret Jane Radin, *Property and Personhood*, 34 STAN. L. REV. 957 (1982) (indicating that property may have value in its personal meaning).

106. KAHN, *supra* note 95; KELLERT, *supra* note 91, at 58; THE BIOPHILIA HYPOTHESIS (Stephen R. Kellert & Edward O. Wilson eds., 1993); Spyke, *Charm in the City, supra* note 50; *see also* SETHA M. LOW, ON THE PLAZA: THE POLITICS OF PUBLIC SPACE AND CULTURE (2000) (studying plazas to show how society shapes public spaces and how the physical form of these places in turn embodies and communicates the social, political, and economic relations of the city).

107. *See* DONAHUE, *supra* note 94, at 176-77; FREYFOGLE, BOUNDED PEOPLE, *supra* note 32, at 151-70; FREYFOGLE, JUSTICE AND THE EARTH, *supra* note 73; Eric T. Freyfogle, *Ownership and Ecology*, 43 CASE W. RES. L. REV. 1269, 1269 (1993); Spyke, *Charm in the City, supra* note 50.

108. *See infra* Section V.

"sense of place."[109] Gene Bunnell, both a scholar and a practitioner of land use planning, asserts that a critical—and core—function of planning is "making places special."[110] In observing that people yearn for "good places" or "special places," Bunnell draws on the empirical work of Kevin Lynch, documenting the role of especially valued places in people's "mental maps" of their local landscape, and Terry Pindell, identifying how communities developed a vision for cities that stood apart as distinctive, attractive, and beloved.[111] As Bunnell points out, the characteristics of "good places" are varied and numerous but tend to stand in contradiction to the sprawling, monotonous, and alienating outskirts of many contemporary urban areas.[112] He refers to several characteristics that have been identified by planner Mark Hinshaw as making places special: connectivity, drama and dignity, variety and whimsy, reflection of local values, sociable settings, and many choices and things to do.[113]

Planning experts Timothy Beatley and Kristy Manning, in their book *The Ecology of Place: Planning for Environment, Economy, and Community*, also call attention to the importance of "place" in land use planning and regulation, but with a particular focus on ecologically sustainable places.[114] Beatley and Manning argue for places that are consistent with the natural environment's carrying capacity, restorative and regenerative, integrative and holistic, and promote community, a high quality of life, land use ethics, and social justice and fairness, [115] all in contrast to the ecologically unsustainable current patterns of "low-density, auto-dependent, sprawling growth."[116] Bunnell and Beatley and Manning support their points with abundant case studies and examples of local communities that are engaged in visionary place-making.[117]

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109. *See* Place: Planning, http://pegasus.cc.ucf.edu/~janzb/place/planning.htm (last visited Aug. 13, 2007) (listing 288 sources relating to place and space). *See also* GREENBERG, *supra* note 50 (asserting as a basic thesis that cities and neighborhoods are ideally places of economic, social, and intellectual exchange); KELLERT, *supra* note 91, at 57-62 (2005) (discussing the role that a "sense of place" or "spirit of place" plays in human physical and mental well-being).

110. GENE BUNNELL, MAKING PLACES SPECIAL: STORIES OF REAL PLACES MADE BETTER BY PLANNING (2002).

111. *Id.* at 33-36. *See also* KEVIN LYNCH, MANAGING THE SENSE OF A REGION (1976); KEVIN LYNCH, WHAT TIME IS THIS PLACE? (1972); LYNCH, *supra* note 50; TERRY PINDELL, A GOOD PLACE TO LIVE: AMERICA'S LAST MIGRATION (1995).

112. BUNNELL, *supra* note 110, at 33, 35-44.

113. *Id.* at 42.

114. TIMOTHY BEATLEY & KRISTY MANNING, THE ECOLOGY OF PLACE: PLANNING FOR ENVIRONMENT, ECONOMY, AND COMMUNITY 86-136 (1997).

115. *Id.* at 27-39.

116. *Id.* at 1.

117. BUNNELL, *supra* note 110, at viii-ix, 55-507 (presenting case studies from Chatta-

Even more broadly, social ecologist Stephen Kellert presents research showing that the human experience with natural environments is critical to human physical and mental well-being.[118] In Kellert's analysis a "sense of place" or a "spirit of place" is a mediator between ecological features and human quality of life: ecological functions and services support preferred landscape features, which support environmental values, which support a sense of place, which support quality of life.[119] He identifies several features of healthy places: continuous, iterative interactions between society and nature producing outcomes not attributable solely to environmental forces alone or social forces alone, connections between culture and nature within bio-geographical context, design to reflect the landscape's natural and social characteristics, community relations among people, diverse activities and opportunities, area-based identity and price, and a sense of rootedness.[120] Likewise, he laments the sense of "placeness" created by land development patterns that alienate people from their environment and from one another.[121]

Many components and processes of the land use regulatory system aid local communities in defining, reshaping, and protecting places within those communities. The planning process itself is organic and adaptive, responding to changing relationships between the local community and its places. Many jurisdictions must engage in some amount of planning (perhaps resulting in a written plan but perhaps not, depending on the jurisdiction) and typically cannot adopt zoning ordinances or make land use permit decisions that are clearly incompatible with the principles of rational planning.[122] However, local comprehensive plans in most jurisdictions do not serve as binding directives for future develop-

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nooga, Tenn., Providence, R.I., Charleston, S.C., and San Diego, Cal.; with an additional CD-ROM with case studies from Madison, Wis., Wichita, Kan., and Westminster, Colo.); BEATLEY AND MANNING, *supra* note 114, at 42-214 (giving countless examples of local efforts to achieve sustainable urban form, engage in ecologically sustainable "green" practices with minimal ecological footprint, build a restorative economy with responsibility and sustainability, promote civic community, and promote ethics and politics of sustainable places).

118. *See* KELLERT, *supra* note 91, at 9-62.

119. *Id.* at 62 fig. 8 (2005). *See also id.* at 57-62.

120. *See id.* at 58-59.

121. *See id.* at 60-61.

122. *See* Standard State Zoning Enabling Act § 3 (U.S. Dept. of Commerce rev. ed. 1926) ("[Zoning] shall be made in accordance with a comprehensive plan . . . ."); Wolf v. City of Ely, 493 N.W.2d 846, 849 (Iowa 1992) (finding that the language in the Standard State Zoning Enabling Act merely requires that the plan be in accordance with a rational process and more than a piecemeal approach, but not requiring a plan external to the zoning ordinance). *Cf.* N.J. STAT. ANN. § 40:55D-28 (2007) (authorizing the creation of a general plan and outlining detailed requirements for the plan). *See generally* SELMI & KUSHNER, *supra* note 34, at 181—202.

ment and regulatory decision making.[123] Instead, they serve more as guidelines that have some influence and force, yet yield to changing conditions, new opportunities, and evolving politics and community goals.[124]

Zoning and regulatory permitting requirements and decisions also reflect and implement local community choices and values about desired and undesired places.[125] When many people (or at least those exercising local political power in the land use regulatory system) desired single-family residential communities of "quiet place[s] where yards are wide, people few, and motor vehicles restricted,"[126] zoning ordinances segregated single-family residences from other land uses, creating places dominated by homes separated from places of employment, retail commerce, and civic gathering.[127] When people came to identify arterial roads not by their scenic corridor characteristics or their capacity to weave together the local region into a community but instead by their commercial utility to support standardized and predictable commercial destinations reached by automobile transit, local govern-

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123. *See* John Mixon & Kathleen McGlynn, *A New Zoning and Planning Metaphor: Chaos and Complexity Theory*, 42 HOUS. L. REV. 1221, 1227—37 (2006) (noting that when viewed as legislative, zoning amendments are usually upheld, but also noting that some jurisdictions consider ordinances that are in conflict with the comprehensive plan illegal). Courts routinely give judicial deference to land use regulations. *See, e.g.*, Kirby v. Twp. Cmty. of Bedminster, 775 A.2d 209, 216 (N.J. Super. Ct. App. Div. 2000);

> A zoning ordinance is insulated from attack by a presumption of validity, which may be overcome by a showing that the ordinance is "clearly arbitrary, capricious or unreasonable, or plainly contrary to fundamental principles of zoning or the [zoning] statute." The party attacking the ordinance bears the burden of overcoming the presumption.... Courts should not question the wisdom of an ordinance, and if the ordinance is debatable, it should be upheld.

Id. (quoting Riggs v. Twp. of Long Beach, 538 A.2d 808 (N.J. 1988)). Additionally, the comprehensive plan or the zoning map or text can be amended. *See* Arnold, *Planning Milagros, supra* note 3, at 107-14.

124. Various flexibility devices exist to overcome the rigid nature of Euclidian Zoning. These include conditional use permits, variances, performance zoning, buffers, floating zones, and overlay zoning, among others. *See* SELMI & KUSHNER, *supra* note 34, at 84—104; Arnold, *Planning Milagros, supra* note 3, at 114-21.

125. Karkkainen, *supra* note 2, at 64-80 (articulating a theory that zoning serves to protect the "neighborhood commons," which is defined by the consumer surplus that residents have in their "neighborhood character" as each neighborhood defines it over time).

126. Village of Belle Terre v. Boraas, 416 U.S. 1, 9 (1974). *See also* Village of Euclid v. Ambler Realty Co., 272 U.S. 365 (1926) (upholding the constitutionality of zoning that segregated industrial uses from single-family residential uses for purposes of creating safe and peaceful places to raise children and enjoy family life away from the ills of the urban environment).

127. *See* Michael Lewyn, *The Law of Sprawl: A Road Map*, 25 QUINNIPIAC L. REV. 147, 155—56 (2006); Edward H. Ziegler, *Urban Sprawl, Growth Management and Sustainable Development in the United States: Thoughts on the Sentimental Quest for a New Middle Landscape*, 11 VA. J. SOC. POL'Y & L. 26, 31—32 (2003).

ing bodies and planning bodies approved development proposals for endless miles of strip shopping centers, restaurant chains and fast-food franchises, big-box retail stores, gas stations, banks, medical offices, grocery stores, and the like.[128] With growing demand for "urban village" environments with mixed uses and compact pedestrian-friendly housing development in proximity to retail and commercial enterprises, localities have amended zoning codes to permit, and even encourage, mixed-use development and to regulate on the basis of "urban forms," not solely on the basis of land use designations.[129] Likewise, the increasing value that many communities are giving to area natural features has resulted in land use regulations to protect hillsides, ridgelines, and slopes, riparian lands along waterways, groundwater aquifer recharge areas, trees, scenic vistas, scenic corridors, wetlands, fish and wildlife habitat, and multi-resource conservation areas.[130] These changes in land use regulation reflect the changing relationship that people have with their social and physical environment.

Moreover, much environmental protection is place-based.[131] One indicator is the growth of environmental groups and collaborative environmental conservation efforts organized around particular bodies of water[132] such as Mono Lake (California),[133] the

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128. *See* Trip Pollard, *Follow the Money: Transportation Investments for Smarter Growth*, 22 TEMP. ENVTL. L. & TECH. J. 155, 156 (2004) (noting that one of the most important issues influencing development and sprawl is investment in transportation infrastructures).

129. *See* CONG. FOR THE NEW URBANISM, CODIFYING NEW URBANISM: HOW TO REFORM MUNICIPAL LAND DEVELOPMENT REGULATIONS (2004); Nicole Stelle Garnett, *Ordering (and Order in) the City*, 57 STAN. L. REV. 1, 58 n.289 (2004) ("The growing number of cities which have designated 'mixed-use' zones reflects the new urbanists' growing influence."); James A. Kushner, *Smart Growth, New Urbanism and Diversity: Progressive Planning Movements in America and Their Impact on Poor and MinorityEthnic Populations*, 21 UCLA J. ENVTL. L. & POL'Y 45, 62—65 (2002/2003) (noting that community and public officials tend to support new urbanist design); CECILY T. TALBERT, CREATING FLEXIBLE ZONING TOOLS FOR SUCCESSFUL MIXED USE DEVELOPMENTS, (2006), *available at* http://d2d.aliaba.org/_files/thumbs/course_materials/SM004_chapter_61_thumb.pdf.

130. *See* Nolon, *In Praise of Parochialism*, *supra* note 21 (describing various local land use regulations to protect the environment); Ortiz, *supra* note 20 (discussing various ways in which land use regulations or practices can protect biodiversity and natural habitat, such as ecosystem management approaches, land trusts and conservation easements, growth management, smart growth, new urbanism, and conservation subdivisions).

131. *See* CHRISTINE A. KLEIN ET AL., NATURAL RESOURCES LAW: A PLACE-BASED BOOK OF PROBLEMS AND CASES (2005); FREYFOGLE, JUSTICE AND THE EARTH, *supra* note 73, at 188-89; Craig Anthony (Tony) Arnold, *Working Out an Environmental Ethic: Anniversary Lessons from Mono Lake*, 4 WYO. L. REV. 1, 26-32 (2004) [hereinafter Arnold, *Mono Lake*]; Robert L. Fischman, *Cooperative Federalism and Natural Resources Law*, 14 N.Y.U. ENVTL. L.J. 179, 196-99 (2005). For an excellent analysis of the role of place-based ecosystem management in urban settings, see Spyke, *Charm in the City, supra* note 50.

132. *See, e.g.*, Peter Lavigne, *Watershed Councils East and West: Advocacy, Consensus and Environmental Progress*, 22 UCLA J. ENVTL. L. & POL'Y 301 (2004); Paul A. Sabatier et al., *Eras of Water Management in the United States: Implications for Collaborative Watershed Approaches*, *in* SWIMMING UPSTREAM: COLLABORATIVE APPROACHES TO WATERSHED

Anacostia River (District of Columbia and Maryland),[134] Lake Whatcom (Washington),[135] the San Francisco Bay Delta (Califor-

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MANAGEMENT 23, 47 (Paul A. Sabiter et al. eds., 2005); John T. Woolley et al., *The California Watershed Movement: Science and the Politics of Place*, 42 NAT. RESOURCES J. 133 (2002); *see also* The American Rivers website, http://www.americanrivers.org (last visited July 30, 2007).

133. Arnold, *Mono Lake*, *supra* note 131.

134. Craig Anthony (Tony) Arnold, *For the Sake of Water: Land Conservation and Watershed Protection*, 14 SUSTAIN 16 (2006) [hereinafter Arnold, *Sake of Water*]. *See also* U.S. ARMY CORPS OF ENG'RS BALTIMORE DIST., ANACOSTIA RIVER AND TRIBUTARIES: MARYLAND AND THE DISTRICT OF COLUMBIA COMPREHENSIVE WATERSHED PLAN: SECTION 905(B) (WRDA 86) ANALYSIS (2005); U.S. ENVTL. PROT. AGENCY OFFICE OF WATER, EPA 841-F-05-004J, SECTION 319 NONPOINT SOURCE PROGRAM SUCCESS STORY: DISTRICT OF COLUMBIA (2005); MARYLAND-NAT'L CAPITAL PARK AND PLANNING COMM'N, 2005 LAND PRESERVATION, PARKS, AND RECREATION PLAN v-1 to v-32 (2005); MD. DEP'T OF NATURAL RES. WATERSHED SERVS. & PRINCE GEORGE'S COUNTY, CHARACTERIZATION OF THE ANACOSTIA RIVER WATERSHED IN PRINCE GEORGE'S COUNTY, MARYLAND (2005); MONTGOMERY COUNTY (MD) DEP'T OF ENVTL. PROT., MONTGOMERY COUNTY'S COMMITMENT TO ANACOSTIA WATERSHED RESTORATION (2003); JAMES W. WOODWORTH, JR. ET AL., OUT OF THE GUTTER: REDUCING POLLUTED RUNOFF IN THE DISTRICT OF COLUMBIA (2002); Uwe Steven Brandes, *Recapturing the Anacostia River: The Center of 21st Century Washington, DC*, 35 GOLDEN GATE U. L. REV. 411 (2005); D'Vera Cohn, *Attempting a Miracle of Muck: Restored Marsh Dedicated at Aquatic Gardens*, WASH. POST, Sept. 22, 1993, at D1; Michael H. Cottman, *D.C., Md. Sign Anacostia River Cleanup Pact*, WASH. POST, May 11, 1999, at B2; Angela E. Couloumbis, *New Bid to Clean Up Anacostia*, CHRISTIAN SCI. MONITOR, Apr. 28, 1994, at 5; Tom Horton, *Death for Streams Lies in the Pavement*, BALTIMORE SUN, Oct. 6, 2000, at 2B; Vernon Loeb, *Currents of Change: The Anacostia River, a Jewel Tarnished by Years of Pollution and Neglect, Is Beginning to Regain Its Former Beauty*, WASH. POST, Dec. 1, 1996, at B1; Tom Shierholz, *Cleaning Washington's Forgotten River*, CHRISTIAN SCI. MONITOR, Dec. 16, 1988, at 1; Michael Kronthal, *Local Residents, the Anacostia River and Community*, unpublished paper prepared for the Environmental Anthropology Project, a joint project of the Society for Applied Anthropology and the U.S. Environmental Protection Agency; Anacostia Watershed Society Homepage, http://www.anacostiaws.org (last visited July 30, 2007); Center for Watershed Protection, Watershed Restoration, http://www.cwp.org/restoration.htm (last visited July 30, 2007); Eyes of Paint Branch, http://www.eopb.org/index.php (last visited July 30, 2007); League of Women Voters of Montgomery County, MD, Inc., The Viability of Agriculture in Montgomery County (2004), http://www.lwvmd.org/mont/fsagr.html; Md. Dep't of Natural Res., Maryland's Surf Your Watershed—Watershed Profile: Anacostia River,
http://mddnr.chesapeakebay.net/wsprofiles/surf/prof/wsprof.cfm?watershed=02140205 (last visited July 30, 2007); Lynn K. Stabenfeldt, Small Habitat Improvement Program in Urban Areas: Washington, D.C. (1996), http://www.chesapeakebay.net/pubs/158.pdf; U.S. Environmental Protection Agency, Case Study: Anacostia Watershed, District of Columbia, http://www.epa.gov/OWOW/NPS/Ecology/cs-ana.html (last visited July 30, 2007); U.S. Fish & Wildlife Service Chesapeake Bay Field Office, Restoring an Urban Watershed, http://www.fws.gov/chesapeakebay/Newsletter/Spring06/Watts/wattsbranch.htm (last visited July 30, 2007).

135. Arnold, *Is Wet Growth Smarter?, supra* note 16, at 10158. *See also* WHATCOM COUNTY COUNCIL, FILE #61-98:ZT—LAKE WHATCOM WATERSHED DEVELOPMENT REGULATIONS, *available at* http://lakewhatcom.wsu.edu/pdfs/Zone.pdf; WHATCOM COUNTY COUNCIL, REVISIONS TO FILE #61-98 WATER RESOURCES PROTECTION OVERLAY ZONE, *available at* http://lakewhatcom.wsu.edu/pdfs/Zone.pdf; WHATCOM COUNTY WATER RES. DIV., DRIVING THE WRIA 1 WATERSHED MANAGEMENT PROJECT: OVERVIEW (2000); Carolyn Nielsen, *County Urged to OK New Watershed Rules*, BELLINGHAM HERALD, June 9, 2003, at 9A; Aubrey Cohen, *Activists Appeal to Fight Sprawl in County's Rural Areas*, BELLINGHAM HERALD, July 5, 2004, at 1A; Katie N. Johannes, *Lake Whatcom Downzone OK'd by County Council*, BELLINGHAM HERALD, Jan. 14, 2004, at 1A; Emily Weiner, *First Sale of Lake Watershed Development Rights Is Complete*, BELLINGHAM HERALD, Jan. 26, 2004, at 5A; North

nia),[136] and the Mackinaw River (Illinois).[137] The construction of environmental conservation efforts around special places may be problematic because preservation of ordinary places and non-geographic components of nature are critical to preservation of healthy, functioning, interconnected ecological systems.[138] Nonetheless, the public's appreciation of special places may be an entry point for building public awareness of, and commitment to, all the parts of nature, whether special or ordinary, geographic or non-geographic.[139]

Relationships between people and places also shape the economic value of real property for sale, purchase, lease, and investment. Real estate is marketed not only with respect to the quantity of land (e.g., acreage), structures (e.g., square footage), types of structures (e.g., 3-bedroom Craftsman bungalow), and other resources (e.g., swimming pool; unsevered oil and gas rights), but also with respect to the property's location.[140] Whether the property is on a scenic bluff overlooking a river, on a highway due to be expanded because of suburban growth, in a "safe" neighborhood, or in an aging inner city area with mixes of industrial, commercial, and residential properties, the "value" of the land is defined by social meanings given to the human and physical environments in which the land is located.[141] The old adage is that market value in real estate is all about "location, location, location."[142]

Third, the mediating function of land use regulation is appar-

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Cascades Audubon Society, NCASLake Whatcom Information, http://www.northcascades audubon.org/php/index.php?chapter,conservation,lake_whatcom (last visited July 30, 2007).

136. NORRIS HUNDLEY, JR., THE GREAT THIRST: CALIFORNIANS AND WATER: A HISTORY 398-425 (rev. ed. 2001); Elizabeth Ann Rieke, *The Bay-Delta Accord: A Stride Toward Sustainability*, 67 U. COLO. L. REV. 341 (1996); Patrick Wright, *Fixing the Delta: The CALFED Bay-Delta Program and Water Policy Under the Davis Administration*, 31 GOLDEN GATE U. L. REV. 331 (2001).

137. FREYFOGLE, BOUNDED PEOPLE, *supra* note 32, at 151-70.

138. *See* Arnold, *Mono Lake*, *supra* note 131, at 30-31; Holly Doremus, *Biodiversity and the Challenge of Saving the Ordinary*, 38 IDAHO L. REV. 325 (2002).

139. For an excellent and richly interdisciplinary article laying out the case for urban ecosystem management based on the special relationships that people form with the urban environment, see Spyke, *Charm in the City, supra* note 50.

140. *See* G. STACY SIRMANS & DAVID A. MACPHERSON, THE COMPOSITION OF HEDONIC PRICING MODELS: A REVIEW OF THE LITERATURE 2—3 (2003), *available at* http://www.realtor.org/ncrer.nsf/files/ExecSummsirmansmacpherson1.pdf/$FILE/ExecSum msirmansmacpherson1.pdf (noting that factors such as lot size, square feet, presence of a swimming pool, or location next to a golf course, ocean front, or lake can impact the selling price of a home).

141. *See id.*

142. Peter Burgdorff, the president and CEO of ERA Real Estate said, "[t]he oldest saying in real estate is 'location, location, location.'" Roberta F. Mann, *The (Not So) Little House on the Prairie: The Hidden Costs of the Home Mortgage Interest Deduction*, 32 ARIZ. ST. L.J. 1347, 1355 n.39 (2000) (citing *20/20*: *Location, Location, Location* (ABC television broadcast June 23, 1999)).

ent in its legal justification: the concept of land use compatibility and segregation of uses. In upholding the constitutionality of zoning in 1926, the United States Supreme Court stated:

> The line which in this field [of regulating land use under the police power] separates the legitimate from the illegitimate assumption of power is not capable of precise delimitation. It varies with circumstances and conditions. A regulatory zoning ordinance, which would be clearly valid as applied to the great cities, might be clearly invalid as applied to rural communities. . . . [T]he law of nuisances . . . may be consulted, not for the purpose of controlling, but for the helpful aid of its analogies in the process of ascertaining the scope of, the [zoning] power. Thus the question whether the power exists to forbid the erection of a building of a particular kind or for a particular use, like the question whether a particular thing is a nuisance, is to be determined, not by an abstract consideration of the building or of the thing considered apart, but by considering it in connection with the circumstances and the locality. . . . A nuisance may be merely a right thing in the wrong place,—like a pig in the parlor instead of the barnyard.
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> . . . The matter of zoning has received much attention at the hands of commissions and experts, and the results of their investigations have been set forth in comprehensive reports. These reports, which bear every evidence of painstaking consideration, concur in the view that the segregation of residential, business, and industrial buildings will make it easier to provide fire apparatus suitable for the character and intensity of the development in each section; that it will increase the safety and security of home life; greatly tend to prevent street accidents, especially to children, by reducing the traffic and resulting confusion in residential sections; decrease noise and other conditions which produce or intensify nervous disorders; preserve a more favorable environment in which to rear children, etc.[143]

143. Village of Euclid v. Ambler Realty Co., 272 U.S. 365, 387-94 (1926) (citation omit-

Thus, the legal authority to regulate land use rests in context-specific determinations about the propriety of particular land uses in particular places, as defined by social needs and desires. Zoning and other land use regulations serve to implement the local government's determinations about the most relevant characteristics and functions of particular areas within the locality's jurisdiction, both protecting existing uses and features of these areas and shaping future uses and features of these areas. Decisions about which uses are incompatible with one another under various circumstances, as well as choices about how to segregate these incompatible uses, are made within the land use regulatory system. In other words, land use regulation is a means by which social environments and physical environments inter-relate to one another. Notably, courts appear to embrace the role of social and physical context in monitoring, legitimizing, and checking the scope of land use regulatory power, often describing at length in their judicial opinions the natural, physical, social, economic, and political characteristics of the land in question.[144]

Fourth, the land use regulatory system utilizes various specific mechanisms to mediate the connections between people and places. Signage ordinances (which regulate the number, size, location, lighting, and appearance of signs) aim to avoid the visual clutter of a proliferation of large garish signs dominating streetscapes.[145] Landscaping requirements in land use permits promote green spaces mixed among the built environment, soften or buffer the borders and entry points at which people first experience the development site, and create a vegetated urban environment with its cooling, shade-producing, visually appealing, and air- and noise-pollution absorbing effects.[146] Density limits in zoning codes regulate the number and concentration of people occupying or interacting with particular places at any given time.[147] In other words, zoning incorporates policy choices about the mix of crowded spaces, sparsely occupied spaces, and everything in between. Zoning districts themselves both reflect and shape the local commu-

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ted).

144. *See generally* Palazzolo v. Rhode Island, 533 U.S. 606 (2001); City of Monterey v. Del Monte Dunes at Monterey, Ltd., 526 U.S. 687 (1999); Arnold, *Reconstitution of Property, supra* note 29, at 347-49 (discussing, *inter alia*, Lucas v. S.C. Coastal Council, 505 U.S. 1003 (1992)). *See also* Spur Indus., Inc. v. Del Webb Dev. Co., 494 P.2d 700 (Ariz. 1972); Nat'l Audubon Soc'y v. Superior Court, 658 P.2d 709 (Cal. 1983); Rowe v. Town of N. Hampton, 553 A.2d 1331 (N.H. 1989); Prah v. Maretti, 321 N.W.2d 182 (Wis. 1982); Just v. Marinette County, 201 N.W.2d 761 (Wis. 1972) .

145. *See* Jacob Loshin, *Property in the Horizon: The Theory and Practice of Sign and Billboard Regulation*, 30 ENVIRONS 101, 143—59 (2006).

146. KELLY & BECKER, *supra* note 83, at 311—13.

147. *See id.* at 207—08.

nity's choices about the types of uses, structures, and even people who are or will characterize particular areas in a community.[148] Moreover, many communities use mechanisms like overlay zones, specific-area plans, and planned unit development (PUD) zoning to define specific land use policies and regulations for geographic sub-areas in the community.[149] Such a sub-area might be a neighborhood, an arterial roadway corridor, a business district, a resort area, an area organized around a particular natural resource such as a waterfront or high desert geography, or any other geographic area within the community delineated by its place-based organizing features. These area-specific controls arise out of specific people-place interactions that define the area and its characteristic features, and affect ongoing and new people-place interactions in the area.

2. Communities and Power

The land use regulatory system also mediates between communities and power. The land use regulatory system coordinates the exercise of power and development of public policy among various communities and identities that are formed in relationship to land.[150]

The types of communities that form in relationship to land or are defined by their relationship with land might simply be loose collections of individuals who have in common their roles as landowners or holders of private property interests in land. However, these communities also include relationships formed among neighbors in a given block, on a given street, in an apartment or condominium complex, in a homeowners' association, in a neighborhood, across several nearby neighborhoods, in the local city or town, throughout the metropolitan area, in an inter-local region, throughout the state, in an interstate region, and across the nation (e.g., a sense of national identity or community). Each of these communities has a physical geography, as well as a social and political identity. Other land-based communities might be or-

148. *See id.* at 203—08.

149. *Id.* at 217—18, 321—35 (discussing PUD zoning and planning for specific areas, such as neighborhoods, corridors, environmentally sensitive areas, historic districts, or downtown areas). S*ee also* SELMI & KUSHNER, *supra* note 34, at 93 (implying that an overlay zone could be used to protect a district made up of historical buildings).

150. *See, e.g.*, GREENBERG, *supra* note 50 (discussing generally the relationship of our use of land and space to the communities that we form); ROBERT DAVID SACK, HUMAN TERRITORIALITY: ITS THEORY AND HISTORY 1-27 (1986) (asserting the role of power in defining socio-spatial arrangements); Karkkainen, *supra* note 2, at 65-85 (describing the creation of community identity and value, bargaining among stakeholders in land use decisions, and democratic participation in land use regulation).

ganized around particular natural or built features of the physical and social environment. More broadly, humans are part of natural communities such as ecosystems, and may be aware of their part in these natural communities. Throughout all of these various land-based communities, there is a common pattern of nesting of communities: smaller communities are nested within larger communities, which are nested within still large communities. Any individual user of land is a part of multiple communities that have some identity or characteristics that relate to land and land use.

There are also several different types of power over land use. Sidestepping tomes upon tomes of definitional debate among philosophers, political theorists, sociologists, social psychologists, linguists, and others,[151] we can consult *Webster's Dictionary*, the basic reference for common meanings of words, to get a general sense of the term: "possession of control, authority, or influence over others."[152] More specifically, though, power with respect to land use includes several dimensions.[153] One is the concept of the legal authority to control the use of land. Another is the concept of political and legal jurisdiction over the land to be controlled. Another is the concept of capacity or ability to control land use, including physical capacity, organizational capacity, financial capacity, socio-psychological capacity, and adequate information and/or skill, among others. Another is the concept of social authority to control the use of land: society's (or the community's) respect for both the legitimacy and capacity of the holder of the power to exercise it. Closely related to all of these concepts, yet with a different emphasis, is the concept of the right or entitlement to control land use. A slightly different concept is persuasive authority to influence land use. Finally, there is the concept of duty or responsibility to control land use.

Mediating the relationships between these communities and types of power is one of the core functions of the land use regulatory system. In many respects, communities receive their power from sources that are at least partially outside the land use regulatory system: organic social processes that create and define

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151. *See, e.g.*, GILLES DELEUZE, DIFFERENCE AND REPETITION (1994); KEITH DOWDING & D. DOWDING, POWER: CONCEPTS IN THE SOCIAL SCIENCES (1996); STEVEN LUKES, POWER: A RADICAL VIEW (2d ed. 2005); NICCOLO MACHIAVELLI, THE PRINCE (Bantam Classics reissue ed. 1984); FREIDRICH NIETZSCHE, BEYOND GOOD AND EVIL (R.J. Hollingdale trans., Penguin Classics reissue ed. 2003); ALVIN TOFFLER, POWERSHIFT: KNOWLEDGE, WEALTH, AND POWER AT THE EDGE OF THE 21ST CENTURY (1990) .

152. WEBSTER'S NINTH NEW COLLEGIATE DICTIONARY 922 (1985) (defining "power").

153. *See, e.g.*, GREENBERG, *supra* note 50 (exploring generally various ways that power is asserted over the design and development of cities and neighborhoods); SACK, *supra* note 150, at 1-27 (discussing the theory and evidence of human exercise of power and control over land and society throughout history).

communities; legal texts, traditions, decisions, and processes; political forces; social norms; and physical and social conditions.[154] The activities of using land and controlling the use of land—the objects of the land use regulatory system—are activities by which these communities exercise their powers. They are also activities by which the powers of these communities come into conflict with one another, are combined or coordinated, are further defined, and are adapted and modified. The land use regulatory system functions to mediate these power relationships.

For example, the land use regulatory system's mediating function can be seen in the crudest common characterization of the system: a conflict between developers who seek to create value for themselves from new development, and neighbors who seek to stop or constrain new development in order to protect their existing quality of life and property values.[155] Simplistic structural models at either extreme of this conflict's spectrum—that powerful and wealthy development and business interests control local land use policy or that growth-distrusting local homeowners who vote in local elections to protect their property interests control local land use policy[156]—fail to convey the many ways by which power over land use is exercised, contested, and shared. Sometimes developers win and sometimes development-opposing neighbors win. Even within a single community, the developer-neighbor conflicts go through many iterations over time, with relative power shifting from time to time. Moreover, not all communities are the same. Some communities are pro-growth and others are anti-growth. Some developers are more successful at achieving their aims than other developers are, just as some neighborhood groups are more successful at achieving their aims than other such groups are. The land use regulatory system serves as both the forum for their com-

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154. *See*, *e.g.*, LUKE W. COLE & SHEILA R. FOSTER, FROM THE GROUND UP: ENVIRONMENTAL RACISM AND THE RISE OF THE ENVIRONMENTAL JUSTICE MOVEMENT (2001) (illustrating through case studies and commentaries how these types of sources influence the power of communities to fight environmental injustices in land use regulation); DONAHUE, *supra* note 94 (an impressive survey of the historical, cultural, legal, physical, political, ecological, and socioeconomic factors affecting Western rangeland uses); EWICK & SILBEY, *supra* note 86, at 34-35 ("Because the term 'law' names assorted social acts, organizations, and persons, including lay as well as professional actors, and encompasses a broad range of values and objectives, it has neither the uniformity, coherence, nor autonomy that is often assumed."); LOW, *supra* note 106; Lea S. VanderVelde, *Local Knowledge, Legal Knowledge, and Zoning Law*, 75 IOWA L. REV. 1057 (1990) .

155. Carol M. Rose describes an example of this scenario in the context of variances where the developers symbolize a class concerned with their own economic interests, while the neighbors, who are also the voters, may be able to challenge the proposed zoning change via a referendum. Rose, *supra* note 11, at 863.

156. *Compare* FEAGIN & PARKER, *supra* note 9, *and* Feagin, *supra* note 10, *with* Ellickson, *Surburban Growth Controls*, *supra* note 9.

peting efforts to achieve their respective goals and the means by which their goals are implemented and achieved.

While the developer-neighbor conflict paradigm captures some part of the land use system, it is hardly a complete picture. The competition for power to control (or influence) land use outcomes occurs among many different groups: between local residents or community activists and professional planners; among different neighborhoods or areas of the locality; between long-time residents and new residents; among different racial, ethnic, and/or socio-economic groups; among different factions within a neighborhood; among different types of businesses or professions; between developers or property owners and government officials; between professional government staff and elected or appointed officials; among competing political factions on elected governing bodies or appointed boards; among different governmental jurisdictions; and so forth.

Moreover, some aspects of the relationship between communities and power over land use are not characterized by conflict. Instead, they are about finding or developing methods of empowerment: pie-expanding, not pie-slicing. For example, increasingly neighborhood residents are actively participating in developing plans and land use regulations for their neighborhoods through techniques like design charrettes,[157] scenario development, impact assessment, participatory land use mapping, computer photo simulation, visual survey techniques, small group and large group discussion of options, individual registration of preferences through surveys or the placement of dots on maps, simulated renderings, photographs, consensus-building activities, and the training of community residents in the use of Geographic Information Systems (GIS) software.[158] Low-income and minority communities that have historically had little influence on land use policies in their neighborhoods and localities are organizing into groups like the Dudley Street Neighborhood Initiative in the Roxbury area of Boston[159] or the Little Village Environmental Justice Organization

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157. A charrette is a process by which a multi-disciplinary team of professionals "works closely with stakeholders through a series of feedback loops, during which alternative concepts are developed, reviewed by stakeholders, and revised accordingly." AM. PLANNING ASS'N, PLANNING AND URBAN DESIGN STANDARDS 57 (2006).

158. *See* CRAIG ANTHONY (TONY) ARNOLD, FAIR AND HEALTHY LAND USE (forthcoming 2007). *See also* AM. PLANNING ASS'N, *supra* note 157, at 46-67; KELLY & BECKER, *supra* note 83, at 11-29; RANDOLPH, *supra* note 33, at 47, 55-74.

159. *See* Antonio Alves et al., *Environmentalism in the Dudley Street Neighborhood*, 14 VA. ENVTL. L.J. 735 (1995); Daniel R. Faber et al., *Solving Environmental Injustices in Massachusetts: Forging Greater Community Participation in the Planning Process*, 3 PROJECTIONS 109 (2002); Michele Estrin Gilman, *Poverty and Communitarianism: Toward a Community-Based Welfare System*, 66 U. PITT. L. REV. 721 (2005); Rose A. Kob, *Riding the Mo-*

in the South Lawndale area of Chicago[160] and are developing their own plans and visions for the revitalization of their neighborhoods. In addition, many local land use decisions are made through the processes of negotiation and/or collaboration, which allow for power sharing and the redefinition of community power relationships.[161]

3. Freedom and Boundaries

The theme of a mix of freedom and boundaries pervades the land use regulatory system, which mediates between the two concepts in practice. This theme is common to many legal systems:

> Legal systems ideally impose boundaries or limits on human and institutional behaviors, while at the same time giving people and institutions the authority, tools, and freedom to act. The component of boundaries emphasizes rules, restrictions or prohibitions, duties and requirements, liabilities, conflict, and responsibility and accountability. The component of freedom emphasizes power and authority, tools and techniques, innovation and creativity, choice and discretion, achievement, collaboration and cooperation, adaptation, and self-assertion. Legal systems should be thought of not so much as having a balance between two competing features (i.e., freedom and boundaries) as having a combination, or mix, of two necessary components of social dynamics. Indeed, we are well aware of the need of humans and human institutions to have both freedom and boundaries from work in a variety of disciplines, including psychology, political science, theology and religion, sociology, philosophy, and education, as well as from our own life experiences.[162]

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mentum of Smart Growth: The Promise of Eco-Development and Environmental Democracy, 14 TUL. ENVTL. L.J. 139 (2000); Benjamin B. Quinones, *Redevelopment Redefined: Revitalizing the Central City with Resident Contro*l, 27 U. MICH. J.L. REFORM 689 (1994); William H. Simon, *The Community Economic Development Movement*, 2002 WIS. L. REV. 377; Sean Zielenbach, *Catalyzing Community Development: Hope VI and Neighborhood Revitalization*, 13 J. OF AFFORDABLE HOUSING & COMMUNITY DEV. L. 40 (2003).

160. *See* Little Village Environmental Justice Organization, http://www.lvejo.org (last visited July 30, 2007).

161. CALLIES ET AL., *supra* note 48; Arnold, *Clean-Water Land Use, supra* note 22, at 325; Camacho, *Installment One*, *supra* note 44; Camacho, *Installment Two*, *supra* note 44.

162. Arnold, *Clean-Water Land Use, supra* note 22, at 349. *See, e.g.*, RANDY E. BAR-

At the most general level, freedom and boundaries inherently serve as corollaries to one another in a regulatory system. The regulators' power and authority to regulate restrict or constrain the freedom of those who are regulated. The rights of the regulated and the limits on the power and authority of the regulators give those who are regulated freedom to act. In these respects, the land use regulatory system's functions of mixing freedom and boundaries are no different than those for any public law system.

At a level more specific to land use, though, both freedom and boundaries are associated with land and interests in land. First, the physical and natural characteristics of the land provide both opportunities for use and constraints on use. Land in its natural state is already in use in "nature's economy," serving ecological functions and adapting to natural disturbances and limits.[163] The land's natural characteristics also provide opportunities for human use, some in ecologically sustainable and healthy ways, some in ways that alter the land or natural environment but in ways to which nature can adapt reasonably well, and some in ways that harm or even destroy the health and integrity of natural systems. At the same time, some natural or physical characteristics of land prevent or deter certain uses of the land because humans cannot (or choose not to) alter these characteristics. For example, land

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NETT, THE STRUCTURE OF LIBERTY: JUSTICE AND THE RULE OF LAW (1998) (discussing law, philosophy, political theory, and economics); THE BOUNDARIES OF FREEDOM OF EXPRESSION & ORDER IN AMERICAN DEMOCRACY (Thomas R. Hensley ed., 2001) (discussing law, political science, and communications); DANA CHIDEKEL, PARENTS IN CHARGE: SETTING HEALTHY, LOVING BOUNDARIES FOR YOU AND YOUR CHILD (2002) (discussing psychology and human development); HENRY CLOUD & JOHN TOWNSEND, BOUNDARIES (1992) (discussing religion and psychology); MARY ANN GLENDON, RIGHTS TALK: THE IMPOVERISHMENT OF POLITICAL DISCOURSE (1991) (discussing law, political theory, and society); CHRISTENA E. NIPPERT-ENG, HOME AND WORK: NEGOTIATING BOUNDARIES THROUGH EVERYDAY LIFE (1996) (discussing sociology); ALAN D.M. RAYNER, DEGREES OF FREEDOM: LIVING IN DYNAMIC BOUNDARIES (1997) (discussing biology, evolutionary ecology, and philosophy); PETER RUTTER, SEX, POWER, AND BOUNDARIES: UNDERSTANDING AND PREVENTING SEXUAL HARASSMENT (1996) (discussing psychiatry and social and human relationships and behaviors); A. JOHN SIMMONS, MORAL PRINCIPLES AND POLITICAL OBLIGATIONS 62-64 (1979) (political theory, philosophy); Adeno Addis, *The Thin State in Thick Globalism: Sovereignty in the Information Age*, 37 VAND. J. TRANSNAT'L L. 1, 12, 168 (2004) (discussing international law and politics and socio-cultural identity); Joel Feinberg, *Autonomy, Sovereignty, and Privacy: Moral Ideals in the Constitution?*, 58 NOTRE DAME L. REV. 445 (1983) (discussing law and philosophy); Michael A. Heller, *The Boundaries of Private Property*, 108 Yale L.J. 1163 (1999) (discussing law and economics); Robert A. Goldwin, *Of Men and Angels: A Search for Morality in the Constitutions, in* THE MORAL FOUNDATIONS OF THE AMERICAN REPUBLIC 24, 24-41 (Robert H. Horowitz ed., 3d ed. 1986) (discussing political and moral theory); Christine Jolls et al., *A Behavioral Approach to Law and Economics*, 50 STAN. L. REV. 1471, 1476-79 (1998); Stephen Macedo, *The Rule of Law, Justice, and the Politics of Moderation*, *in* THE RULE OF LAW, NOMOS XXXVI 148-77 (Ian Shapiro ed., 1994) (discussing law and political theory); Marilyn McKean Skaff, *Of Roots and Wings: The Postmodern Paradox of Caregiving*, 47 CONTEM. PSYCHOLOGY: APA REV. OF BOOKS 305-06 (2002) (discussing psychology, mental health, and social culture).

163. *See* Sax, *supra* note 73.

characterized by substantial seismic activity, steep slopes, wetlands, old growth forests, flooding, or habitat to rare species pose practical and/or ethical obstacles to boundless development and use. The land use regulatory system may or may not choose to attempt to overcome these obstacles, but there will be costs and impacts from altering nature. For example, replacing the watershed functions of pervious lands with impervious cover associated with ubiquitous urban sprawl has resulted in increased quantity and velocity of runoff, increased flooding, degraded quality of surface waters, decreased recharge of groundwater, harm to fish and wildlife habitat, erosion of land and waterway banks, de-vegetation of riparian areas, loss of economic activity from fishing and water recreation, and many other such effects.[164]

Second, social norms and legal doctrines concerning private real property rights limit the potential scope of land use regulation and guarantee property owners certain freedoms. For example, the government cannot permanently occupy a landowner's property or regulate the use of his or her land so strictly as to deny the landowner all economically viable use of his or her property without paying just compensation.[165] On the other hand, the American system of private property rights imposes boundaries on the landowner's freedom, prohibiting nuisances, trespasses, waste, or other violations of limits inherent in title, giving government entities property-based legal authority to regulate land use.[166]

Even more specifically, the combination of both freedom and boundaries explains much of the operation of the land use regulatory system in the United States. The nature of planning, zoning, and discretionary permitting is about finding an appropriate mix of landowner freedom and boundaries, within a government decision making framework that gives regulators both power and limits. The system neither imposes stringent, unyielding restrictions on land use nor guarantees interest-holders in land unfettered freedom to use their land in any way they wish. Regulators have both broad authority to regulate and numerous limits on their powers. Interest-holders in land have both considerable freedom to possess, use, manage, and develop their lands, while also facing restrictions on their uses and requirements of government approval for many kinds of development or use of land. Most land

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164. Arnold, *Clean-Water Land Use, supra* note 22, at 294-301.

165. *See* Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419 (1982); Lucas v. S.C. Coastal Council, 505 U.S. 1003 (1992).

166. *See* Michael C. Blumm & Lucus Ritchie, Lucas*'s Unlikely Legacy: The Rise of Background Principles as Categorical Takings Defenses*, 29 HARV. ENVTL. L. REV. 321 (2005); Joseph L. Sax, *Some Thoughts on the Decline of Private Property*, 58 WASH. L. REV. 481 (1983).

uses are neither absolutely prohibited (at least in the end) nor allowed without some degree of government control. The overwhelming majority of land use controls, at least in effect or impact, are project-by-project negotiated discretionary permits authorizing private landowners to engage specific land uses but subject to certain conditions, exactions, and limits under: a) broad decision making standards, b) standardized yet relatively adaptable procedures, c) the dominance of local government regulation, and d) the superdominance of private property norms.

Assume, for example, that a landowner desires to develop a vacant parcel of land surrounded by developed lands in a metropolitan area into a residential condominium ("condo") project. In nearly any metropolitan jurisdiction, the landowner cannot simply develop the condos without obtaining the necessary land use approvals. First, she may find that the local government cannot approve the project if it is in conflict with the locality's comprehensive plan for land use, transportation, housing and economic development, and the like. However, she is likely to find that the local comprehensive plan serves more like a guideline than a regulation and that government officials may choose loose interpretations of consistency or just modify the comprehensive plan to reflect their new land use goals if they agree with the parcel's use for residential condos. Second, she may find that her parcel is not zoned for multi-family residential use or, even if it is, the zoning code imposes density limits and setback requirements that prevent her from building her desired number of condos in her desired location on the parcel. However, she may seek and could be granted a rezoning of her parcel, an amendment to the text of the zoning code, or variances for the use (if the jurisdiction allows use variances), density, and setbacks. One way that the local government can provide the authority to approve her project without allowing it out-right is to use a flexible zoning technique like: a) making condominiums conditional uses in her zoning district, thus requiring a conditional use permit (CUP); b) approving a planned unit development (PUD) plan as the applicable zoning on her property; or c) amending the zoning code to impose performance zoning on condos or an overlay zone on the parcel in question. The subdivision of her land into condo units, as well as any CUP, PUD, or other discretionary land use permit, will require her to submit her development proposal and plans to the local government for approval. The government officials must follow certain procedures in considering and deciding on her project, but they are fairly basic. The government officials must also apply certain standards in deciding whether to grant or deny the permit(s), but these standards

are fairly general, such as whether the project will adversely affect the public health, safety, or welfare; whether the project will unreasonably impact surrounding land uses; and whether the project is appropriate for the size and location of the parcel. In other words, the government decision makers face some parameters, but they also have considerable discretion and flexibility. They are likely to impose specific conditions on the applicants' permit if they grant it, tailoring the conditions in such a way as to avoid, minimize, or mitigate any impacts the project may have. The landowner may negotiate the scope and nature of these conditions with the local planning staff, the planning commission, or the city council. These conditions will restrict the landowner's freedom to develop or use her parcel, but only in limited, measured ways tailored to the specific project, instead of through generally applicable regulations. This discretion gives the potential for under-regulation in some cases and over-regulation in others. Most notably, though, the nature of planning, zoning, and discretionary permitting is about finding an appropriate mix of landowner freedom and boundaries, within a government decision making framework that gives regulators both power and limits.[167]

B. Other Functions and Dysfunctionality

In satisfying ourselves that the land use regulatory system primarily serves mediating functions, we need to consider carefully the constitutive, distributive, and protective functions of the system. First, some might argue that land use regulation defines and shapes the places in which we exist in our society, which in turn defines and shapes our values, norms, and expectations about land use.[168] According to one commonly identified illustration of this concept, the structure and content of zoning codes in most commu-

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167. From 1999 to 2002, I served on the Planning Commission of the City of Anaheim, including a term as its chairman. In that experience, I observed the appreciation that both planning commissioners and many applicants had for the combination of discretionary flexibility and nondiscretionary limits. While they might test or push the limits at times, they seemed relieved that there were limits, even though they constrained their freedom to pursue their self-interest. In these experiences and observations, my thoughts about the universal human need for both freedom and boundaries began to crystallize, even though I had been aware of these needs in the areas of human development, personal ethics, and faith. For an excellent description of the mix of authority, power, limits, and obligations in local use of development agreements to both control and authorize development, see CALLIES ET AL., *supra* note 48.

168. *See* GREENBERG, *supra* note 50 (arguing generally that the way that we define land development in our cities shapes our values and behaviors); ERAN BEN-JOSEPH, THE CODE OF THE CITY: STANDARDS AND THE HIDDEN LANGUAGE OF PLACE MAKING (2005) (making the case that land development standards and rules shape the places where we live, which in turn shape our society).

nities encourage or facilitate suburban sprawl, which we come to see as normal and desirable because suburbia is the environment in which we live.[169] At some level, the land use patterns and practices that result from our land use regulatory system shape our norms, attitudes, values, and even our cognitive and social biases.

However, this constitutive function arises out of the land use patterns, practices, regulations, and policies that result from the system's mediation between society and its physical environment. Social, political, economic, psychological, and cultural forces have shaped the content of our land use policies, practices, and laws.[170] If the outcomes of the land use regulatory system shape our values, norms, and preferences, it is only because the land use regulatory system is a conduit for the forces in society that are already shaping our values, norms, and preferences. To the extent that elites, professional planners, interest groups, or ideologies control the outcomes of the land use regulatory system,[171] the system merely reflects social choices and/or social structures that pervade many other areas of public policy and many other decision making systems in our society. In addition, while the structure of the land use regulatory system inevitably limits the choices that society has and shapes the choices that society makes, it does in the sense of a tool's characteristics or a vehicle's qualities shape or limit what the user can do with them.

Thus, suburban sprawl or racially segregated residential patterns are not inevitable results of the American land use regulatory system because of the structure of the system. Instead they are the inevitable result of consumptive norms[172] and racial prejudices[173] that are reflected in, and given spatial manifestation by, the land use regulatory system. In fact, as society's goals and val-

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169. *Id.* at 8-10, 57-73.

170. *See* DONAHUE, *supra* note 94 (an impressive survey of the historical, cultural, legal, physical, political, ecological, and socioeconomic factors affecting Western rangeland uses); MATTHEW E. KAHN, GREEN CITIES: URBAN GROWTH AND THE ENVIRONMENT (2006) (discussing economic forces that shape both growth and urban environmental quality); SACK, *supra* note 150, at 1-27 (discussing political, social, and geographic forces); SENNETT, *supra* note 50 (discussing cultural and social forces).

171. *See* FEAGIN & PARKER, *supra* note 9; JUDD, *supra* note 9, at 1—9; KELLY & BECKER, *supra* note 83, at 27—29, 37—39; SIEGAN, *supra* note 9, at 179—201; Briffault, *supra* note 9, at 3—5; Bullard, *supra* note 3, at 32-33; Ellickson, *Suburban Growth Controls, supra* note 9; Feagin, *supra* note 10; Frug, *supra* note 9, at 1047—48; Daniel P. Selmi, *Reconsidering the Use of Direct Democracy in Making Land Use Decisions*, 19 UCLA J. ENVTL. L. & POL'Y 293 (2001/2002); Michael Allan Wolf, *Danngerous Crossing: State Brownfields Recycling and Federal Enterprise Zoning*, 9 FORDHAM ENVTL. L.J. 495, 532 (1998).

172. *See* Garrett Hardin, *The Tragedy of the Commons*, 162 SCI. 1243 (1968); Andrew Auchincloss Lundgren, *Beyond Zoning: Dynamic Land Use Planning in the Age of Sprawl*, 11 BUFF. ENVTL. L.J. 101, 118 (2004).

173. *See* Paul M. Hendrick, *Racism in American Land Use Decisions: The Slicing of the American Pie*, 2 FLA. COASTAL L.J. 395 (2001).

ues have changed, zoning codes and land use decisions are increasingly changing to facilitate mixed-use development and other anti-sprawl techniques, to protect the natural environment, and to promote mixed-race, mixed-income housing development.[174] What may be said to be true about the land use regulatory system, though, is that it may lag behind changes in social norms, values, and preferences. Thus, the system at any point in time may reflect choices that are now contested or have changed. This delayed-response aspect of the system, though, should not be confused with a constitutive function. The critical point is to understand that land use in the United States is changing as society changes.

Some would argue instead that the land use regulatory system is a distributive system.[175] There can be little doubt that the land use regulatory system serves distributive functions. The authority or permission to use land is something of value or meaning that is distributed within the land use regulatory system.[176] If a city, for example, has approved a dozen permits for automotive repair shops over the past two decades but then ceases to approve new applications for permits due to the adverse impacts of over-concentration of automotive repair shops in the area, it is making a distributive decision. Additionally, decisions about land uses in our society affect who receives certain kinds of resources in society, such as different types of housing stock; parks and recreational facilities; natural landscapes; access to retail shopping opportunities, schools, and educational opportunities; and transportation infrastructure and services, among others.[177] Nonetheless, the land use regulatory system is not primarily a distributive system. It is not merely a market of free exchange. Nor is it a top-down centralized provider of goods and services. Both advocates and critics of economic analysis likely find the land use regulatory sys-

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174. *See, e.g.*, Myron Orfield, *Land Use and Housing Policies to Reduce Concentrated Poverty and Racial Segregation*, 33 FORDHAM URB. L.J. 877 (2006); Patricia E. Salkin, *Sorting Out New York's Smart Growth Initiatives*: *More Proposals and More Recommendations*, 8 ALB. L. ENVTL. OUTLOOK 1 (2002); Amanda Seik, Comment, *Smart Cities: A Detailed Look at Land Use Planning Techniques that Are Aimed at Promoting Both Energy and Environmental Conservation*, 7 ALB. L. ENVTL. OUTLOOK 45 (2002).

175. *See* DANIEL R. MANDELKER, ENVIRONMENT AND EQUITY: A REGULATORY CHALLENGE (1981).

176. *See id.*; Alan Weinstein, Book Review, 11 B.C. ENVTL. AFF. L. REV. 203, 204 (1983) (reviewing DANIEL MANDELKER, ENVIRONMENT AND EQUITY: A REGULATORY CHALLENGE (1981)).

177. Richard Briffault, *Our Localism: Part II—Localism and Legal Theory*, 90 COLUM. L. REV. 346, 438—39 (1990) (noting that suburban zoning increases the difficulties for the less wealthy to buy homes, which relegates them to poorer localities with mediocre educational systems); Denise C. Morgan, *The Less Polite Questions: Race, Place, Poverty and Public Education*, 1998 ANN. SURV. AM. L. 267, 281 (1998) (noting that the location of housing affects access to quality education, jobs, transportation, municipal services, and public safety).

tem irritatingly evasive of conceptually neat explanations based either completely in economic analysis or completely in a rejection of economic analysis. Land is an economic resource, but it is also more than an economic resource. "Who gets what?" is an important question in land use, but so is "what do we want?" The mediating nature of the system facilitates choices about economic and non-economic relationships with places and land. With one project, the dominant concern might be the economic utility of the project or its contribution to the local government's fiscal health, whereas with another project, arguments based in some community standard or sense of justice might prevail. Distributive patterns are difficult to predict with great accuracy. Some critics of the land use regulatory system claim that development and business interests tend to dominate,[178] and other critics claim that NIMBYist neighbors have the upper hand.[179] The likely reason for these two opposite claims is that the distributive outcomes vary greatly from city to city, region to region, time to time, and even conflict to conflict. Even though land use policies have disproportionately burdened or disfavored low-income and minority communities, not all such communities have felt these effects, even in the same local jurisdiction. The lack of simple answers or accurately predictable models is due to the complex and varied array of forces and influences that the land use regulatory system must mediate as society makes choices about general land use policies and specific land uses.

The protective system is the third alternative to the mediating system. Some would suggest that the land use regulatory system functions primarily to protect neighbors from the adverse impacts of development and nearby land uses,[180] to protect advantaged groups from interactions with disadvantaged groups,[181] or to protect the natural environment (ecological sphere) or the social environment (public sphere) from "excessive" harm from uncontrolled

178. Wolf, *supra* note 171, at 532 ("[L]ocal officials are too easily 'captured' by '**interest groups**' (at times developers seeking zoning changes, at other times home-ownership associations concerned about NIMBYs)."). *See generally* FEAGIN & PARKER, *supra* note 9; Feagin, *supra* note 10.

179. Wolf, *supra* note 178, at 532. *See generally* Ellickson, *Suburban Growth Controls, supra* note 9.

180. Robert L. Glicksman, *Making a Nuisance of Takings Law*, 3 WASH. U. J.L. & POL'Y 149, 165 (2000).

181. Mandara Meyers, Note, *(Un)Equal Protection for the Poor: Exclusionary Zoning and the Need for Stricter Scrutiny*, 6 U. PA. J. CONST. L. 349, 352—55 (2003) (describing exclusionary zoning as a normal practice in modern cities and noting that zoning arose out of the need for wealthy Americans in the early twentieth century to safeguard their property interests).

development and growth.[182] The mere variety of these possible protective goals tells us that the system's protective functions are subsumed under its mediating functions. In addition, examples of decisions not to protect against the impacts of some land uses and development suggest that protection is not the primary or essential function of the land use regulatory system.[183] The mediating function defines who or what is to be protected from whom or what and under which circumstances.

Finally, we need to consider whether the inherent limits of the land use regulatory system undermine its mediating function. Problems caused by land use regulation, such as urban sprawl, environmental degradation, or racial and ethnic segregation, give some commentators reason to question whether the land use regulatory system is even a mediating system at all, and even if it is, perhaps it is a dysfunctional system.[184] The first type of criticism emphasizes the inherent pathologies in the land use regulatory system that shape society into a sprawling, ecologically degraded and unhealthy, segregating, distributively inequitable, and alienating environment. The second type of criticism, while accepting that society primarily shapes land use regulation rather than vice-versa, contends that the system has failed to achieve a vision of a good society and instead has achieved a dystopia.

These criticisms confuse the functionality of the land use regulatory system as a mediating system with its functionality as a producer of good public policy and practices. In other words, they confuse the vehicle with the vehicle's destination or direction as decided by the vehicle's occupants. If people are alienated from nature or from their physical environment, it is because of social pathologies and choices about ethics and values, not because of the structure of the land use regulatory system.[185] The loss of community is a widespread social phenomenon and is not limited to land use policy.[186] Consumption of land well beyond its carrying

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182. Debra Lyn Bassett, *The Rural Venue*, 57 ALA. L. REV. 941, 960 (2006) (noting that some zoning ordinances have a purpose of preserving recreational or aesthetic values). *Seealso* Arnold, *Clean-Water Land Use, supra* note 22.

183. *See, e.g.*, R.I.S.E., Inc. v. Kay, 768 F. Supp. 1144, 1145 (E.D. Va. 1991) (upholding the siting of a landfill in a predominantly African-American neighborhood despite evidence of racial discrimination); Bean v. Sw. Waste Mgmt. Corp., 482 F. Supp. 673 (S.D. Tex. 1979) (upholding the siting of a solid waste facility despite admitting it would affect the health and safety of the community members).

184. *See supra* Part III.

185. *See* MAX HORKHEIMER, ECLIPSE OF REASON 92-127 (Continuum Books 1974) (1947).

186. *See* ROBERT D. PUTNAM, BOWLING ALONE: THE COLLAPSE AND REVIVAL OF AMERICAN COMMUNITY (2000). *See also* ROBERT WUTHNOW, LOOSE CONNECTIONS: JOINING TOGETHER IN AMERICA'S FRAGMENTED COMMUNITIES (1998) (making the case that innovative forms of connectivity are replacing traditional forms).

capacity is much more an issue of self-centered greed, ignorance, blind optimism, and alienation from nature than it is an issue of regulatory system design.[187] We clearly need to improve our land use practices and policies, and some of them must change fundamentally. However, the land use regulatory system provides the mediating functions that will facilitate these improvements and changes if and when we have the will to do so. The variety, utility, and adaptability of land use regulatory tools available in the U.S. offer great opportunities for effectuating improved policy choices. Many examples of good land use practices and policies bear witness to the potential for the land use regulatory system to function well as a mediator between social and physical environments, communities and power, and freedom and boundaries.

IV. THE LOCATION AND SCALE OF THE LAND USE REGULATORY SYSTEM

The land use regulatory system is located primarily at the local level of governance and decision making in the United States, despite the rise of federal and state statutes and regulations that govern certain aspects of land use.[188] The bulk of government control over land use comes from the planning activities, zoning codes, permitting requirements and permit conditions, and subdivision controls of the tens of thousands of cities and counties for which land use regulation is one of their core governmental functions.[189]

Federal and state land use controls supplement and—in some limited cases—displace or alter local land use controls. The "quiet revolution" of federal and state control over land use during the past 35 to 40 years stands in contrast to a tradition and perhaps theory that land use is a purely local matter.[190] Nonetheless, the

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187. LEOPOLD, *supra* note 92, at viii; Freyfogle, *supra* note 107; Barton H. Thompson, Jr., *Tragically Difficult: The Obstacles to Governing the Commons*, 30 ENVTL. L. 241 (2000).

188. ROBERT V. PERCIVAL ET AL., ENVIRONMENTAL REGULATION: LAW, SCIENCE, AND POLICY 768 (3d ed. 2000); ("Land use regulation in the United States traditionally has been the province of local governments using *zoning ordinances* and *building codes* as their principal regulatory tools."); ZYGMUNT J.B. PLATER ET AL., ENVIRONMENTAL LAW AND POLICY: NATURE, LAW, AND SOCIETY 1164 (2d ed. 1998) ("In day-to-day practice, the overwhelming majority of land-use management occurs at the local level, predominately through local government regulation"); Buresh, *supra* note 18, at 1436; Mandelker, *supra* note 18, at 489; Nolon, *In Praise of Parochialism*, *supra* note 21, at 373; Tarlock, *Watershed, supra* note 11, at 149. *But see* BABBITT, *supra* note 16, at 5 ("The notion that land use is a local matter has come to dominate the political rhetoric of our age, obscuring the historical reality that the national government has been involved in land use planning since the early days of the republic.").

189. Arnold, *Clean-Water Land Use, supra* note 22, at 302-03.

190. David L. Callies, *The Quiet Revolution Revisited: A Quarter Century of Progress*, 26 URB. LAW. 197 (1994). *See also* FRED P. BOSSELMAN ET AL., FEDERAL LAND USE REGULATION (1977) (depicting the increasing federalization of land use controls).

United States has not seen a federal or state displacement of local responsibility and authority for land use regulation. Typically any federal or state land use controls are merely "overlays" on top of local controls.[191] If a landowner seeks to develop land containing endangered species' habitat or wetlands having a reasonably direct nexus to navigable waters, he or she will need to obtain federal permits under the Endangered Species Act[192] and Section 404 of the Clean Water Act.[193] However, the landowner will still need to comply with local zoning regulations and permit requirements. Thus, if he or she seeks to build an office building on property zoned for residential uses, he or she will not be able to do so without local approval of a zoning amendment regardless of how species-friendly or wetland-preserving the project is. Federal and/or state laws have preempted local regulation of only a small handful of land use categories, such as group homes[194] and perhaps certain kinds of waste facilities.[195] The potential for state planning and land use controls to displace local land use authority is greater than the federal government's potential in part due to the constitutional limits of federal power (in contrast to the states' broad police powers) and in part due to the political and administrative imprac-

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191. Arnold, *Is Wet Growth Smarter?, supra* note 16, at 10165. *See, e.g.*, Peter A. Buchsbaum, *Permit Coordination Study by the Lincoln Institute of Land Policy*, 36 URB. LAW. 191 (2004) (layers of regulation of species' habitat and land use); Lindell L. Marsh & Peter L. Lallas, *Focused, Special-Area Conservation Planning: An Approach to Reconciling Development and Environmental Protection*, *in* COLLABORATIVE PLANNING FOR WETLANDS AND WILDLIFE: ISSUES AND EXAMPLES 7, 9 (Douglas R. Porter & David A. Salvesen eds., 1995) (same).

192. Endangered Species Act, 16 U.S.C. §§ 1531-1544 (2000). *See also* Nat'l Ass'n of Home Builders v. Babbitt, 130 F.3d 1041 (D.C. Cir. 1997); Friends of Endangered Species, Inc. v. Jantzen, 760 F.2d 976 (9th Cir. 1985).

193. Federal Water Pollution Control Act § 404, 33 U.S.C. § 1344 (2000). *See also* United States v. Riverside Bayview Homes, Inc., 474 U.S. 121 (1985).

194. *See, e.g.*, Lanterman-Petris-Short Act, CAL. WELF. & INST. CODE § 5116 (1982) (designating a group home of six or fewer mentally disabled adults as residential use for zoning purposes); City of Edmonds v. Oxford House, Inc., 514 U.S. 725 (1995) (interpreting provisions of the Federal Fair Housing Act that prohibit discrimination on the basis of familial status and against people who are handicapped in case involving local zoning of a group home); Nicholson v. Conn. Half-way House, Inc., 218 A.2d 383, 384—86 (Conn. 1966) (finding a halfway house for prison parolees a residential use). State law may also preempt localities from using exclusionary zoning techniques to limit the supply of affordable housing in their communities. *See, e.g.*, MASS. GEN. LAWS ch. 40B, §§ 20—23 (1973) (authorizing the state to preempt local exclusionary zoning); S. Burlington County NAACP v. Twp. of Mount Laurel (Mount Laurel I), 336 A.2d 713, 713 (N.J. 1975) (holding that zoning laws must allow for low and moderate income housing); S. Burlington County NAACP v. Twp. of Mount Laurel (Mount Laurel II), 456 A.2d 390, 410 (N.J. 1983) (holding that a county's zoing laws could not absolutely ban mobile homes).

195. *See, e.g.*, Bradford C. Mank, *Environmental Justice and Discriminatory Siting: Risk-Based Representation and Equitable Compensation*, 56 OHIO ST. L.J. 329, 348-51 (1995); Rachel D. Godsil, Note, *Remedying Environmental Racism*, 90 MICH. L. REV. 394, 402-07 (1991); Claire L. Hasler, Comment, *The Proposed Environmental Justice Act: "I Have a (Green) Dream*," 17 U. PUGET SOUND L. REV. 417, 456—57 (1994).

ticalities of a nationwide system of land use regulation. However, the number of states with regional or statewide planning and regulation is limited.[196] In most cases, state requirements do not directly regulate land use but instead impose obligations or restrictions on local land use regulatory programs, except for a handful of areas of special environmental significance and statewide concern, such as the California coastal zone[197] and the New Jersey Pine Barrens.[198] The overall picture of land use regulation in the U.S., though, is one of local control. In fact, strong political pressures and values create barriers to the federal or state displacement of local land use regulatory authority.

Local land use regulation occurs in the shadow of the super-dominance of private control of land, though. This super-dominance has three manifestations. The first manifestation is the set of legal constraints on land use regulatory powers to protect private property rights. These constraints include the regulatory takings doctrine, the exactions takings doctrine, substantive and procedural due process rights, judicial protections of vested rights and nonconforming uses, and other such doctrines.[199]

The second manifestation of the super-dominance of private control of land is the cultural, political, and psychological regard for private property rights and the value of the private property system in the United States.[200] Private property norms serve as political, cultural, and even psychological constraints on decision makers from exercising strong government control over privately owned lands. For example, when the U.S. Supreme Court held that the term "public use" in the Takings Clause of the Fifth Amendment permits a local government's exercise of eminent domain to take a private home for economic development when the

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196. SELMI & KUSHNER, *supra* note 34, at 369-98.

197. California Coastal Act of 1976, CAL. PUB. RES. CODE §§ 30000 et seq. *See also* Briggs v. State of California, 159 Cal. Rptr. 3d 190, 201 n.6 (1979) (discussing the history of the California Coastal Act, which established the California Coastal Commission with regulatory authority over land use in the coastal zone).

198. New Jersey Pinelands Comprehensive Management Plan, N.J. STAT. ANN. § 13:18A-8 (West 2003).

199. *See* MANDELKER, *supra* note 24, at 2-1 to 2-63, 5-56 to 5-68, 5-73 to 5-87, 6-14 to 6-26.

200. *See, e.g.*, FREYFOGLE, JUSTICE AND THE EARTH, *supra* note 73; JENNIFER NEDELSKY, PRIVATE PROPERTY AND THE LIMITS OF AMERICAN CONSTITUTIONALISM (1990); Butler, *supra* note 72; Joan Williams, *The Rhetoric of Property*, 83 IOWA L. REV. 277 (1998). Note that the widespread ownership of land in the United States contributes to the dominance of private property norms. *See* LAWRENCE M. FRIEDMAN, A HISTORY OF AMERICAN LAW 230-34 (3d ed. 2005). *See also Home Ownership Reaches Record*, DAYTON DAILY NEWS, Jan. 22, 1998, at 7B (reporting that 65.7 percent of all American families owned their own homes in 1997); *Most U.S. Real Estate Still American-Owned*, HOUSTON CHRON., June 30, 1991, at 8 (summarizing study showing that individuals owned about 60 percent of the nation's real estate).

ultimate use would also be private,[201] legislatures in at least 23 states responded to the public outcry by enacting legislation to prohibit such exercises of the eminent domain power, and another 20 states have considered or are considering such legislation.[202] Protection of private property values serves not only to impose informal limits on government regulatory power but also to generate private restrictions on land use. These restrictions take the forms of deed restrictions, covenants, governing rules of common-interest communities, and easements (including conservation easements).[203] These restrictions often go much further than local government land use controls in restricting private land use, but only in specific ways and for certain areas. They mostly serve the interests of surrounding properties.

The third manifestation is the dependence on private landowners for land uses and land use patterns, even if government regulation can effectively constrain or prohibit certain uses. In other words, the land use regulatory system largely defines what may not occur, but it usually does not mandate that landowners use their land in any particular way.[204] Government investment in, or construction of, public infrastructure creates certain land uses, such as parks, libraries, and even sports arenas or hospitals, and may stimulate certain kinds of private land development. However, if the owner of Parcel X does not wish to develop it this year, or does not want to build a hotel on the property, there is very little a government agency can do under our current system to force the owner to do so, short of the government taking the property by eminent domain, compensating the owner for its fair market value, and developing the property itself. Fiscal and political constraints, as well as a growing amount of post-*Kelo* eminent-domain-

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201. Kelo v. City of New London, 125 S. Ct. 2655 (2005).

202. Patricia E. Salkin, *Update on Kelo v. City of New London and the Use of Eminent Domain for Economic Development and Redevelopment*, SM004 ALI-ABA 1633, ALI-ABA LAND USE INST., Aug. 17-19, 2006.

203. *See* Carol Necole Brown, *A Time to Preserve: A Call for Formal Private-Party Rights in Perpetual Conservation Easements*, 40 GA. L. REV. 85 (2005); Frederico Cheever, *Public Good and Private Magic in the Law of Land Trusts and Conservation Easements: A Happy Present and a Troubled Future*, 73 DENV. U. L. REV. 1077 (1996); Clayton P. Gillette, *Courts, Covenants, and Communities*, 61 U. CHI. L. REV. 1375 (1994); John L. Hollingshead, *Conservation Easements: A Flexible Tool for Land Preservation*, 3 ENVTL. LAW. 319 (1997); Gerald Korngold, *Privately Held Conservation Servitudes: A Policy Analysis in the Context of in Gross Real Covenants and Easements*, 63 TEX. L. REV. 433 (1984); John Walliser, *Conservation Servitudes*, 13 J. NAT. RESOURCES & ENVTL. L. 47 (1997); James L. Winokur, *The Mixed Blessings of Promissory Servitudes: Toward Optimizing Economic Utility, Individual Liberty, and Personal Identity*, 1989 WIS. L. REV. 1 (1989).

204. This is in contrast with American land use law in the colonial period, when private property owners had affirmative duties to put their lands to certain uses or suffer forfeiture. *See* John F. Hart, *Colonial Land Use Law and Its Significance for Modern Takings Doctrine*, 109 HARV. L. REV. 1252 (1996).

restraining legislation, make it unlikely that widespread new land use patterns will result from government development and affirmative use of land.

The result is a regime of "regulatory patches" influenced by political and legal disturbances, not a system of nested hierarchies (as federalism is sometimes characterized). Insights about ecosystem scale help to understand the scale of different human systems. Some ecosystems, like watersheds, are organized as nested hierarchies, with smaller units nested inside larger units, which are nested inside still larger units.[205] However, many ecosystems are organized by "patch dynamics," which is "[t]he idea that communities are a mosaic of different areas (patches) within which nonbiological disturbances (climate, etc.) and biological interactions proceed."[206]

The comfortable and common image of the land use regulatory system is that private landowners are nested within local government jurisdictions with local land use regulatory powers, which are nested within states that are the sources of local power and constrain local power, and states are then nested within the national jurisdiction of the federal government that preempts state and local land use power with federal regulatory programs and exercises of federal power.[207] However, at best this image is more theory than reality. Practical and political constraints on total federal and state displacement of local land use power mean that federal and state regulatory efforts are limited by subject matter, method, resource constraints, and geography. Regulatory activities at any given scale are often fragmented and divided, not by geographic units but by function or subject matter, such as the division of land use regulatory powers at the federal level among many different federal agencies, including the Environmental Protection Agency, the Army Corps of Engineers, the Fish and Wild-

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205. *See, e.g.*, NAT'L RESEARCH COUNCIL, NEW STRATEGIES FOR AMERICA'S WATERSHEDS (1999); RANDOLPH, *supra* note 33, at 256-57; U.S. ENVTL. PROT.AGENCY, EPA-840-R-00-001, PROTECTING AND RESTORING AMERICA'S WATERSHEDS: STATUS, TRENDS, AND INITIATIVES IN WATERSHED MANAGEMENT 9 (2001); G.E. Griffith et al., *Ecoregions, Watersheds, Basins, and HUCs: How State and Federal Agencies Frame Water Quality*, 54 J. SOIL & WATER CONSERVATION 666 (1999); Ruhl et al., *supra* note 18, at 933.

206. THE DICTIONARY OF ECOLOGY AND ENVIRONMENTAL SCIENCE 397 (Henry W. Art ed., 1993). *See also* GRUMBINE, *supra* note 93, at 53-56 (explaining patch dynamics); REICHMAN, *supra* note 93, at 36-57 (discussing mosaic patches of tallgrass prairies and the disturbances that shape them); Fred Bosselman, *What Lawmakers Can Learn From Large-Scale Ecology*, 17 J. LAND USE & ENVTL. L. 207 (2002) (discussing the legal and policy implications of patch ecology). For an interesting treatment of geography and epistemology as a "mosaic of forms," see ANNE BUTTIMER, GEOGRAPHY AND THE HUMAN SPIRIT 87-119 (1993).

207. *See, e.g.*, John R. Nolon, *Champions of Change: Reinventing Democracy Through Land Law Reform*, 30 HARV. ENVTL. L. REV. 1, 13-14 (2006) [hereinafter Nolon, *Champions of Change*].

life Service, and numerous other agencies. Furthermore, the types of regulatory activities at smaller scales are not necessarily merely smaller-scale versions of regulatory activities at larger scales, but instead may be different types of activities altogether or may even conflict with larger-scale efforts. In some cases, there may be very little coordination between the private landowner, the local government, the state government, and the federal government. In other cases, the dynamics may resemble cooperation among distinctly separate organisms or entities, instead of a hierarchical flow of power and control from federal to state to local to individual levels.

Nonetheless, federal and state agencies' assertions of power or pursuit of authority over land use decisions can serve as "disturbances" to prompt local government action.[208] Local governments will seek to maintain their niche and primary authority over land use regulation, and often will respond to threats to their dominant functions or competition from other units of government by developing policy innovations to address prominent land use issues.[209] Alternatively, federal and state assistance to localities or the assumption of federal or state responsibility for specific land use issues may serve to strengthen local capacity to regulate land use or may fill regulatory gaps left by localities. The "patterns" of regulatory authority look far more like patchy mosaics than nested hierarchies.

V. THE COMPONENTS OF THE LAND USE REGULATORY SYSTEM

The land use regulatory system is composed of numerous component parts. Most obviously, the system is defined by its object: land. While land use regulation may be concerned with other aspects of the natural and physical environment, such as water or wildlife, it encompasses those other elements only to the extent that they relate to land.[210] Land is a core component of the system.

The "law" component of the land use regulatory system con-

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208. For discussions of the role of disturbances in patch ecology in the natural world, see REICHMAN, *supra* note 93, at 36-57; John M. Blair et al., *Ecosystems as Functional Units in Nature*, 14 NAT. RES. & ENV'T 150 (2000); Bosselman, *supra* note 206.

209. Nolon, *Champions of Change, supra* note 207, at 11-16. Nolon refers to crises that prompt reactive innovation as "perturbation effects" and the potential for future crises that prompt preventative innovation as "anticipatory effects." *Id.* at 11.

210. *See, e.g.*, WET GROWTH: SHOULD WATER LAW CONTROL LAND USE? (Craig Anthony (Tony) Arnold ed., 2005) [hereinafter WET GROWTH]; Craig Anthony (Tony) Arnold, *Conserving Habitats and Building Habitats: The Emerging Impact of the Endangered Species Act on Land Use Development*, 10 STAN. ENVTL. L.J. 1 (1991) [hereinafter Arnold, *Conserving Habitats*].

tains legal authority and limits, which are particular manifestations of the freedom-boundaries mix discussed in Section III.A.3.[211] However, the land use regulatory system does not have a thick, deep, far-reaching, substantial set of legal principles and rules, at least in comparison to other areas of law. Instead, the land use regulatory system contains a wide variety of tools for managing land uses and gives broad authority and discretion to various participants in the system to make choices about land use. In other words, the "law" of land use regulation is only partly about rules, limits, and remedies; instead, the greater portion of land use "law" is about flexible regulatory and planning tools, discretionary choice, and public policy. Thus the terms "rules and tools," "discretionary judgment," and "thin law, thick policy" characterize the land use regulatory system.

Consider for example that the area of "land use law" has a relatively modest set of judicial doctrines governing land use and its regulation, both in quantity and quality. There simply are not very many generally applicable legal rules in land use law, relative to other areas of law. Instead, much of the study and practice of law involves regulatory tools and processes, negotiation, collaborative problem-solving, conflict management, and the intersection of law, planning, politics, and various other areas of technological or social analysis.[212] The real "law" of land use regulation exists mostly in zoning codes and regulatory procedures, as well as in the actions or decisions of local land use regulatory bodies. Consider all the planning, zoning, and regulatory permitting decisions (e.g., conditional use permits, variances, subdivision maps or plats, site plans, planned unit developments, development agreements) that are made every week throughout the year, in comparison to the number of reported judicial opinions or even lawsuits that are resolved by the courts on the merits on land use issues in any given year. For example, in 2000, the Anaheim (California) Planning Commission considered and made one or more decisions (in many cases multiple decisions) on 225 land use projects.[213] In the same year, no reported judicial opinions addressed land use issues in Anaheim.[214]

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211. *See supra* Section III.A.3.

212. *See generally* DAVID L. CALLIES ET AL., CASES AND MATERIALS ON LAND USE (3d ed. 1999); ROBERT C. ELLICKSON & VICKI L. BEEN, LAND USE CONTROLS: CASES AND MATERIALS (3d ed. 2005); SELMI & KUSHNER, *supra* note 34.

213. Anaheim Planning Commission documents on file with author.

214. Although court opinions issued in 2000 would likely be addressing land use applications decided by the Planning Commission in earlier years, the statistics are offered merely for magnitude comparisons. We can reasonably assume that the general magnitude of Planning Commission decisions per year and reported outcomes of litigation per year do

However, legal rules do exist and play an important role, but only in setting broad parameters for the participants in the land use regulatory system. For example, the regulatory takings doctrine requires compensation only when the land use regulation has denied the landowner all economically viable use of the property[215] or is an extreme interference with reasonable and distinct investment-backed expectations in the use of the property.[216] According to the U.S. Supreme Court, with respect to the former, an economically viable use can be merely one house worth $200,000 on a small upland portion of 18 acres of coastal property that would be worth $3.15 million if the rest of the coastal wetland portion were developable.[217] With respect to the latter, judicial determinations that the regulation has gone far enough or that the landowners' expectations are both clear and reasonable enough to require just compensation are extremely rare.[218] Thus, the constitutional protection of private property against uncompensated takings by the government gives the government very broad parameters to regulate without risking liability for compensation.[219]

Even for the standard judicial review of permit decisions, courts typically merely require that there be standards to guide the decision makers and applicants and that decisions be supported by substantial evidence on the record. However, the standards can be quite general, and the amount of evidence merely has to be enough evidence that a reasonable person would accept it as a basis for making a decision, a test requiring very little evidentiary quality or quantity. Permit decision makers retain vast, albeit not boundless, discretion under typical legal standards.

Likewise, legal requirements for rational planning to characterize land use regulatory decisions are distinct to land use law but

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not vary dramatically from year to year, at least for purposes of illustrating that very few local government decisions about land use result in judicial directives. In fact, a search in Westlaw showed no reported judicial opinions addressing land use issues in Anaheim in 2001.

215. Lucas v. S.C. Coastal Council, 505 U.S. 1003 (1992).

216. Penn Cent. Transp. Co. v. New York City, 438 U.S. 104 (1978).

217. Palazzolo v. Rhode Island, 533 U.S. 606 (2001).

218. Animas Valley Sand & Gravel, Inc. v. Bd. of County Comm'rs, 38 P.3d 59, 67 (Colo. 2001) (landowners entitled to compensation under Penn Central belong to a "rare category"); Mark W. Cordes, *Takings Jurisprudence as Three-Tiered Review*, 20 J. NAT. RESOURCES & ENVTL. L. 1 (2005).

219. A notable exception, though, involves judicial review of exactions and development conditions imposed on developers under the takings doctrine and various principles of state land use law. *See, e.g.*, Nollan v. Cal. Coastal Comm'n, 483 U.S. 825 (1987); Dolan V. City of Tigard, 512 U.S. 374 (1994). *See generally* CALLIES ET AL., *supra* note 48, at 5-90. Nonetheless, empirical research shows that many localities do not come close to the lines at which just compensation is due or the condition could be invalidated. Ann E. Carlson & Daniel Pollak, *Takings on the Ground: How the Supreme Court's Takings Jurisprudence Affects Local Land Use Decisions*, 35 U.C. DAVIS L. REV. 103 (2001).

are not especially strong or burdensome. Consider the following analysis:

> The consistency doctrine requires that all zoning and land use decisions be "in accordance with a comprehensive plan," and that planning not be merely advisory or rhetorical. Legislatures in a number of states have adopted statutes expressly mandating that local land use decisions and zoning codes be consistent with written, locally adopted comprehensive plans. Land use experts often comment that comprehensive plans can easily be amended, be ignored, or become out-of-date. However, in my experience as a member of a planning commission and a general plan advisory board in a jurisdiction with a statutory consistency doctrine (California), comprehensive plans play a useful role if neither too much nor too little is expected of them. Plans are not regulations. They do not mandate that a particular vision of future development actually be achieved, nor can they in a system based on private ownership and control of land. Plans must adapt not only to changing conditions but also to inaction by private landowners (who usually cannot be compelled to put their land to the desired use) and development proposals and opportunities not anticipated during the planning process. Often in the periods between comprehensive planning efforts, public officials and planners formulate new planning principles to guide development in response to new or reframed problems. On the other hand, the comprehensive planning process serves to focus officials, planners, and the public on the principles and objectives that they wish to guide development, regulations, and decisions about specific projects. It facilitates the identification of problems that exist beyond specific parcels or particular permit decisions. The consistency requirement, even if it is difficult to enforce legally, imposes background expectations on decisionmakers (and perhaps even landowners and developers) that land use and development must be consistent with the plan's contents or there must be a good reason to justify amending the plan. It can make the process more thoughtful than it might oth-

> erwise be (and arguably more thoughtful than decisionmaking processes among other organizations, at least in my experience). Like the pirate's code in *Pirates of the Caribbean*, plans are "more what you'd call 'guidelines' than actual rules."[220]

Finally, a number of forces shape land use regulatory decisions and human relationships with the land, and thus are component parts of the land use regulatory system. Political power and interests have strong influence in this area of public policy and public law.[221] Social norms, institutions, and networks also play a substantial role.[222] Land use choices are both powered by and limited by economic forces and interests.[223] In land use policy and regulation, we see framing effects and the psychology of expectations and judgment.[224] We may also see ethical, spiritual, and humanistic aspirations contained within pragmatic realities.[225] Local culture and local knowledge determine to some degree the content of land use regulations and how they are applied to make specific decisions.[226] Both professional experts (such as planners, engineers, and lawyers) and lay persons (especially members of the public) share authority.[227] Professional norms and public values may be

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220. Arnold, *Is Wet Growth Smarter?*, *supra* note 16, at 10172-73 (quoting Charles M. Haar, *In Accordance with a Comprehensive Plan*, 68 HARV. L. REV. 1154 (1955), and PIRATES OF THE CARIBBEAN: THE CURSE OF THE BLACK PEARL (Disney 2003) (screenplay by Terry Rossio & Ted Elliott)) (other citations omitted).

221. *See generally* MICHAEL P. BROOKS, PLANNING THEORY FOR PRACTITIONERS 9-19 (2002); LOW, *supra* note 106; Mary Dawson, *The Best Laid Plans: The Rise and Fall of Growth Management in Florida*, 11 J. LAND USE & ENVTL. L. 325 (1996); Mark Fenster, *Takings Formalism and Regulatory Formulas: Exactions and the Consequences of Clarity*, 92 CAL. L. REV. 609 (2004); Patricia E. Salkin, *The Politics of Land Use Reform in New York: Challenges and Opportunities*, 73 ST. JOHN'S L. REV. 1041 (1999).

222. *See generally* LOW, *supra* note 106; Garnett, *supra* note 129; Nolon, *Champions of Change, supra* note 207; Spyke, *Land Use-Environmental Law Distinction*, *supra* note 37; Stephanie Lasker, Note, *Sex and the City: Zoning "Pornography Peddlers and Live Nude Shows,"* 49 UCLA L. REV. 1139 (2002).

223. KAHN, *supra* note 170, at 50-60 (economics play a role in the "greenness" of cities).

224. *See generally* Arnold, *Clean-Water Land Use, supra* note 22, at 340-41; Lynda L. Butler, *Private Land Use, Changing Public Values, and Notions of Relativity*, 1992 BYU L. REV. 629.

225. *See generally* William Blatt, *Holy River and Magic Mountain: Public Lands Management and the Rediscovery of the "Sacred in Nature,"* 39 LAW & SOC'Y REV. 681 (2005); James P. Karp, *Aldo Leopold's Land Ethic: Is an Ecological Conscience Evolving in Land Development Law?*, 19 Envtl. L. 737 (1989); John Copeland Nagle, *The Spiritual Values of Wilderness*, 35 ENVTL. L. 955 (2005); Patricia E. Salkin, *From* Euclid *to Growing Smart: The Transformation of the American Local Land Use Ethic into Local Land Use and Environmental Controls*, 20 PACE ENVTL. L. REV. 109 (2002); Spyke, *Charm in the City, supra* note 50; Spyke, *Land Use-Environmental Law Distinction*, *supra* note 37.

226. VanderVelde, *supra* note 154.

227. *See* BROOKS, *supra* note 221, at 9-19; JOHN FORESTER, THE DELIBERATIVE PRACTITIONER: ENCOURAGING PARTICIPATORY PLANNING PROCESSES (1999); Craig James Doran, Comment, First English Evangelical Lutheran Church of Glendale v. County of Los Angeles

consistent with one another or may be in tension with one another. And of course, biological, chemical, and physical forces in nature shape land and land use.[228] The critical point to understand is that the land use regulatory system is not a self-contained legal system that shapes land use, but is instead a medium of various forces in society.[229]

VI. THE PROCESSES OF THE LAND USE REGULATORY SYSTEM

Land use regulation is not a unitary activity.[230] Like any system, the land use regulatory system must be understood not only for its functions and component parts but also for its processes. Systemic processes are regularly operating sets of actions or operations that contribute to the overall functioning of the system, but they do not need to be continuous (i.e., without interruption), dominant within the system, or immutable.[231] At least thirteen

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and Nollan v. California Coastal Commission*: The Big Chill*, 52 ALB. L. REV. 325, 347 (1987);

> The local planning mechanism is usually comprised of a professional planner, who is educated in the area of public administration and planning; a planning board or commission which is comprised of elected laypeople serving for a specified term; and a review board or board of appeal which is also comprised of elected community residents. . . . The actual composition of the local planning mechanism, however, is but one cog in the machine which guides land-use policy-making. Other cogs include citizen interest groups; information providers, including planning consultants, consulting firms, legal advisors, educators, statisticians, and sociologists; and members of the public who are either concerned or affected by regulations.

Id.

228. *See, e.g.*, BABBITT, *supra* note 16, at 13 (2005) ("In south Florida, hurricanes are the prime movers of land use planning."); DONAHUE, *supra* note 94, at 176-77; KAHN, *supra* note 170, at 17-18 (noting that physical geography is a major determinant of a city's environmental conditions); Butler, *supra* note 72.

229. This point rejects the legal centralist perspective and adopts the legal pluralist perspective. *See, e.g.*, ROBERT C. ELLICKSON, ORDER WITHOUT LAW: HOW NEIGHBORS SETTLE DISPUTES 4-6, 137-55 (1991); EWICK & SILBEY, *supra* note 86, at 34-35; Cary Coglianese, *Social Movements, Law, and Society: The Institutionalization of the Environmental Movement*, 150 U. PA. L. REV. 85, 95-102 (2001); Abner S. Greene, Kiryas Joel *and Two Mistakes About Equality*, 96 COLUM. L. REV. 1, 13 n.57 (1996); Pauline T. Kim, *Norms, Learning, and Law: Exploring the Influences on Workers' Legal Knowledge*, 1999 U. ILL. L. REV. 447; John Lande, *Getting the Faith: Why Business Lawyers and Executives Believe in Mediation*, 5 HARV. NEGOT. L. REV. 137, 147-49 (2000).

230. I have begun to explore this concept in evaluating the appropriate scale for land use regulatory authority to protect water quality and watershed integrity. *See* Arnold, *Clean-Water Land Use, supra* note 22, at 323-28 (discussing the functions of: 1) general planning; 2) specific-area planning; 3) regulation of land uses; 4) development and maintenance of public infrastructure and projects; 5) decisions about project-specific permits; 6) study and assessment; 7) public participation, empowerment, and education; 8) coordination and collaboration; 9) enforcement; and 10) monitoring and feedback).

231. *See, e.g.*, REICHMAN, *supra* note 93, at 1-8, 49-57; Grimm et al., *supra* note 83, at

distinctly identifiable, yet related processes comprise the control of land use in the United States. These processes are described briefly below.

A. Studying and Assessing

The process of studying and assessing pervades land use decision making and regulation.[232] Land use planners assess current conditions and study the potential impacts of various possible future scenarios when developing land use plans, whether comprehensive long-term (or medium-term) plans for the entire jurisdiction or area-specific plans (such as a neighborhood plan). Local officials and their staff identify the current effects of existing zoning code provisions and zoning map designations, as well as changes in local conditions, when evaluating the need for zoning text and/or map amendments. Land use decision makers study the details of proposed projects and the likely impacts of those projects before making decisions on permits for the projects. Decisions about public infrastructure development typically follow periods of study and assessment about needs, locations, scope, design, and numerous other details. For a variety of land use decisions, it is not uncommon for planners to consult practices, studies, and trends in other jurisdictions, as well as to consult with a variety of local experts, ranging from the city engineer to the fire marshal to consulting firms that conduct studies. Elected and appointed officials may visit the site of a proposed project or drive or walk around an area that will be the object of new planning efforts. In some jurisdictions, environmental impact study and analysis may be required for land use regulatory decisions.[233] Moreover, private landowners and developers typically engage in their own study and assessment activities as they evaluate potential land uses, project financing needs, plan and design the details of their projects, and identify likely regulatory issues.[234]

95, 98-99, 104-05; Steward T.A. Pickett, *Why Is Developing a Broad Understanding of Urban Ecosystems Important to Science and Scientists?*, *in* UNDERSTANDING URBAN ECOSYSTEMS, *supra* note 83, at 58, 64-68.

232. Arnold, *Clean-Water Land Use, supra* note 22, at 325—26; KELLY & BECKER, *supra* note 83, at 17—21;

233. *See, e.g.*, MONT. CODE ANN. § 75-1-201(1)(B)(iv) (2005); N.C. GEN. STAT. § 113A-4(2) (2006); WASH. REV. CODE § 43.21C.240 (2007).

234. *See, e.g.*, URBAN LAND INST., RESIDENTIAL DEVELOPMENT HANDBOOK, 15-99 (2d ed. 1997). In many cases developers do an environmental assessment of the property to avoid liability under the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§ 9601-74 (1988).

B. Planning

The process of planning is the process of systematically establishing goals and policies to guide future land use activities.[235] Professional planners—land use planners, urban planners, transportation planners, community services planners, and others—play an important role in the land use regulatory system.[236] Land use decisions of all types are required by statute, case law, or both to be "in accordance with a comprehensive plan."[237] As with other features of the land use regulatory system, the importance of planning processes should not be confused with the value of planning processes. Some critics question whether comprehensive long-term planning is possible given limits inherent in human cognition and human institutions.[238] Others criticize the normative value of planning from the perspectives of political theory, economic theory, or theories of justice.[239] Still others argue that planning in practice does not fulfill its theoretical promise.[240] For example, some jurisdictions do not require local governments to adopt a written comprehensive plan; instead, courts in these jurisdictions evaluate on a case by case basis any legal challenges to land use decisions for lack of rational, comprehensive planning.[241] Even in jurisdictions that require comprehensive written plans, these plans may be too general, too easily ignored, or too easily amended to provide much legally effective constraint on ad hoc land use decision making.[242] In many respects, plans serve more like "guidelines"[243]

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235. *See generally* KELLY & BECKER, *supra* note 83.

236. *See id.* at 3-7. In addition, developers also do their own planning for their development projects. *See* URBAN LAND INST., *supra* note 234, at 193-254.

237. *See* Charles M. Haar, *In Accordance with a Comprehensive Plan*, 68 HARV. L. REV. 1154 (1955). *See also* IOWA CODE § 414.3 (2005); ME. REV. STAT. ANN. tit. 30-A, § 4352(2) (2006); R.I. GEN. LAWS § 45-24-30 (2007); Friends of "B" Street v. City of Hayward, 165 Cal. Rptr. 514 (Cal. Ct. App. 1980) (mandating consistency with a city's general plan in a public works project); Green v. County Council of Sussex County, 508 A.2d 882 (Del. Ch. 1986) (zoning regulations must be in accordance with a comprehensive plan, but the plan does not have to be a separate written manuscript). *See generally* Daniel J. Curtin, Jr. & Jonathan D. Witten, *Windfalls, Wipeouts, Givings, and Takings in Dramatic Redevelopment Projects: Bargaining for Better Zoning Density, Views, and Public Access*, 32 B.C. ENVTL. AFF. L. REV. 325, 331—37 (2005) (discussing the consistency of development with comprehensive plans); A. Dan Tarlock & Lora A. Lucero, *Connecting Land, Water, and Growth*, LAND USE L. & ZONING DIGEST, Apr. 2002, at 3, 7 (referring to the "consistency doctrine" that requires that land use regulation be consistent with a comprehensive plan as the "linchpin" for ensuring rational planning of land use that does not exceed the carrying capacity of our watersheds and water supplies).

238. *See* Tarlock, *Consistency, supra* note 7.

239. *See* Andrew P. Morriss & Roger E. Meiners, *The Destructive Role of Land Use Planning*, 14 TUL. ENVTL. L.J. 95 (2000).

240. *See* Rose, *supra* note 11.

241. *See, e.g.*, N.J. STAT. ANN. § 40:55D-28 (LEXIS 2007) (making the adoption of a comprehensive plan optional).

242. *See* Rose, *supra* note 11. *See also* Arnold, *Is Wet Growth Smarter?, supra* note 16,

than as "constitutions for development."[244] Notwithstanding arguments over the legitimacy of planning in general or the efficacy of planning today, planning processes are very much a part of the land use regulatory system. A land use regulatory system that had no planning activities at all would look very different than the one that the United States has today. At a more fundamental level, both the human impulse or drive to plan and the human impulse or drive to engage in ad hoc actions may be inherent parts of any land use regulatory system, inevitably in some degree of tension with one another.

C. Regulating and Segregating

Obviously the land use regulatory system contains processes of regulation: processes of defining permissible, conditionally permissible, impermissible, and mandatory land use activities. Zoning codes are frequently used vehicles for land use regulatory processes, but other vehicles include statutes, other ordinances, regulations, conditions in permits, and administrative orders. Three observations about the regulatory process itself merit special attention. The first is that regulatory processes themselves are related to—but not exactly the same as—other processes that are a part of the land use regulatory system, such as planning, deliberating and deciding, and investing. The second is that the system regulates many different kinds of land use activities, ranging from the location and density of residential housing, to the kinds of uses that require permits, to the hours of operation for a commercial facility, to the kind of landscaping that must be planted on a site. The third is that one method inherent in land use regulatory processes in the U.S. is the segregation of incompatible uses from one another.[245] Despite growing trends towards approval—and even encouragement—of mixed-use developments[246] and towards regulation of land use through best management practices and performance standards,[247] these trends are in relation to the common and

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at 10172 ("Land use experts often comment that comprehensive plans can easily be amended, be ignored, or become out-of-date.").

243. Arnold, *Is Wet Growth Smarter?, supra* note 16, at 10172-73.

244. *See* Citizens of Goleta Valley v. Bd. of Supervisors, 801 P.2d 1161, 1171 (Cal. 1990) (affirming that the general plan is the "'constitution for all future developments' within the city or county"). *Cf.* Curtin & Witten, *supra* note 237, at 332 (arguing that most jurisdictions view the plan as a "'constitution' for development").

245. Village of Euclid v. Ambler Realty Co., 272 U.S. 365, 388 (1926).

246. *See* CONG. FOR THE NEW URBANISM, *supra* note 129; Garnett, *supra* note 126, at 58 n.289 ("The growing number of cities which have designated 'mixed-use' zones reflects the new urbanists' growing influence."); Talbert, *supra* note 129.

247. *See* SANJAY JEER ET AL., AM. PLANNING ASS'N REPORT NO. 476, NONPOINT SOURCE POLLUTION: A HANDBOOK FOR LOCAL GOVERNMENTS 76, 78 (1997); LANE KENDIG ET AL.,

persistent activity of regulating land use by segregating uses. One part of these regulating/segregating processes is making decisions about the compatibility and incompatibility of various combinations of uses.

D. Deciding

The land use regulatory system does not have a set of long-established, clearly-defined, unchanging, self-executing rules that control land use. As discussed in Section V,[248] discretionary decision making—whether about specific projects needing permits or about the rules governing land use (e.g., zoning ordinances)—is at the heart of the land use regulatory system. These decisions might include whether or not to rezone a parcel of land from single-family residential zoning to planned residential zoning to allow a mobile home park.[249] They might include deciding whether a nudist club is a permissible use in a conservation zone.[250] They might include whether to grant or deny approval of a development plan for a complex of self-storage mini-warehouse, gas station, convenience store, and car wash.[251] They might include whether to approve a residential subdivision plan with arguable water runoff and drainage problems.[252] In fact, every day literally countless decisions are made by individual landowners, development company managers, engineers and architects, clerks at the city or county zoning and permits counter, professional planners in government agencies, government administrators, planning commissions, zoning boards of adjustment or appeal, city and county councils, and many other people and entities. The process of making decisions about land use is shaped by social and psychological dynamics, local culture and knowledge, political and economic forces, physical realities, information, deliberative processes, professional or group norms, legal requirements and restrictions, and many other such forces.[253]

E. Deliberating

Closely related to the process of deciding is the process of delib-

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PERFORMANCE ZONING (1980); Acker, *supra* note 45, at 364; Arnold, *Is Wet Growth Smarter?, supra* note 16, at 10172-75; Jon D. Witten, *Protecting Drinking Water Resources Under the Source Water Assessment Program*, THE COMMISSIONER, Winter 2001, at 1, 4.

248. *See supra* Section V.

249. Fasano v. Bd. of County Comm'rs, 507 P.2d 23 (Or. 1973).

250. Bd. of Supervisors v. Gaffney, 422 S.E.2d 760 (Va. 1992).

251. City of Colorado Springs v. Securcare Self Storage, Inc., 10 P.3d 1244 (Colo. 2000).

252. Burrell v. Lake County Plan Comm'n, 624 N.E.2d 526 (Ind. Ct. App. 1993).

253. *See supra* Section V.

erating. Individuals can deliberate in the sense of giving careful and thorough consideration to a decision, and groups of decision makers or stakeholders can deliberate in the sense of discussing and considering among themselves the reasons for and against a particular decision.[254] Both types of deliberation occur in planning and land use regulation, as empirical research by planning scholar John Forester demonstrates.[255] Moreover, both types of deliberation involve not only cognitive processing but also emotions, ethical values, political vision, and pragmatic skill.[256] According to political theorist John Dryzek, authentic deliberation—in which the opportunity of affected persons to participate is now identified as the basis for democracy's legitimacy—is any communication that "induce[s] reflection upon preferences in [a] non-coercive fashion."[257] Thus, reflection and communication are essential elements of good deliberation in a political institution. Of course, some land use decisions appear to be based on very little, if any, individual deliberation or public deliberation. Others may involve individual deliberation but very little, if any, public deliberation. However, the combination of politics, social norms, statutory "open government" requirements, and democratic principles put strong pressure on land use regulators to provide forums for public discussion of land use decisions and to engage in deliberative discussions during publicly accessible meetings, especially on decisions that are controversial or highly visible.

F. Enforcing

As with any regulatory system, enforcement activities are critical.[258] Requirements that landowners obtain permits before developing or using land in certain ways create mechanisms for monitoring compliance with land use regulations and educating landowners about their responsibilities and limits. Time limits on permits and periodic renewal requirements further aid enforcement oversight. Building inspections, housing code compliance inspections, public nuisance investigations, and public complaint

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254. *See* WEBSTER'S NINTH NEW COLLEGIATE DICTIONARY 336 (1985) (definitions of deliberate and deliberation).

255. *See generally* FORESTER, *supra* note 51.

256. *Id.* at 5-6.

257. JOHN S. DRYZEK, DELIBERATIVE DEMOCRACY AND BEYOND: LIBERALS, CRITICS, CONTESTATIONS 2 (2000).

258. *See generally* Bridget M. Hutter, *Regulation: Standard Setting and Enforcement*, 27 LAW & SOC'Y REV. 233 (1993); Joel A. Mintz, *Has Industry Captured the EPA?: Appraising Marver Bernstein's Captive Agency Theory After Fifty Years*, 17 FORDHAM ENVTL. L. REV. 1 (2005); Matthew D. Zinn, *Policing Environmental Regulatory Enforcement: Cooperation, Capture, and Citizen Suits*, 21 STAN. ENVTL. L.J. 81 (2002).

procedures also provide enforcement mechanisms. Regulators can also pursue litigation against violators or even theoretically available (but rarely used) criminal prosecutions. However, public education, accessible and understandable information, and interactions between government staff and interested persons (e.g., landowners, developers, community groups, the general public) create less formal but more effective regulatory enforcement mechanisms than do more formal legal processes.

G. Creating and Building

The processes of creating and building are very much a part of the land use regulatory system. Without the processes of creating or building places, structures, and facilities, the land use regulatory system would be minimal, or at least substantially different. On one level, the system is regulating the processes of land development, which are the processes of creating and building. On another level, regulators choose to build public infrastructure and create public spaces as part of land use plans that mediate between social and physical environments. On an even deeper level, the process of creating or building cannot be entirely separated from the process of regulating the creation and building process. Of course, as noted throughout this article, the land use regulatory system may have an objectionable bias towards displacing the natural environment that serves ecological functions with the artificial built environment that serves human consumption and production.[259] However, as a system, land use regulation contains not only processes of creating and building, but also processes of preserving and conserving.[260] The processes of deliberating, deciding, and regulating help to manage and shape the relationship between the building and preserving processes.

H. Investing, Using, Operating, Maintaining, and Enjoying

As with the processes of creating and building, the land use regulatory system inherently encompasses the processes of developing, investing in, using, maintaining, and enjoying land, the very activities that the system aims to regulate. The real world of land use regulation does not match neat conceptual categories of a closed system of regulatory activities that operates on a closed system of activities making use of land. Instead, these two categories form a symbiotic whole within the land use regulatory system,

259. *See supra* note 16 and Parts II.B-C.
260. *See infra* Part VI.I.

with use of, enjoyment of, and investment in land shaping regulatory processes just as regulatory processes shape the use of, enjoyment of, and investment in land. Moreover, the very same government agencies that regulate land use also use and develop land, operate and maintain land activities, invest in land, and enjoy land uses (or at least the public whom they represent enjoys land uses). These land use activities are integrally connected to the government's regulatory activities and policies. Finally, the different categories of land use processes—creating and building; investing; using, operating, and maintaining; enjoying; and preserving—necessitate planning, regulatory, and decision making processes that address each category. People relate to, and interact with, land in a variety of ways, and the land use regulatory system mediates between people and land by encompassing and integrating many of the processes that characterize these people-land relationships.

I. Preserving

The preservation process deserves special attention, in part because it is relevant to the land use regulatory system's capacity to conserve natural capital. Even though the system contains consumptive processes, it also contains preservation processes. The land use regulatory system mediates between people and places by preserving and protecting the features of special places or especially valued land-related resources. For example, local and state governments widely use historic preservation ordinances to preserve historic structures, districts, architectural features, and sites.[261] An increasing array of environmental conservation ordinances in many localities protect riparian lands and watershed features, wetlands, aquifer recharge zones, forests, hillsides and slopes, vistas, scenic corridors, open space, and many other natural or undeveloped features of land.[262] In addition, land use controls in general protect the character of neighborhoods and preserve a certain place-based "quality of life" for area residents from intense, rapid, or burdensome development.[263]

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261. *See* JULIAN CONRAD JUERGENSMEYER & THOMAS E. ROBERTS, LAND USE PLANNING AND DEVELOPMENT REGULATION LAW 510-29 (2003) (describing historic preservation protections at federal, state, and local levels); SELMI & KUSHNER, *supra* note 34, at 727 (citing Russell v. Town of Amite City, 771 So. 2d 289 (La. Ct. App. 2000) and Maher v. City of New Orleans, 516 F.2d 1051 (5th Cir. 1975)).

262. *See generally* WET GROWTH, *supra* note 210; Nolon, *In Praise of Parochialism, supra* note 21.

263. *See generally* Karkkainen, *supra* note 2; Spyke, *Charm in the City, supra* note 50.

J. Competing, Disputing, Cooperating, and Problem Solving

The land use regulatory system also contains processes of competition, conflict, cooperation, and problem solving. Developers and neighbors engage in conflict to influence decision makers' choices about proposed land uses, but they also engage in multi-stakeholder problem solving, negotiation, or mediation to reach cooperative solutions.[264] Various local groups, political factions, or leaders may compete with one another to shape the locality's policies and future, yet collaborative planning processes can yield a shared vision.[265] Developers may compete with one another for cost-saving or outcome-maximizing favorable treatment from local land use regulators to give their development projects a competitive market advantage over others, but they may also cooperate with one another through associations and industry groups to influence land use policies and processes.[266] Local governments compete with one another for investment, economic activity, and residents through the packages of governmental services, taxes and fees, and land use policies that they offer, but they also cooperate on matters of inter-local or regional concern.[267] To characterize land use decision making either as primarily conflict-ridden or as primarily cooperative would be simplistic. Both conflict and cooperation are essential and inevitable processes in land use. In fact, as a result of any number of complex factors and circumstances, conflict can yield to cooperation or cooperation can turn to conflict.

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264. *See* Maryann Froehlich, *A New Approach to Managing Growth*, *in* CITIES AND NATURE: A HANDBOOK FOR RENEWAL 7, 11 (Roger L. Kemp ed., 2006); Karkkainen, *supra* note 2, at 81-83; Rose, *supra* note 11.

265. *See generally* Fenster, *supra* note 221; Daniel R. Mandelker & A. Dan Tarlock, *Shifting the Presumption of Constitutionality in Land-Use Law*, 24 URB. LAW. 1 (1992); David J. Harmon, Comment, *Problems and Opportunities for Progressive Comprehensive Land Use Planning in Richland County, South Carolina After* McClanahan v. Richland County Council, 54 S.C. L. REV. 837 (2003).

266. *See generally* Richard A. Forsten, *If Only It Were That Simple: Land Use and Government Regulation*, 17 DEL. LAW. 4 (1999); Shelley Ross Saxer, *Planning Gain, Exactions, and Impact Fees: A Comparative Study of Planning Law in England, Wales, and the United States*, 32 URB. LAW. 21 (2000). For examples of developers organized for cooperation, see, e.g., Nat'l Ass'n of Home Builders v. Babbitt, 130 F.3d 1041 (D.C. Cir. 1997); Associated Home Builders of the Greater Eastbay, Inc. v. City of Livermore, 557 P.2d 473 (Cal. 1976).

267. *Compare* Been, *supra* note 25 (analyzing constitutional constraints on exactions in light of theory and evidence that local governments compete with one another for consumers of public goods and services), *with* John R. Nolon, *Grassroots Regionalism Through Intermunicipal Land Use Compacts*, 73 ST. JOHN'S L. REV. 1011 (1999) (documenting the use of inter-local mechanisms for cooperation on land use issues). *See also* Froehlich, *supra* note 264, at 10-11 (discussing both competition and cooperation among local governments over land use).

K. Adapting

Finally, the land use regulatory system contains processes of adaptation and change. As with any functional system, the land use regulatory system adapts to disturbances (whether natural, social, political, economic, or legal).[268] It also adapts to changing conditions and opportunities for improved functioning.[269] With increasing urbanization, industrialization, and automobile uses, zoning codes replaced nuisance law, informal norms, and private deed restrictions as the most common methods to control land use in urban areas.[270] Traditional Euclidean zoning was supplemented, and perhaps even functionally supplanted to some degree, by flexible and advanced zoning techniques.[271] These techniques include conditional use permits (special exceptions or special uses), variances, planned unit developments, development agreements, overlay zones, and performance zoning. As the cost of public infrastructure grew, suburban growth expanded, municipal funds were increasingly stretched, and political support increased for the idea that development should pay for itself, so local governments increasingly came to impose exactions and impact fees on new development.[272] Uses of zoning and land use regulation to locate intensive, polluting, unhealthy land uses in low-income communities of color are now giving way to the uses of zoning and land use regulation by those very communities, environmental justice advocates, and local planning officials to plan and regulate for healthy and revitalized neighborhoods.[273] Finally, with growing awareness of, and concern over, the environmental impacts of development and the social impacts of sprawl, local governments are now adopting land use controls to protect ecological resources and to promote "smart growth" policies.[274] Environment-protecting local govern-

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268. *See, e.g.*, Ruhl, *supra* note 84.

269. *See* Froehlich, *supra* note 264, at 8 (stating that land use patterns change as consumer preferences change in response to changes in demographics and values); Karkkainen, *supra* note 2, at 80 (defending the flexibility of zoning to change over time as conditions and values change).

270. JUERGENSMEYER & ROBERTS, *supra* note 261, at 1-2, 43-45.

271. *Id.* at 92-93.

272. *Id.* at 274-77.

273. *See* ARNOLD, *supra* note 158 (describing disparate zoning patterns and historic discriminatory uses of zoning and planning but also describing how environmental justice policies can be incorporated into land use planning, zoning, regulation, and development, including examples from East Austin neighborhoods in Austin, Texas; the Little Village Environmental Justice Organization's neighborhood mapping and planning process in Chicago, Illinois; and revisions to industrial zoning code provisions in Denver, Colorado).

274. *See, e.g.*, BEATLEY & MANNING, *supra* note 114, at 42-214 (giving countless examples of local efforts to achieve sustainable urban form, engage in ecologically sustainable "green" practices with minimal ecological footprint, build a restorative economy with responsibility and sustainability, promote civic community, and promote ethics and politics of

ments may serve as agents of change by creating land use regulatory innovations that other localities can copy.[275] However, we still have much to learn about the various combinations of conditions that stimulate different kinds of changes in the land use regulatory system.[276]

VII. THE VALUES OF THE LAND USE REGULATORY SYSTEM

Finally, there is no single set of principles or values governing land use decisions in the United States. In the 1940s, naturalist Aldo Leopold called for a "land ethic," defining good and right practices by their promotion of the health and integrity of the land biotic system.[277] Although his vision has normative power and ap-

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sustainable places); BUNNELL, *supra* note 110, at viii-ix, 55-507 (presenting case studies from Chattanooga, Tenn., Providence, R.I., Charleston, S.C., and San Diego, Cal., with an additional CD-ROM with case studies from Madison, Wis., Wichita, Kan., and Westminster, Col.); CITIES AND NATURE, *supra* note 264, at 39-245 (documenting many examples of local ecologically sustainable practices and land use innovations); Arnold, *Sake of Water, supra* note 134, at 20 (using Anacostia River watershed as example of various watershed protection and land conservation that are being adopted to address degradation by land use practices); Nolon, *In Praise of Parochialism, supra* note 21; THOMAS R. SCHUELER, SITE PLANNING FOR URBAN STREAM PROTECTION (1995), *available at* http://www.cwp.org/SPSP/TOC.htm; U.S. Env. Prot. Agency, Source Water Protection, Case Studies, http://cfpub.epa.gov/safewater/sourcewater/sourcewater.cfm?action=Case_Studies (last visited July, 30, 2007) [hereinafter EPA, Source Water Protection].

275. *See* Nolon, *Champions of Change, supra* note 207, at 11-16.

276. Professor Nolon refers to imminent or perceived future crises ("perturbation effects" and "anticipatory effects"), local leaders ("change agents"), "tools" like "data, technical information, guidebooks, best management protocols, case studies of successful innovations, persuasive policies, and economic incentives," and networks of regulatory agencies that diffuse innovations. *Id.* at 11-16. In an unpublished presentation at a symposium at Chapman University on the legal authority to control urban runoff, I speculated, based on my study of local responses to watershed degradation and urban runoff problems, that the following elements are necessary to achieve meaningful land use regulatory innovation:

1) one or more disturbances to the local land use regulatory environment, such as the threat of preemptive federal or state regulation, litigation or its threat, disasters with adverse human or economic consequences, growing land use problems with obvious costs to many, and political events, movements, and forces;

2) understanding by decision makers (and to some degree the public) of the nature of the problem and its causes and possible solutions, at the levels of a) cognitive framing; b) reliable, relevant, and thorough data or information; and c) good analysis;

3) tools (legal, policy, scientific/technical, educational, etc.), options, creative solutions, and resources that enable action to address the problem;

4) policy entrepreneurs to exercise leadership;

5) public participation and engagement, including changes in political conditions and/or social norms to support changes to address the problem; and

6) collaborative problem solving processes among the major stakeholders (whether or not preceded by conflict and even litigation).

Craig Anthony (Tony) Arnold, Unexercised Authority to Conrol Urban Runoff, Presentation at the Chapman University School of Law Symposium: The Slippery Slope: Urban Runoff, Water Quality, and the Issue of Legal Authority (Jan. 27, 2006). *See also* Arnold, *Clean-Water Land Use*, *supra* note 22, at 340-43 (listing and discussing a similar set of factors required to achieve policy innovation).

277. LEOPOLD, *supra* note 92, at 201-26.

peal,[278] it does not empirically describe the governing principles of the land use regulatory system.[279] Instead of adhering to a single "land use" ethic, the system is characterized by ethical pluralism: a diversity of values. Fred Bosselman argues that four different ethics characterize land use policies: order, reform, responsibility, and opportunity.[280] Timothy Beatley also contends that moral pluralism describes the land use regulatory system.[281] He discusses several different sets of land use ethics, including: utilitarianism and free market control; harm prevention; rights-based ethics; distributive duties; environmental ethics; and obligations to future generations.[282] The land use regulatory system is the means by which people consider, deliberate about, interact over, and make choices among land use ethics. It is also the means by which they implement their value judgments through policies, practices, and actions.

Nonetheless, the land use regulatory system values its own functions, scale, components, and processes. In other words, it intrinsically accords value to its own operational framework. It is not surprising that self-maintenance or self-replication is a core principle of any functioning system.[283] In the land use regulatory system, value is placed on people-place relationships; community-power relationships; mixes of both freedom and boundaries; the patchwork (mosaic) scale of decision making authority; the combination of both legal rules and tools; the contrast of relatively "thin" law to relatively "thick" policy, strong societal dynamics, and discretionary choice; and the variety of processes characterizing the land use system. Moreover, the system's ethical pluralism is both a result and an element of its use of mixed components and proc-

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278. *See, e.g.*, JULIANNE LUTZ NEWTON, ALDO LEOPOLD'S ODYSSEY (2006); Eric T. Freyfogle, *A Sand County Almanac at 50: Leopold in the New Century*, 30 ENVTL. L. REP. 10058 (2000); Eric T. Freyfogle, *The Land Ethic and Pilgrim Leopold*, 61 U. COLO. L. REV. 217 (1990).

279. In fact, Eric Freyfogle laments that environmental, land use, and property law—and even the environmental conservation movement itself—have failed to grasp and implement Leopold's land ethic. ERIC T. FREYFOGLE, WHY CONSERVATION IS FAILING AND HOW IT CAN REGAIN GROUND 14-51 (2006). *But see* Karp, *supra* note 225 (asserting that progress is being made in incorporating Leopold's land ethic into land use law).

280. Fred Bosselman, *Four Land Ethics: Order, Reform, Responsibility, Opportunity*, 24 ENVTL. L. 1439 (1994).

281. TIMOTHY BEATLEY, ETHICAL LAND USE: PRINCIPLES OF POLICY AND PLANNING 16-17 (1994).

282. *Id.* at 33-152.

283. *See* K. Eric Drexler & Jason Wejnert, *Nanotechnology and Policy*, 45 JURIMETRICS 1, 8 (2004) (describing a self-replicating system); David M. Frankford, *The Normative Constitution of Professional Power*, 22 J. HEALTH POL. POL'Y & L. 185, 206 n.17 (1997) ("*Functionalism* is a mode of analysis in the social sciences in which a system is held to be self-sustaining because it has generated institutions that perpetuate its existence."). *See generally* Ruhl, *supra* note 83.

esses to mediate both among various social goals for land use and between society and its physical environment. Ethical pluralism arguably is itself an important value to the functioning of the land use regulatory system.[284]

However, the land use regulatory system is not devoid of ethical considerations. It does not need to be an amoral agent of purely utilitarianism objectives or the relentless pursuit of self-serving interests. To the contrary, ethics and values feature prominently in land use decisions, even though no single ethical system controls.[285] The land use regulatory system facilitates people's engagement with the ethical implications of their land use choices. Thus, the land use regulatory system mediates among people, their environments, and their ethics or values. Through land use decisions and practices, people and communities make concrete ethical choices and do not merely contemplate ethics in the abstract. The concrete nature of land use decisions offers great potential for moral development among all of us, including the development of ethical, socio-cultural, and personal commitments to the health and integrity of ecosystems. The place-based nature of land use decisions is particularly relevant to the development of an environmental ethic. Studies in psychology, philosophy, geography, planning, evolutionary biology, and other fields document the role that concrete experiences with one's environment—particularly special places—have in the development of environmental ethics and values.[286] These experiences include the ways

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284. BEATLEY, *supra* note 281; Bosselman, *supra* note 280. A more complex assessment of the situation is that humans have a weak genetic affinity for natural environments that provide a foundation for nine biophilic values that in turn form a biocultural ethic of sustainability. KELLERT, *supra* note 91, at 49-57, 178-84. This biophilia concept has some aspects of plural values within a unified ethical and biological framework.

285. *See generally* BEATLEY, *supra* note 281. Freyfogle worries about the dominance of market-oriented, anthropocentric, consumptive, selfish "values" in our contemporary land use choices, but he seems to indicate that our legal and regulatory systems are compatible with conservation ethics if we would transform our culture, understandings of the human-nature interconnection, and ethical principles. *See, e.g.*, FREYFOGLE, THE LAND WE SHARE, *supra* note 73; FREYFOGLE, *supra* note 279; Eric T. Freyfogle, *Private Land Made (Too) Simple*, 33 ENVTL. L. REP. 10155 (2003).

286. *See generally* E.N. ANDERSON, ECOLOGIES OF THE HEART: EMOTION, BELIEF, AND THE ENVIRONMENT (1996); BEATLEY & MANNING, *supra* note 114; THE BIOPHILIA HYPOTHESIS, *supra* note 106; DIETRICH BONHOEFFER, ETHICS 64-88, 85 (Eberhard Bethge ed., Neville Horton Smith, trans., First Collier Books 1985) (1949); THOMAS R. HUFFMAN, PROTECTORS OF THE LAND AND WATER: ENVIRONMENTALISM IN WISCONSIN, 1961-1968 (1994); KAHN, *supra* note 95; KELLERT, *supra* note 91; ERAZIM KOHAK, THE EMBERS AND THE STARS: A PHILOSOPHICAL INQUIRY INTO THE MORAL SENSE OF NATURE (1984); CLAUDE LEVY-LEBOYER, PSYCHOLOGY AND ENVIRONMENT (David Canter & Ian Griffiths trans., 1982); ROBERT J. MAXWELL, CONTEXTS OF BEHAVIOR: ANTHROPOLOGICAL DIMENSIONS (1983); WILLIAM M. KURTINES & JACOB L. GEWIRTZ, MORAL DEVELOPMENT THROUGH SOCIAL INTERACTION (1987); PERSPECTIVES ON ENVIRONMENT AND BEHAVIOR: THEORY, RESEARCH, AND APPLICATIONS (Daniel Stokols ed., 1977); RADIN, *supra* note 75; READINGS IN ENVIRONMENTAL PSY-

in which people use land and the decisions they make about their social and physical environments.

Three obstacles stand in the way of a nature-regarding ethic pervading land use regulation and practices. First, the legal, political, and administrative units of land management fragment land use decisions and actions by individual parcels and discrete local units of government. This fragmentation could prevent policies, regulations, and decisions that correspond to the interconnected, trans-boundary scales of ecosystems. Second, the land use regulatory system focuses on land and land use, potentially ignoring the ecosystem functions, processes, and components that are not defined or measured by geography. Third, the non-ecological aspects of land use decisions and practices may inevitably undermine any real ability or willingness by American society to use land within nature's carrying capacity. However, in a growing number of case studies, local communities have begun to incorporate conservation principles into their land use practices.[287] These examples demonstrate that people can—and will—think and act beyond: 1) the boundaries of individualized property ownership and fragmented local regulatory authority, even if they are addressing issues at a local level; 2) the land-focused aspects of ecosystems, even if they are making choices about land use; and 3) the false dichotomy between human welfare and nature's welfare, even if their decisions still leave some footprint on nature. These changes do not happen in ways that are quick, easy, complete, or ideal. Yet they happen as relationships that people have with their natural environment and within their social, political, and

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CHOLOGY: LANDSCAPE PERCEPTION (Amita Sinha ed., 1995); PHILIP SHABECOFF, EARTH RISING: AMERICAN ENVIRONMENTALISM IN THE 21ST CENTURY 76-81 (2000); MITCHELL THOMASHOW, BRINGING THE BIOSPHERE HOME: LEARNING TO PERCEIVE GLOBAL ENVIRONMENTAL CHANGE 73-103 (2002); EUGENE VICTOR WALTER, PLACEWAYS: A THEORY OF THE HUMAN ENVIRONMENT (1988); EDWARD O. WILSON, BIOPHILIA (1984); Fred R. Myers, *Ways of Placemaking*, *in* CULTURE, LANDSCAPE, AND THE ENVIRONMENT 72, 72-110 (Kate Flint & Howard Morphy eds., 2000); Spyke, *Land Use-Environmental Law Distinction, supra* note 37, at 89-94; Elliot Turiel et al., *Social Contexts in Social Cognitive Development*, *in* HANDBOOK OF MORAL BEHAVIOR AND DEVELOPMENT, VOLUME 2: RESEARCH 307-32 (William M. Kurtines & Jacob L. Gewirtz eds., 1991).

287. *See, e.g.*, BEATLEY & MANNING, *supra* note 114, at 42-214 (giving countless examples of local efforts to achieve sustainable urban form, engage in ecologically sustainable "green" practices with minimal ecological footprint, build a restorative economy with responsibility and sustainability, promote civic community, and promote ethics and politics of sustainable places); BUNNELL, *supra* note 110, at viii-ix, 55-507; CITIES AND NATURE, *supra* note 264, at 39-245 (documenting many examples of local ecologically sustainable practices and land use innovations); Arnold, *Sake of Water, supra* note 134, at 16 (using Anacostia River watershed as example of various watershed protection and land conservation that are being adopted to address degradation by land use practices); Nolon, *In Praise of Parochialism, supra* note 21; SCHUELER, *supra*, note 274; EPA Source Water Protection, *supra*, note 274.

economic communities change in concrete ways.

VIII. ECOSYSTEM SERVICES AND THE LAND USE REGULATORY SYSTEM

Despite the mosaics comprising the land use regulatory system's functions, scale, components, processes, and values, experts seek to solve specific land-related problems through land use regulation. Increasingly, the land use regulatory system is called on to protect or manage ecosystems. Ecosystems are biological communities, with their processes, forces, and physical environments assembled and interacting in whole units.[288] They can be defined as geographic units, management units, functional units, or ecosystem service units.[289] Likewise, ecosystems can be defined in discrete place-based terms or in terms of ecological processes.[290]

One perspective on ecosystems is that ecosystems provide valuable services to human society.[291] Scholars addressing the law and policy of ecosystem services, such as the co-organizers of this symposium, J.B. Ruhl and Jim Salzman, argue for the protection of ecosystems for their anthropocentric—mostly economic—value.[292] Examples of these services include:

- mitigation of droughts and floods
- purification of air and water
- generation and preservation of soils and renewal of their fertility
- detoxification and decomposition of wastes
- pollination of crops and natural vegetation
- dispersal of seeds
- cycling and movement of nutrients
- control of the vast majority of potential agricultural pests
- maintenance of biodiversity
- protection of coastal shores from erosion by waves
- protection from the sun's harmful ultraviolet rays
- partial stabilization of climate
- moderation of weather extremes and their im-

288. NAGLE & RUHL, *supra* note 101, at 302; Blair et al., *supra* note 208.

289. NAGLE & RUHL, *supra* note 101, at 303-04.

290. Blair et al., *supra* note 208.

291. JOHN PETERSON MYERS ET. AL., NATURE'S SERVICES: SOCIETAL DEPENDENCE ON NATURAL ECOSYSTEMS (Gretchen C. Daily ed., 1997); Salzman, *Valuing Ecosystem Services, supra* note 23.

292. NAGLE & RUHL, *supra* note 101, at 300, 312-18; Salzman, *Valuing Ecosystem Services*, *supra* note 23.

pacts.[293]

Estimates have placed the value of all ecosystem services to the global economy at over $33 trillion dollars.[294]

The scholarship on ecosystem services, in grossly simplified terms, aims to: 1) identify the services that nature provides to human society and the economy; 2) estimate the economic value of these services; 3) promote institutions that protect or conserve this natural capital from wasteful over-exploitation; and 4) either develop markets for ecosystem services so that they are properly valued, invested in, conserved, and used, or develop legal and regulatory protections of ecosystem services where markets fail or where ecosystems should be treated as a public or common resource.[295] The ecosystem services perspective can be criticized for both its anthropocentrism and its utilitarianism; good arguments can be made that nature has intrinsic value and should not be commodified or even treated as an economic resource.[296] On the other hand, the ecosystem services perspective may simply be supporting environmental conservation generally by adding an economic reason to the non-economic reasons for conservation and ecological responsibility. Moreover, advocates of the ecosystem services concept are arguably looking for ecologically-based metrics that can be translated into human valuation systems and public policies to protect nature and its ecosystems.[297]

Nonetheless, setting aside the normative debate over the ecosystem service perspective for other articles and other venues, the specific question for this article is whether the land use regulatory system can value, conserve, and maximize the services that ecosystems provide to human society and the economy. The short answer is that the land use regulatory system can assist in conserv-

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293. NAGLE & RUHL, *supra* note 101, at 313.

294. Robert Costanza et al., *The Value of the World's Ecosystem Services and Natural Capital*, 387 NATURE 253 (1997). *See also* Andrew Balmford et al., *Economic Reasons for Conserving Wild Nature*, 297 SCI. 950 (2002).

295. *See, e.g.*, NAGLE & RUHL, *supra* note 101, at 299-393; NATURE'S SERVICES, *supra* note 291; Balmford et al., *supra* note 294; Costanza et al., *supra* note 294; Salzman, *A Field of Green?*, *supra* note 23; Salzman, *Valuing Ecosystem Services*, *supra* note 23.

296. NAGLE & RUHL, supra note 101, at 317-18 (The "work on ecosystem service valuation has opened up a sizable rift among ecologists, many of whom argue that it is immoral to attempt to assign anthropometric values to biometric processes."); Freyfogle, *supra* note 285.

297. NAGLE & RUHL, *supra* note 101, at 318 (quoting and citing Edward Farnworth et al., *The Value of Natural Ecosystems: An Economic and Ecological Framework*, 8 ENVTL. CONSERVATION 275 (1981)). I must admit, though, that I lament a public policy system that has to find quantifiable economic value to ecosystems in order to protect them. It seems very similar to trying to find quantifiable economic value to families, neighborhoods, networks of friendship, or even the legal system itself in order to justify protection of these institutions or systems from harm.

ing "nature's capital" but that it is not designed to do so in a systematic or complete way. More completely, though, there are five barriers to the land use regulatory system conserving ecosystems services, and there are ten characteristics of the land use regulatory system that provide opportunities to conserve ecosystem services.

The five limits are:

1. The land use regulatory system is not an ecosystem protection system at its core;
2. Land, which is the focus of the land use regulatory system, is only one aspect of ecosystems and their services;
3. The land use regulatory system operates at different political and legal scales than the natural scales of ecosystems;
4. The land use regulatory system lacks precise measurements for ecosystem services potentially lost due to land uses; and
5. Social, political, and psychological factors within the land use regulatory system will skew protections for, and valuations of, ecosystem services.

The ten opportunities are:

1. Land use affects ecosystems;
2. Many impairments to ecosystem services adversely affect land use;
3. The land use regulatory system increasingly protects the social, psychological, and political services that ecosystems provide to local communities, as well as traditionally economic services;
4. The ecosystem services concept is an anthropocentric valuation process for which the land use regulatory system can offer market alternatives and alternative markets;
5. The land use regulatory system can help to develop an ecosystem-regarding psychology and ethic of place in communities;
6. Information about the impacts of land use activities on ecosystems is increasingly better and more readily available;
7. The land use regulatory system's environmental impact assessment process can create demand for in-

formation about the relationships between land use and ecosystem services;
8. Site-specific and project-specific discretionary decisions can tailor land use activities to protect ecosystem services in context while accommodating land use and other social goals;
9. The land use regulatory system offers the potential for innovation, experimentation, and adaptive functionality; and
10. The land use regulatory system is a mediating system, which is necessary for better values and choices.

A. Barriers to Accounting for Ecosystem Services in the Land Use Regulatory System

In several respects, the land use regulatory system will not and cannot meet the demands for land uses to account for and protect ecosystem services. First, the land use regulatory system is not an ecosystem protection system at its core. As a mediating system, it does not have the capacity to form the values that people place on ecosystem services in the manner that a constitutive system would, to allocate the benefits and costs of ecosystem services in the manner that a distributive system would, or to protect ecosystem services in the manner that a protective system would. Moreover, the land use regulatory system is structured to mediate all the points of connection between human communities and the physical environment, not just relationships between humans and ecosystems. Therefore, ecosystem services will only be a part of any considerations about land use proposals, goals, and wants. For example, a county commission's deliberations over whether to approve a proposed residential subdivision may address impacts on the filtration and purification services of watersheds, the crop-sustaining qualities of soils, and perhaps even the biodiversity-supporting services of local forests, but is also likely to address impacts on a rural or small town way of life, historic structures and sites, the location of jobs and economic growth, downtown redevelopment initiatives in the larger metropolitan area, the attractiveness of new homes with the latest design features, and traffic congestion, among others. At best, the role of ecosystem services is likely to be only one factor in defining the community's relationship with its spatial environment.

Second, the land use regulatory system is structured around land as the focus of place-people dynamics, and land is only one

part of ecosystems. Land use patterns and practices have substantial direct and indirect effects on ecosystems and the services that they provide society. However, a comprehensive ecosystem services policy would need to encompass many activities that normally are not subject to land use regulation such as: agricultural, forestry, and mining practices; uses of surface waters and groundwater; fuel consumption and vehicle emissions (only partially related to urban sprawl); and recovery efforts for service-provider species that are in decline, such as pollinators.

Third, the land use regulatory system operates at political and legal scales that often vary from the many natural scales of ecosystems. American legal, political, and administrative boundaries fail to correspond to nature's boundaries.[298] Moreover, despite proposals—both old and new—to organize regulatory and planning jurisdictions around a particular ecological unit of geography (such as watersheds)[299] such changes are neither likely nor necessarily ideal for addressing the many complex ways in which land use and the natural environment, both with diverse scales and functions, inter-relate with one another.[300] As a result, in most cases no single entity has regulatory authority over all the land in a given ecosystem. In many cases, the number of entities with some land use regulatory authority within an ecosystem may be quite large. Coordination of regulatory policies, methods, and implementation among so many different localities and other government agencies can be daunting. The interests, understandings, or political will of government officials and the public to protect ecosystems may exist in some localities but not in neighboring localities. Thus, a city trying to reduce pollution in a river or stream may face the frustrating reality that the pollution is coming from upstream land

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298. *See* William Goldfarb, *Watershed Management: Slogan or Solution?*, 21 B.C. ENVTL. AFF. L. REV. 483, 484 (1994); Ruhl et al., *supra* note 18, at 930-31; Tarlock, *Watershed, supra* note 11, at 149. *See generally* STEWARDSHIP ACROSS BOUNDARIES (Richard L. Knight & Peter B. Landres eds., 1998); Eric T. Freyfogle, *The Tragedy of Fragmentation*, 32 ENVTL. L. REP. 11321 (2002); Charles P. Lord et al., *Natural Cities: Urban Ecology and the Restoration of Urban Ecosystems*, 21 VA. ENVTL. L.J. 317 (2003).

299. *See, e.g.*, Ruhl et al., *supra* note 18, at 930 (arguing for regional watershed management agencies with preemptive control over land use regulation); Woolley et al., *supra* note 132, at 141 (reporting that the Western Water Policy Review Advisory Commission recommends restructuring government around watersheds). Janet Neuman—building on John Wesley Powell's vision for the West as a "dryland democracy" organized politically and jurisdictionally around watersheds—encourages the creation of new watershed institutions with greater governance over both land use and water management. However, Professor Neuman also acknowledges that achieving Powell's vision may be politically difficult after decades of local control over land use. Janet Neuman, *Dusting Off the Blueprint for a Dryland Democracy: Incorporating Watershed Integrity and Water Availability into Land Use Decisions*, *in* WET GROWTH: SHOULD WATER LAW CONTROL LAND USE?, *supra* note 210, at 119-99.

300. *See generally* Arnold, *Clean-Water Land Use, supra* note 22.

uses in another city that is not concerned with its polluted runoff. A county that is trying to conserve the ecological functions and services of a forest will likely have no legal authority to prevent land use actions that degrade that portion of the forest in another county. The harm from those extra-territorial land use disturbances to the forest may greatly diminish or even eliminate its healthy functioning biologically, chemically, and physically, including the services that it provides society.

Fourth, the land use regulatory system, by and large, lacks precise measurements for the quantity and value of ecosystem services that are or would be lost due to various kinds of land uses. In general, the concept of ecosystems' worth to society remains at a fairly global scale, defying precise measurements, even by ecosystem experts, of the cost of the loss of a particular component of a particular ecosystem in a particular location. Thus, while we may be able to estimate the overall value of the earth's wetlands for flood control and pollution filtration, we cannot produce reliable figures on the costs of losing one acre of wetlands in location X or 2.7 acres of wetlands on the eastern edge of location Y, for example. We know that ecosystems can adapt to certain human disturbances up to a point but can then decline rapidly and geometrically once the quantity or quality of human disturbances reaches a threshold—yet we cannot identify with accuracy exactly where those thresholds are.[301] Land use planners and local government officials are even less well equipped than scientists and economists at the nation's leading universities to measure and value discrete impacts on identified ecosystems. However, the problem is not merely one of the relative infancy of the ecosystem services research and methodologies in general. With respect to land use decisions, decision makers need to know the relatively precise implications of various land use and development scenarios in specific locations. General policies like the importance of preserving forests serve as precautionary guiding principles, but they do not tell us how much development at the edge of a forest will impair its ecological functioning and society-sustaining services. In order to identify the kinds of land uses that are appropriate—appropriate in limited respects under numerous conditions and inappropriate for specific locations and environments—policy makers and permit deciders will need increasingly detailed knowledge about land use impacts on ecosystems.

Fifth, social, political, and psychological factors inherent in the land use regulatory system are likely to produce under-protection

301. Bosselman, *supra* note 280.

of ecosystem services and functions in some respects and over-protection of ecosystem services and functions in other respects, regardless of whether those services are measured in economic values, biotic values, or policy values of a conservation ethic. For example, aesthetic concerns and emotion-driven valuation of familiar places and their features may mean that landowners, developers, and local officials prefer non-native landscaping to the use of native vegetation, with the end result being the invasive spread of the non-native species, the decline and loss of native species, and the impairment of the local ecosystem's natural functioning and biodiversity. More problematic, though, are the myriad commitments to local economic development, adequate supplies of affordable housing, access to abundant and diverse retail shopping opportunities, human-developed facilities for recreation, automobile transportation networks, cheap fuel, and many other such non-ecological aspects of local landscapes, as well as political and economic interests and private property norms. The land use regulatory system is shaped and used by people and groups that are seeking objectives other than, or in addition to, ecosystem conservation goals.

On the other hand, overprotection of ecosystems is also a possibility. A local community's attachment to a lake or a field might be far out of proportion to the ecosystem functions or values that the lake or field actually serve. Standardization of ecological "best practices" in land development and design might produce improved ecosystem conditions, but might instead merely produce a proliferation of marginally beneficial features too fragmented or diffused to make much difference. Even more troubling is the fear that local political forces could combine ecosystem conservation goals with quality-of-life and exclusionary interests to generate restrictive land use controls in one locality and push development pressures to other localities, resulting in an overall net decline in ecosystem services.[302]

B. Opportunities to Account for Ecosystem Services in the Land Use Regulatory System

Despite the limits of the land use regulatory system, it has several characteristics offering great potential for incorporating con-

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302. *See* David A. Dana, *Natural Preservation and the Race to Develop*, 143 U. PA. L. REV. 655 (1995). In my view, the potential that other localities will under-protect the environment is no reason for land use decision makers to decline to enact needed and desired environmental protections. However, over-protective policies with exclusionary anti-growth elements needlessly shift development pressures to other communities.

siderations of nature's services into how land is used in the United States. Most obviously, land use affects ecosystems (often adversely), and many impairments to ecosystem services adversely affect land use. For example, both impervious cover from urban development and the development of wetlands harm the healthy functioning of watersheds, which in turn contributes to flooding, soil erosion, pollution of water supplies, and loss of recreational uses of polluted waters.[303] Attention to the integrity and health of ecosystem functions when making land use decisions is necessary to protect both ecosystems and local communities. Degraded ecosystems and failures of ecosystem services impose costs on local governments, local economies, and private property owners.[304]

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303. *See* RANDOLPH, *supra* note 33, at 363, 373, 375-76, 404-06, 469-70, 486-87. *See generally* AM. RIVERS ET AL., PAVING OUR WAY TO WATER SHORTAGES: HOW SPRAWL AGGRAVATES THE EFFECTS OF DROUGHT (2002); TOM DANIELS & KATHERINE DANIELS, THE ENVIRONMENTAL PLANNING HANDBOOK FOR SUSTAINABLE COMMUNITIES AND REGIONS (2003); JEER ET AL., *supra* note 247; JON KUSLER & TERESA OPHEIM, ENVTL. LAW INST., OUR NATIONAL WETLAND HERITAGE: A PROTECTION GUIDE (2d ed. 1996); U.S. GEN. ACCOUNTING OFFICE, Report No. GAO-02-12, FEDERAL INCENTIVES COULD HELP PROMOTE LAND USE THAT PROTECTS AIR AND WATER QUALITY (2001); U.S. ENVTL. PROT. AGENCY, EPA-841-B-05-004 , NATIONAL MANAGEMENT MEASURES TO CONTROL NONPOINT SOURCE POLLUTION FROM URBAN AREAS (2005); U.S. ENVTL. PROT. AGENCY, EPA-840-R-00-001, PROTECTING AND RESTORING AMERICA'S WATERSHEDS: STATUS, TRENDS, AND INITIATIVES IN WATERSHED MANAGEMENT (2001); U.S. ENVTL. PROT. AGENCY & U.S. DEP'T OF AGRIC.,CLEAN WATER ACTION PLAN: RESTORING AND PROTECTING AMERICA'S WATERS 10 (1998); David F. Boutt et al., *Identifying Potential Land Use-Derived Solute Sources to Stream Baseflow Using Ground Water Models and GIS*, 39 GROUND WATER 24, 24-34 (2001); Patrick Gallagher, *The Environmental, Social, and Cultural Impacts of Sprawl*, 15 NAT. RESOURCES & ENVT. 219, 221 (2001); Timothy J. Iannuzi & David F. Ludwig, *Historical and Current Ecology of the Lower Passaic River*, 2 URBAN HABITATS 147 (2004); C. Leitch & J. Harbor, *Impacts of Land Use Change on Freshwater Runoff into the Near-Coastal Zone, Holetown Watershed, Barbados: Comparisons of Long-Term to Single-Storm Effects*, 54 J. SOIL & WATER CONSERV. 584, 584-92 (1999); Barbara J. Mahler et al., *Parking Lot Sealcoat: An Unrecognized Source of Urban Polycyclic Aromatic Hydrocarbons*, 39 ENVTL. SCI. & TECH. 5560 (2005); Timothy N. McPherson et al., *Dry and Wet Weather Flow Nutrient Loads from a Los Angeles Watershed*, 41 J. AM. WATER RES. ASS'N 959 (2005); Monica G. Turner et al., *Land Use*, *in* STATUS AND TRENDS OF THE NATION'S BIOLOGICAL RESOURCES (U.S. Geological Survey ed., 1998); S. Scott Burkhalter, Comment, *Oversimplification: Value and Function: Wetland Mitigation Banking*, 2 CHAP. L. REV. 261 (1999); Douglas A. Miltenberger, Comment, *Development on the Banks of the Letort Spring Run: What Can Be Done to Save Pennsylvania's Waterways from Post Construction Stormwater Runoff*, 11 PENN. ST. ENVTL. L. REV. 127 (2002); Caryn Ernst, *Smart Growth, Land Conservation, and Clean Water*, 4(1) GETTING SMART (Smart Growth Network), *available at* http://tpl.org/tier3_cd.cfm?content_item_id=14105&folder_id=1885.

304. *See, e.g.*, Arnold, *Sake of Water, supra* note 134, at 16;

> We know that the degraded quality of surface and coastal waters adversely affects commercial and recreational fishing. We also know that urban runoff is a major cause of beach closures nationwide, resulting in high costs to local economies. We know that it is substantially more expensive to treat contaminated sources of drinking water supplies for public water systems than it is to purchase and set aside undeveloped land in runoff and recharge zones to prevent contamination to source waters. Increasingly, the common wisdom of economic development pol-

These costs may include damage caused by flooding, public infrastructure needed to handle flooding or treat polluted water supplies, the lost value of recreational uses of polluted waters, public health costs from health conditions caused by environmental contaminants, erosion of soils and coastlines, treatment of waste failing to naturally decompose, energy costs related to elevated temperatures in urban areas, enhancement of depleted soil nutrients, and the like. Conversely, ecologically sustainable land development patterns support economic development, value, and activity.[305] As local officials come to understand the scope and source of these costs and benefits, the relationships of land use policies and patterns to ecosystem functioning, and the benefits to their local land use goals provided by healthy functioning ecosystems, they are adopting measures to protect ecosystems and their services. For example, Roanoke, Virginia, has set a goal of reaching a forty percent tree canopy, increased its tree planting budget, modified its land use regulations to require more trees and their protection for new development, and partnered with other agencies, land trusts, and the public to plant more trees, because officials discovered that trees filter air pollutants, absorb runoff, and reduce air temperatures.[306] New York City exercised extraterritorial regulatory jurisdiction over land use in upstate areas to prevent development that would pollute its drinking water sources through runoff and groundwater recharge. It did so because the costs associated with land use regulation and land acquisition were cheaper than the costs of building additional water treatment facilities.[307]

The land use regulatory system increasingly protects ecosystems not only for their traditional economic services, but also for their social, psychological, and political services. Particular ecosystems are critical to human connections to nature and to particular places in nature. Indeed, the land use regulatory system can help to develop an ecosystem-regarding psychology and ethic of

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> icy and urban planning is that well-protected environmental amenities, including natural, vibrant aquatic resources, are key features to attracting the most desired businesses and economic growth, in large part due to the demand of business leaders and employees to live and work in ecologically sustainable communities.

Id. (footnotes omitted).

305. *See generally* KENT E. PORTNEY, TAKING SUSTAINABLE CITIES SERIOUSLY: ECONOMIC DEVELOPMENT, THE ENVIRONMENT, AND QUALITY OF LIFE IN AMERICAN CITIES (2003).

306. Haya El Nasser, *Some Cities Are Finding Money Does Grow on Trees*, USA TODAY, July 28, 2005, at 1A; Haya El Nasser, *Barren Cities Turn Over a New Leaf: Forest Renewal Is Catching on as Urban Areas Learn Benefits*, USA TODAY, July 28, 2005, at 3A.

307. Barton H. Thompson, Jr., *Markets for Nature*, 25 WM. & MARY ENVTL. L. & POL'Y REV. 261 (2000).

place in communities by the way that it mediates between people and places. Government officials and the public may give special priority to protecting landscapes, bodies of water, forests, parklands, and other places with both natural and social value.[308] They may be seen as places of community gathering, places of quiet retreat, or places that define the local identity. Although these considerations have very little to do with the biological, chemical, and physical services provided by ecosystems, they may prompt local land use regulations that have the effect of protecting ecosystems and their economic services. In fact, Stephen Kellert's research shows that the natural features of the landscape to which people develop attachments and work to protect serve as loose proxies for ecosystem health and services, and therefore serve to develop ethical commitments to protect ecosystems.[309] Thus, ecological and non-ecological values become joined or mixed in the mediating function of the land use regulatory system.

One way that the land use regulatory system mediates between people and places is by creating both alternatives to markets and alternative markets in land where traditional markets do not adequately value certain aspects of land in particular contexts. For example, people may value the non-commodification of community membership or political participation as it relates to places and land uses. People may value certain aspects of their neighborhood, a region's ecological features, or a city's downtown center for which adequate private-sector markets have not formed or may not be capable of being formed. The land use regulatory system offers alternative methods and means for valuing these features. Prohibitions or limitations on developing certain kinds of lands reflect the value that land use regulators place on those lands and their characteristics or on surrounding areas that would be affected by development. Moreover, regulations have effects on market values for land and for land development. The common use of discretionary land use permits as a regulatory technique allows for value-creating negotiations between regulators and developers (perhaps with the participation of neighbors and other activists) over the scope and features of the development, as well as developer-provided infrastructure. Land use plans, especially area-specific plans, have the effect of both reflecting and framing the valuation of an area's existing assets and identifying new or changed area

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308. *See* THE ECOLOGICAL CITY, *supra* note 66, at 277, 280-81 (exploring biodiversity and ecosystem protection through protection of urban wetlands, lakes, watersheds, urban forests and trees, urban landscaping, wildflower meadows, sand dunes, urban parks, creeks and riparian lands, endangered species' habitats, and urban greenscapes).

309. KELLERT, *supra* note 91, at 30-45, 58, 62, 178-84.

characteristics that will enhance the area's identity as a place, support of the community, or value to those who use it. Public provision of infrastructure, such as affordable housing, civic centers, parks, and roads, advances land use policies while also meeting local needs for public goods that are not likely to be provided by private markets.

The extra-market operation of the land use regulatory system is relevant to the law and policy of ecosystem services because, even though we know that ecosystems provide tremendous value to society, we lack adequate methods and means of quantifying, protecting, and investing in the value of ecosystem services in the context of specific decisions. The land use regulatory system—with its local political participation, relationship to community identity, and consideration of non-quantified place-based values—is likely an important avenue for preventing the irreversible loss of important ecosystem services. If development markets are not valuing and protecting ecosystem services, local planning, zoning, and permitting decisions can do so. In addition, public infrastructure policies can create conservation areas, redesign public infrastructure in ecologically sustainable ways (e.g., pervious or semi-pervious pavement; use of native plants and trees in parks and other public landscaping), enhance the local tree canopy, and adopt many other such ecosystem-supporting practices.

Specifically, the land use regulatory system has the capacity to consider ecosystem services in four respects. First, despite the arguments of skeptics that local governments do not have the informational and technological capacity to understand ecosystem processes and their relationships to land use, local officials increasingly have ready access to good—and improving—information about the relationships between land use and ecosystem functions, as well as tools for adapting land use decisions to minimize or mitigate adverse impacts on ecosystems.[310]

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310. *See, e.g.*, AM. PLANNING ASS'N, *supra* note 157; DANIELS & DANIELS, *supra* note 303; THOMAS E. DAVENPORT, THE WATERSHED PROJECT MANAGEMENT GUIDE 32 (2003); ENVTL LAW INST., CONSERVATION THRESHOLDS FOR LAND USE PLANNERS (2003); WILLIAM B. HONACHEFSKY, ECOLOGICALLY BASED MUNICIPAL LAND USE PLANNING (2000); JEER ET AL., *supra* note 247, at 29-53; HANDBOOK OF WATER SENSITIVE PLANNING AND DESIGN (Robert L. France ed., 2002); JAMES M. MCELFISH JR., NATURE-FRIENDLY ORDINANCES: LOCAL MEASURES TO CONSERVE BIODIVERSITY (2004); NOLON, OPEN GROUND, *supra* note 21; BETSY OTTO ET AL., AM. PLANNING ASS'N, ECOLOGICAL RIVERFRONT DESIGN: RESTORING RIVERS, CONNECTING COMMUNITIES (2004); RANDOLPH, *supra* note 33; U.S. ENVTL. PROT. AGENCY, EPA-841-B-05-004, NATIONAL MANAGEMENT MEASURES TO CONTROL NONPOINT SOURCE POLLUTION FROM URBAN AREAS (2005); NATURAL RES. DEF. COUNCIL, STORMWATER STRATEGIES: COMMUNITY RESPONSES TO RUNOFF POLLUTION (2005); U.S. ENVTL. PROT. AGENCY, EPA 231-K-06-001, PARKING SPACES/COMMUNITY PLACES: FINDING THE BALANCE THROUGH SMART GROWTH SOLUTIONS (2006); U.S. ENVTL. PROT. AGENCY, EPA-840-R-00-001, PROTECTING AND RESTORING AMERICA'S WATERSHEDS: STATUS, TRENDS, AND INITIATIVES IN

Second, the growing trend for land use officials to evaluate the environmental impacts of proposed land uses when making plans, regulations, and decisions is increasingly creating a demand for information about relationships between land use and ecosystems. Although environmental impact assessment in land use decision making is not all that it could or should be, environmental impact assessment is a significant and growing part of the land use regulatory system.[311]

Third, most land use decisions are site-specific and project-specific discretionary decisions that offer opportunities to tailor land use activities to protect specific ecosystem services in the particular context of the land use in question, while also accommodating other non-environmental goals of the land use system.[312] For example, land development permits, like subdivision approvals, conditional use permits, and building permits, offer opportunities to require design features and operational conditions that protect ecosystem features and processes as they exist in relation to the particular parcel or project under consideration.

Fourth, the land use regulatory system is an adaptive and functional system that has evolved over time to meet changing social needs. With its local scale, many components, and diverse processes, it offers the potential for innovation and experimentation in different methods of protecting ecosystem services and modifying land use patterns and practices to be more ecologically sustainable.[313] Instead of a one-size-fits-all approach to valuing ecosystem services, the land use regulatory system is likely to produce a diversity of policies and methods.

Finally, the land use regulatory system has the potential to increase public commitment to protecting ecosystems and acting in ecologically responsible ways. Despite the fact that the concept of ecosystem services is about giving attention to the economic benefits of ecosystem functions and processes to human society, I agree

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WATERSHED MANAGEMENT (2001); Beverly Suderman, *Planning for Invasive Plant Management in Cities*, 9 ENVTL. PLANNING J. 6-11 (2006); Model Ordinances for Aquatic Resource Protection, http://www.stormwatercenter.net/intro_ordinances.htm (last visited Aug. 13, 2007); Model Ordinances to Protect Local Resources, http://www.epa.gov/owow/nps/ordinance (last visited Aug. 13, 2007); EPA Source Water Protection, *supra* note 274.

311. *See generally* Patricia E. Salkin, *Zoning and Land Use Planning*, 32 REAL ESTATE L.J. 429 (2003); Kathryn C. Plunkett, Comment, *Local Environmental Impact Review: Integrating Land Use and Environmental Planning Through Local Environmental Impact Reviews*, 20 PACE ENVTL. L. REV. 211 (2002);.

312. Arnold, *Clean-Water Land Use, supra* note 22, at 10174-75; Arnold, *Sake of Water, supra* note 134, at 22.

313. Richard Register suggests several tools that could be adapted to local efforts to protect ecosystems and their services, including "ecocity zoning," "transfer of development rights," "the ecological general, plan," and a "roll back sprawl campaign." REGISTER, *supra* note 72, at 229-52.

with environmental ethicists who contend that recalibration of markets, without changes in human ethics and choices, will not be sufficient to protect nature from short-sighted, selfish, consumptive behaviors. On the other hand, though, giving attention to the economic benefits of nature and society's dependence on ecosystem services is not inconsistent with attention to the ethical dimensions of environmental and land use decisions, despite arguments that the two systems of thought are conceptually incompatible. As a mediating system, the land use regulatory system offers the potential to facilitate relationships between the economic values and non-economic values of ecosystem protection. Moreover, the land use regulatory system also offers the potential to facilitate relationships between people and ecosystems in ways that increase appreciation for ecosystems and promote more ecologically sustainable land use choices.

IX. CONCLUSION

The task before us is to improve our land use practices and decisions. While the system through which these practices emerge and these decisions are made is a functional system, it does not necessarily follow that we are using the system well. The system's utility does not absolve us of our ethical responsibilities for the use of land. To the contrary, we face the moral blame and practical consequences of poor land use choices.

Some of the most pressing land use issues we face today include: 1) inequities in land use and environmental conditions by race and class; 2) barriers to meaningful and deliberative public participation in land use decision making; 3) land development patterns degrading watersheds and water quality, while consuming water supplies; 4) loss of forests to development, including urban forests, forests owned by private timber companies moving their operations overseas, and overall tree canopy; 5) loss of wildlife habitat and biodiversity-supporting ecosystem functions; 6) development patterns that promote consumption of energy sources and emission of air pollutants, especially automobile usage; 7) the non-use, mis-use, and under-use of "brownfields," many of which are in core urban areas burdened by these contaminated sites; and 8) all-too-persistent beliefs that land is to serve primarily selfish, consumptive, private interests.[314]

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314. Craig Anthony (Tony) Arnold, Inaugural Boehl Distinguished Lecture in Land Use Policy, Louis D. Brandeis School of Law, University of Louisville, The People's Land: Justice Brandeis, Environmental Conservation, and Wisdom for Today's Land Use Challenges (Feb. 13, 2007) (webcast available at http://www.law.louisville.edu/media/2007/02/14/the-peoples-

We are more likely to find good means of addressing these problems if we turn from blaming the land use regulatory system itself for imagined inherent defects and instead turn to studying how the functions, components, scale, processes, and values of this adaptive system can be used to achieve better land use practices, including practices that value and conserve nature's services. Research into a regulatory structure that is both broad and deep, coupled with research into each of several land use problems that are broad and deep, are formidable tasks of substantial scope. The challenge is well worth our effort, though. After all, what is at stake are the qualities of the places in which we form and maintain communities.

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THE "BACKGROUND PRINCIPLES" OF NATURAL CAPITAL AND ECOSYSTEM SERVICES—DID *LUCAS* OPEN PANDORA'S BOX?

J.B. RUHL*

I. INTRODUCTION

> *"When . . . a regulation . . . goes beyond what the relevant background principles would dictate, compensation must be paid to sustain it"*[1]

What are the "relevant background principles" of natural capital and ecosystem services?[2] Although there is much yet to be learned about the ecology, geography, and economy of natural capi-

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1. Lucas v. S.C. Coastal Council, 505 U.S. 1003, 1030 (1992).

2. I am assuming readers have a working background understanding of the concepts of natural capital and ecosystem services. Briefly, ecosystem service, also known as environmental services, are non-commodity, economically valuable benefits humans derive from ecological resources directly, such as storm surge mitigation provided by coastal dunes and marshes, and indirectly, such as nutrient cycling that supports crop production. Natural capital consists of the ecological resources that produce these service values, such as forests, riparian habitat, and wetlands. Other articles in this symposium issue provide examples of natural capital and ecosystem services in specific ecological contexts. The primary aim of my contribution is to examine how the common law treats natural capital and ecosystem services in general. Portions of this work also appear in a more extensive examination of the status and future of natural capital and ecosystem services in law, J.B. RUHL, STEVEN KRAFT & CHRISTOPHER LANT, THE LAW AND POLICY OF ECOSYSTEM SERVICES (2007).

tal and ecosystem services, what is already known demands attention from the discipline of the law. Notwithstanding all the complications revealed through those other fields of study, in many cases the underlying ecosystem processes are well understood, the service can be traced from its natural capital source to its human beneficiaries, and we know the service is valuable to those people. So the obvious question is, what can be done to better integrate natural capital and ecosystem service values into land use and resource management decisions? As a starting point, one should know the baseline of common law doctrine from which any evolution of the law, whether it be judicially or legislatively initiated, is launching.

That is the purpose of this Article—to provide a general sense of where the common law sits today with respect to natural capital and ecosystem services. Part II explores two views of that landscape—one gloomy and the other hopeful. The gloomy view draws heavily from Professor John Sprankling's profoundly insightful article, *The Antiwilderness Bias of American Property Law*.[3] Although it has been largely overlooked in the literature on environmental law, Sprankling's careful documentation of how American common law systematically subverted incentives to conserve wilderness has recently enjoyed newfound attention by scholars interested in the development of the next phase of environmental common law.[4] Clearly, though, Sprankling's message for my purposes is that the common law has resisted integration of concepts like natural capital and ecosystem service values. The antiwilderness bias of the common law, in other words, erects anti-ecosystem background principles for natural capital and ecosystem services.

The more hopeful view painted in Part II draws heavily from work by Professor Michael Blumm exploring the implications of Justice Scalia's suggestion, made in his majority opinion in *Lucas v. South Carolina Coastal Council*,[5] that the background principles of the common law of property and nuisance can evolve.[6] On the one hand, the opinion is most noted for its proposition, quoted as

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3. John G. Sprankling, *The Antiwilderness Bias of American Property Law*, 63 U. CHI. L. REV. 519 (1996).

4. *See, e.g.*, Craig Anthony Arnold, *The Reconstitution of Property: Property as a Web of Interests*, 26 HARV. ENVTL. L. REV. 281, 320-321 (2002); Lee P. Breckenridge, *Can Fish Own Water?: Envisioning Nonhuman Property in Ecosystems*, 20 J. LAND USE & ENVTL. L. 293, 305 (2005); Alexandra B. Klass, *Adverse Possession and Conservation: Expanding Traditional Notions of Use and Possession*, 77 U. COLO. L. REV. 283, 330-32 (2006).

5. 505 U.S. 1003 (1992).

6. *See* Michael C. Blumm & Lucas Ritchie, Lucas*'s Unlikely Legacy: The Rise of Background Principles as Categorical Takings Defenses*, 29 HARV. ENVTL. L. REV. 321 (2005).

the opening of this Article, that "when . . . a regulation . . . goes beyond what the relevant background principles would dictate, compensation must be paid to sustain it."[7] On the other hand, what interests Blumm, and me, is Justice Scalia's observation that "changed circumstances or new knowledge may make what was previously permissible [under common law] no longer so."[8] The background principles, in other words, can evolve.

Recognizing that many people believe this evolution should be based on scientific, moral, and ethical arguments on behalf of ecological protection, I take a more instrumentalist—and I think realistic—approach based in welfare economics and the economic value of ecosystem services.[9] My thesis is that the rapidly amassing

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7. *Lucas*, 505 U.S. at 1030.
8. *Id.* at 1031.
9. Jim Chen has objected that:

> [T]he instrumentalist view inherent in the ecosystem services concept dictates that the "chemical, physical, and biological" integrity of basic environmental media such as water not be viewed as an objective for its own sake, but rather as the crucial first step toward achieving human goals such as "propagation of fish" and "recreation in and on the water."

Jim Chen, *Webs of Life: Biodiversity Conservation as a Species of Information Policy*, 89 IOWA L. REV. 495, 548 (2004) (citing 33 U.S.C. § 1251(a)(2) (2000)). The environmental philosopher Mark Sagoff has more vehemently dismissed focusing on ecosystem services as excessively instrumentalist. *See* MARK SAGOFF, PRICE, PRINCIPLE, AND THE ENVIRONMENT (2004). Integrating ecosystem service values into environmental decision making, however, does not preclude considering scientific, moral, and ethical factors as well. Moreover, given the reasons for the anti-ecosystem bias in property doctrine, it seems more likely that courts will respond to instrumentalist arguments regarding why the bias is misguided than they will to moral and ethical arguments. To put it more bluntly, the moral and ethical arguments have only moved the ball so far, and clearly not far enough, so it seems counterproductive to refuse to consider instrumentalist arguments that focus attention of the courts on the raw economic value to humans of natural capital and the provision of ecosystem services. It is not as if ecosystem services would not exist but for the efforts of economists and ecologists examining their economic potential. They have measurable value to humans, and whether we know their precise economic value or not, the fact that society has to choose how to allocate natural resources necessarily requires valuation of ecosystem services in some form or another. Failure to refine our understanding of their value, and the consequent inability to account for those values in regulatory and market settings and, more importantly, in the public mind, is unlikely to promote their conservation. As David Pearce has put it:

> [T]he playing field is not level; rather, it is tilted sharply in favor of economic development. Two things have to be done to correct this situation. First, one has to show that ecosystems have economic value—indeed, that all ecological services are economic services. Second, a way has to be found to "capture" the nonmarket values of ecosystems and turn them into real benefits for those who practice conservation.

David Pearce, Commentary, *Auditing the Earth: The Value of the World's Ecosystem Services and Natural Capital*, 40 ENVIRONMENT 23, 23 (1998). Robert Costanza et al. make the point more succinctly in urging that "although ecosystem valuation is certainly difficult and fraught with uncertainties, one choice we do not have is whether or not to do it." Robert

knowledge about the value of natural capital and ecosystem services can and should trigger a shift in the common law's baseline by disrupting the instrumentalist premises on which the anti-ecosystem bias of the common law rests.[10]

Part III of the Article assembles evidence that this effect is already afoot. With increasing frequency, albeit still in low numbers, courts are recognizing the economic value of natural capital and ecosystem services as relevant to outcomes under public nuisance claims and the public trust doctrine. What is remarkable about these cases is the ease and nonchalance with which the courts do so. It takes no revolutionary vision of the common law to find that the destruction of *economically* important natural resources should factor into the common law's decision calculus. Rather, this trend is simply the natural evolution of the common law motivated by new knowledge about nature's economic value.

It is too early to tell how significant the trend will be. The number of cases following it is not large, and the context of natural capital and ecosystem services presents many complex issues for courts. But new ideas and approaches in the common law have a way of spreading, usually slowly, but sometimes with remarkable speed and pervasive results.[11] For the moment, therefore, I feel safe in my conclusion that the cracks appearing in the common law's anti-ecosystem floor suggest some upheaval at deeper foundations could be at work. *Lucas* may indeed have opened Pandora's box.

II. MOVING THE BASELINE WITH THE "NEW KNOWLEDGE" PRINCIPLE

This Article is part of a larger project exploring how to integrate natural capital and ecosystem service values into the common law. Step one in that project is to define the baseline from which I am working. Step two, given how bleak the answer is to step one, is to find a way to move the baseline.

Costanza et al., *The Value of the World's Ecosystems and Natural Capital*, 387 NATURE 253, 255 (1997).

10. I have suggested, but not fully developed, this thesis in previous work. *See* J.B. Ruhl, *Toward a Common Law of Ecosystem Services*, 18 ST. THOMAS L. REV. 1 (2005); J.B. Ruhl, *Ecosystem Services and the Common Law of "The Fragile Land System,"* 20 NAT. RESOURCES & ENV'T 2, 3 (2005).

11. *See, e.g.*, Jeff L. Lewin, *The Genesis and Evolution of Legal Uncertainty About "Reasonable Medical Certainty*," 57 MD. L. REV. 380 (1998) (tracing the spread of the "reasonable medical certainty" doctrine in the common law).

A. The Common Law's Anti-Ecosystem Baseline

As Sprankling observes, American property law has traditionally been portrayed as silent or neutral on the question of what rights or duties a landowner has over undeveloped land on which wilderness is located.[12] This "neutrality paradigm," as he calls it, supported the premise that property law neither encourages nor discourages property owners from destroying or degrading natural capital, meaning that the decision whether to do so must be seen as a voluntary act driven by rational economic behavior.[13] Indeed, were this the case, it would be encouraging to the project of defining rights in natural capital and ecosystem services, for it would mean that the law would be improving the clarity of rights rather than reorienting settled principles.

But a careful reading of the evolution of American property law from its English common law roots to its contemporary framework suggests it is not gaps that must be filled, but walls that first must be taken down. Indeed, Sprankling convincingly demonstrates why American property law is anything but unclear about a landowner's discretion over the fate of natural capital and ecosystem services. His thorough historical analysis reveals that early American property law, as formulated through judicial opinions building the common law of property rights, embraced agrarian development as its central purpose and saw the nation's abundance of wilderness as essentially a license to tilt property law toward what he calls an "antiwilderness bias."[14] It was "an instrumentalist judiciary [that] modified English property law to encourage the agrarian development, and thus destruction, of privately owned American wilderness,"[15] and this was perceived as having no downside given the supply of undeveloped land the nation enjoyed. No less than the United States Supreme Court joined in this retooling of common law, as Justice Story observed in 1829 that "[t]he country was a wilderness, and the universal policy was to procure its cultivation and improvement."[16] The result was a body of law that actually *encouraged* destruction of wilderness and devalued its status in the market.

In one of his most striking examples, Sprankling traces the evolution of American property law on the doctrine of adverse possession, under which the long-term possessor of land can oust the

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12. *See* Sprankling, *supra* note 3, at 520.
13. *Id.*
14. *Id.*
15. *Id.* at 521.
16. Van Ness v. Pacard, 27 U.S. (2 Pet.) 137, 145 (1829).

true title owner of possession.[17] The doctrine was a means of resolving title disputes in England, which lacked an organized title recording system, in the context of what was a densely agrarian landscape long before the development of American law. English common law, which early American courts adopted wholesale, required the adverse claimant, among other things, to have engaged in open and obvious activities likely to afford notice to a diligent owner, such as establishing residence on the land, cultivating it, or fencing in portions.[18] Over time, however, American courts began systematically to promote development by modifying these requirements based on the nature of the land involved. Thus, adverse possession of wilderness lands could successfully be established by infrequent, inconspicuous acts, such as occasional berry picking or taking of timber, that would likely have gone unnoticed by anyone, even an observant and diligent owner.[19] This made it easier to establish adverse possession of wilderness lands through minimal development activity, and thus sent a clear message to landowners to develop their land first lest they lose it to interlopers.

Similarly, the common law doctrine of waste was enforced in England mainly to preserve the status quo between co-owners, "resolv[ing] disputes between competing interest holders by preferring existing uses to new uses."[20] Particularly given England's wood-dependent economy and wood-scarce landscape, any substantial cutting of trees on forested land was considered waste, allowing the objecting co-owner to prevent his or her co-owners from doing so. In the early American context, the situation was quite the reverse—the landscape was tree-abundant and farm-scarce. The English version of waste would have impeded agricultural development, and thus the American courts soon deemed that "[l]ands in general with us are enhanced by being cleared" and that it would "be an outrage on common sense" to apply the English doctrine.[21] This sentiment eventually forged the American "good husbandry" standard of waste, which permitted a co-owner to clear wilderness land for cultivation or grazing without fear of being found to have committed waste.[22] Sprankling surveys more recent case law to demonstrate that, while the number of cases decided pursuant to the common law doctrine has diminished considerably

17. Sprankling, *supra* note 3, at 538-39.
18. *Id.* at 538.
19. *Id.* at 539.
20. *Id. at* 534.
21. Hastings v. Cruncklеton, 3 Yeates 261, 262 (Pa. 1801).
22. Sprankling, *supra* note 3, at 535.

(likely because most co-owners today act through formal governing agreements), the courts remain committed to this approach, leaving "the modern law of waste . . . staunchly hostile to wilderness."[23]

Even the law of nuisance, the common law doctrine most attuned to the relationship between property owners, joined in the evolution of the anti-wilderness bias. As Sprankling explains, English common law enforced a strict harm-based test for nuisance, under which any act that harmed the productive usefulness of other land could be deemed a nuisance.[24] In America, however, the pro-development common law evolved so that the "reasonableness" of the harm mattered, and locality and circumstances became the criteria with which to measure what was reasonable.[25] The result was that "[a]ll other things being equal, conduct was less likely to be enjoined as a nuisance if it occurred in a wilderness area than in another, more developed, locality."[26] One court, for example, went so far as to refuse to enjoin a dam that would have flooded a tract "so wet, marshy and sour as to be worthless for agricultural . . . purposes."[27] Of course, as nuisance law systematically made it less likely a court would find harmful land uses a nuisance in wilderness areas than in developed areas, potential nuisance-causing land uses gravitated to undeveloped areas to reduce their exposure to liability.[28]

As one might expect, the American West was where Sprankling found the anti-wilderness bias has penetrated deepest into property law. Because of England's dense crop and pasture land uses, English common law held to rigid lines on the doctrine of trespass, making stock owners liable for any damage their animals might cause to other landowners.[29] By contrast, American law, particularly in the West, tore down the "invisible fence" of English trespass law and replaced it with a "free-range" standard under which stock could roam over private lands without creating trespass liability.[30] By statute, many American states purported to reverse

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23. *Id.* at 569.
24. *Id.* at 553.
25. *Id.* at 554.
26. *Id.*
27. McNeal v. Assiscunk Creek Meadow Co., 37 N.J. Eq. 204, 204 (1883). For a comprehensive history of the English common law regarding wetlands, focusing on the many ways in which the law contributed to a sustainable wetlands ecology, see Fred P. Bosselman, *Limitations Inherent in the Title to Wetlands at Common Law*, 15 STAN. ENVTL. L.J. 247 (1996).
28. Sprankling, *supra* note 3, at 556.
29. *Id.* at 549-50.
30. *Id.* at 550.

the English rule so as to facilitate agrarian development.[31] Locating livestock near forested land or the prairie thus became viewed as a beneficial use of the adjoining natural resources. Although courts in New England states construed these statutes quite narrowly, elsewhere they prevailed under theories that the free-range standard had become the common law equivalent of "customary use" of undeveloped lands, in effect making privately owned wilderness open access land for purposes of grazing.[32] As the Ohio Supreme Court put it, "to leave uncultivated lands uninclosed [sic], was an implied license to cattle and other stock at large to traverse and graze them."[33]

Sprankling's assessment of American property law thus reveals why accounting for natural capital and ecosystem services in property law will involve more than simply clarifying property rights, as if the rules and liabilities are not already clear. Rather, it seems perfectly clear that owning undeveloped land, which is where one would reasonably expect to find intact natural capital, is a *burden* to landowners under American property law. On balance, a landowner is better off developing natural capital to other uses, lest ownership be lost to an adverse possessor, lest co-owners get to it first, lest nuisance uses locate in the vicinity for safe harbor from liability, lest stock owners graze their cattle there, and so on. The goal of recognizing natural capital as an economically valuable asset can only be hindered under this entrenched common law cloud.

Of course, today it would be unusual for a judge to characterize a wetland as a worthless tract of sour marsh. Modern understanding of the ecological function of wetlands has raised them from wasteland status to an important public resource. For example, in upholding federal regulation of development in wetlands the United States Supreme Court acknowledged that "wetlands may serve to filter and purify water draining into adjacent bodies of water . . . and to slow the flow of surface runoff into lakes, rivers, and streams and thus prevent flooding and erosion . . . ."[34] But this change of heart has largely been embodied through public legislation with its focus on the use of public lands or the protection of discrete resources on public and private lands. Notwithstanding the changes in public perception and the rise of public legislation

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31. *Id.*

32. *Id.* at 551.

33. Kerwhaker v. Cleveland, Columbus & Cincinnati R.R. Co., 3 Ohio St. 172, 179 (1854).

34. United States v. Riverside Bayview Homes, Inc., 474 U.S. 121, 134 (1985). Other cases in which courts assign similar value to wetlands are discussed in Blumm and Ritchie, *supra* note 6, at 337.

aimed at protecting the environment, Sprankling found that the contemporary common law of property has remained stuck in its nineteenth century antiwilderness bias. His conclusion:

> Modern courts have lost sight of the historical roots of our property law system. Although espousing prowilderness sentiments in good faith, the judiciary blindly applies most of the antiwilderness doctrines of the past. Thus, individual disputes tend to be resolved in favor of wilderness exploitation. More importantly, the historic body of antiwilderness opinions continues to exist, setting public norms for private conduct outside of the litigation arena. The accumulated precedents of the two centuries constitute a virtual common law of wilderness destruction that threatens the existence of privately owned wilderness sanctuaries.[35]

While Sprankling couches this phenomenon on the effect the common law's bias has on conservation of wilderness, the importance of undisturbed wild lands to the sustainability of dynamic ecosystems surely demands that the bias be reframed as one of "anti-ecosystem" dimensions. And as the productivity of natural capital and delivery of ecosystem services depend on the sustainability of ecosystems, the common law's bias strikes at the heart of the goal of accounting for natural capital and ecosystem services in property rights, as well as in law and policy generally.

Indeed, further evidence supporting Sprankling's dim evaluation of the fate of natural capital under American property law is found in the absence of precedent for the proposition that landowners have rights in the continued flow of ecosystem services from other person's lands. After all, such rights, if they were recognized and enforced, would be the antithesis of any notion that property law favors the development of natural capital. If Sprankling were wrong about the anti-ecosystem bias of the common law, therefore, one could reasonably expect to find precedent supporting a landowner's right inherent in title—that is, without formal contractual agreement, regulatory intervention, or claim resolved under nuisance law—to some level of continued provision of ecosystem services flowing from natural capital found on another's land. At the very least, under the assumption that such rights are presently unclear, one should expect to find the law silent on the mat-

35. Sprankling, *supra* note 3, at 569.

ter. In fact, however, the property law of ecosystem services is the mirror image of the property law of natural capital—the common law is clear that there are no such rights inherent in title to land.

In this sense English and American common law are much closer in unison than is the case for the common law of natural capital. Strictly speaking, the kind of right that would require one landowner to refrain from interfering with the flow of ecosystem services to other lands is referred to as a negative easement.[36] The English common law recognized four negative easements inherent in title: the rights to stop other landowners from (1) blocking one's windows, (2) interfering with the flow of air in a defined channel, (3) removing artificial support for buildings, and (4) interfering with the flow of water in an artificial channel.[37] Also, under the doctrine of "ancient lights," if a landowner received light from across adjacent parcels for a sufficient period of time, a negative easement could arise by prescription.[38] But English courts, cautious in general of attaching too many encumbrances to land, stopped there in establishing any more expansive negative easements as a matter of title.[39] American courts accepted all of those doctrines but the ancient lights doctrine, which has been disavowed repeatedly in this country,[40] and stopped there except for adding the widely recognized doctrine that landowners must provide the lateral and subjacent support that an adjacent parcel would receive under natural conditions, imposing a general duty on landowners not to cause subsidence on other properties through excavation of soil or withdrawal of groundwater.[41] Beyond this limited set of negative rights American property law ventured no further.

Even in the absence of such rights, nuisance law might have developed so as to mediate competing claims of reasonable use in favor of continued enjoyment of ecosystem services. Indeed, American legal scholars many decades ago suggested that a set of "natural rights" should guide nuisance law to protect a landowner's use of land in its natural condition, with one boldly claim-

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36. *See* JESSE DUKEMINIER ET AL., PROPERTY 736-38 (6th ed. 2006).

37. *Id*. at 736.

38. *Id*. at 737 n.26.

39. *Id*. at 736.

40. For a famous example, see Fontainebleu Hotel Corp. v. Forty-Five Twenty-Five, Inc., 114 So. 2d 357, 359 (Fla. 3d DCA 1959) (noting that the English doctrine "has been unanimously repudiated in this country").

41. *See* DUKEMINIER ET AL., *supra* note 36, at 645-46. To be sure, American courts have been more generous than their English counterparts in recognizing the creation of negative easements *by agreement*. Land trusts routinely employ that mechanism to purchase (and not use) rights to develop land, leaving title and limited use rights in the seller. *See id*. at 738-40.

ing that "[o]wnership of land insures far more than mere occupation and use of soil and vegetation on the surface of the earth. It protects the reasonable use of all the elements nature places on the surface."[42] To date, however, few published judicial opinions have picked up on that thesis. One court in Texas found that cloud seeding unreasonably interfered with natural rainfall on the plaintiff's property, holding that a "landowner is entitled . . . to such rainfall as may come from clouds over his own property that Nature, in her caprice, may provide."[43] In a more modern context, the Wisconsin Supreme Court found that interfering with the flow of light to solar panels could give rise to a nuisance claim given that "[a]ccess to sunlight as an energy source is of significance both to the landowner who invests in solar collectors and to a society which has an interest in developing alternative sources of energy."[44] Yet these are rare exceptions, not the general rule. Nuisance doctrine, while not flatly rejecting the idea that loss of ecosystem services could give rise to an actionable claim, has been in no hurry to embrace it either.

As it stands today, therefore, American property law is not simply neutral on the question of private property rights in natural capital and ecosystem services, but downright hostile to them, making it no wonder that neither finds much stock in the marketplace. The private landowner in such a system has no reason to think that conserving natural capital will be to his or her advantage; indeed, doing so may be a disadvantage. Likewise, the beneficiaries of ecosystem services flowing from natural capital on other person's lands have no expectation based on our common law experience that they may protect those benefits through enforcement of property rights. Neither condition is the result of private property rights being "poorly defined." Rather, in the absence of intervening public legislation, we have been handed a clear set of rules from our common law system of property rights—landowners have almost total discretion over natural capital on land they own, with strong incentives to destroy it, and they have no inherent rights in the continued provision of ecosystem services from land owned by others. There is no gap in private property rights to be filled, in other words, but rather a well-constructed wall to be taken down.

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42. Note, *Who Owns the Clouds?*, 1 STAN. L. REV. 43, 53 (1948).

43. Southwest Weather Research, Inc. v. Rounsaville, 320 S.W. 2d 211, 216 (Tex. Civ. App. 1958).

44. Prah v. Maretti, 321 N.W. 2d 182, 189 (Wis. 1982).

B. Integrating New Knowledge of Natural Capital and Ecosystem Services

Sprankling's account of the evolution of the common law of property rights, confirmed in other historical studies,[45] finds unmitigated support in the unlikely field of regulatory takings law. The tenacity of the common law's drift toward the anti-ecosystem bias meant that any meaningful protection of natural resources on private lands would have to come through private volunteerism and public legislation. Although many sporadic instances of conservation legislation happened in the states simultaneously with the common law's evolution in the opposite direction,[46] no one could reasonably argue that a comprehensive body of statutory public law existed, even by the mid-1900s, to reverse the anti-ecosystem bias of the common law. The wave of federal environmental legislation beginning in 1970[47] did include laws with substantial impact on private land use, most notably the Endangered Species Act[48] and the regulation of wetlands that has grown out of Section 404 of the Clean Water Act.[49] But as that body of land use regulation expanded, the claim grew ever louder that its effect cut so hard against the grain of settled common law property rights as to constitute a taking of property without just compensation in contravention of the Fifth Amendment to the Constitution.[50]

Ironically, although this so-called "regulatory takings" tension has not resulted in many successful litigation claims seeking compensation, it led eventually to a legal development that placed the pro-development common law in the role of gatekeeper for the validity of pro-environment legislation. As noted previously, in his opinion for the majority in *Lucas*, Justice Scalia announced that where a new land use regulation denies all economically beneficial or productive use of land—in that case a blanket prohibition of development in coastal dune areas—it must be treated as a *per se* taking of property for which just compensation is due under the Fifth Amendment.51 Justice Scalia's caveat was that just com-

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45. *See* Klass, *supra* note 4; Steven J. Eagle, *Environmental Amenities, Private Property, and Public Policy*, 44 NAT. RESOURCES J. 425 (2004); James M. McElfish, *Property Rights, Property Roots: Rediscovering the Basis for Legal Protection of the Environment*, 24 ENVTL. L. REP. (Envtl. L. Inst.) 10231 (1994).

46. McElfish, *supra* note 45.

47. RICHARD J. LAZARUS, THE MAKING OF ENVIRONMENTAL LAW 67-97 (2004).

48. 16 U.S.C. §§ 1531-1544.

49. 33 U.S.C. § 1344.

50. LAZARUS, *supra* note 47, at 126-37.

51. *Lucas*, 505 U.S. at 1028-32.

pensation would not be due if the regulation does "no more than [simply] duplicate the result that could have been achieved in the courts—by adjacent landowners (or other uniquely affected persons) under the State's law of private nuisance, or by the State under its complementary power to abate nuisances that affect the public generally . . . ."[52] In his concurring opinion, Justice Kennedy expressed concern with the idea that state regulation could go no further than duplicating the common law of nuisance without exposing itself to the now infamous "categorical taking" problem, for as he put it, "[c]oastal property may present such unique concerns for a fragile land system that the State can go further in regulating its development and use than the common law of nuisance might otherwise permit."[53] In other words, Justice Kennedy took it as a given, as Justice Scalia and the majority also clearly did, that the common law of property does not protect the "fragile land system." Indeed, although leaving the final say to state courts, Justice Scalia surmised that "[i]t seems unlikely that common-law principles would have prevented the erection of any habitable or productive improvements on petitioner's land . . . ."[54]

In an effort to turn Justice Scalia's caveat into the exception that swallows the rule, many legal scholars have rediscovered the importance of the common law of property rights in the constellation of environmental law, not as a constraint, but rather as a liberator. For example, in *Lucas's Unlikely Legacy: The Rise of Background Principles and Categorical Takings Defenses*, Professor Michael Blumm and co-author Lucas Ritchie offer a comprehensive survey of common law doctrines that could, in some cases in their existing forms and in others only through some evolutionary judicial development, impose restrictions on the ability of a landowner to destroy natural capital and thus insulate public regulation that duplicates that effect from attack as a regulatory taking of property.[55] Most of the doctrines they examine, which include the public trust doctrine,[56] the natural use doctrine,[57] the federal navigation servitude,[58] water rights,[59] and the wildlife trust,[60] relate to common law formulations of ostensibly superior *public* rights in

52. *Id.* at 1029.
53. *Id.* at 1035 (emphasis added).
54. *Id.* at 1031 (citing Curtin v. Benson, 222 U.S. 78, 86 (1911)).
55. *See* Blumm & Ritchie, *supra* note 6.
56. *Id.* at 341-44.
57. *Id.* at 344-46.
58. *Id.* at 346-47. Although not a principle of state common law, the *Lucas* majority pointed to the federal navigation servitude as an example of background principles. *See Lucas*, 505 U.S. at 1027.
59. Blumm & Ritchie, *supra* note 6, at 350-52.
60. *Id.* at 352-53.

resources, and the authors' focus is on defending public regulation of private land from regulatory takings claims, not on adjusting or redefining rights as between *private* property owners.[61] Even within that limited scope, moreover, Blumm and Ritchie do not suggest that the anti-ecosystem bias of the common law has been substantially softened, much less reversed altogether. For example, in support of their thesis they point to the famous case of *Just v. Marinette County*,[62] in which the Wisconsin Supreme Court held that "[a]n owner of land has no absolute and unlimited right to change the essential natural character of his land so as to use it for a purpose for which it was unsuited in its natural state and which injures the rights of others."[63] Although they maintain that this "natural use doctrine" has firm roots in English common law and has been adopted by a few other American state courts,[64] at best its contours remain hazy and its development nascent. In short, notwithstanding their considerable efforts to uncover property doctrine exceptions to Sprankling's thesis, examples remain few and far between. More significantly, even their most promising candidates fail to use natural capital and ecosystem service values as an explicit basis for the departure.[65]

But recall Justice Scalia's observation that "changed circumstances or new knowledge may make what was previously permissible no longer so."66 Many property law scholars take this to mean that the background principles for purposes of government takings liability evolve dynamically with the changing contexts of appropriate land uses and property rights.[67] Property law, in other words, adjusts to new knowledge—for example, about natural capital and ecosystem services—by arriving at new configurations of the relative balance of rights within the property system,

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61. For a similar focus, see Robert L. Glicksman, *Making a Nuisance of Takings Law*, 3 WASH. U. J.L. & POL'Y 149, 169-82 (2000).

62. Just v. Marinette County, 201 N.W. 2d 761 (Wis. 1972).

63. *Id*. at 768.

64. Blumm & Ritchie, *supra* note 6, at 345.

65. Granted that courts might act consistent with integration of natural capital and ecosystem service values without mentioning those words, it is nonetheless remarkable that so few courts even connect ecosystems with common law doctrine. In a search of the ALLSTATES Westlaw database, I found only seven pre-2000 cases mentioning the terms "public trust doctrine" and "ecosystem," and in none of the cases did the terms appear in the same paragraph. Similarly, I found only eight cases mentioning "public nuisance" and "ecosystem," only one of which mentioned them in the same paragraph. In none of either set of cases did the courts use the terms in a way consistent with any sense of softening of the anti-ecosystem bias.

66. *Lucas*, 505 U.S. at 1031.

67. *See,* e.g., Richard J. Lazarus, *Putting the Correct "Spin" on Lucas*, 45 STAN. L. REV. 1411, 1419 (1993); Glenn P. Sugameli, *Lucas v. South Carolina Coastal Council: The Categorical and Other "Exceptions" to Liability for Fifth Amendment Takings of Private Property Far Outweigh the "Rule,"* 29 ENVTL. L. 939, 971 (1999).

and the "background principles" relevant to *Lucas* shift in synch.[68]

Although some legal scholars do not agree Justice Scalia meant to leave this door open or that going through it would be wise,[69] state and lower federal courts have begun to take up Justice Scalia's invitation. For example, in *Machipongo Land & Coal Co. v. Commonwealth*,[70] the Pennsylvania Supreme Court rejected a regulatory takings claim coal owners brought in connection with a state agency's decision to designate their properties as unsuitable for surface mining. The basis for the designation was the finding that mining coal in the area, which was the watershed of a stream that was a source of drinking water, "'would adversely affect the use of the stream as an auxiliary water supply' and . . . 'disrupt the hydrological balance causing decreases in the net alkalinity of discharges . . . .'"[71] Surface mining of coal, of course, has a long history in Pennsylvania, even in watersheds of streams, but the court nonetheless determined that it would constitute a public nuisance in this case. As the court observed:

> The rules and understandings as to the uses of land that are acceptable and unacceptable have changed over time. The fact that sewage was once strewn into city streets does not give rise to a permanent reasonable expectation that such behavior can continue indefinitely . . . . While the owner of land might once have been permitted to mine his land without regard to the effect that it had on public streams, as evidenced by the spoilage of "11,000

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68. This is a long and widely held conception of the common law. For example, in support of the proposition Justice Scalia pointed to the Restatement (Second) of Torts, which explains with respect to nuisance claims that:

> The character of a particular locality is, of course, subject to change over a period of time and therefore the suitability of a particular use of land to the locality will also vary with the passage of time. A use of land ideally suited to the character of a particular locality at a particular time may be wholly unsuited to that locality twenty years later. Hence the suitability of the particular use or enjoyment invaded must be determined as of the time of the invasion rather than the time when the use or enjoyment began.

RESTATEMENT (SECOND) OF TORTS § 828 cmt. g (1979). In short, "the specific harms that nuisance governs are neither fixed nor objective. Rather, what nuisance law treats as a harm is highly contextual and determined by community norms." Albert C. Lin, *The Unifying Role of Harm in Environmental Law*, 2006 WIS. L. REV. 897, 904 (2006).

69. *See, e.g.*, David L. Callies, *Custom and Public Trust: Background Principles of State Property Law?*, 30 ENVTL. L. REP. (Envtl. L. Inst.) 10003 (2000).

70. Machipango Land & Coal Co. v. Commonwealth, 799 A.2d 751 (Pa. 2002).

71. *Id.* at 757 (quoting Machipongo Land & Coal Co., Inc. v. Commonwealth, No. 248 M.D.1992, slip op. at 3 (Pa.Cmwlth. 2000).

> miles of streams" in this country, that expectation is, and has been for some time, no longer reasonable. Despite the fact that one may have purchased property with the expectation to use it in such a manner that was acceptable before the purchase, there may come a point in time when the original owner's expectations may no longer be reasonable.[72]

Shutting off the flow of ecosystem services from one's property to others may also, in many contexts, have long been acceptable, but just as with sewage strewn into streets and acid runoff from mines, there is no permanent reasonable expectation that such behavior can continue indefinitely. Part III examines two cases, one arising in the context of a public nuisance and the other under the public trust doctrine, suggesting that such behavior may indeed be becoming unacceptable in the eyes of the common law.

III. EVIDENCE OF EVOLUTION

Although the new knowledge principle works throughout the full breadth of the common law, it does so, usually, as part of the ordinary co-evolution of law and society. As Blumm and Ritchie suggest, however, the way in which the new knowledge principle arises in *Lucas* says nothing less than "bring it on" to government and environmental interest group attorneys intent on containing the scope of categorical takings. The problem, as Sprankling's work drives home, is that the common law has had little interest in new knowledge about the environment *qua* environment. The smattering of cases Blumm and Ritchie identify hardly amounts to a shift of tides against the common law's anti-ecosystem bias. By contrast, when the environment can be linked to utilitarian costs and benefits, which is precisely what the burgeoning research on natural capital and ecosystem services is revealing about ecological resources, the common law is more likely to pay attention. The cases are not numerous by any means, but there is evidence that this theme is being picked up in the law of public nuisance and of the public trust doctrine.

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72. *Id*. at 772-73 (quoting Mugler v. Kansas, 123 U.S. 623, 669 (1887). This is the generally held conception of nuisance doctrine—i.e., that "the specific harms that nuisance governs are neither fixed nor objective. Rather, what nuisance law treats as a harm is highly contextual and determined by community norms." Albert C. Lin, *The Unifying Role of Harm in Environmental Law*, 2006 WIS. L. REV. 897, 904 (2006).

A. Public Nuisance

A public nuisance "is an unreasonable interference with a right common to the general public."[73] Rights common to the general public need not be rights in land;[74] indeed, rights in land held by numerous landowners do not necessarily amass into a right common to the general public.[75] Ecosystem service nuisances seem ready-made for public nuisance under all these conditions.

In *Palazzolo v. State*,[76] for example the Rhode Island trial court considered a regulatory takings claim the United States Supreme Court had left dangling in *Palazzolo v. Rhode Island*.[77] The Supreme Court rejected the plaintiff's claim that state agency denial of a permit to fill and develop a marsh area adjacent to a pond constituted a categorical taking of property under *Lucas*, because the agency allowed plaintiff to develop some of his parcel, and left it to the state courts initially to decide whether the permit denial was a regulatory taking. The state trial court reasoned that *Lucas* "establish[ed] public nuisance as a preclusive defense to takings claims,"[78] and found that "clear and convincing evidence demonstrates that Palazzolo's development would constitute a public nuisance"[79] on the following grounds:

> [P]alazzolo's proposed development has been shown to have significant and predictable negative effects on Winnapaug Pond and the adjacent salt water marsh. The State has presented evidence as to various effects that the development will have including increasing nitrogen levels in the pond, both by reason of the nitrogen produced by the attendant residential septic systems, and the reduced marsh area *which actually filters and cleans runoff*. This Court finds that the effects of increased nitrogen levels constitute a predictable (anticipatory) nuisance which would almost certainly result in an ecological disaster to the pond.[80]

Palazzolo thus involved the type of transboundary property

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73. RESTATEMENT (SECOND) OF TORTS § 821B(1) (1979).
74. RESTATEMENT (SECOND) OF TORTS § 821B cmt. h (1979).
75. RESTATEMENT (SECOND) OF TORTS § 821B cmt. g (1979).
76. Palazzolo v. State, 2005 WL 1645974 (R.I. 2005).
77. 533 U.S. 606 (2001).
78. *Palazzolo*, 2005 WL 1645974 at *5.
79. *Id.*
80. *Id.* (emphasis added).

rights issue that is likely to be ubiquitous for the law and policy of natural capital and ecosystem services, and the case demonstrates the easy time public nuisance law has for integrating those values into a straightforward analysis: Palazzolo owned the marsh; the marsh filtered and cleaned runoff into the pond; those services were positive externalities flowing off of Palazzolo's property; the public in general enjoyed the benefits of that service; Palazzolo therefore had no property right to fill the marsh. It's that simple.[81]

Nevertheless, as easily as the court's decision integrated ecosystem services into public nuisance doctrine, the decision also illustrates the difficulty of making the same move in private nuisance doctrine and, perhaps to a lesser degree, when asserting public nuisance affirmatively rather than as a defense. The nuisance analysis arises in cases like *Palazzolo* only in connection with the government's assertion of the nuisance exception to the landowner's regulatory taking claim. If the government can establish the exception under the public nuisance branch simply by demonstrating the *qualitative* effect on ecosystem service delivery, it need not establish proof of *quantitative* harm to specific property owners. The government's litigation incentives thus are far different from those a private landowner or sovereign might advance against actions like Palazzolo's filling of the marsh.

In *Palazzolo*, for example, although the court acknowledged the "valuable filtering system" the marsh provided[82] and that the pond and marsh system provided "amenity value to …the land owners in the area,"[83] the curtailment of ecosystem service values to private landowners did not register in the record or with the court. The court simply noted that "no neighboring landowner has made a private nuisance claim" and that the potential for obstruction of views of the water would not constitute a private nuisance under Rhode Island law.[84] It would have been unlikely, however, that any neighboring landowner would advance a private nuisance

81. Although not raising ecosystem services in connection with the "background principles" exception to regulatory takings, in another recent case a court referred to ecosystem services as one of the reciprocal benefits of environmental regulation that factor into the regulatory takings analysis and cut against a finding that the regulation has gone too far. *See* R & Y, Inc. v. Municipality of Anchorage, 34 P.3d 289, 298 (Alaska 2001) (pointing to "the unique ecological and economic value that wetlands provide in protecting water quality, regulating local hydrology, preventing flooding, and preventing erosion" and finding that regulations protecting such wetlands "provide ecological and economic value to the landowners whose surrounding commercially-developed land is directly and especially benefitted [sic] by the[ir] functioning.") .

82. *Palazzolo*, 2005 WL 1645974 at *3.

83. *Id.*

84. *Id.* at *6.

claim having to do with loss of the marsh filtering function before it was known whether the state would grant the permit for the project, and that was even less likely after the state rejected the permit. In short, the law of ecosystem services in private nuisance claims, as well as for claims asserting public nuisance affirmatively rather than as a defense, is unlikely to develop in the context of regulatory takings claims—it will emerge only when private landowners and sovereigns start suing landowners over the effects of natural capital degradation. Nevertheless, the outcome under cases such as *Palazzolo* suggests that, with reliable evidence of significant injury resulting from curtailment of ecosystem services, such private and public nuisance actions may very well succeed. [85]

B. The Public Trust Doctrine

"The Public Trust Doctrine traces its roots to the Institutes of Justinian in Roman Law, which declared that there are three things common to all people: (1) air; (2) running water; and (3) the sea and its shores."[86] Along with the Romans, this principle invaded England and became part of its common law, which the states imported with minor variations after the American Revolution. While the British version held that tidelands were held by the King for the benefit of all English subjects, the American version replaced the crown with the states, and the courts became the doctrine's chief enforcer.

The scope of the trust imposed by the public trust doctrine can be thought of in several dimensions. First, it has a geographic reach that must be defined. In the American version, this has generally meant all lands subject to the ebb and flow of the tide, and all waters navigable in fact, such as rivers, lakes, ponds, and streams. Next, the uses that the trust protects and prohibits must be defined. In American jurisprudence, fishing, commerce, and navigation are core protected uses, with other uses such as boating, swimming, anchoring, and general recreation being recognized as well in most states. Uses inconsistent with those protected values may be prohibited—that is, even if the state wishes to facilitate such incompatible uses, it may be restrained from doing so. Finally, the public trust doctrine carries with it restrictions on the alienation of public

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85. In related work I advocate for this development and explore the details of such private nuisance claims. *See* J.B. Ruhl, *Making Nuisance Ecological*, CASE W. RES. L. REV. (forthcoming) (manuscript available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=931248).

86. The brief summary of the public trust doctrine that follows in the text is drawn from JOHN COPELAND NAGLE & J.B. RUHL, THE LAW OF BIODIVERSITY AND ECOSYSTEM MANAGEMENT 780-86 (2nd ed. 2006)

trust lands to private interests when to do so would undermine the protected public uses. In all of these dimensions, "[c]ourts have held that consideration of trust concerns occurs in advance of proposed governmental action, requires prior comprehensive resource planning or specific cost/benefit balancing, and *includes a continuing duty to reconsider when circumstances and knowledge change*."[87]

Areas subject to the public trust doctrine unquestionably will often contain natural capital resources supplying ecosystem service to areas within and beyond the geographic boundaries of the trust's reach. Hence, even if the scope of uses protected by the public trust doctrine is utilitarian in focus (e.g., navigation, hunting, fishing, swimming, boating), ecosystem service values fit neatly under that umbrella. In *Avenal v. State*,[88] for example, the Louisiana Supreme Court considered the claims of state land oyster bed lessees that the state's plan to move their bed sites to make way for a coastal diversion canal project constituted a taking. The purpose of the project was to restore freshwater flow (and the sediment carried with it) from the Mississippi River to coastal areas in order to impede loss of coastal marshes.[89] Because this would have lowered salinity in the waters overlying the oyster beds, the state established a program to allow operators to move their beds.[90] Many lessees, however, objected and sought compensation through an inverse condemnation action.[91]

A central issue in the case became the validity and enforceability of hold harmless clauses in most of the leases that specifically referenced coastal restoration and which the state argued was designed to support application of the public trust doctrine.[92] Under Louisiana law, the public trust doctrine is implemented as a "balancing process in which environmental costs and benefits must be given full and careful consideration along with economic, social and other factors."[93] The court found that the diversion project

> [F]its precisely within the public trust doctrine. The public resource at issue is our very coastline, the loss

87. Richard J. Lazarus, *Changing Conceptions of Property and Sovereignty in Natural Resources: Questioning the Public Trust Doctrine*, 71 IOWA L. REV. 631, 652 (1986) (emphasis added).

88. 886 So. 2d 1085 (La. 2004).

89. *Id.* at 1088.

90. *Id.* at 1090.

91. *Id.* at 1104.

92. *Id.* at 1093.

93. *Id.* at 1101 (citing Save Ourselves, Inc. v. Louisiana Envtl. Control Comm'n, 452 So. 2d 1152, 1157 (La. 1984)).

> of which is occurring at an alarming rate. The risks involved are not just environmental, but involve the health, safety, and welfare of our people, as coastal erosion removes *an important barrier between large populations and ever-threatening hurricanes and storms*.[94]

Ecosystem service values, therefore, should stand on equal footing with other economically valuable uses protected under the public trust doctrine. Indeed, when those other uses are not present in particular public trust lands, ecosystem service values provide the state a means to point not merely to environmental integrity as the basis for denying development or extractive uses, but to *economic* integrity as well. It presents no revolutionary twist of the public trust doctrine for courts, as did the court in *Avenal*, to integrate natural capital and ecosystem service values into the doctrine in this manner.[95] Rather, doing so simply reflects new knowledge of the economic importance of natural capital and ecosystem services.

IV. CONCLUSION

It is, of course, stating the obvious to observe that the common law evolves with new knowledge. And the principle appears in the *Lucas* majority opinion merely as a passing reference, something like an exception to an exception to a special rule of regulatory takings jurisprudence. Yet it also should have been obvious that the passing reference ultimately would be washed in fluorescent highlighting by lawyers searching for a way out of the categorical takings box *Lucas* constructed. To use "relevant background principles" of the common law of property as the test for how far regulation may go, and then to observe that those background principles may evolve with new knowledge, is to invite the creative minds of lawyers to find that new knowledge and figure out how to use it to budge the background principles. Blumm and Ritchie have given them the template for doing so across a broad array of common law property doctrines.

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94. *Id*. (emphasis added). Although Blumm and Ritchie discuss *Avenal*, they do so in connection with the "destruction by necessity" defense to takings claims, not in connection with the court's discussion of the public trust doctrine. *See* Blumm & Ritchie, *supra* note 6, at 41-42.

95. In related work Jim Salzman and I explain how recognition of natural capital and ecosystem service values can reshape the public trust doctrine in the manner suggested here. *See* J.B. Ruhl & James Salzman, *Ecosystem Services and the Public Trust Doctrine: Working Change from Within*, 15 SE. ENVTL. L.J. 223 (2007).

My purpose in this Article has been more specific. I am unabashedly interested in plugging natural capital and ecosystem service values into the common law. Step one in that project—this Article—is to define the baseline from which I am working, which corresponds handily to Justice Scalia's concept of relevant background principles. Though not written with *Lucas*-avoidance in mind, much less with explicit reference to natural capital and ecosystem service values, Sprankling's exposition on the anti-wilderness bias of American property law serves that first step well, though the story it tells is dejecting to my purpose. In short, I see an uphill road ahead.

I am all too happy, therefore, to piggy-back on Blumm and Ritchie's push for evolution of the background principles of *public* property doctrines. It makes sense for them, given their purpose, to focus on doctrines that will most come into play when private landowners challenge public regulation. That is by no means outside the scope of my purposes, but I am equally as interested in reshaping the *private* side of property law as well. The question in both contexts, of course, is what will be the new knowledge that prompts the evolutionary push? If Sprankling is right, the common law has not been much impressed thus far with appeals to ecological integrity as such. Blumm and Ritchie identify only a relatively small universe of cases suggesting otherwise.

Palazzolo and *Avenal*, however, evidence a very recent and perhaps significant trend based on judicial recognition of natural capital and ecosystem service values. The economic value of natural capital and ecosystem services surely resonates more with common law property doctrine than does appeal merely to ecological integrity. Indeed, that ecosystems produce economically valuable services undercuts the very premise of the anti-ecosystem bias of the common law. The common law, to put it bluntly, has been based on a mistaken conception of the economic value of functioning ecosystems. What could be more appropriate as new knowledge for purposes of shifting the common law's baseline?

To be sure, the context in which the two cases arise—government defense of regulatory takings claims using public nuisance (*Palazzolo*) and public trust (*Avenal*) doctrines—admittedly does not place much pressure on this argument. As the *Palazzolo* court suggested, more would be expected of a private nuisance claimant demanding relief from another landowner's curtailment of ecosystem service flows. But the new knowledge principle recognizes not simply that the common law evolves, but why it evolves. It evolves in the private property context when, among other reasons, landowners gain new knowledge about the economic

harm they suffer from other landowners' actions and seek remedies.[96] And when they do so in the context of economic losses associated with curtailed ecosystem service flows, cases like *Palazzolo* and *Avenal* from the public property side of the common law will have paved the way for establishing the theory of their case. And it all would have begun with Justice Scalia's passing reference to the new knowledge principle.

So, *Lucas* did open a Pandora's box and, if I am right, the impact on the common law of property will be profound.

96. *See* Paul H. Rubin, *Why Is the Common Law Efficient?*, 6 J. LEGAL STUD. 51 (1977) (explaining the reasons why private interests attempt to influence the evolution of common law).

IS THERE A POSSIBLE ROLE FOR REGULATORY ENFORCEMENT IN THE EFFORT TO VALUE, PROTECT, AND RESTORE ECOSYSTEM SERVICES?

DAVID MARKELL[1]

I. INTRODUCTION

In a predecessor symposium on the topic of ecosystem services,[2] several distinguished scholars suggested that the major "failing" of contemporary environmental law is its failure to protect

1. Steven M. Goldstein Professor of Law, Florida State University College of Law. I would like to thank Professors Robin Kundis Craig, Jon Klick, Kenneth Kristl, Dan Markel, Joel Mintz, Benjamin Priester and J.B. Ruhl, and several EPA officials, including Beth Cavalier and, Melissa Raack of the Special Litigation and Project Division at the EPA Office of Enforcement and Compliance Assistance, and Jonathan Libber, the BEN Coordinator at EPA OECA, for their helpful comments on drafts of this article. Ms. Cavalier and Ms. Raack were quite helpful concerning aspects of EPA's SEPs program; Mr. Libber provided helpful information on EPA's penalty calculation methodologies. None of the commenters, or EPA as an organization, necessarily endorses the contents of the article and the agency officials' comments should not be taken to constitute such an endorsement. I am solely responsible for the contents of the article. Please direct any comments to me at dmarkell@law.fsu.edu.

2. Symposium, *Ecosystem Services*, 20 STAN. ENVTL. L.J. 309 (2001).

ecosystems and the services they provide.[3] Their rationale was two-fold. First, ecosystems and the services they provide are of central importance to human and other existence; yet, second, environmental governance has traditionally given short shrift to the protection of such ecosystems and services. Thus, protection of ecosystems and the services they provide is a significant environmental priority that has not engendered a meaningful or effective regulatory response.

The importance of ecosystems and the services they provide does not seem to be in dispute. A burgeoning literature explains that ecosystems provide conditions and processes that are necessary to sustain human life.[4] These processes include purifying the air we breathe and the water we drink, recycling waste, replenishing soil nutrients, maintaining biodiversity, regulating climate, flood and pest control, and pollination.[5] Jim Salzman points out in a recent article that, for example, "[o]ne cannot begin to understand flood control . . . without realizing the impact that widespread wetland destruction has had on the ecosystem service of water retention . . . ."[6] This example is particularly salient in light of the enormous damage that Hurricane Katrina wrought. Several studies have suggested that past destruction of wetlands contributed significantly to the devastation from Hurricane Katrina because the loss of these wetlands reduced the capacity of the natural environment to retain the water unleashed during the storm.[7] Other examples abound of the services that different types of eco-

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3. James Salzman, Barton H. Thompson, Jr. & Gretchen C. Daily, *Protecting Ecosystem Services: Science, Economics, and Law,* 20 STAN. ENVTL. L.J. 309, 310 (2001) (claiming that "the single greatest failing of modern environmental law and its greatest challenge today [is] the inadequate protection of ecosystems and the services they provide."). The purported failings of environmental law are legion; no doubt others would have their own choice for greatest flaw. *See e.g.*, David L. Markell, *The Role of Deterrence-Based Enforcement in a "Reinvented" State, Federal Relationship: The Divide Between Theory and Reality*, 24 HARV. ENVTL. L. REV. 1 (2000) [hereinafter *Deterrence-Based Enforcement*] (summarizing various calls for reform).

4. *See e.g.*, Gretchen C. Daily, *Introduction: What Are Ecosystem Services?, in* NATURE'S SERVICES: SOCIETAL DEPENDENCE ON NATURAL ECOSYSTEMS 1, 3-4 (Gretchen C. Daily ed., 1997); NATIONAL RESEARCH COUNCIL, VALUING ECOSYSTEM SERVICES: TOWARD BETTER ENVIRONMENTAL DECISION-MAKING (2005); MILLENNIUM ECOSYSTEM ASSESSMENT, ECOSYSTEMS AND HUMAN WELL-BEING: A FRAMEWORK FOR ASSESSMENT 1 (2003) (noting that, for example, the human species "has always depended on the services provided by the biosphere and its ecosystems.").

5. *See* Daily, *supra* note 4, at 3-4.

6. *See* James Salzman, *Creating Markets for Ecosystem Services: Notes from the Field*, 80 N.Y.U. L. REV. 870, 872 (2005).

7. *See, e.g.* ENVIRONMENTAL DEFENSE, ET AL, ONE YEAR AFTER KATRINA: LOUISIANA STILL A SITTING DUCK: A REPORT CARD AND ROADMAP ON WETLANDS RESTORATION (2006), *available at* http://www.environmentaldefense.org/documents/5416_KatrinaReportCard.pdf (citing loss of coastal marsh and swamp forests as factors contributing to Louisiana's increasing vulnerability to hurricanes).

systems provide, and of the enormous value and importance of these services.[8] Studies indicate that the cost to replace the loss of pollinating plants in the United States alone, as one example, would be on the order of billions of dollars. [9]

The need for regulation to protect ecosystem services also does not appear to be in dispute.[10] Some scholars have suggested that environmental law and policy have essentially "ignored" the challenge of protecting ecosystems and their services, despite their importance.[11] While market-based approaches and other strategies that do not, in at least some formulations, require regulatory intervention hold promise and deserve consideration as well,[12] the practical consequence of current market failures and the absence of regulatory gap-filling is that those who engage in activities that harm ecosystems and the services they provide are not being held fully accountable for, or expected fully to address, these "negative externalit[ies]."[13]

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8. *See, e.g.,* Salzman, *supra* note 6, at 871-72.

9. *See, e.g., id.* at 872 and n. 2.

10. There is a vast literature on the appropriateness of regulation in different circumstances. *See e.g.*, R.H. Coase, *The Problem of Social Cost, in* THE ECONOMICS OF THE ENVIRONMENT 68 (Wallace E. Oates ed. 1992); Don Fullerton & Robert N. Stavins, *How Economists See the Environment, in* ECONOMICS OF THE ENVIRONMENT: SELECTED READINGS 3, 5 (Robert N. Stavins ed., 4th ed. 2000) (noting that "negative externalit[ies]," such as pollution, may produce a total social cost of production that exceeds the value to consumers, so that regulation is appropriate because, "[i]f the market is left to itself, too many pollution-generating products are made."). R. David Simpson highlights the need to consider the value of ecosystem services in formulating regulatory strategies in *Economic Analysis and Ecosystems: Some Concepts and Issues, in* ECONOMICS OF THE ENVIRONMENT; SELECTED READINGS 529, 536-37 (suggesting that "[g]overnments must act to correct 'externalities.' . . . . Pollution is the 'classical example' of [a negative externality.] . . . [W]e need to think about the value of ecosystems and environmental amenities in order to make reasonable social decisions concerning their conservation. The fact that many of the things we care about are not traded in the existing economic system makes it more, rather than less, important that we think carefully about what their values really are.").

11. Salzman, Thompson & Daily, *supra* note 3, at 311, 312 (concluding that "[d]espite their obvious importance to our wellbeing, ecosystem services have largely been ignored in environmental law and policy."). For articles considering the adequacy of different environmental laws for protection of ecosystem services, see for example, Robert L. Fischman, *The EPA's NEPA Duties and Ecosystem Services*, 20 STAN. ENVTL. L.J. 497, (2001) (examining "the relationship between the EPA's NEPA duties and valuation of ecosystem services"); J. B. Ruhl & R. Juge Gregg, *Integrating Ecosystem Services into Environmental Law: A Case Study of Wetlands Mitigation Banking*, 20 STAN. ENVTL. L.J. 365 (2001) (discussing the federal wetland mitigation banking experience); James Salzman, *Valuing Ecosystem Services*, 24 ECOLOGY L.Q. 887, 899 (1997); James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, 53 STAN. L. REV. 607 (2000) (examining use of environmental trading markets (ETMs)); Salzman, Thompson, & Daily, *supra* note 3, at 311 (citing Janet S. Herman et al., *Groundwater Ecosystem Services*, 20 STAN. ENVTL L.J. 479, 481 (2001)).

12. *See, e.g.,* Steven N. S. Cheung, *The Fable of the Bees: An Economic Investigation*, 16 J. L. & ECON. 11, 29-32 (1973) (concluding that there are situations in which the benefits from ecosystems involved in pollination have been internalized through contracts that bee keepers and farmers have negotiated).

13. *See e.g.,* Fullerton & Stavins, *supra* note 10, at 5.

This Article focuses primarily on the possible role that the "back end" of the regulatory state, notably environmental enforcement, may play in protecting ecosystems and the services they provide.[14] Effective enforcement has long been recognized to be a central feature of effective regulation.[15] The oft-stated premise is that without enforcement, compliance would suffer significantly, thereby undermining achievement of the normative goals of underlying legislation.[16] For example, government permits that are intended to protect the environment by limiting destruction of wetlands or discharges of pollutants into streams are unlikely to be as effective as possible if the regulated parties that are subject to these permits violate their terms.[17] While improved regulatory norms may be needed as well, regulated party compliance with the norms that are in place is likely to advance protection of the envi-

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14. My main purpose in this article is to make the general point that enforcement has promise as a mechanism for protecting ecosystem services, and to explore the different types of enforcement relief that may be especially valuable. To some degree, I conflate the concepts of protecting ecosystem functions and maintaining or protecting ecosystem services in order to facilitate my making this broader point. While the two are, of course, related, there are important distinctions as well. Enforcement intended to protect the environment may be structured to protect ecosystem services, or not. For example, as Professor Ruhl points out in his wetlands piece, wetland banking might be neutral with respect to ecological functions in a watershed but, because it moves wetlands, have negative effects on the distribution and absolute total of ecosystem services within the watershed. *See* Ruhl & Gregg, *supra* note 11. Thus, if, for instance, a violator destroys or degrades wetlands in one location (place A), and the government, through an enforcement action, enjoins the violator to restore wetlands in a different location (place B), that injunctive relief might make the environment whole in the sense that it would address any aggregate ecological impacts, but that relief might not restore service values to the human population around place A. This distinction between ecosystem functions and services has implications for the type of relief that is appropriate if the goal is to redress harm to ecosystem services (in addition to redressing harm to ecosystem functions). Those interested in pursuing relief that advances ecosystem services in particular would be well-advised to keep this distinction in mind, particularly to the degree that a purpose of such relief is to redress the harm to ecosystem services that a violation causes. One option is to require relief that would, in some way, offset the loss of the lost or reduced ecosystem services.

15. *See generally*, A. Mitchell Polinsky & Steven Shavell, *The Economic Theory of Public Enforcement of Law*, 38 J. ECON. LITERATURE 45 (2000) (noting the importance of public enforcement of law). Markell, *Deterrence-Based Enforcement, supra* note 3, at 12; MARVER H. BERNSTEIN, REGULATING BUSINESS BY INDEPENDENT COMMISSION 224 (1955).

16. Markell, *Deterrence-Based Enforcement, supra* note 3, at 10-12.

17. There are questions concerning optimal levels of compliance, and optimal levels of environmental protection. *See, e.g.*, Daniel A. Farber, *Taking Slippage Seriously: Noncompliance and Creative Compliance in Environmental Law*, 23 HARV. ENVTL. L. REV. 297 (1999); Polinsky & Shavell, *supra* note 15, at 72 (concluding that "it . . . appears that these [present] levels [of deterrence] are often too low.… [S]ociety probably should raise levels of deterrence in many areas of enforcement.") I do not address these issues here. Compliance with norms is a significant issue at all levels of governance. *See, e.g.*, Jutta Brunnée, *Multilateral Environmental Agreements and the Compliance Continuum, in* MULTILEVEL GOVERNANCE OF GLOBAL ENVIRONMENTAL CHANGE: PERSPECTIVES FROM SCIENCE, SOCIOLOGY AND THE LAW 387, 387 (Gerd Winter ed., 2006) (noting that "[t]he promotion of compliance with international environmental commitments is among the most challenging issues of global environmental governance.").

ronment, including protection of ecosystems and the services they provide.

I focus on the possible value that each of three "tools" in the Environmental Protection Agency's (EPA's) enforcement tool box — 1) penalties, 2) injunctive relief, and 3) a form of "beyond compliance" injunctive relief, known as SEPs -- has for producing ecosystem benefits.[18] Theoretically, there are at least five ways in which enforcement has the potential to protect the environment, including ecosystems and the services they provide. First, enforcement has the potential to prevent harm to ecosystems by *deterring* violations that would cause such harm. Second, enforcement has the capacity to require violators to *cease* violations that are causing or threatening harm. Third, enforcement includes the authority to require violators to *fix* ecosystems they have harmed (to *restore* or *remediate* harmed ecosystems). Fourth, EPA has used enforcement to negotiate settlements that commit violators to take action to benefit the environment in circumstances in which EPA otherwise lacks the legal authority to compel performance of such projects or to undertake them itself (to achieve protection *"beyond compliance"*). Finally, enforcement has the capacity to *advance learning* that will help to protect ecosystems and the services they provide.[19]

The three enforcement tools I discuss in this Article appear to have the potential to protect ecosystems in several ways. For example, EPA's power to penalize violators enables the agency to *de-*

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18. For a summary of different regulatory tools and approaches, see for example, U.S. CONGRESS, OFFICE OF TECH. ASSESSMENT, ENVIRONMENTAL POLICY TOOLS: A USER'S GUIDE OTA-ENV-634 (U.S. Gov't Printing Office, 1995).

19. For a recent assessment of key data needs, see for example, THE H. JOHN HEINZ III CENTER FOR SCIENCE, ECONOMICS AND THE ENVIRONMENT, FILLING THE GAPS: PRIORITY DATA NEEDS AND KEY MANAGEMENT CHALLENGES FOR NATIONAL REPORTING ON ECOSYSTEM CONDITION 27 (2006), *available at* http://www.heinzctr.org/Programs/Reporting/Working%20Groups/Data%20Gaps/Gaps_LongReport_LoRes.pdf (identifying ten key information gaps that "prevent effective reporting on . . . the condition and use of U.S. ecosystems" and thus limit our capacity for informed decision making.) A 2002 Heinz Center Report previously found that nearly half of the 103 "ecosystem indicators" that "described ecological conditions in the nation's coasts and oceans, farmlands, forests, fresh waters, grasslands and shrublands, and urban and suburban areas" could not be reported on because of data gaps and other deficiencies. *Id.* at 13. *See* THE H. JOHN HEINZ III CENTER FOR SCIENCE, ECONOMICS AND THE ENVIRONMENT, THE STATE OF THE NATION'S ECOSYSTEMS: MEASURING THE LANDS, WATERS, AND LIVING RESOURCES OF THE UNITED STATES 33-195 (2002), *available at* http://www.heinzctr.org/ecosystems/pdf_files/sotne_complete.pdf. There is also much to learn in terms of valuing ecosystems and their services. *See, e.g.*, Jason F. Shogren, *A Political Economy in an Ecological Web, in* ECONOMICS OF THE ENVIRONMENT: SELECTED READINGS, *supra* note 10, at 646, 656 (noting "that while nonuse values may be a valid concept, the measurement tool is still blunt."); Simpson, *supra* note 10, at 540 ("economists cannot make any very precise statements about the values of most ecological goods and services. . . . It will be a long time . . . before we can make as strong statements about the value of ecological goods and services as we can about, say, the value of a potato or a haircut.").

ter violations, particularly to deter regulated parties from violating the law in ways that harm the environment (including ecosystems and the services they provide).[20] EPA claims the injunctive authority as part of its enforcement arsenal to require regulated parties to *end violations* that are causing such harm and to *repair* any harm their violations have caused.[21] In addition, for over two decades EPA has used its enforcement authorities to negotiate settlements of enforcement cases that commit violators to take steps to protect and restore the environment that go *"beyond compliance,"* that is, beyond their obligations under the law.[22] Each of these enforcement tools has the potential to *advance learning* that is likely to be helpful in protecting ecosystems and their services. Further, the latter two tools empower EPA to shift the burden of doing much of this ecosystem-beneficial work to the regulated community.[23] This feature is likely to be of particular appeal, especially during times characterized by scarce government resources and limited government capacity (i.e., all times). Enforcement offers an opportunity for environmental progress and new learning that, quite simply, is not likely to occur if it were dependent entirely on government resources and initiatives.

Part II of this Article provides an overview of regulatory enforcement that offers a framework for considering the possible utility of enforcement in protecting ecosystems and their services. Parts III-V review in more detail the three types of relief listed above, notably penalties (Part III), injunctive relief (Part IV), and "beyond compliance" actions that EPA commits regulated parties to complete through negotiated settlements of enforcement proceedings (Part V).[24] I also include a brief conclusion.

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20. *See, e.g.*, CLIFFORD RECHTSCHAFFEN & DAVID L. MARKELL, REINVENTING ENVIRONMENTAL ENFORCEMENT AND THE STATE/FEDERAL RELATIONSHIP (2003).

21. *See* Final EPA Supplemental Environmental Projects Policy Issued, 63 Fed. Reg. 24796, 24797 (May 5, 1998) [hereinafter Final SEPs Policy].

22. *Id.*

23. Some economists would look at the efficiency of such expenditures regardless of the party bearing them.

24. While my effort in this article is to focus on current key elements of EPA's enforcement tool box, there obviously are an enormous range of possible mechanisms and approaches that may be helpful in protecting ecosystems and the services they provide. As indicated in the text, this article focuses on the relatively incremental approach of revamping existing regulatory enforcement approaches as a possible strategy to increase protection (including enhancement and restoration) of ecosystems that provide important services; it does not consider fundamental restructuring of our regulatory apparatus as a way to achieve this goal.

II. AN OVERVIEW OF EPA REGULATORY ENFORCEMENT[25]

A. The Level and Nature of EPA Enforcement Activity

EPA's enforcement world is a busy one. Agency officials undertake a significant number of inspections each year in order to monitor compliance with the various environmental regulatory statutes. In FY 2005, for example, EPA staff conducted 22,000 inspections and investigations.[26] Through a variety of means, including government inspections, self-reporting by regulated parties, and tips that workers and members of the public provide, Agency staff annually discover significant numbers of violations, including a substantial number that are serious enough to warrant formal enforcement. To use the statistics from EPA's most recent fiscal year again, in FY 2005 EPA issued a total of 2,229 administrative penalty complaints and initiated 259 civil judicial referrals (generally, referrals to the Department of Justice of cases involving violations of environmental laws for filing of civil complaints in federal court).[27] In FY 2005, EPA finalized a total of 2,273 admin-

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25. This article focuses on traditional enforcement situations, in which a regulated party violates the law and the government decides to undertake a formal enforcement action against the party in order to obtain an adequate penalty and, potentially, appropriate injunctive relief. The government uses a wide variety of compliance promotion tools beyond traditional enforcement. See, e.g., U.S. ENVTL PROT. AGENCY, FY 2005 PERFORMANCE AND ACCOUNTABILITY REPORT, GOAL 5-1 (Nov. 2005), available at http://www.epa.gov/cfo/finstatement/2005par/par05.pdf [hereinafter EPA FY 2005 Report]; Markell, *Deterrence-Based Enforcement, supra* note 3, at 8; RECHTSCHAFFEN & MARKELL, *supra* note 20, at 60-83. While these are worth considering for their possible relevance to ecosystem services, they are not the focus of this Article.

26. EPA FY 2005 REPORT, GOAL 5, supra note 25, at 160; *see* U.S. ENVTL. PROT. AGENCY, COMPLIANCE AND ENFORCEMENT ANNUAL RESULTS: FY2005 NUMBERS AT A GLANCE [hereinafter NUMBERS AT A GLANCE], http://www.epa.gov/compliance/resources/reports/endofyear/eoy2005/2005numbers.html (last visited Sept. 7, 2007) EPA's enforcement efforts represent the tip of the iceberg in the enforcement arena. In many states, for one or more of the major pollution control regulatory programs, state officials have primary implementation responsibility. David L. Markell, *"Slack" in the Administrative State and its Implications for Governance: The Issue of Accountability*, 84 OR. L. REV. 1, 20-21 (2005) [hereinafter Markell, *Slack*]. This includes conducting inspections, reviewing facility-generated reports, identifying instances of significant non-compliance for possible follow-up action, and undertaking such action in appropriate circumstances, either through administrative or judicial enforcement. *See, e.g.*, ENVTL. COUNCIL OF STATES & U.S. ENVTL. PROT. AGENCY, ONE STOP REPORTING PROGRAM, ENVIRONMENTAL POLLUTANT REPORTING DATA IN EPA'S NATIONAL SYSTEMS: DATA COLLECTION BY STATE AGENCIES 1 (1999) (suggesting that states conduct approximately ninety percent of all inspections and initiate more than eighty percent of all enforcement actions each year). The ideas explored in this Article are potentially relevant to state enforcement efforts as well. Furthermore, some of the regulatory statutes require regulated parties to monitor their own compliance and to report the results to the government. The Clean Water Act discharge monitoring report (DMR) program is probably the best example of this approach.

27. OFFICE OF ENFORCEMENT AND COMPLIANCE ASSURANCE, U.S. EVNTL. PROT. AGENCY, EPA FY 2005 COMPLIANCE & ENFORCEMENT ANNUAL RESULTS 7, 9 (2005) [hereinafter *Annual Results*], *available at* http://www.epa.gov/compliance/resources/reports/end-

istrative penalty order settlements and 157 civil judicial conclusions.[28] In FY 2005, EPA enforcement addressed a total of 5,137 facilities in 4,346 cases.[29]

In short, on an annual basis, EPA: 1) invests considerable resources in the enforcement arena; 2) discovers a substantial number of significant violations; and 3) in numerous cases, initiates, and ultimately completes, enforcement action.[30] In many of these cases the Agency imposes penalties and requires significant violators to reduce pollutant discharges or otherwise act in ways that enhance protection of human health and the environment. Increasingly, EPA has sought to monitor and measure the environmental impacts (benefits) of its enforcement actions. According to an EPA FY 2005 report, "28.8 percent of enforcement actions required that pollutants be reduced, treated, or eliminated and populations and ecosystems be protected."[31]

In the following section I review the nature and mechanics of contemporary enforcement in order to explore in some detail the opportunities that this significant level of government activity potentially affords for protection of ecosystem services.

B. An Overview of Traditional Enforcement[32]

The enforcement process, considered broadly, includes several steps. Key elements include: 1) monitoring regulated parties' performance of their legal obligations; 2) identification of violators; 3) prioritization of violations (deciding which violations to pursue and which to give low priority); 4) choice of an enforcement or compliance-promotion approach in particular cases;[33] 5) pursuit of the selected approach in cases for which the Agency decides action is warranted; and 6) post-action follow-up (e.g., to assess whether a violator has returned to compliance).[34]

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ofyear/eoy2005/2005resultscharts.pdf; NUMBERS AT A GLANCE, *supra* note 26.

28. *Annual Results, supra* note 27, at 8, 10; NUMBERS AT A GLANCE, *supra* note 26.

29. *Annual Results, supra* note 27, at 12.

30. I do not address here the merits of criticisms that there have been declines in recent years in EPA (and state) enforcement activity.

31. EPA FY 2005 REPORT, Goal 5-3, *supra* note 25, at 152. Markell, *Slack, supra* note 26, at 59.

32. For a more comprehensive treatment of EPA enforcement, *see generally*, RECHTSCHAFFEN & MARKELL , *supra* note 20; JOEL A. MINTZ, ENFORCEMENT AT THE EPA: HIGH STAKES AND HARD CHOICES (Univ. of Texas 1995); Joel A. Mintz, *"Neither the Best of Times Nor the Worst of Times": EPA Enforcement During the Clinton Administration*, 35 ELR 10390 (June 2005).

33. EPA has expressed considerable interest in recent years in pursuing more cooperative and less adversarial responses to non-compliance, as have the states. RECHTSCHAFFEN & MARKELL, *supra* note 20, at 59.

34. As is the case with many lists, this one creates somewhat artificial categories.

EPA does not pursue a formal enforcement action in the vast majority of situations in which it uncovers violations.[35] As might be expected, EPA's policy is to reserve initiation of formal enforcement proceedings for the most serious violations. Many of EPA's programs characterize these violators as being in "significant noncompliance," or SNC.[36]

The criteria EPA uses to determine the types of violations that are significant and that warrant formal enforcement action have been the subject of considerable debate over the years.[37] Each of EPA's major regulatory programs has developed specific definitions of "significant noncompliance."[38] In some cases the program offices have revisited these definitions periodically.[39] But, as might be expected, a constant is that a key factor or criterion has been the extent to which a violation has caused or threatened significant harm to human health or the environment.[40]

EPA often considers seeking a variety of types of relief for violations for which the Agency determines formal enforcement action is warranted. EPA typically will seek to require such violators to

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It is possible (and reasonable) to categorize the enforcement process in different ways. U.S. ENVTL. PROT. AGENCY, PRINCIPLES OF ENVIRONMENTAL ENFORCEMENT, 1-5 (Feb. 1992). Many of these elements include several components. Monitoring, for example, requires deciding which sources to monitor (priority-setting, etc.), determining the nature of the monitoring effort (the development of monitoring protocols and the like and deciding the appropriate level of monitoring for different situations), and scheduling and performance of inspections and other monitoring activities.

35. RECHTSCHAFFEN & MARKELL, *supra* note 20, at 82 (citing Richard G. Kozlowski & Howard Bleichfeld, *Wetlands Enforcement: Lion or Lamb?,* NAT. RESOURCES & ENV'T, Winter 1996, at 62). Instead, the Agency pursues informal strategies intended to promote compliance. RECHTSCHAFFEN & MARKELL, *supra* note 20, at 82 (citing SUSAN HUNTER & RICHARD WATERMAN, ENFORCING THE LAW: THE CASE OF THE CLEAN WATER ACTS 50-65 (1996)).

36. Markell, *Deterrence-Based Enforcement, supra* note 3, at 4; Markell, *Slack, supra* note 26. RECHTSCHAFFEN & MARKELL, *supra* note 20. There are instances in which the Agency has departed from the SNC convention. See, for example, the Clean Air Act program's use of the phrase "high priority violations." Memorandum from Eric Shaeffer, Director, Office of Regulatory Enforcement, U.S. Envtl. Prot. Agency, Issuance of Policy on Timely and Appropriate Enforcement Response to High Priority Violations 3 (Dec. 22, 1998) [hereinafter EPA Memo], *available at* http://www.epa.gov/compliance/resources/policies/civil/caa/stationary/issue-ta-rpt.pdf.

37. Markell, *Deterrence-Based Enforcement, supra* note 3, at 24.

38. *Id*. at 43. For a recent example, see the EPA's draft guidance for wet weather discharges under the Clean Water Act, which describes circumstances in which such discharges constitute "significant" non-compliance with CWA permits. National Pollutant Discharge Elimination System (NPDES) Permit Requirements for Peak Wet Weather Discharges From Publicly Owned Treatment Works Treatment Plants Serving Separate Sanitary Sewer Collection Systems, 70 Fed. Reg. 76013, 76015-18 (U.S. Entl. Prot. Agency Dec. 22, 2005), *available at* http://www.epa.gov/fedrgstr/EPA-WATER/2005/December/Day-22/w7696.htm.

39. Markell, *Deterrence-Based Enforcement, supra* note 3 at 45; RECHTSCHAFFEN & MARKELL, *supra* note 20, at 164.

40. *See e.g.*, U.S. ENVTL. PROT. AGENCY, HAZARDOUS WASTE CIVIL ENFORCEMENT RESPONSE POLICY 4 (Dec. 2003) [hereinafter HAZARDOUS WASTE POLICY], *available at* http://www.epa.gov/compliance/resources/policies/civil/rcra/finalerp1203.pdf.

pay a penalty.[41] Each of the major environmental regulatory statutes contains a list of factors courts and EPA are to consider in determining appropriate penalty amounts in particular cases.[42] The Agency generally considers three primary factors in determining the appropriate size of a payable penalty — the "economic benefit" the violator gained through its violations, an additional "gravity" component that is based on the seriousness of the violation and that is intended to put the violator in a worse position than a competitor that is in compliance with its legal obligations, and any "adjustment" factors, such as ability to pay.[43]

In addition, particularly in cases in which a violation is ongoing or there is a reasonable likelihood that a violation will recur, and in situations in which the violation has caused an adverse impact on human health or the environment, EPA will consider injunctive relief, through which the Agency will require a violator to return to compliance and to fix or remediate any environmental harm its violations caused.[44]

In some cases, EPA pursues other forms of relief as well. I focus on one such form of relief in this article, notably environmentally beneficial projects that violators agree to undertake, even though they do not have a legal obligation to do so. These are negotiated projects incorporated into formal settlements used to resolve enforcement actions without litigation (or to conclude litigation). As part of such settlements, EPA generally reduces a violator's payable penalty as the *quid pro quo* for the violator's commitment to perform such "beyond compliance" work. EPA labels these actions Supplemental Environmental Projects (SEPs).[45]

The following data, from EPA's report for the most recent federal Fiscal Year (2005), entitled *FY 2005 Compliance & Enforcement Annual Results*, shows the dollar value for each of the past five years of each of these types of relief — penalties, injunctive relief, and SEPs. As the *Annual Results* data reflects, in FY 2005

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41. *See e.g.*, EPA Memo, *supra* note 36, at 15.

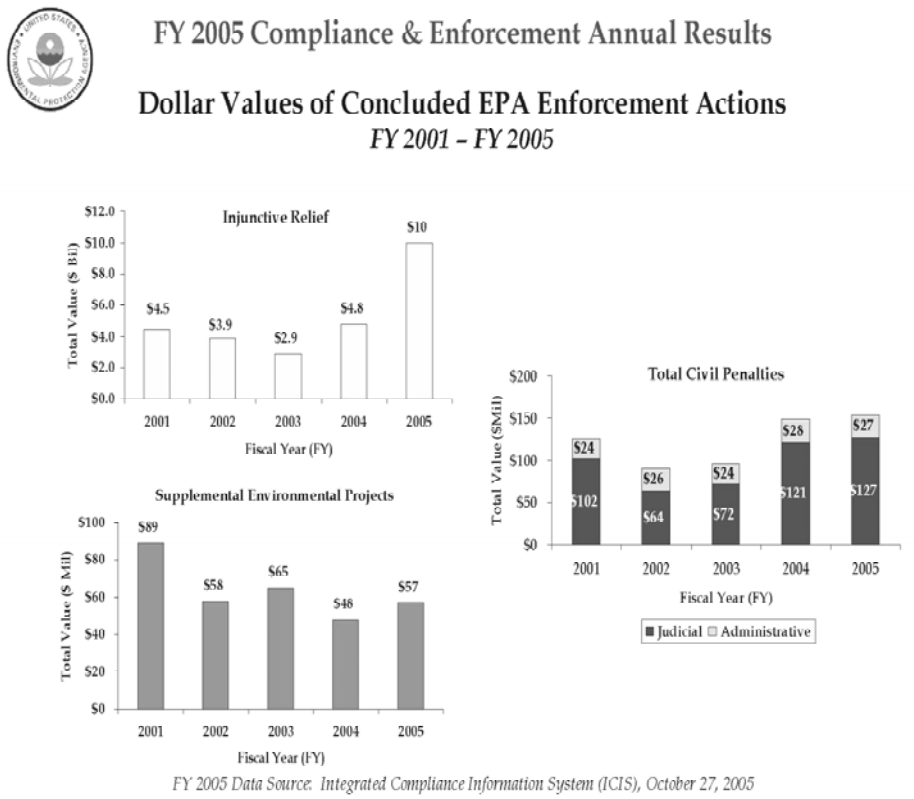
42. 33 U.S.C. § 1319 (2000), 42 U.S.C. § 3008 (2000). Under most regulatory statutes EPA has the authority to bring an enforcement action administratively or judicially. *See e.g.*, CWA § 309(b), (d); CAA § 113(b); RCRA § 3008(a), (g) (all authorizing civil actions); CWA § 309(g); CAA § 113(d) (authorizing administrative enforcement penalties for violations)

43. *See infra* note 57 and Part II.B.

44. *See* CWA § 309(b); United States v. Alcoa Inc., 98 F. Supp. 2d 1031 (N.D. Ind. 2000).

45. *See infra* Part IV. EPA has a variety of other enforcement-based tools as well that I do not address in this article, including the authority to modify and revoke permits. *See e.g.*, HAZARDOUS WASTE POLICY, *supra* note 40, at 9. *See also* David L. Markell, *States as Innovators: It's Time for a New Look to Our "Laboratories of Democracy" in the Effort to Improve Our Approach to Environmental Regulation*, 58 ALB. L. REV. 347 (1994) (discussing several types of enforcement authorities).

EPA obtained relief worth more than $10 billion through its enforcement efforts: $154 million in payable penalties; $10 billion in injunctive relief; and $57 million in violators' commitments to conduct SEPs.[46] This is obviously a substantial amount of enforcement-generated relief. To provide one basis for comparison, the value of this relief exceeds EPA's entire budget, which in FY 2005 was less than $8 billion.[47]



The question for this article is whether there is a role for one or more of these forms of relief in protecting and restoring ecosystems

46. These figures understate the scope of government enforcement quite significantly because they only cover EPA civil enforcement efforts. EPA also pursues criminal enforcement in appropriate cases. NUMBERS AT A GLANCE, *supra* note 26. Further, the figures do not include information on enforcement relief obtained through state and local government enforcement efforts.

47. *See* Budget of the United States Government, FY 2007, http://www.whitehouse.gov/omb/budget/fy2007/epa.html (lasted visited Aug. 19, 2007) (indicating that EPA's total outlay in 2005 was just under $8 billion).

and the services they provide. I turn now to a more detailed look at each of these forms of traditional enforcement relief in order to explore this issue.

III. A MORE DETAILED LOOK AT PENALTY CALCULATIONS

This section contains an elaboration on five points that I think are worth making in considering the promise of penalties for protecting ecosystems and their services. First, penalties give EPA leverage to deter violators from committing violations that will harm or threaten to harm such ecosystems and their services.[48] Related, Congress has periodically ramped up penalty levels to ensure EPA's legal authorities are adequate to give it substantial penalty leverage to promote deterrence.[49] Second, Congress and EPA have embraced an "economic benefit plus gravity" framework for determining appropriate penalties in particular cases; penalties are to be sufficient to "disgorge economic benefit" (that is, to require a violator to pay an amount at least equal to the economic benefit it gained through its violation), and also are to include a "gravity" component that is tailored to the seriousness of the violation and puts the violator in worse position financially than if it had complied with its legal obligations.[50] Third, there is theoretical support for EPA's paying attention to harm in calculating penalties, in addition to considering economic benefit.[51] Fourth, there is reason to believe that EPA may not be fully exploiting the leverage its penalty authorities provide it to promote deterrence because of the relatively little attention the Agency traditionally has given in determining penalties to the harm (especially harm to ecosystem services) that violations cause or threaten.[52] Finally, there appears to be at least some practical capacity for EPA to do better—that is, to increase the attention it gives to harm (including harm to ecosystem services) in calculating penalties.[53]

In short, my premise is that, while 1) EPA's legal penalty authorities give it the ability to deter violations, including violations that harm ecosystems and the services they provide, through im-

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48. Markell, *Deterrence-Based Enforcement, supra* note 3, at 40. I am not suggesting that EPA is obligated to determine that any particular level of harm occurred when deciding to pursue an enforcement case or determining to impose a penalty. Instead, EPA's legal authorities generally impose strict liability and do not require EPA to establish that a violation caused or threatened harm as a predicate for suit.

49. *Infra* note 54 and related text. *See also* Markell, *Deterrence-Based Enforcement, supra* note 3.

50. *See infra* Part III.B

51. *See infra* Part III.C.

52. *See infra* Part III.D.

53. *Id*.

position of penalties that disgorge economic benefit and are tailored to the seriousness of the harm the violation caused or threatened, 2) theoretically, it makes sense for EPA to use this authority, and 3) as a practical matter, EPA has some capacity to do so, 4) there is reason to consider whether EPA is not using these authorities as effectively as it should to deter significant violations because it is not paying enough attention to harm (including harm to ecosystem services) in calculating penalties. In the remaining portion of this section, I work through these four issues, pointing out the significant empirical and other questions that need to be addressed in testing the accuracy of this premise.

A. EPA's Authority to Impose Penalties to Deter Significant Violations

EPA's authority to impose penalties gives the Agency significant leverage to create general and specific deterrence in order to reduce the number and significance of violations of the environmental laws. Under many of the significant regulatory statutes, EPA can impose substantial penalties — up to $32,500 per day, per violation.[54] As a result, the maximum statutory penalty for a set of violations can be quite high. For example, if a regulated party violates a law such as the Clean Water Act for thirty days, the total maximum penalty is $975,000 (thirty x $32,500). If the regulated party has committed three different violations of the Clean Water Act for a month, the total maximum potential penalty increases to $2,925,000 ($975,000 x three). For cases that involve multiple violations that continue for an extended period of time, in short, the violator is potentially subject to significant penalties, which easily extend into the multi-million dollar range.[55]

EPA enforcement policies make it clear that, as noted above, the EPA staff are to consider three key factors in determining ap-

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54. Congress has increased the maximum penalties significantly over the years for violations of major environmental regulatory statutes such as the Clean Water Act, Clean Air Act, and RCRA. For example, the CWA provided for penalties not to exceed $10,000 per day of violation until Congress increased this maximum civil penalty amount to $25,000 per day in the 1987 Amendments. Water Quality Act of 1987, Pub. L. No. 100-4, Title V, §313, 101 Stat. 45 (Feb. 4, 1987) (codified at 33 U.S.C. § 1319). Because Congress provided for penalties to keep pace with inflation, the current statutory maximum is $32,500. Adjustment of Civil and Monetary Penalties for Inflation, 40 C.F.R. 819.4 (2007).

55. A January 2007 search of EPA's Enforcement and Compliance History Online (ECHO) database found that, in 2006, EPA settled 24 cases in which it assessed penalties of $500,000 or more. Four of those were administrative cases, the rest judicial. See http://www.epa.gov/echo/index.html. *See e.g.*, Chesapeake Bay Found., Inc. v. Gwaltney of Smithfield, Ltd., 791 F.2d 304, 313-14 (4th Cir. 1986) (holding that a violation of a monthly average parameter constitutes a violation of each day of the month); *cf.* U.S. v. Allegheny Ludlum Corp., 366 F.3d 164, 188-89 (3d Cir. 2004).

propriate penalty amounts. First, the staff are to consider the economic benefit the regulated party gained through its violations. Second, the staff are to consider the gravity or seriousness of the violations. Finally, staff consider "adjustment" factors, such as ability to pay.[56]

EPA has made considerable progress in making the calculation of economic benefit more routine, systematic, and consistent. It has developed an interactive computer model known as BEN to facilitate calculation of economic benefit.[57] BEN is intended to be a user-friendly tool that "yields a reliable, objective dollar figure" that represents the economic benefit a violator gained through its violations.[58] The Science Advisory Board (SAB) has concluded, and EPA enforcement officials have acknowledged, that the Agency devotes the majority of its penalty calculation efforts to determining the economic benefit associated with particular violations.[59] The SAB has characterized recapturing economic benefit that accrues from noncompliance as "the cornerstone" of EPA's objective of using penalties to deter violators.[60]

It is clear that Congress intended that EPA consider the seriousness or gravity of a violation in determining an appropriate penalty. Most of the major statutes direct EPA to do so. Section 309(d) of the Clean Water Act (CWA) (covering civil penalties), for example, provides that: "In determining the amount of a civil penalty the court shall consider the *seriousness* of the violation. . . . ."[61] Similarly, CWA section 309(g)(3) (covering administrative penalties) provides that: "In determining the amount of any penalty . . .

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56. *See e.g.*, U.S. ENVIRONMENTAL PROTECTION AGENCY, POLICY ON CIVIL PENALTIES (GM-21) (Feb. 16, 1984) [hereinafter 1984 POLICY ON CIVIL PENALTIES], *available at* http://www.wildlaw.org/Eco-Laws/civ-pen.htm.

57. ENFORCEMENT ECONOMIC MODELS, http://www.epa.gov/compliance/civil/econ models/index.html (last visited Aug. 19, 2007). For articles about BEN by an EPA lawyer who serves as the BEN Model Coordinator, *see* Jonathan Libber, Making the Polluter Pay: EPA's Experience in Recapturing a violator's Economic Benefit from Noncompliance, 5th Int'l Conf. on Envtl Compliance and Enforcement 465 (1998); Jonathan D. Libber, *Penalty Assessment at the Environmental Protection Agency: A View From Inside*, 35 S.D. L. REV. 189, 193-97 (1990) [hereinafter Libber, *View from Inside*]. The Agency has refined its BEN model several times. There is a long-standing debate about the appropriate scope of BEN, particularly concerning the extent to which EPA should consider "illegally-obtained" profits in calculating economic benefit. U.S. ENVTL. PROT. AGENCY SCIENCE ADVISORY BOARD, AN ADVISORY OF THE ILLEGAL COMPETITIVE ADVANTAGE (ICA) ECONOMIC BENEFIT (EB) ADVISORY PANEL OF THE EPA SCIENCE ADVISORY BOARD, EPA-SAB-ADV-05-003 (Sept. 7, 2005) [hereinafter SAB Report]. I do not address these issues here.

58. Jonathan Libber, EPA's BEN Model Coordinator, indicates that 27 states were using BEN to some degree as of 1990. Libber, *View from Inside, supra* note 57, at 193.

59. *See* SAB Report, *supra* note 57; Letter from Granta Y. Nakayama, Asst. Adm'r, EPA, to M. Granger Morgan, Chair of EPA Science Advisory Board (Feb. 21, 2006) [hereinafter EPA Comment on SAB Report] (on file with the author).

60. SAB report, *supra* note 57, at 10.

61. 33 U.S.C. § 1319(d)(2002) (emphasis added).

the Administrator . . . shall take into account the nature, circumstances, extent and *gravity* of the violation" in addition to the economic benefit the violator gained through the violation.[62] Section 3008(a)(3) of the Resource Conservation and Recovery Act (RCRA) likewise requires that, in "assessing . . . a penalty, the Administrator shall take into account the seriousness of the violation."[63]

It is also clear that in referring to "seriousness" or "gravity" of a violation, Congress intended that EPA consider the environmental harm or potential harm that a violation caused in determining an appropriate penalty amount.[64] Numerous courts have so concluded.[65] Courts have increased the gravity component of a penalty in situations involving significant harm.[66] On the flip side, courts have viewed the lack of such harm as a "significant mitigating factor" in determining a penalty amount, even in cases involving substantial numbers of violations.[67]

In short, there is no statutory impediment to EPA's considering actual or potential environmental harm (including harm to ecosystems and the services they provide) in determining penalty amounts. Instead, Congress intended and directed that the

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62. 33 U.S.C. § 1319(g)(3)(2002) (emphasis added).

63. 42 U.S.C. § 6928(a)(3)(2002). In the criminal context, the U.S. Sentencing Guidelines indicate that a court should enhance a defendant's offense level if the site cleanup "required a substantial expenditure." U.S.S.G. § 2Q1.3(b)(3)(1993)(requiring an enhancement "if cleanup [associated with an offense] required a substantial expenditure, increase by 4 levels.") *See also* U.S.S.G. § 2Q1.2 (addressing toxic and hazardous pollutants); U. S. v. Phillips, 367 F.3d 846, 857-58 (9th Cir. 2004) (holding that courts should include calculations of cleanup expenses, including CERCLA expenses, in deciding whether to enhance a sentence under U.S.S.G. § 2Q1.3((b)(3)). *See also*, U.S. v. Eidson, 108 F.3d 1336, 1344-45 (concluding that "preliminary [site] examination [costs], which exceeded thirty thousand dollars, are properly considered cleanup costs.").

64. *See e.g.*, U.S. v. Alshabkhoun, 277 F.3d 930, 935 (7th Cir. 2002); Catskill Mountains Chapter of Trout Unlimited, Inc. v. City of New York, 244 F.Supp. 2d 41, 49-50 (N.D.N.Y. 2003) (noting that under the Clean Water Act courts should consider the severity of the violations and their effect on the environment in determining penalties).

65. *Trout Unlimited, Inc.,* 244 F.Supp. 2d at 50; U.S. Pub. Interest Research Group v. Atl. 786 F.Sup. 747-49; Salmon of Maine, L.L.C., 257 F.Supp. 2d 407, 428 (D. Me. 2003) (noting that the violations in this case "are of a significant nature. . . because they . . . inflict a significant short-term damage on the environment . . . and endanger the survival of the wild Atlantic salmon."); Friends of the Earth, Inc. v. Laidlaw Environmental Services (TOC), Inc., 956 F.Supp. 588, 602 (D.S.C. 1997) (holding that "[t]he presence or absence of environmental harm is relevant to the assessment of a Clean Water Act penalty.").

66. EPA notes that "Courts have considered the extent of environmental harm associated with violations in determining the 'seriousness of violations' pursuant to the factors in 309(d)." Revised Interim Clean Water Act Settlement Penalty Policy, Environmental Protection Agency, 25 Envtl. L. Rep. 35618, 35622 n.18 (1995).

67. *Laidlaw, Inc.,* 956 F.Supp. 588, at 602 (citing Hawaii's 1000 Friends v. City and County of Honolulu, 821 F.Supp. 1368, 1395-96 (D. Haw. 1993)) (adopting the view that "the lack of [demonstrated] material harm . . . [is] a significant mitigating factor in assessing penalties."). *But compare* Atl. States Legal Found., Inc. v. Universal Tool & Stamping Co., 786 F.Sup. 747-49 (N. D. Ind. 1992), *with* U.S. v. Smithfield Foods, Inc., 972 F.Supp. 338, 344 (D. Va. 1997).

Agency do so.

It also is clear that EPA has taken several steps to "operationalize" this Congressional direction to consider the significance of violations, including the harm the violations cause, in determining penalties. The Agency has developed general enforcement guidance that adheres to this statutory direction. EPA's 1984 overarching enforcement directive, entitled *A Framework for Statute-Specific Approaches to Penalty Assessments: Implementing EPA's Policy on Civil Penalties*,[68] directs each EPA media program (water, air, etc.) to "develop a system for quantifying the gravity of violations of the laws and regulations it administers."[69] The Framework indicates that the system "must be based, whenever possible, on objective indicators of the seriousness of the violation." The Framework provides that "[t]he seriousness of the violation should be based primarily on: 1) the risk of harm inherent in the violation at the time it was committed and 2) the actual harm that resulted from the violation."[70] In other words, elaborating on the "gravity component" of penalty calculation, the Framework directs EPA

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68. U.S. ENVTL. PROT. AGENCY, A FRAMEWORK FOR STATUTE-SPECIFIC APPROACHES TO PENALTY ASSESSMENTS: IMPLEMENTING EPA's POLICY ON CIVIL PENALTIES (Feb. 16, 1984) [hereinafter 1984 Framework], *available at* http://www.elistore.org/Data/guidance documents/htmls/AD03225.htm. EPA intended that this Framework "provid[e] a framework for medium-specific penalty policies." EPA's Framework is intended to be a companion document to the Agency's 1984 Policy on Civil Penalties, which was to "establish a consistent Agency-wide approach to the assessment of civil penalties. . . ," and "to promote the goals of deterrence, fair and equitable treatment of the regulated community, and swift resolution of environmental problems." Memorandum from Courtney M. Price, Asst. Adm'r, Enforcement and Compliance Monitoring (Feb. 15, 1984) (on file with author). EPA intended in the Policy on Civil Penalties to "focus[] on the general philosophy" behind EPA's approach to penalties. *Id.*

The Policy directs EPA staff to assess penalties with three main components: 1) a "benefit" component — "penalties generally should, at a minimum, remove any significant economic benefits resulting from failure to comply with the law [p. 3], 2) a "gravity" component that "reflects the seriousness of the violation," and 3) consideration of "adjustment" factors such as ability to pay. POLICY ON CIVIL PENALTIES, *supra* note 56 at 3, 4, 8. Courts have recognized that economic benefit may be difficult to estimate and, as a result, "[r]easonable approximations . . . will suffice". U.S. v. Smithfield Foods, Inc., 191 F.3d 516, 529 (4th Cir 1999) (citing Pub. Interest Research Group of N.J., Inc. v. Powell Duffryn Terminals Inc., 913 F2d 64, 80 (3d. Cir. 1990)). One court has suggested that the court's job is to reach a "rational estimate…resolving uncertainties in favor of a higher estimate." U.S. v. Municipal Authority of Union Township, 929 F.Supp. 800, 806 (M.D. Pa. 1996) (citing *Gwaltney,* 611 F. Supp. at 1558). In the court's view, "[i]t would eviscerate the [CWA] to allow violators to escape civil penalties on the ground that such penalties cannot be calculated with precision." *Id.* at 806-7.

The Policy on Civil Penalties indicates the benefit and gravity components will yield a "preliminary deterrence amount" that is subject to adjustment based on several factors. 1984 POLICY ON CIVIL PENALTIES, at 8. The Policy indicates that EPA should provide specific incentives to settle by considering reducing the gravity component in situations in which the violator institutes expeditious remedies to the identified violations and undertakes additional environmental cleanup. *Id.* at 6.

69. 1984 Framework, *supra* note 68, at app. II.A.

70. *Id.*

staff to assess violations according to the seriousness of the violation(s), with seriousness to be determined based on factors including "actual or possible harm."[71]

The Framework also directs staff to *quantify* the seriousness of violations. The Framework's offers the following guidance for doing so:

> Assigning a dollar figure to represent the gravity of a violation is an essentially subjective process. Nevertheless, the relative seriousness of different violations can be fairly accurately determined in most cases. This can be accomplished by reference to the goals of the specific regulatory scheme and the facts of each particular violation. Thus, linking the dollar amount of the gravity component to these objective factors is a useful way of ensuring that violations of approximately equal seriousness are treated the same way.[72]

Beyond its overarching Framework, EPA has further operationalized or implemented its approach to penalty calculation through development of a series of program-specific policies. EPA has issued at least 35 "penalty policies" or "enforcement response policies" for its different programs.[73] There are variations among these policies in their approach to environmental harm, but the idea that EPA should consider environmental harm as a factor in determining penalties is a common feature of these policies.[74]

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71. 1984 Framework, *supra* note 68, at II. The Framework provides that EPA should consider the amount and toxicity of any pollutants involved, as well as the sensitivity of the environment, in evaluating actual or possible harm. Id. See also SAB Report, *supra* note 57, at II. (noting that EPA is to rank violations based on the seriousness of the act and consider actual or possible harm in completing such rankings). In addition to actual or potential harm, the Framework directs EPA staff to consider "importance to the regulatory scheme" (that is, the importance of the requirement to achieving the goal of the statute or regulation) in determining the gravity component of a penalty. *Id*.

72. 1984 Framework, *supra* note 68, at app. II.A. The Framework also reflects intention that EPA staff consider the harm a violation causes to the environment in determining the gravity component of a penalty by providing that EPA staff may reduce the gravity component of a penalty if the violator "cooperates" by correcting the environmental problem prior to litigation. Such cooperation may justify a 50% reduction in the gravity component of a penalty. Thus, a violator may be able to reduce its penalty by taking actions to abate or redress environmental harm that it has caused, including to an ecosystem and the services it provides. *Id*. at app. I.

73. EPA Comment on SAB Report, *supra* note 59, at 5.

74. I reviewed EPA's enforcement or penalty policies for the CWA NPDES program, the CWA § 404 program, RCRA, the CAA stationary source program, and EPA's UST program in preparing this article. U.S. ENVTL. PROT. AGENCY, REVISED INTERIM CLEAN WATER ACT CIVIL PENALTY POLICY (June 2003), *available at* http://www.epa.gov/compliance/resources/policies/civil/rcra/rcpp2003-fnl.pdf; U.S. ENVTL. PROT. AGENCY, CLEAN AIR ACT STA-

Beyond this legislative and Agency policy direction that EPA staff should consider harm in determining penalty amounts, the Agency has identified key rationales for pursuing enforcement that support such an approach as well. EPA has identified three basic goals for its enforcement efforts: 1) deterrence, 2) fairness, and 3) swift resolution of environmental problems.[75] Particularly when violations cause significant harm, the theoretical literature suggests that imposing a penalty that incorporates such harm furthers at least the first two of these goals.

B. Theoretical Support for EPA's Considering Significant Environmental Harm in Determining Penalties

There is theoretical support for EPA's considering harm in imposing penalties, particularly for significant violations that cause or threaten substantial harm.[76] Failure to consider harm ade-

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TIONARY SOURCE PENALTY POLICY (May 2002), *available at* http://www.epa.gov/compliance/resources/policies/civil/caa/stationary/penpol.pdf; U.S. ENVTL. PROT. AGENCY, CLEAN WATER ACT SECTION 404 SETTLEMENT PENALTY POLICY (2001), *available at* http://www.epa.gov/compliance/resources/policies/civil/cwa/404pen.pdf. Federal district court judges are not obligated to use these guidance documents. For an example of a court deciding not to use the Policy, see *Laidlaw, Inc.*, 956 F.Supp. 588, at 601 (declining, in a citizen suit, to consider EPA's March 1995 Interim Clean Water Act Settlement Penalty Policy in calculating an appropriate penalty amount). States similarly are not obligated to use them. Some states have developed their own policies, but not all. State approaches deserve focused attention, particularly since states conduct the vast majority of enforcement.

75. 1984 POLICY ON CIVIL PENALTIES, *supra* note 56, at 1 (establishing a "single set of goals for penalty assessment," notably "deterrence, fair and equitable treatment of the regulated community, and swift resolution of environmental problems.").

76. There is a considerable literature on the issue of optimal enforcement. Mark A. Cohen, *Optimal Enforcement Strategy to Prevent Oil Spills: An Application of a Principal-Agent Model with Moral Hazard*, 30 J.L. & ECON. 23 (1987); Daniel A. Farber, *Taking Slippage Seriously: Noncompliance and Creative Compliance in Environmental Law*, 23 HARV. ENVTL. L. REV. 297 (1999). For purposes of this article it is necessary only to make the point that enforcement theory supports considering harm in a variety of contexts. To provide a very brief and incomplete overview, there are two key types of deterrence, absolute and conditional. As the SAB has put it, society would never condone some offenses — like violent assaults and rapes - and these are treated as "unconditionally deterred" offenses. They are to be deterred, regardless of the private benefit to the offender. One framework for absolutely deterring violations in the environmental arena is to require the violator to disgorge the economic benefit it has gained through its violations. The idea is that if a rational economic actor knows that it will be required to disgorge any benefit it gains from the violations, it will have no incentive to violate. Economists also recognize, however, that this theory of absolute deterrence does not always work in practice, and that it may be appropriate to consider harm or other factors to increase the penalty beyond economic benefit when the goal is absolute deterrence.

As the SAB and others have noted, environmental violations may also be treated under a framework known as "conditional deterrence." The notion here is that pollution is usually a byproduct of a socially beneficial activity and therefore should be considered to be a "conditionally deterred" offense—one that we only want to prohibit when its overall social costs exceed its overall social benefits. Economists suggest that harm is an appropriate basis for determining penalties in a context in which the goal is conditional deterrence because under this approach a violator's incentive is to obey the law if the harm it will cause by violating

quately in determining penalties may result in *under-deterrence* (i.e., it may result in too high levels of non-compliance), particularly of violations that cause significant harm. Regulated parties are more likely to commit violations that harm the environment (and that reduce the services ecosystems provide) when the penalties imposed do not force the violators to internalize the costs of such harm.[77]

The SAB provides an example to explain why in order to achieve appropriate deterrence EPA and other agencies should consider the harm a violation causes in determining an appropriate penalty amount, particularly when the harm is significant:

> It is worth emphasizing that this optimal penalty is based on the "harm" caused by the offense, not the "gain" to the offender. To take a simple criminal example, if a mugger obtained $100 in a robbery and the victim ended up spending three days in the hospital, a penalty based on the $100 gain to the offender would surely be too low — and would "underdeter" such offenses. The appropriate penalty would compensate the victim for three days in the hospital and pain and suffering. In the context of environmental offenses, suppose a firm fails to install a $100 safety valve and as a result 10,000 gallons of crude oil spilled into a sensitive coastal area. The $100 "gain" to the offender would certainly not be an appropriate starting point for a penalty. In both of these cases, the problem is the failure to take account of the harm done to the victim in setting the penalty.[78]

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will exceed the benefit it will derive by doing so. Under this framework, a penalty based on harm creates the proper incentives for behavior in the economics literature. It should be noted that, under conditional deterrence theory, if the gain due to noncompliance is large relative to the harm, a harm-based penalty will not deter noncompliance, but many economists are comfortable with this "conditional deterrence" result since, because the gain from noncompliance exceeds the harm, noncompliance is actually the overall socially efficient outcome. Some environmental violations are considered to be of the "unconditional deterrence" variety; thus, while economists might argue that they should be forgiven if the benefit from committing them exceeds the costs, the legislature has answered that question differently. SAB Report, *supra* note 57, at 25.

77. *See* SAB report, *supra* note 57. Penalty authority carries with it a risk of overdeterrence as well. This is true, for example, in a case in which a penalty includes an estimate of the harm that is too high.

78. *Id.* at 25. As noted, *supra* at note 76, there is an argument that, theoretically, penalties that recoup economic benefit should absolutely deter violations. As the SAB puts it, if EPA were in every case to impose a penalty equal to the gain to the offender divided by

The threat of more significant sanctions for violations that cause relatively significant harm also may provide what some economists have characterized as marginal deterrence. As Polinsky and Shavell put it:

> [E]xpected sanctions influence which harmful acts individuals choose to commit. Notably, such individuals will have a reason to commit less harmful rather than more harmful acts if expected sanctions rise with harm. Deterrence of a more harmful act because its expected sanction exceeds that for a less harmful act is sometimes referred to as marginal deterrence.[79]

Polinsky and Shavell conclude that:

> Other things being equal, it is socially desirable that enforcement policy creates marginal deterrence, so that those who are not deterred from committing harmful acts have a reason to moderate the amount of harm that they cause. This suggests that sanctions should rise with the magnitude of harm. . . . [M]arginal deterrence is naturally accomplished if the expected sanction equals harm for all levels of harm; for if a person is paying for harm done, he will have to pay appropriately more if he does greater harm."[80]

The SAB suggests that EPA should also consider harm in setting penalties because doing so will lead to *more fair* results (another policy objective EPA articulates in its enforcement policies):

> An important aspect of fairness is the *restoration of the status quo*: the law has been violated, and one

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the probability of detection and punishment, it would never be in the potential offender's interest to violate the law. SAB Report, *supra* note 57, at 25. But, there are several circumstances in which this argument does not hold — e.g., if there is uncertainty as to whether EPA will discover a violation, or pursue it, or be successful in determining, and requiring the disgorgement of, the entire economic benefit. *Id.* at 25-26.

79. Polinsky and Shavell, *supra* note 15, at 63.

80. *Id.* "[M]arginal deterrence also can be promoted by increasing the probability of detection as well as the magnitude of sanctions. For example, [as the SAB puts it,] kidnappers can be deterred from killing their victims if greater police resources are devoted to apprehending kidnappers who murder their victims than to those who do not." *Id.* This point obviously has implications for the allocation of resources to, and design of, EPA inspection and monitoring schemes and their effectiveness in uncovering violations that threaten or cause significant harm to ecosystems and their services.

> objective of the penalty system is to return to the status quo before the violation occurred. . . . [R]emoving the economic benefit is not the *only* action that might be required in order to restore the status quo. With a violation of an environmental regulation, there is a loss resulting from the polluter's action in the form of some harm to the natural environment. Whether the natural resource that is harmed belongs to a private individual or the general public, restoration of the status quo can call for some appropriate compensatory action, perhaps in the form of a penalty based on harm to the environment rather than on gain to the polluter.[81]

To sum up, it appears to be undisputed that Congressional and Agency policies direct Agency staff to consider environmental harm (actual and potential) in determining penalty amounts. There also appears to be theoretical support for EPA to pursue such approaches. Thus, the major remaining questions involve the extent to which EPA is, in fact, considering harm, including harm to ecosystem services, in determining penalty amounts and, re-

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81. SAB Report, *supra* note 57, at 1. The SAB characterizes as "the major focus" of EPA's penalty policy the fairness notion that the "restorative objective of a penalty system is to undo the violation and return the situation to how it was before the violation occurred." *Id*. at 9. The SAB notes that restoring the status quo requires not only disgorging the unwarranted gain to the violator, but also making good on the "unwarranted loss" to some other party. The SAB notes that a compensatory action could include both clean-up and some form of environmental restoration. "The costs of clean-up and environmental restoration are thus compensation that should be paid by the polluter in order to restore the status quo." *Id*.

The SAB elaborates on this issue as follows:

> In summary, the restoration of the status quo would appear to be an important aspect of the fairness objective in setting the penalty for a violation of an environmental regulation. This restorative goal can be seen to have two possible implications. If one focuses on the polluter's unlawful gain, restoration of the status quo implies that he should give up the gain. If one focuses on the unlawful harm to the environment, restoration of the status quo implies that he should pay an amount covering the cost of cleanup and/or environmental restoration. In general, there is no reason to expect that the two different approaches will lead to a similar assessment of a monetary payment: the cost avoided by failing to control pollution need bear no relationship to the damage caused by the pollution. This raises two questions: Which approach is presently adopted by the EPA? Which approach seems preferable, or should they be combined in some manner?
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> With regard to the first question, . . . the current EPA penalty policy . . . contain[s] some elements of both approaches. . . .

Id. at 9-10.

lated, the challenges associated with its doing so. It is to these questions that I now turn briefly in the following section.

C. EPA's Experience in Assessing Environmental Harm in Determining Penalties and its Challenges in Doing So

A recent SAB report suggests the possibility of a significant gap between the Congressional and Agency policy direction (discussed in Section III.A) and the theory supporting considering harm (discussed in Section III.B), and the reality on the ground. The SAB report indicates that the reality in the penalty calculation context is that, despite the direction in the generic and media-specific agency policies, EPA has traditionally focused much of its penalty calculation efforts on the first prong in the Agency's penalty calculation methodology, determining economic benefit, and it has paid little attention to harm.[82] After spending almost two years reviewing EPA's approach to calculating penalties,[83] the SAB noted that EPA devotes much more effort to determining and recouping economic benefit than it pays to determining and monetizing environmental harm as part of its gravity analysis. "[T]he current EPA penalty process appears to focus overwhelmingly on the calculation of the unlawful gain to the polluter, with no systematic consideration of the monetary value of the environmental damage caused by the violation…."[84] Along the same lines, the SAB concluded that "[s]ince 1978, the EPA has made the violator's economic benefit from . . . violating the Clean Air and Clean Water Acts the centerpiece of its calculation of civil penalties." [85] In its comments on the SAB report, EPA acknowledges this is the case.[86]

The SAB has concluded that it is feasible for EPA to calculate harm, and has recommended that EPA embark on such an effort, but EPA has not embraced this recommendation with open arms. The SAB offers the following advice in its cover letter to the 2005 report: "The Panel believes that the state-of-the art in benefits estimation has progressed to the point where EPA should seriously explore how it might incorporate 'harm-based' measures into its

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82. SAB Report, *supra* note 57, at 10.

83. Mike Ferullo, *Panel Says EPA Penalty Assessment Process Should Tally Value of Environmental Harm*, BNA DAILY ENV'T REPORT, Sept. 21, 2005, at A-8.

84. SAB Report, *supra* note 57, at 9-10. *See also id*. at 7 (asserting that, "[s]ince 1978, the EPA has based civil penalties under the CAA and CWA on the violator's economic benefit from noncompliance from violating the law.").

85. *Id.* at 1.

86. EPA Comment on SAB Report, *supra* note 59.

penalty formula. . . . "[87] On the other hand, EPA points to various constraints as an explanation for its limited consideration of harm: "even when the harm can in theory be monetized, in almost all civil penalty actions the analytical resources and efforts necessary to accomplish this could be very substantial."[88]

The SAB's optimism, coupled with EPA's identification of roadblocks, suggests the possible value of more in-depth assessment of the possibilities for developing greater agency capacity to integrate harm-based evaluations into its penalty calculation methodologies. Little such in-depth assessment has been done to date. Thus, my main purpose in this section is to suggest the beginnings of a future research agenda to develop a better understanding of current practices, and future challenges and opportunities. Questions that deserve attention include: 1) How often does EPA consider harm, including harm to ecosystem services?; 2) What motivates the Agency to consider harm in some cases and not in others?; 3) How does EPA carry out such efforts?; 4) Are there significant regional variations in the answers to these questions; and 5) To the extent there is a gap between theory and policy directives, on the one hand, and implementation on the other, what are the practical constraints or other factors that may account for this gap, and are there ways EPA can overcome these constraints so the Agency is able to consider harm to ecosystem services more than it does currently? The answers to these questions will help to inform consideration of the extent to which, and possible ways in which, EPA can and should pay more attention to the harm (and potential harm) a violation causes in determining the appropriate penalty.

A final observation is that EPA's penalty calculation authorities provide it with a forum for promoting learning about ecosystem services. The ecosystem services literature is full of references to data limitations.[89] To name three, there are significant limits to our knowledge about: 1) baseline conditions — the current state of the environment and the services it provides; 2) impacts — the extent to which different types of environmental insults cause harm to different types of ecosystems; and 3) valuation — the dollar

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87. Letter from Dr. A. Myrick Freeman III, Chair, Illegal Competitive Advantage (ICA) Economic Benefit (EB) Advisory Panel, EPA Science Advisory Board, to Stephen L. Johnson, EPA Administrator (Sept. 7, 2005) (on file with the author). See also SAB Report, *supra* note 57, at 5, 26. In concluding that benefits estimation is feasible in some cases, the SAB notes that "there is some continuing disagreement about the relative merits of alternative approaches and their overall reliability." *Id.* at 26.

88. *Id.* at 4. EPA also indicates that "[w]hile the Agency's penalty policies do consider the environmental harm from the violations (when present)," it asserts that "the violations EPA prosecutes rarely involve provable environmental damage." *Id.*

89. *See e.g.*, *supra* note 19.

value of the level of harm particular violations cause. EPA has the opportunity to advance learning in all three of these areas as part of its efforts to calculate penalties. To provide one example, if a violation harms a particular wetland, EPA has the authority, in determining an appropriate penalty, to gather data on the natural environment involved (e.g., the qualities of the wetland and the services the wetland provides); it has authority to gather data on the nature and extent of the harm that the violation caused to the wetland and the services it provides; and the Agency has the authority to calculate, and place, a monetary value on this harm. EPA can use these types of data-gathering and valuation efforts to learn more about the particular resources involved. It also can incorporate this knowledge and expertise on a broader scale, to bolster our knowledge of natural inventories by improving our understanding of baseline conditions and services. Thus, in short, learning the Agency derives from calculating a "harm-based" penalty for one set of violations may provide information that will facilitate understanding, protecting, and restoring ecosystems and the services they provide in a range of contexts.

IV. INJUNCTIVE RELIEF

As noted above, EPA's enforcement authorities include the authority to impose injunctive relief, in addition to the power to impose penalties. In at least some circumstances, EPA has defined the scope of its injunctive authority to include the power to require violators to cease violations and to repair any harm the violations have caused. EPA has noted, for example, that "[i]n settling enforcement actions, EPA requires alleged violators to promptly cease the violations and, to the extent feasible, remediate any harm caused by the violations."[90]

EPA's injunctive authorities appear to give it significant opportunities to protect ecosystems and the services they provide, in at least three ways. Most obviously, if a violation is causing harm to an ecosystem or threatening to do so, EPA can enjoin the violator to change its behavior by terminating the activities that are causing or threatening harm and to take steps to minimize the prospects for recurrence. There are limitations on EPA's authority, including courts' having the equitable discretion to determine appropriate relief in particular cases and thereby override EPA's preferred approach.[91] Nevertheless, in broad terms EPA has long as-

90. Final EPA Supplemental Environmental Projects Policy Issued, 63 Fed. Reg. 24796, 24796 (May 5, 1998) [hereinafter Final SEPs Policy].

91. Courts generally have extraordinarily broad equitable authority to "do justice" in

serted the power to require violators to cease their violations and return to compliance.[92]

Second, as indicated in the initial paragraph in this section, in at least some cases EPA asserts that its injunctive authorities empower it to enjoin a violator to act affirmatively to address harm that it has caused. Professor Edward Lloyd and others have suggested limits to this authority. [93] In many cases, however, EPA has negotiated agreements that obligated alleged violators to remediate harm their violations have caused, and in others courts or EPA's judges or Environmental Appeals Board have required violators to do so.

Finally, EPA's injunctive authorities appear to give it significant capacity for learning that will promote protection of ecosystems and the services they provide by advancing understanding of ecosystems and these services. As noted above, the ecosystem services literature identifies significant data-related shortcomings to our ability to protect and restore ecosystems. These include limits in our understanding of: 1) baseline conditions — the current state of the environment and the services it provides; 2) impacts — the extent to which different types of environmental insults cause harm to different types of ecosystems and, related, the impact of these harms on the capacity of ecosystems to provide services such as pollination, flood control, and the like; and 3) the efficacy and cost of different approaches to protecting and restoring ecosystems and the services they provide. EPA has the opportunity to use its injunctive authorities to advance learning in all three of these areas. To use the same example discussed above, if a violation harms a wetland, EPA claims the authority, in determining appropriate injunctive relief, to: 1) gather data on the qualities of the wetland and on the services the wetland provides; 2) develop in-

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resolving cases involving violations of the environmental laws. *See, e.g.,* Weinberger v. Romero-Barcelo, 456 U.S. 305, 320 (1982) (indicating that the CWA "permits the district court to order that relief it considers necessary to secure prompt compliance with the Act"); *cf.* Tennessee Valley Authority v. Hill, 437 U.S. 153 (1978). (holding that Congress had limited the courts' traditionally broad equitable jurisdiction). EPA also has broad enforcement discretion to decide whether to prosecute, how to prosecute, and whether to settle a case. *See e.g.*, Heckler v. Chaney, 470 U.S. 821 (1985) (an agency's discretion not to enforce is generally committed to the agency's absolute discretion); Oil Chemical & Atomic Workers v. Occupational Safety & Health Review Comm'sn, 671 F.2d 643, 650 (D.C. Cir. 1982) (EPA's enforcement discretion includes the discretion to settle a case).

92. 1984 EPA POLICY ON CIVIL PENALTIES, *supra* note 56.

93. Edward Lloyd, *Supplemental Environmental Projects Have Been Effectively Used in Citizen Suits to Deter Future Violations as Well as to Achieve Significant Additional Environmental Benefits*, 10 WIDENER L. REV. 413, 425 (2004) (discussing amendments proposed to the CWA in 1993, which would have authorized courts to order a violator to restore the natural resources damaged or destroyed as the result of the violation at issue, S. 1114, 103rd Cong. 262 (1993), and asking why such amendments were needed if courts already have this authority).

formation on the nature and extent of the harm that the violation caused to the wetland and the services it provides; and 3) require the violator to cease the violation that is causing harm (and to identify and evaluate different options for doing so) and to abate the harm that it has caused (again, after identifying and evaluating different options for doing so).

While the same types of barriers to EPA's pursuing more harm-based penalty calculations exist in the injunctive relief context, such as resource constraints, methodological challenges, and the like, the fact that EPA has the ability in some cases to direct the violators to do the basic investigatory and remedial or restorative work means that EPA can reduce these barriers by shifting much of the work to the violators rather than undertake this work itself. While EPA needs to maintain the capacity to direct and oversee a violator's work, the resource demands should be less than if EPA were doing the work itself. Further, the economic valuation work will be in much less demand on the injunctive end of the relief spectrum, thereby simplifying EPA's methodological challenges in justifying commitments from violators.

Another point worth mentioning concerning the promise of EPA's injunctive authority as a tool to protect ecosystems is that EPA has structured its enforcement policies to create leverage for its efforts to have violators undertake needed remedial work. EPA's Framework allows Agency staff to reduce the gravity component of a penalty significantly if the violator "cooperates" by correcting the environmental problem prior to litigation.[94] This approach obviously creates an incentive for violators to reach agreement with EPA on appropriate injunctive actions to abate and/or redress environmental harm that they have caused, including to an ecosystem and the services it provides, so that the violators may reduce their penalty by taking such actions.

V. SEPs

EPA has coined the acronym SEPs (shorthand for Supplemental Environmental Projects) to refer to a third type of enforcement-related relief that holds promise for advancing knowledge of ecosystems and the services they provide, and for protecting, restoring, and enhancing such services. This Part examines the poten-

94. 1984 Framework, *supra* note 68; *See also* Catskill Mountains Chap. of Trout v. City of NY, 244 F.Supp. 2d 41 (N.D.N.Y. 2003) (reducing penalty because of mitigation efforts). More generally, the Clean Water Act's direction that courts consider a defendant's good faith effort to comply in assessing a penalty similarly indicates that efforts to comply can help to mitigate a penalty. *Laidlaw, Inc.,* 956 F.Supp. at 607-8.

tial for SEPs to serve as a useful form of relief for improving protection of ecosystem services.[95]

Commentators who have lauded the promise of SEPs as a mechanism for enhancing environmental protection, including protecting ecosystems and the services they provide, have tended to highlight two key features of SEPs.[96] SEPs are in a sense "environmental freebies" — projects that will have a positive environmental impact that would not be undertaken otherwise.[97] Further, EPA's enforcement policies create leverage for EPA to persuade violators to undertake environmentally beneficial SEPs they are not legally obligated to undertake, including the possibility that EPA may reduce the penalty it will impose on a violator in exchange for the party's undertaking a SEP. [98]

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95. While I focus on EPA's SEPs policies and practices, states' interest in SEPs appears to have increased as well. A 2005 survey of State SEP approaches found that 30 states have adopted formal, published SEP policies, up from 19 eight years before. Steven Bonorris et al., *Environmental Enforcement in the Fifty States: The Promise and Pitfalls of Supplemental Environmental Projects*, 11 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 185, 188 (2005). Another 13 states also negotiate SEPs, but do so based on informal, unwritten practices. *Id*. Only two states, North Carolina and South Carolina have rejected SEPs. *Id*.

96. *See* David A. Dana, *The Uncertain Merits Of Environmental Enforcement Reform: The Case Of Supplemental Environmental Projects*, 1998 Wis. L. Rev. 1181, 1181-83; Kenneth T. Kristl, *Making a Good Idea Even Better: Rethinking the Limits on Supplemental Environmental Projects*, 31 VT. L. REV. 217 (2007); Lloyd, *supra* note 93, at 413-4. *Cf*. Bonorris et al., *supra* note 95, at 221 (suggesting that SEPs' potential value extends beyond providing environmental benefits in particular settlements to "hold[ing] the promise of a reinvented regulatory model, one of cooperative enforcement, rather than the procrustean standard of traditional top-down, 'command and control' regulation.").

97. For favorable characterizations of SEPs, *see, e.g.*, Dana, *supra* note 96, at 1205 (noting that several commentators and others have referred to SEPs as "win-win" opportunities); Laurie Droughton, Comment, *Supplemental Environmental Projects: A Bargain for the Environment*, 12 PACE ENVTL. L. REV. 789, 789 (1995) (referring to SEPs as a "bargain for the environment"); Kristl, *supra* note 96, at 1 (characterizing a SEP as a "win-win" proposition because the plaintiff "achieves both prevention and restoration," the defendant reduces its penalty, and the environment benefits); Lloyd, *supra* note 93, at 413 (concluding that "[t]he use of citizen suit SEPs is widespread and largely successful."). For expressions of concern about SEPs, *see generally*, Michael Greve, *The Private Enforcement of Environmental Law*, 65 TUL. L. REV. 339 (1990); Dana, *supra* note 96, at 1184, 1215, 1216 (suggesting that SEPs may lower the cost of violating the environmental laws and thereby result in undeterrence of such violations, and that, ultimately, SEPs are "an unattractive vehicle to promote environmental good works" and suggesting that there are alternative means available for the government to promote environmental good works that do not undermine deterrence objectives — namely, government grants to regulated entities for such projects).

98. Final SEPs Policy, *supra* note 90, at 24803 (noting that "the enforcement context has two distinct advantages. First, firms can be motivated to innovate . . . through penalty reduction, improved relations with the Agency, and improved public relations. Second, since the firm has committed to implement the innovative project in its consent agreement with the Agency . . . there is a strong incentive to stick with the project even when technical difficulties arise. Enforcement thus creates a 'window of opportunity' in which options for technological change receive more serious consideration than usual."). Defendants have other possible reasons for agreeing to SEPs as well. *See, e.g.*, Matthew D. Zinn, *Policing Environmental Regulatory Enforcement: Cooperation, Capture, and Citizen Suits*, 21 STAN. ENVTL. L.J. 81, 87 (2002) (noting that industry groups and regulators have supported SEPs on the grounds that they avoid or reduce litigation costs, foster fairness for regulated parties, and

EPA has had considerable experience with SEPs. The Agency issued its Final SEPs Policy in 1998,[99] but the Agency had been entering into SEPs for approximately twenty years prior to its issuance of the 1998 Policy.[100] The Agency has continued to give SEPs substantial policy attention; it has issued at least 17 guidance memoranda on SEPs since 1998.[101]

The Agency's rhetoric has generally been quite supportive of SEPs. In its 1998 Final SEPs Policy, EPA announced that it "placed a high priority" on including SEPs in settlements.[102] EPA has issued a series of post-1998 refinements to its SEPs Policy in order to "help promote the use of SEPs in enforcement settlements."[103] It has, for example, taken steps to simplify the process for approval of SEPs and to increase incentives for violators to agree to SEPs.[104] In a 2002 Memorandum, the Agency stated that

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"increase popular support." They also may engender a greater degree of cooperation among regulators, regulated parties, and interested citizens.) Professor David Dana identifies a variety of reasons why regulators may be favorably disposed to SEPs. Dana, *supra* note 96, at 1200-1 (suggesting that regulators may generate political backing from local residents and that this increased local goodwill may produce more resources. Further, "[i]ncreased local goodwill may translate into purely psychic benefits for regulators. [R]egulators may experience psychic satisfaction in witnessing an environmental improvement that results directly from their efforts." Regulators may find it beneficial to use SEPs as a learning opportunity or as a "testing ground" for future regulatory programs.). Dana also suggests that SEPs may be beneficial by engendering greater internalization of "the norms of good environmental citizenship" and therefore lead to increased compliance. *Id*. at 1211. For general reasons why defendants might opt to settle a case rather than litigate it, such as the cost of litigation and the risks inherent in litigation, *see* Robert D. Cooter and Daniel L. Rubinfield, *Economic Analysis of Legal Disputes and Their Resolution*, 27 J. ECON. LIT. 27, pp. 1067-97 (1989) (providing survey results).

99. Final SEPs Policy, *supra* note 90.

100. *Id*. For two recent, detailed historical reviews of EPA's development and use of SEPs, *see generally*, Kristl, *supra* note 96; Lloyd, *supra* note 93. Citizens negotiate SEPs in settling enforcement cases as well. *See, e.g.*, Lloyd, *supra* note 93, at 413 (noting that the "use of citizen suit SEPs is widespread and largely successful"); Greve, *supra* note 97.

101. EPA provides a list of its SEPs Policy and Guidance online. SEPs Policy and Guidance, http://cfpub.epa.gov/compliance/resources/policies/civil/seps (last visited Aug. 18, 2007). They cover the availability of SEPs in a wide range of enforcement contexts (for example, settlements with municipalities of CWA enforcement case, green buildings, retrofitting school buses, etc.). *See also* Memorandum from Phyllis Harris, Principal Deputy Asst. Adm'r, EPA OECA, to Reg'l Adm'rs, Clarification and Expansion of Environmental Compliance Audits under the Supplemental Environmental Projects Policy (Jan. 10, 2003), *available at* http://www.epa.gov/compliance/resources/policies/civil/seps/sepauditclar-mem.pdf (advising that EPA is expanding the environmental compliance audit category of SEPs) *and* Kristl, *supra* note 96, at 17.

102. Final SEPs Policy, *supra* note 90, at 24796.

103. Memorandum from John Peter Suarez, Asst. Adm'r, EPA OECA, to Asst. Adm'rs et al., Expanding the Use of Supplemental Environmental Projects 3 (June 11, 2003), *available at* http://www.epa.gov/compliance/resources/policies/civil/seps/seps-expandinguse.pdf [hereinafter Suarez, Expanding Use].

104. *Id.* In addition, EPA has included a project idea form on its website; it develops a project ideas memorandum that it updates and sends out regularly; and it provides SEP information on the Enforcement and Compliance History Online system (www.epa.gov/echo). E-mail from Beth Cavalier, Special Litigation and Project Division, EPA OECA, to author (Feb. 28, 2007, 07:21:00 EST) (on file with the author).

"SEPs are an important part of the settlement process and are an appropriate means to further Agency enforcement goals and objectives. We encourage the Regions to continue to promote SEPs and look for opportunities to incorporate such projects into their settlements."[105] Echoing the Agency's rhetoric, Professor David Dana suggested in a 1998 article that "the use of SEPs by public regulators . . . soon will become (or arguably already has become) a major component of environmental enforcement."[106]

In light of the internal and external optimism about SEPs and support for them, EPA's track record in negotiating SEPs might come as a bit of a surprise. The use of SEPs has not increased substantially, as one might expect from EPA's rhetoric.[107] Instead, as the *Annual Results* data above reflects, in EPA's FY 2001, EPA estimated the value of the SEPs it entered into that year to be about $90 million, while over the past four years, the value of SEPs has declined to amounts in the range of $45-$65 million annually.[108] Data that Professor Kenneth Kristl has compiled indicates that the number of SEPs has not increased in recent years either.[109]

The rest of this Part reviews key features of SEPs. It concludes by identifying, and briefly exploring, several possible strategies for expanding use of SEPs beyond historic and current levels.

A. Definitions: What are SEPs?

As EPA explains, SEPs have a unique role in EPA's enforcement tool box. They are intended to "obtain environmental and public health protection and improvements *that may not otherwise*

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105. Memorandum from Sylvia Lowrence, Acting Asst. Adm'r, EPA OECA, to Regl. Adm'rs, Supplemental Environmental Projects (SEPs) Policy, (Mar. 22, 2002), *available at* http://www.epa.gov/compliance/resources/policies/civil/seps/sepguide-mem.pdf [hereinafter Lowrence, 2002 SEPs Memo].

106. Dana, *supra* note 96, at 1181 n.1.

107. *See* Dana, *supra* note 96, at 1181 (anticipating a significant increase in SEPs).

108. *Id.*. While David Dana reported in 1998 that the dollar value of SEPs in FY 1995 substantially exceeded the value of civil and administrative penalties that EPA assessed ($103,840,773 vs. approximately $70 million), in 1996, SEPs declined to $65 million, while civil and administrative penalties increased to more than $96 million. Dana, *supra* note 96, at 1189. The *Annual Results*, *supra* note 27, at 5, which brings these figures up to date for the past five years, reflects that while the ratio of the value of SEPs to the value of civil penalties was relatively stable from 2001-2003, at about 65-70% (2001 = 71%, or 89/126; 2002=64%, or 58/90; and 2003 = 68%, or 65/96), there has been a dramatic drop-off in SEPs the past two years. In 2004, the ratio is only 32%, $48 million SEPs/$149 million civil penalties; and in 2005 the ratio was 37%, $57 million/$154 million. Professor Kenneth Kristl has compiled information on the numbers of SEPs negotiated over the past several years. *See* Kristl, *supra* note 96.

109. *See* Kristl, *supra* note 96.

have occurred . . . ." [110] In this way they complement EPA's traditional injunctive authority to require violators to cease violations and remediate any harm the violations have caused.[111]

EPA has established three threshold criteria for consideration of a project as a SEP. First, the project must be "environmentally beneficial." EPA explains that "environmentally beneficial" means a "SEP must improve, protect, or reduce risks to public health, or the environment at large."[112]

Second, the violator must not be legally obligated to perform the project that it will undertake as a SEP. EPA notes that, for example, "if a court is likely to order a defendant to perform a specific activity in a particular case, such an activity does not qualify as a SEP."[113]

Third, the alleged violator must commit to perform the project as part of a settlement of an enforcement action.[114] SEPs are available only in the enforcement arena; they are not available as part of EPA's regulatory process (for example, as permit conditions EPA includes in authorizing a facility to operate under one or more environmental laws) or through EPA's exercise of its rulemaking authorities. Further, in the enforcement arena, EPA only pursues SEPs in settlements, not as relief in litigated cases.[115]

B. Additional Requirements for and Features of SEPs

EPA has established additional requirements for approval of SEPs, directing that its staff use a four-step process in considering a possible SEP project, after ensuring that the project meets the definition of a SEP: 1) the project must satisfy all legal guidelines (including "nexus"); 2) it must fit within a designated category of SEPs; 3) EPA staff must determine the appropriate amount of penalty mitigation; and 4) EPA staff must ensure that a project satisfies various implementation and other criteria.[116] This sec-

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110. Final SEPs Policy, *supra* note 90, at 24796 (emphasis added).

111. *Id.*

112. *Id.* at 24798.

113. EPA notes that "[t]he statutes EPA administers generally provide a court with broad authority to order a defendant to cease its violations, take necessary steps to prevent future violations, and to remediate any harm caused by the violations." Final SEPs Policy, *supra* note 90, at 24798 n.3. EPA continues: "[i]f a court is likely to order a defendant to perform a specific activity in a particular case, such an activity does not qualify as a SEP." *Id.*

114. *Id.* at 24797 (noting that "[t]his is a settlement policy and thus is not intended for use by . . . courts. . . ."). Some commentators have suggested that courts retain the equitable discretion to require SEPs. Kristl, *supra* note 96, at 15.

115. Final SEPs Policy, *supra* note 90, at 24797-98.

116. *Id.* at 24797.

tion briefly reviews each of these steps.[117]

1. Legal Guidelines[118]

SEPs raise at least two threshold legal questions: 1) whether EPA has the legal authority to negotiate commitments to perform environmentally beneficial work that it cannot require a defendant to undertake; and 2) whether EPA has the authority to reduce the size of a penalty in exchange for such a commitment?

The short answer is that for the past twenty-plus years, EPA has answered each of these questions in the affirmative, in its various SEPs policies and elsewhere. The Agency has consistently claimed that it has authority to negotiate commitments for work that it lacks legal power to impose or require; and, further, the Agency has the ability to offer reduced penalties in exchange for such commitments.[119]

The Agency has, however, established certain "legal guidelines" to bolster its legal position that SEPs are defensible, including requiring a "nexus" between a proposed project and the violations at issue.[120] In its 1998 SEPs Policy, EPA indicates that the requisite

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117. For more extensive treatment, see generally Lloyd, *supra* note 93; Kristl, *supra* note 96; Dana, *supra* note 96.

118. Final SEPs Policy, *supra* note 90, at 24798-99.

119. EPA's lawyers and others claim that EPA has the authority to enter into SEPs that commit alleged violators to take action that EPA could not order the violators to undertake because the SEPs are the result of negotiations and, as a result, they are projects the violator has entered into willingly. Final SEPs Policy, *supra* note 90, at 247897-98. I do not address the merits of this issue in this article. For legal analyses of EPA's authority, see for example, Kristl, *supra* note 96, at 24-34; Dana, *supra* note 96, at 1182-1184 (suggesting that "[t]he only serious controversy regarding SEPs has concerned their statutory basis," and summarizing some of the arguments pro and con); Lloyd, *supra* note 93, at 413-15 (concluding that "[b]oth the courts and Congress have accepted, if not actively encouraged, SEPs either by affirmative approvals or passive acceptance" and that EPA has "adopted SEPs as a major component of its own enforcement regime.") (Professor Lloyd acknowledges that he is an attorney with Columbia's law clinic, has brought several citizen suits that included SEPs, and is a strong advocate for SEPs); *and* Bonorris et al., *supra* note 95, at 198, 199 ("courts have upheld the legality of consent decrees that go beyond the express relief outlined in a statute, with the proviso that the decrees are consistent with the underlying purpose of the statute.").

EPA, and the U.S. government through the Department of Justice, have opposed SEPs in citizen suits in some cases. Lloyd, *supra* note 93, at 430 (suggesting that EPA and DOJ have "kept a watchful eye" on settlements of citizen suits). Lloyd notes that courts "ordinarily" have entered proposed consent decrees resolving citizen suits with a SEP component, even over EPA and DOJ objections. *Id*.

120. *See e.g.*, Suarez, Expanding Use, *supra* note 103.

> To ensure that the Agency's enforcement discretion is used appropriately and in compliance with the U.S. Constitution and the MRA, all SEPs must satisfy several key elements. To be approved as a SEP, a project must: 1) Be related to or have a "nexus" to the underlying violation; 2) Provide significant environmental and public health benefits; 3) Benefit the community affected by the violation; and 4) Secure public health

relationship between a project and a violation may exist in *any* of three ways: 1) the project will reduce the likelihood that similar violations will occur in the future; 2) the project will reduce the adverse impact to public health or the environment to which the violation at issue contributes; or 3) the project will reduce the overall risk to public health or the environment potentially affected by the violation at issue.[121]

This broad definition of SEPs seemingly would include a significant number of projects that have the potential to improve the environment. For example, under the third type of nexus, a SEP project would seem to have adequate nexus if the project operates to protect or enhance a part of the environment if a violation poses a risk to that part of the environment, such as a particular ecosystem. There is some suggestion that EPA is prepared to define "nexus" even more broadly than that. EPA's SEPs Policy continues that "[n]exus is easier to establish if the primary impact of the project is . . . in the same ecosystem or within the immediate geographic area."[122] Implicit in this is that a SEP is approvable even

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> and/or environmental improvements beyond what can be achieved under applicable environmental laws.

Id. at 2. Not all commentators agree that nexus is needed. *See e.g.*, Kristl, *supra* note 96. EPA has established other limitations on SEPs as well. For example, the Final SEPs Policy indicated that SEPs may not be profitable to a defendant. Final SEPs Policy, *supra* note 90, at 24798. EPA modified this policy in 2003, issuing a memorandum that EPA may accept SEPs that prove profitable to a defendant in some cases. Memorandum from John Peter Suarez, Asst. Adm'r, EPA OECA, to Reg'l Counsel et al., Guidance for Determining Whether a Project is Profitable, When to Accept Profitable Projects as Supplemental Environmental Projects, and How to Value Such Projects (Dec. 5, 2003), *available at* http://www.epa.gov/compliance/resources/policies/civil/seps/seps-profitableprojects.pdf.

121. Final SEPs Policy, *supra* note 90, at 24798. The other four "legal guidelines" that EPA identifies in its Policy appear to limit the availability of SEPs in ways that might limit SEPs for ecosystem services in some contexts, but by no means all. Thus, a project cannot be "inconsistent with any provision of the underlying statute;" EPA cannot play a role in managing or controlling funds for the SEP or manage the SEP, but it can oversee it; the settlement agreement must provide sufficient detail concerning the project; and EPA cannot use a project to meet its statutory obligations or another agency's obligations. *Id*. at 24798. EPA's Lowrence, 2002 SEPs Memo, *supra* note 105, reiterates these elements of the Policy. The 2002 SEPs Memo also lists other restrictions:

> 7) A project may not provide EPA . . . with additional resources to perform a particular activity for which Congress has specifically appropriated funds.
> 8) A project may not provide additional resources to support specific activities performed by EPA employees or EPA contractors.
> 9) A project may not provide a federal grantee with additional funds to perform a specific task identified within an assistance agreement.
> 10) Projects that involve only contributions to a charitable or civic organization are not acceptable.

Id. at 2.

122. Final SEPs Policy, *supra* note 90, at 24798.

if it may benefit other ecosystems or other geographic areas; presumably, in some cases, even if its primary impact is to do so.[123]

In sum, EPA's definition of "nexus" in its 1998 Policy appears to create the potential for a broad range of SEPs that could protect ecosystems and the services they provide.[124] A 2002 Memorandum from EPA's Director of Office of Regulatory Enforcement that focused on the "nexus" requirement indicates that "[i]n most cases, nexus is not difficult to establish."[125]

Further, as one commentator has noted, EPA's "consistent theme" in its post-1998 SEPs Policies has been to encourage Agency staff to expand their use of SEPs.[126] In a June 2003 memorandum, aptly entitled *Expanding the Use of Supplemental Environmental Projects*, for example, EPA's then head of enforcement urged agency staff to "consider every opportunity to increase our use of SEPs and include more environmentally significant SEPs whenever possible."[127] The memorandum indicates that during FY 2002, 10 percent of EPA's civil penalty settlements included a SEP, but urged that, while EPA "should be proud of these figures," "we have a tremendous opportunity to achieve greater benefits for the environment and communities affected by violations."[128] In a December 15, 2003 Guidance, EPA's enforcement head identified opportunities to expand the universe of potential SEPs. He indicated that EPA staff may, in certain circumstances, aggregate SEPs in multiple cases (e.g., EPA may allow regulated parties to pool re-

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123. For example, EPA officials indicated that if a violation occurs in a tributary or stream of a larger river; the SEP may take place in a different part of the river to improve the overall quality of the river as a whole. E-mail from Beth Cavalier, supra note 104. On the other hand, in an October 2002 memorandum, EPA suggests that "geography alone does not create nexus. The mere fact that a SEP is beneficial to an area near a facility does not by itself satisfy the nexus requirement. Enforcement staff must be able to demonstrate how the project relates to the violations that are the subject of the enforcement action." Memorandum from Walker Smith, Dir., Office of Regulatory Enforcement, to Reg'l Counsel, Importance of the Nexus Requirement in the Supplemental Environmental Projects Policy 2 (Oct. 31, 2002), *available at* http://www.epa.gov/compliance/resources/policies/civil/seps/sepnexus-mem.pdf [hereinafter Smith, Importance of the Nexus]. (ORE is now called the Office of Civil Enforcement.) Thus, while geography does not appear to be necessary in all cases to establish nexus, it is also not necessarily sufficient to do so. Kristl, *supra* note 96.

124. *See* Dana, *supra* note 96, at 1186 (noting that the SEPs policy defines nexus broadly).

125. Smith, Importance of the Nexus, *supra* note 123, at 1. *Also see infra* notes 168-179 and accompanying text.

126. Kristl, *supra* note 96, at 18.

127. Suarez, Expanding Use, *supra* note 103, at 1; *see also* Memorandum from John Peter Suarez, Asst. Adm'r, EPA OECA, to Reg'l Counsels et al., Guidance Concerning the Use of Third Parties in the Performance of Supplemental Environmental Projects (SEPs) and the Aggregation of SEP Funds (Dec. 15, 2003), *available at* http://www.epa.gov/compliance/resources/policies/civil/seps/seps-thirdparties.pdf [hereinafter Suarez, 2003 Guidance].

128. Suarez, Expanding Use, *supra* note 103, at 1; *see also* Suarez, 2003 Guidance, *supra* note 127 (to the same effect).

sources to implement a consolidated SEP), noting that aggregation "could provide increased leverage and allow for projects with a greater environmental or public health benefit. . . ."[129] Similarly, he indicated that in some circumstances EPA staff may negotiate "complementary, segregable SEPs" with defendants in different cases that are, for example, interested in performing "discrete and segregable tasks within a larger project."[130] Such projects "can result in a significant environmental or public health benefit that might otherwise be unavailable."[131]

Specific categories of projects EPA has identified as suitable for SEPs reinforce the message embodied in the rhetoric summarized in this section, notably that EPA's approach to SEPs appear to make them well-suited for ecosystems protection-related projects.

2. Specific Categories of Projects

EPA lists seven specific categories of projects that may qualify as SEPs. This list provides strong evidence that EPA is prepared to approve SEPs that have significant potential to protect ecosystems and the services they provide.[132] For example, EPA's fourth category of permissible SEPs, entitled "Environmental Restoration and Protection," refers explicitly to projects "which enhance[ ] the condition of the ecosystem or immediate geographic area adversely affected."[133] The Agency continues: "These projects may be used to restore or protect natural environments (such as ecosystems). . . . This category also includes any project which protects the ecosystem from actual or potential damage resulting from the violation or improves the overall condition of the ecosystem."[134] EPA lists "[restoration of] a wetland in the same ecosystem . . . in which the

129. Suarez, 2003 Guidance, *supra* note 127, at 2.

130. *Id*.

131. *Id*. On the other hand, then Enforcement head Suarez indicates that EPA's OGC vetoed the idea of aggregating SEP funds because of concerns that doing so would raise questions under the MRA. "A cash payment, such as a payment . . . to a SEP 'bank,' where there is no further responsibility for the defendant . . . to ensure that a specific project is completed, is prohibited because it could easily be construed as a diversion from the Treasury of penalties due and owing the government." *Id*. at 3. Suarez indicates that defendants may hire third parties to assist with SEPs, so long as the defendant retains full responsibility for the SEP. A defendant may not negotiate a SEP that involves making a cash payment to a third party to conduct the SEP without the defendant's retraining full responsibility. *Id*. at 4.

132. Final SEPs Policy, *supra* note 90, at 24799-24800; U.S. ENVTL. PROT. AGENCY, OFFICE OF ENFORCEMENT AND COMPLIANCE ASSURANCE, EPA 325-R-01001, BEYOND COMPLIANCE: SUPPLEMENTAL ENVIRONMENTAL PROJECTS, at 4-5, (Jan. 2001) [hereinafter BEYOND COMPLIANCE].

133. Final SEPs Policy, *supra* note 90, at 24799.

134. *Id*.

facility is located" as one such project.[135] The Agency also lists as a permissible project the "purchase and management of a watershed area by the defendant/respondent to protect a drinking water supply where the violation (e.g., a reporting violation) did not directly damage the watershed but potentially could lead to damage due to unreported discharges."[136] EPA's 1998 SEPs Policy also provides that projects that have "environmental merit" may qualify as a SEP even if the projects do not fit within one of the seven specified categories, with the approval of EPA's enforcement office.[137]

A January 5, 2004 EPA Memorandum, Recommended Ideas for Supplemental Environmental Projects,[138] includes an updated list of potential SEPs projects that EPA indicates it will support (any of these projects must still meet all conditions of the SEPs Policy if proposed for inclusion in a particular settlement). Several of the types of projects EPA lists in this Memorandum similarly reflect EPA's policy position that SEPs may encompass protection and restoration of ecosystems and ecosystem services:

> Implement projects that create, restore and/or preserve threatened aquatic resources, including wetlands. Mechanisms to accomplish this goal can include:
> - Aquatic resource restoration project
> - Land trust projects to preserve aquatic resources threatened with degradation or destruction by unregulated activities.
> - Purchasing and retiring credits from mitigation

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135. *Id*.

136. *Id*.; *see also*, BEYOND COMPLIANCE, *supra* note 132, at 5 (noting that "[f]or example, by purchasing land or developing conservation programs for the land, a company could protect a natural habitat for wildlife or a source of drinking water. Beyond preservation, such a SEP might involve restoring natural areas that are vital to long-term protection of the environment or public health."). Final SEPs Policy, *supra* note 90, at 24799; Bonorris et al., *supra* note 95, at 204 and n.149;

137. Final SEPs Policy, *supra* note 90, at 24,796-801.

138. Memorandum from John Peter Suarez, Asst. Adm'r, EPA OECA, to Asst. Adm'rs et al., Recommended Ideas for Supplemental Environmental Projects (January 5, 2004) (on file with the author) [hereinafter Suarez, Recommended Ideas for SEPs]. EPA also has developed a more recent document entitled "Project Ideas for Potential Supplemental Environmental Projects" (updated July 2006), *available at* http://www.epa.gov/Compliance/resources/policies/civil/seps/potentialproject-seps0607.pdf. The latter document is a list of possible SEPs that NGOs and government agencies have submitted. EPA includes a disclaimer at the outset that "[i]nclusion of a project [on the list] does not constitute or imply [EPA's] endorsement. . . ." *Id.* EPA also has encouraged its Regional offices to consider development of SEP libraries. U.S. Envtl. Protect. Agency, Interim Guidance for Community Involvement in Supplemental Environmental Projects, 68 Fed. Reg. 35884, 35885 (June 17, 2003) [hereinafter EPA, Community Involvement Guidance].

> banks approved by EPA and the Corps. [139]

Some of EPA's program-specific policies identify possible SEPs projects as well. EPA's Section 404 Penalty Policy, for example, offers the following regarding SEPs:

> SEPs are particularly encouraged in the Section 404 program if the SEP results in protection of a wetland resource or other special aquatic site. For example, purchase and dedicated use of buffer land around a wetland helps ensure the survival of wetland resources, and is an appropriate and valuable SEP, as is upland land acquisition lying in wetland mosaics. In addition, deeding over wetlands in perpetuity for the purpose of conservation promotes program interests and the goals of the Clean Water Act.[140]

In short, EPA's SEPs policies, and some of its program-specific enforcement policies, define permissible (and desirable) SEPs in a way that encompasses projects that will protect, enhance, and restore ecosystems.[141] In at least some circumstances, these projects may focus on ecosystems other than the one that a violator has harmed. In this way, SEPs would seem to have the potential to serve as a helpful compliment to EPA's traditional injunctive relief authority in protecting and restoring ecosystems and the services they provide.

3. SEPs' Penalty Mitigation Potential

The discussion in the preceding two sections highlights the potential value of SEPs as a "beyond compliance" tool that EPA potentially can use to require protection and restoration of ecosystems. A violator may, however, need to spend considerable funds to negotiate a SEP with EPA, to develop and implement the SEP, and to monitor and document its effectiveness. Further, a violator

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139. Suarez, Recommended Ideas for SEPs, *supra* note 138.

140. Memorandum from Sylvia Lowrance, Acting Asst. Adm'r, EPA OECA, to Waters Prot./Mgmt. Div. of Dir. et al., Issuance of Revised CWA Section 404 Settlement Penalty Policy 20 (Dec. 21, 2001), *available at* http://www.epa.gov/compliance/resources/policies/civil/cwa/404pen.pdf. EPA's 404 Policy continues that "restoration of any area of the violation, or any mitigation in the form of injunctive relief to remedy such violations (including mitigation for the temporal loss of wetlands functions and values), does not constitute a SEP." *Id*. at 20.

141. As indicated above, EPA's SEPs policies identify a wide variety of projects that may qualify as SEPs. The 1998 Policy includes as a catchall category "other types of projects" that have environmental merit. Final SEPs Policy, *supra* note 90, at 24800.

may take on new sanctionable commitments in agreeing to perform a SEP. The obvious question is, why would an alleged violator agree to perform such "beyond compliance" work and accept the additional attendant liability risks.[142] This is work the violator is not obligated to do, money it is not obligated to spend, and risks of punishment it is not required to accept.

The intuitive short answer is that EPA's substantial penalty authority gives it significant leverage to negotiate SEPs, since EPA has indicated its willingness to reduce a penalty for a SEP. EPA indicates in the 1998 SEPs Policy that

> Evidence of a violator's commitment and ability to perform a SEP is also a relevant factor for EPA to consider in establishing an appropriate settlement penalty. All else being equal, the final settlement penalty will be lower for a violator who agrees to perform an acceptable SEP compared to the violator who does not agree to perform a SEP.[143]

The 1998 SEPs Policy spells out the extent to which EPA is prepared to reduce a payable penalty in exchange for a commitment to perform a SEP. Ordinarily, a penalty would be the sum of the economic benefit and gravity — in EPA's words, "this sum is the minimum amount that would be necessary to settle the case without a SEP."[144] The SEPs Policy provides that "in settlements in which the defendant/respondent committed to conduct a SEP, the final settlement penalty must equal or exceed either: a) The economic benefit of noncompliance plus 10 percent of the gravity component; or b) 25 percent of the gravity component only; whichever is greater."[145] Thus, the SEPs Policy anticipates that EPA staff may mitigate up to 90% of the gravity component of a penalty in some cases, in exchange for a regulated party's commitment to perform a SEP. This is likely to be attractive to a violator, at least in cases in which the gravity component of a penalty is substantial.

Two examples make this clear. Assume a situation in which EPA would seek a penalty of $500,000, based on the Agency's calculation of a $400,000 economic benefit and a $100,000 gravity component. In this case, a violator would still have to pay a pen-

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142. Another question involves the scope of EPA's authority to encourage and agree to "beyond compliance" projects as a factor EPA will consider when determining an appropriate penalty.

143. Final SEPs Policy, *supra* note 90, at 24797. See *supra* note 98 for other reasons why a regulated party might be interested in performing a SEP.

144. Final SEPs Policy, *supra* note 90, at 24801.

145. *Id.*

alty of $410,000, even if it committed to do a SEP.[146] Next assume a situation in which the figures are reversed: the economic benefit is $100,000 and the gravity is $400,000. Here, a violator conceivably could have its penalty reduced to $140,000.[147] In the latter case, a violator has the ability to significantly reduce its penalty by performing a SEP; SEPs in such cases are likely to hold particular interest.

The SEPs Policy includes a number of other details relevant to deciding how much a SEP should reduce a payable penalty. For example, EPA considers the "quality of the SEP" to determine what percentage of the SEP cost should be applied as mitigation against the amount EPA would settle for, but for the SEP. [148] EPA lists six factors to consider in evaluating the quality of SEPs. Two are particularly relevant to ecosystem services. Indeed, in its description of each factor EPA specifically refers to protection and restoration of ecosystems as reasons to provide maximum penalty reduction in exchange for a regulated party's implementation of a project. First, EPA considers "benefits to the public or environment at large." [149] EPA notes that SEPS will "perform well" on this factor "to the extent they result in significant and . . . measurable progress in protecting and restoring ecosystems (including wetlands and endangered species habitats)."[150] Second, EPA considers "innovativeness." [151] It elaborates on this factor as follows:

> SEPS which perform well on this factor will further the development, implementation, or dissemination of innovative processes, technologies, or methods which more effectively: reduce the generation, release or disposal of pollutants; conserve natural resources; restore and protect ecosystems; protect endangered species; or promote compliance.[152]

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146. The violator would have to pay the entire economic benefit of $400,000, plus ten percent of the gravity component of $100,000, for a total of $410,000.

147. The violator would have to pay the entire economic benefit of $100,000, plus ten percent of the gravity component of $400,000, for a total of $140,000.

148. Final SEPs Policy, *supra* note 90, at 24802. The Policy defines the "SEP cost" to be the "net present after-tax cost of the SEP." The notion of "SEP cost" has been the subject of considerable debate. *See e.g.,* Kristl, *supra* note 96; Dana, *supra* note 96.

149. Final SEPs Policy, *supra* note 90, at 24802.

150. *Id*.

151. *Id*.

152. *Id*. The other four factors that EPA considers in assessing the quality of the SEP and therefore the mitigation percentage the violator should receive, are environmental justice, community input, multimedia impacts, and pollution prevention. *Id*. SEP projects that are of high quality because of the factors discussed in the text presumably will fare even better if any of these other factors exists also.

EPA indicates that the "better the performance of the SEP under each of these factors, the higher the appropriate mitigation percentage." [153]

A second key feature of SEPs' impact on penalty amounts is that, with limited exceptions, the mitigation percentage may not exceed eighty percent of the SEP cost.[154] Some commentators have criticized this limitation on the ground that it makes rational violators less likely to agree to perform SEPs.[155] Even with this limitation, however, the possibility exists for significant penalty reduction in exchange for a SEP in some circumstances.

The bottom line in terms of SEPs' potential for penalty mitigation is that, particularly for substantial penalties that include a significant gravity component, EPA has significant leverage to encourage a regulated party to perform a SEP by offering in exchange a sizeable reduction in that component of the penalty.[156]

4. Additional Implementation and Other Criteria

The SEPs Policy identifies several other key features for acceptable SEPs projects. Two features are likely to be especially useful in terms of SEPs' potential value as learning experiments. As indicated above, there is a lot to learn about ecosystems and the services they provide, and about the efficacy of different approaches in restoring or protecting such ecosystems and services. The Policy encourages efforts to fill this gap. Further, it creates an expectation that defendants will bear the cost of such efforts. The Policy provides that "[t]o the extent feasible, defendant/respondents should be required to quantify the benefits associated with the project and provide EPA with a report setting forth how the benefits were measured or estimated."[157] This feature of a SEPs project gives EPA the ability to encourage a violator to esti-

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153. *Id*.

154. *Id*. In a 2000 memo, EPA's Director of the Office of Regulatory Enforcement reinforced that the mitigation percentage should rarely exceed 80 percent of the SEP cost. Memorandum from Eric V. Schaeffer, Dir., Office of Regulatory Enforcement, to Reg'l Counsels, Appropriate Penalty Mitigation Credit under the SEP Policy (Apr. 14, 2000), *available at* http://www.epa.gov/compliance/resources/policies/civil/seps/seppenmit-mem.pdf.

155. *See e.g*., Kristl, *supra* note 96, at 42 (suggesting that EPA could increase violators' incentives to do SEPs by increasing the extent to which the Agency is prepared to forgive a penalty in exchange for such a project, and recommending that EPA increase its mitigation percentage to one hundred percent of a SEP's cost). Edward Lloyd has concluded that EPA's approach to penalty mitigation is a "rational" one. See Lloyd, *supra* note 93, at 437.

156. EPA encourages its staff to "consider giving more credit to a defendant who agrees to implement a SEP where there has been a commitment to include affected communities into the SEP selection." EPA, Community Involvement Guidance, *supra* note 138, at 35887.

157. Final SEPs Policy, *supra* note 90, at 24803.

mate the benefits the project produces in terms of ecosystems services. To the extent that EPA is able to pursue such analyses in numerous settings throughout the country, involving a wide range of ecosystems and services, this experience is likely to advance learning about the value added from different types of projects in terms of their impacts on the services that ecosystems provide and the value of such services.

Similarly, the Policy requires violators to submit a final report to EPA that documents completion of the SEP and SEP expenditures.[158] Thus, in addition to fostering learning about benefits to ecosystems and the services they provide from different types of projects, SEPs have the potential to foster learning about the costs of such projects. This type of information, too, is likely to be helpful to EPA and others interested in exploring options for protecting, enhancing, and/or restoring ecosystems and the services they provide.

In sum, EPA's SEPs policy reflects EPA's view that it may negotiate enforcement settlements that commit violators to implement projects that protect, enhance, and restore ecosystems and the services they provide. Such projects logically may include projects that: 1) help to diagnose the extent of ecosystem and ecosystem services degradation; 2) identify and implement strategies to protect and/or improve the ecosystem and its services; and 3) monitor the effectiveness of the work done. The fact that EPA can negotiate to have violators bear the responsibility and cost for undertaking this work adds to the potential value of SEPs as a tool to advance understanding and protection of ecosystems and their services in a world of limited government resources.[159]

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158. *Id*.

159. Bonorris et al., *supra* note 95, at 204 (making the same point with respect to state SEP programs, noting that "because regulators often lack resources to pursue cutting edge environmentally beneficial projects, state SEP programs provide a laboratory for innovation"). While EPA settlements must be implemented by defendants, Final SEPs Policy at 24,797-98, citizen-negotiated SEPs "are more often carried out by third parties, i.e., entities that are not parties to the litigation." Lloyd, *supra* note 93, at 433. Prof. Lloyd includes several examples of what he characterizes as successful use of SEPs in citizen suit settlements. Lloyd, *supra* note 93, at 444-448 (for example, a settlement with the City of New York for CWA violations that its sewage treatment plants committed, which led to creation of a $4 million Long Island Sound and Jamaica Bay Dissolved Oxygen Fund, which is available to support land acquisition projects, habitat restoration, and water quality improvement projects or for studies benefiting Jamaica Bay or Long Island; and creation of the Quinnipiac River Fund, as part of the settlement of a case that NRDC and the Connecticut Fund for the Environment brought against Upjohn. Upjohn agreed to make payments totaling $1,800,000 and the settlement provided that the money would be used to improve the environmental quality of the Quinnipiac River and New Haven Harbor, the watersheds of these waterbodies, and otherwise to benefit the environment of these resources. The illustrative, but not exclusive, listing of acceptable environmental projects provided in the settlement reads as follows: 1. studying the ecology of those waterbodies; 2. studying pollution of those

C. Challenges and Possible Opportunities

The preceding discussion is intended to suggest that SEPs have substantial promise as an enforcement tool to protect ecosystems and the services they provide, and that those interested in advancing such protection would be well-served by learning more about this tool and exploring its greater use.[160]

The intriguing question about SEPs with which I end this section is whether there are ways to enhance the value of SEPs for this purpose — are there steps EPA can take, for example, that are likely to increase the number of SEPs that protect ecosystems and the services they provide, or that increase the value such SEPs provide. As noted above, the *Annual Results* data reflects that, despite EPA's rhetorical support for SEPs, the track record over the past five years reflects stable (at best) use of SEPs since 2001, rather than increasing use.[161] EPA's own high-ranking enforcement officials have touted the promise of SEPs to move well beyond this level.[162]

There are some likely inherent limits in the use of SEPs. These include the additional transaction costs that regulated parties and the Agency each need to invest to negotiate a SEP. In some cases these are undoubtedly significant. Thus, unless the potential penalty is significant, it may not be worth the transaction costs to pursue a SEP. Further, there are likely cases in which the regulated parties desire finality by concluding an enforcement matter, rather than agreeing to continuing obligations.[163]

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waterbodies; 3. researching methods of reducing pollution or otherwise improving the environmental health of those waterbodies; habitat restoration).

160. Again, I am not suggesting that SEPs are necessarily the most desirable way to advance such goals (*see, for example*, Dana, *supra* note 96), or that their use does not raise concerns. *See e.g.,* Greve, *supra* note 97.

161. In his recent article, Kenneth Kristl claims to have made the first effort to analyze SEPs data from 1992-2005, and concludes that less than thirteen percent of settlements annually in cases involving penalties during this period included SEPs, and that this percentage has been "steadily declining" since the mid-1990s. Kristl, *supra* note 96, at 2. Kristl's data, which provide numbers of SEPs finalized rather than dollar value of SEPs negotiated, appear to show a highwater mark of 348 SEPs finalized in 1995. Beginning in 1998, the SEP numbers he reports are: 1) 1998: 221; 2) 1999: 197; 3) 2000: 193; 4) 2001: 164; 5) 2002: 157; 6) 2003: 150; 7) 2004: 213; and 8) 2005: 207. Kristl, *supra* note 96, at 22-23. For a review of Kristl's methodology, see Kristl, *supra* note 96. EPA itself has suggested that there is a "tremendous opportunity" to increase negotiation of SEPs. Suarez, Expanding Use, *supra* note 103, at 1. Because SEPs are limited to enforcement settlements, it is important to consider the numbers of SEPs negotiated in the context of the number of settlements finalized each year.

162. Suarez, Expanding Use, *supra* note 103.

163. Telephone Interview with Beth Cavalier and Melissa Raack, EPA SEPs Coordinators, in Washington, D.C. (July 10, 2006). EPA's 1998 SEPs Policy indicates that EPA will hold a violator liable for not completing a SEP satisfactorily and may impose additional

Nevertheless, it seems worthwhile to explore whether there are strategies that might operate to increase the use of SEPs given their apparent promise. I offer below four possible approaches to increase the use of SEPs, assuming this is the policy direction of choice. None of these is intended to be a panacea — challenges will remain, and there are policy reasons not to pursue some of these approaches, in addition to reasons to consider them.

1. *Revamping the process for proposing and approving SEPs, and the substantive criteria for doing so*. One obvious place to look for possible opportunities for EPA to improve upon its SEPs performance is at the processes the agency uses to review and approve SEPs, and at the substantive criteria it applies in doing so. The current process does not appear seamless, in a number of respects.

One question is whether there are steps EPA can take that would streamline or expedite the process for identifying SEPs and then reaching agreement with a regulated party on an appropriate SEP for a particular case. EPA's policies place EPA staff in a reactive position with respect to SEPs. EPA may react to a regulated party's proposal to include a particular SEP in an enforcement settlement, but EPA staff may not propose a SEP themselves.[164] This approach would seem to create the potential for a "we'll know it when we see it" scenario, a structure unlikely to inspire violators to pursue creative possibilities for SEPs.[165] EPA reports that it has made progress in educating regulated parties about the likely parameters for acceptable SEPs, through creation of libraries of SEPs projects and other steps.[166] Close review is needed, however,

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penalties if this occurs. Final SEPs Policy, *supra* note 90, at 24802. Further, a violator may not transfer this liability to the contractor or consultant that it retains to help it to implement a SEP, if it does so. *Id*. Interestingly, the Final SEPs Policy also provides that a violator should pay stipulated damages if it completes the SEP for less money than estimated. Specifically, if the SEP costs less than ninety percent of the estimated cost, the violator must pay between ten and twenty-five percent of the original mitigation awarded percent. *Id*. at 24,803.

164. EPA currently expects a violator to propose a particular SEP, rather than do so itself. Bonorris et al., *supra* note 95, at 213; Kristl, *supra* note 96, at 40; U.S. Environmental Protection Agency, Interim Revised EPA Supplemental Environmental Projects Policy, 60 Fed. Reg. 24858 (May 10, 1995). Some states follow this approach while others do not. Bonorris et al., *supra* note 95, at n.209 & 210. EPA officials informed me that EPA may provide suggestions for a SEP if a violator asks. In addition, as noted above, EPA's website includes a list of potential projects, and EPA staff often direct alleged violators to that website. EPA may also encourage an alleged violator to reach out to community groups, who may have ideas for projects that could be considered as a SEP. E-mail from Beth Cavalier, *supra* note 104.

165. Separation of powers concerns have motivated some governments to follow this approach. The concern is that the administrator otherwise might implement "her own programmatic agenda under the guise of environmental enforcement." *See* Bonorris et al., *supra* note 95, at 213.

166. *See e.g*., EPA, Community Involvement Guidance, *supra* note 138, at 35,887; Bonorris et al., *supra* note 95, at 213, 214 (regarding state initiatives of this sort and identifying

of the effectiveness of these initial steps, and of the opportunity to improve upon these actions by doing more to inform regulated parties of the types of SEPs that would be acceptable in particular instances. Further, it would be worthwhile to explore the extent to which putting EPA staff in a reactive position, rather than allowing them to identify SEPs they believe would be particularly useful, dampens EPA staffs', and regulated parties', enthusiasm for SEPs.[167]

A second issue, which concerns both process and substance, involves the extent to which EPA Headquarters has sent its staff a "mixed message" in terms of the enthusiasm they should have in pursuing SEPs. Perhaps somewhat paradoxically, in addition to its expressions of encouragement to Regional staff to pursue SEPs, EPA Headquarters also has issued a variety of memoranda that would seem to have the opposite effect. In particular, EPA has sent out what Regional staff would likely consider to be mixed signals by: 1) cautioning Regional staff that they should consult with Headquarters personnel before approving a SEP if there is any question concerning nexus; and 2) warning staff that they face dismissal and sanctions if they approve a SEP inappropriately.[168] The practical consequence of this direction, given the apparent considerable confusion that exists about the definition of nexus, [169]

Delaware, Maine, and Illinois as having created SEP libraries); Suarez, Expanding Use, *supra* note 103, at 1 (discussing the "piloting [of] a SEP library which will serve as a clearinghouse for possible SEPs.").

167. There are procedural justice as well as distributive justice issues associated with the identification, review, and approval of SEPs, and one question is whether the current process is structured appropriately in terms of each of these sets of issues. See David L. Markell, *Understanding Citizen Perspective on Government Decision Making Processes as a Way to Improve the Administrative State*, 36 ENVTL. L. 651 (2006) for a review of procedural and distributive justice.

168. Smith, Importance of the Nexus, *supra* note 123, at 2 (citing 31 U.S.C. § 3302(d)). The opening sentence provides that "[t]he purpose of this memo is to emphasize the importance of nexus in evaluating proposed [SEPs]" and it indicates that nexus is importance to "avoid[ ] problems related to the Miscellaneous Receipts Act (MRA)." *Id*. at 1. EPA indicates that the MRA requires that an EPA "official that receives money for the Government from any source shall deposit the money in the Treasury . . . ." *Id.* at 2 (citing 31 U.S.C. § 3302(b)). The memorandum also notes that penalties for violating the MRA include removal from office and personal liability for the amount of money misappropriated. *Id.* (citing 31 U.S.C. § 3302(d)). Professor Kristl takes the position that "elimination or substantial relaxation of the nexus requirement would create significant opportunities for increasing SEP utilization." Kristl, *supra* note 96, at 3. In Kristl's view, the EPA/DOJ fixation on nexus as a way to minimize EPA's problematic legal authority to negotiate SEPs is misplaced; he argues that the "nexus requirement" is "not legally justified." *Id*. at 3, 24.

169. EPA Headquarters noted in memos in 2002 and 2003 that there was considerable confusion about the definition of nexus. In a 2003 memo EPA indicated that

> several Regional and Headquarters offices raised questions about the complexity of the existing SEP Policy. Specifically, we heard a number of questions concerning how to define an appropriate nexus in certain situations, and whether or not nexus can be waived in particular cir-

is that Regional staff are likely to favor consultations in a substantial number of cases where SEPs might be in play.

EPA includes a list of "action items" in its June 2003 SEPs Guidance that identify steps the Agency committed to take to effect improvements in the SEPs policy. The Agency, while reaffirming that nexus is "important to ensure compliance with the MRA and . . . cannot be waived," also indicated that EPA believed that "there may be ways to simplify nexus, and still ensure that there remains a connection between the underlying violation and the SEP."[170] While the Agency indicated in 2003 that it was "launching an effort to simplify the SEP Policy,"[171] in a recent article Professor Kenneth Kristl refers to EPA's current guidance on nexus as "a kind of 'we know it when we see it' platitude."[172] He indicates that, while "as of 2003, the agency knew that the nexus issue continued to create internal issues and that further clarification was necessary-though so far it has not issued such a clarification."[173] Professor Kristl continues: "In lieu of providing guidance on how to deal with such circumstances [when nexus is not clear], the memorandum in effect takes the decision out of the hands of enforcement personnel and puts it squarely within USEPA headquarters."[174]

> cumstances . . . . Given this . . . we believe that there may be ways to simplify nexus. . . ."

Suarez, Expanding Use, *supra* note 103, at 3. A 2002 EPA Memorandum similarly reflected EPA Headquarters' awareness that the nexus requirement was a source of confusion for staff with the front lines capacity to negotiate SEPs, noting that Headquarters "continues to receive many inquiries from enforcement staff regarding nexus in reviewing proposed SEPs." Smith, Importance of the Nexus, *supra* note 123, at 1.

170. *Id*. at 3.

171. Suarez, Expanding Use, *supra* note 103, at 2.

172. Kristl, *supra* note 96, at 240.

173. *Id*. at 245.

174. *Id*. at 241. I reviewed the entire list of SEPs Memoranda, Policies, and Guidance to try to determine the approval process EPA uses. The only documents that I found that are relevant are the April 1998 Final SEPs Policy itself, and a July 21, 1998 Memorandum from Eric Schaeffer, then Director of EPA's Office of Regulatory Enforcement, entitled Revised Approval Procedures for Supplemental Environmental Projects (July 21, 1998). The July 21, 1998 memorandum indicates that SEPs that do not meet all of the legal guidelines "may require Assistant Administrator approval" and will require a legal analysis from the relevant staff explaining why the project is within EPA's legal authority. Further, all projects that "may not fully comply" with the SEPs Policy "must be approved" by the OECA Assistant Administrator. For "other" projects, the appropriate OECA official has approval authority, with consultation by the Special Litigation and Projects Division, unless otherwise delegated. Otherwise, per the April 1998 Policy, "the authority of a government official to approve a SEP is included in the official's authority to settle an enforcement case and thus, subject to the exceptions set forth here, no special approvals are required." April 1998 Final SEPs Policy, *supra* note 90, at 20 (section J). EPA officials advised me that the majority of SEPs do not need Headquarters approval. They indicated that only two categories of SEPs need approval from the media-specific enforcement division director in Headquarters: Compliance Promotion SEPs and Other SEPs and this is usually done quickly, and is not a burdensome process. In addition, a settlement may need approval from the AA for OECA if

His pessimistic conclusion is that EPA's more recent memoranda on SEPs "likely result[ ] in eliminating nexus as a useful policy concept that can guide Agency staff or defendants seeking to conduct SEPs because it is difficult to tell just what is needed to satisfy the nexus requirement."[175]

Headquarters' cautionary notes to the Regions about SEPs seem to be worth investigating further for their possible impact on regional interest in negotiating SEPs. These memos raise a conventional "efficacy of delegation" issue.[176] Part of the answer to this question lies in the empirical data, which has not been compiled to my knowledge — questions concerning the number of cases in which the Regions have negotiated SEPs without Headquarters input compared to the number of cases in which the Regions sought such input; the level of effort required to solicit and obtain Headquarters "sign-off" on SEPs projects (e.g., the number of people to be contacted and the number of approvals required, the level of effort needed to initiate and complete such contacts, the amount and length of time it took to pursue this consultation process, etc.); and the results of consultations with Headquarters (e.g., the number of cases in which SEPs were ultimately negotiated, the number of situations in which SEPs were significantly modified, the number of cases in which SEPs fell through, etc.). Intuitively, it would seem that the greater the transaction costs associated with obtaining "sign-off" or pursuing other consultations, and the less likely the consultations are to pay dividends, the less likely a regional official would be to bother. Thus, it seemingly would be worthwhile to try to assess the costs these signals engendered and, if the costs appear to be significant, it would seem to be worthwhile to consider alternative delegation structures that might yield a more effective balancing of concerns about possible Regional missteps with the desire to encourage the Regions to pursue SEPs.

Professor Kristl's conclusion appears to be that, conceptually, it is logical to assume that EPA's cautionary notes have led EPA officials to play it safe and not be overly ambitious in pursuing possible SEPs:

> Without clear guidance on what nexus really is, Agency personnel and defendants are likely to 'play it safe' and choose projects that have been approved

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the minimum penalty requirement is not met; again, this is not usually a lengthy process. E-mail from Beth Cavalier, *supra* note 104.

175. Kristl, *supra* note 96, at 19 (referring to Smith, Importance of the Nexus, *supra* note 123).

176. *See* Markell, *Slack*, *supra* note 26, at 21.

> before or simply avoid SEPs altogether instead of exploring new ways of utilizing SEPs that might in fact be at the outer limits of nexus. [177]

His further view is that the empirical data on SEPs support this perspective. These data show a "steady decline" in the actual number of SEPs and in "annual SEP utilization rates" after 1995, which is when EPA issued an earlier version of its SEPs Policy that included an "emphasis on nexus and lowered the mitigation percentage ceiling from 100% to 80%."[178] He contends that these data "strongly suggest that a link between these policy changes and the SEP utilization declines is more than simply coincidental."[179]

EPA officials from whom I sought input offered a different perspective:

> It is not accurate to look at the numbers of SEPs without also considering the number of enforcement cases concluded each year, as SEPs cannot occur in the absence of an enforcement action. The number of enforcement actions concluded each year varies. The percentage of settlements each year that include a SEP has remained constant at approximately 9-10% over the past several years. The data does not support the conclusion that there has been a decline in the inclusion of SEPs in settlements.[180]

In either case—a decline in SEPs as Kristl suggests, or a relatively stable level of use, as EPA contends—the type of data-gathering effort I suggest above might yield insights about why SEPs use has not increased, despite Headquarters encouragement

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177. Kristl, *supra* note 96, at 19.

178. *Id*. at 23-24.

179. *Id*. at 24. Kristl suggests that relaxing or eliminating nexus requirements would enable EPA to approve a wider variety of SEP projects. He suggests that the nexus requirement creates limits on aggregation of SEPs based on factors such as geography and time that, if relaxed, would create a "more hospitable environment for SEPs and the benefits they can produce. . . ." *Id*. at 36. The Hastings Report, in contrast, concluded that legal doctrine supports a nexus requirement and recommends that states include a variant of nexus in their policies. Bonorris et al., *supra* note 95, at 188. The Hastings Report also indicates that: "Most state environmental protection agencies find themselves in the same position as EPA, fashioning settlements not expressly authorized by their legislatures. PLRI has uncovered no state court case finding that a state environmental agency overstepped its statutory authority in implementing SEPs." *Id.* at 195. The Hastings Report also indicates that "PLRI research indicates that no court has ever invalidated an EPA-approved settlement with a SEP." *Id*. at 196.

180. E-mail from Beth Cavalier, *supra* note 104.

to negotiate SEPs and outsider predictions that such increases were likely to occur.

One fix to at least some of these issues that would likely increase SEPs use significantly would be for Congress specifically to empower EPA to negotiate SEPs. EPA has developed many of the administrative constraints it has created for SEPs because of concerns about the agency's legal authority to pursue SEPs.[181] Clear Congressional endorsement for SEPs would alleviate these concerns and, depending on Congress's direction, might be a significant inducement for more aggressive agency pursuit of such projects. [182]

2. *Revising the incentives for regulated parties to agree to conduct SEPs*. One way to increase regulated parties' incentives to pursue SEPs is for EPA to increase the financial benefit violators reap by doing so. One possibility in this arena is for EPA to reduce penalties by one hundred percent of the cost of the SEP project, rather than limit the reduction to eighty percent of the project's cost, as is currently the case.[183] In other words, rather than give a violator at most a $0.80 reduction in penalty for a $1.00 SEP, EPA should give the violator a full $1.00 reduction. Professor Kristl, urging such a change in his recent article, criticizes the "clear 'second rate' status that dollars spent on SEPs suffer" under EPA's SEP policies.[184] He argues that this eighty percent limitation in mitigation is "neither legally nor economically justified," and that "allowing dollar-for-dollar penalty reductions would create significant opportunities for increasing SEP utilization."[185] Kristl contends that raising the mitigation percentage to one hundred percent (and abolishing nexus, as discussed above) are "simple, legally justifiable steps that will unshackle SEPs and allow the maximum environmental benefits possible."[186] To date, EPA has concluded

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181. Kristl, *supra* note 96, at 25-26.

182. Commentators have suggested that only the CAA specifically provides for SEPs. Kristl, *supra* note 96, at 25 (citing 42 U.S.C. § 7604(g)(2) which allows a court to order that civil penalties be used in beneficial mitigation projects rather than be deposited in the U.S. Treasury). *See also* Nicholas Targ et al., *The Possibility of SEP Legislation and Lessons from the Fifty States*, TRENDS (ABA-SEER), July/August 2007, at 4.

183. EPA considers the after-tax cost of the SEP in order to prevent a violator from benefiting twice. As a result, the defendant should not get economic value for doing a SEP that should raise the value of a SEP dollar. Kristl, *supra* note 96, at 37. *See also*, Final SEPs Policy, *supra* note 90, at 24801. Other possible reasons to discount SEP dollars include: 1) the possibility that a violator reaps a public relations benefit from a SEP; and 2) SEPs have less deterrent effect than penalties. Kristl, *supra* note 96, at 37-38.

184. Kristl, *supra* note 96, at 36.

185. *Id*. at 3-4.

186. *Id.* at 4. As Kristl indicates, EPA's 1991 SEP Policy allowed a penalty reduction as high as one hundred percent of a SEP's value. *Id*.

that such a change may increase concerns about the MRA.[187] Unless the government revisits this issue and reaches a different conclusion, a legislative fix might be needed to effect this change in approach.

3. Revising EPA's measures for evaluating enforcement performance to create greater incentives for Regional Staff to encourage SEPs. Other changes that might be effective in encouraging SEPs go beyond the world of SEPs. One such change involves the measures EPA uses to evaluate enforcement performance. EPA traditionally has used "output" measures as one indicator of enforcement performance — e.g., the number of inspections conducted each year, or the number of cases brought in a particular year. To the extent that EPA staff are evaluated based on these sorts of "beans," or activity measures, such measures seem to have the potential to create disincentives for staff to pursue time-consuming projects, including SEPs. This is not necessarily the case, of course. An appropriately calibrated weighting system might give a Regional official or office more credit for a time-consuming project (like a SEP) than for a less time-consuming one (such as a "simple" penalty case). The question is whether current measures, and the weight attached to them, may create management-based disincentives to undertake particularly environmentally valuable work, including negotiating SEPs that yield especially useful results. Research into EPA's current performance measures would be helpful in determining the extent to which performance measures serve to discourage (or encourage) EPA staff to pursue SEPs.

4. *Expanding EPA's administrative enforcement authority*. A final set of possible actions that might encourage SEPs would involve an expansion of EPA's administrative enforcement authority. EPA's SEPs Coordinators indicate that most SEPs are negotiated in the context of administrative rather than judicial settlements.[188] On the one hand, this is not surprising since EPA brings many more administrative than judicial cases.[189] Further, steering a proposed SEP through multiple agency bureaucracies may well entail increased transaction costs.[190]

On the other hand, because some of EPA's statutes allow for more limited penalties in the administrative setting than in judi-

187. E-Mail from Beth Cavalier, *supra* note 104.

188. Telephone Interview with Beth Cavalier and Melissa Raack, *supra* note 163.

189. U.S. ENVTL. PROT. AGENCY, OFFICE OF THE CHIEF FIN. OFFICER, FY 2005 PERFORMANCE AND ACCOUNTABILITY REPORT (2005) *available at* http://www.epa.gov/ocfo/finstatement/2005par/par05.pdf.

190. EPA and DOJ both typically would need to sign-off on a judicial settlement, while only EPA would typically sign-off on an administrative settlement.

cial enforcement,[191] there are a variety of reasons why one might expect SEPs to be particularly promising in cases that EPA currently lacks jurisdiction to settle. Judicial cases are likely to be the more significant cases that warrant higher penalties, and therefore are more likely to involve environmental harm. Further, the higher penalties available in judicial cases seemingly would give EPA more leverage to reduce penalties in exchange for performance of a SEP.

One option is for Congress to increase EPA's administrative penalty authorities. Congress has made legislative changes of this sort (increasing penalty authorities, including administrative penalties) as it has amended the major regulatory statutes over the past twenty years. Congress initially did not provide administrative penalty authority in the Clean Water and Clean Air Acts, for example.[192] It only created such authorities in later iterations of these laws.[193] For the Clean Air Act, Congress first established administrative penalty authority in its 1990 Amendments to that Act.[194] One option is for Congress to adopt in the Clean Air and Clean Water Acts its RCRA model, by eliminating the artificial limits it has included in the former two statutes on administrative penalties vis-à-vis civil penalties.[195]

VI. CONCLUSIONS

Ecosystems provide enormously important services to our species, in addition to the non-anthropomorphic benefits they produce.[196] Yet, many knowledgeable scholars have complained that we have failed to design systems of governance that recognize this reality or devote sufficient attention to understanding or protecting the services ecosystems provide. The consequence is that we

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191. The CWA and CAA each provides for higher penalties in judicial civil cases than in administrative civil cases. CWA §§ 309(d), (g) (2006); CAA §§ 113(b), (d) (2006).

192. Michael Herz & Neal Devins, *The Consequences of DOJ Control of Litigation on Agencies' Programs*, 52 ADMIN. L. REV. 1345, 1368-69 (2000).

193. CWA § 309(g) (2006); CAA § 113(d) (2006).

194. CAA § 113(d)(1), 42 U.S.C. § 7413(d)(1) (2000); Christopher M. Wynn, *Facing a Hobson's Choice? The Constitutionality of the EPA's Administrative Compliance Order Enforcement Scheme under the Clean Air Act*, 62 WASH. & LEE L. REV. 1879, 1892-93 (2005).

195. For discussions of the appropriateness of judicial and administrative penalties, see David L. Markell, *"Reinventing Government": A Conceptual Framework for Evaluating the Proposed Superfund Reform Act of 1994's Approach to Intergovernmental Relations*, 24 ENVTL. L. 1055 (1994); Herz & Devins, *supra note* 192, at 1368-69.

196. Ecosystems and other parts of our natural environment have value in ways other than the services they provide to humans. Thus, a focus solely on such services risks under-valuing these natural resources and poses a challenge for those interested in preserving such resources for other reasons. The question of how best to approach this challenge is a critical one, but it is beyond the scope of this article.

under-value these services quite substantially and, as a result, we squander them in various ways.

In the world of ecosystems and the services they provide, ignorance is unlikely to be bliss. Instead, it is a recipe for ill-informed market-place decisions and for ill-informed policy choices that lead to under-protection of our natural environment. There are numerous strategies for learning more about the threats that human activity poses to ecosystems and their services and for enhancing protection of such systems and restoration of systems that have sustained harm. Market-based approaches offer considerable promise,[197] as do new or refined regulatory regimes. In this effort to consider these questions in the context of regulatory enforcement, my tentative conclusion is that, at both the conceptual level and in the real world, enforcement has promise to serve as an effective tool to help us improve our understanding of ecosystems and the services they provide, and to aid in protecting and restoring such ecosystems and services. In addition to suggesting some possible regulatory fixes myself to advance the goal of more effective protection of ecosystems and the services they provide, this article is intended to serve as a challenge to regulatory aficionados and experts in various types of ecosystems to consider how best to structure and use these enforcement tools (and compliance promotion more generally) to achieve this important public policy objective.

197. *See, e.g.,* Salzman, *supra* notes 3,6,11; PAUL A. U. ALI & KANAKO YANO, ECO-FINANCE: THE LEGAL DESIGN AND REGULATION OF MARKET-BASED ENVIRONMENTAL INSTRUMENTS (2004).

ECOSYSTEM SUBSIDIES OF FOSSIL FUELS

DAVID R. HODAS*

I. INTRODUCTION

Of all the services ecosystems provide, the service of collecting, concentrating, and storing solar energy is most central to the human story. Not only do ecosystems collect and store solar energy in biomass, but the world's ecosystems transform biomass into fossil fuels such as coal, petroleum, and natural gas.[1] These fossil fuels "are energy from the Sun, stored within the earth."[2] In the process of doing that, the world's ecosystems produced an oxygen rich atmosphere and enveloped the globe in a blanket of greenhouse gases that warm the earth to a level temperate enough to support life as we know it. Yet the value of these ecosystem services is ignored by our legal and economic regimes. By taking these services for granted the law allows the market to value the earth's fossil fuel manufacturing services at $0.00. We treat oil, coal, and natural gas fossil fuels and our chlorophyll-based biota as glorious, inexhaustible, unconditional gifts.

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1. Coal, petroleum, and natural gas (methane or CH4) are commonly referred to as fossil fuels because they are made by the same geologic process as fossils — sedimentary pressure over millions of years. Ecosystems collect solar energy and convert that energy into plant and animal life. Over tens or hundreds of millions of years the dead plant and animals accumulated by the ecosystems become part of the sedimentary process. In the case of fossil fuels, the ancient plant and animal material is "cooked" by the heat from the sedimentary pressure. The particular fossil fuel made depends on the biologic input, the temperature at which it is cooked, and the kind of pot (geologic formation) it is cooked in. Methane, although located in large underground deposits generally associated with oil and coal, can also be naturally created over short time frames by bacteria acting on organic material such as garbage in dumps, bacteria in the stomachs of ruminants such as cows, and other anaerobic decomposition of organic matter such as in rice paddies, swamps, and even mulch piles. However, the gigantic underground pools of natural gas we exploit were created over millions of years in geologic formations that trapped the methane. DAVID GOODSTEIN, OUT OF GAS: THE END OF THE AGE OF OIL 23—24, 32—33 (2004).

2. *Id*. at 24.

Even the emerging field of ecosystems services science, policy, and law does not address it. Although "[*e*]*cosystem services* are the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life,"[3] the leading scholarship in the field does not include energy in its list of critical ecosystem services. Daily's list of thirteen ecosystem services necessary to support life, and which we ordinarily take for granted, is lengthy, but does not mention energy,[4] even though energy supports all of them. Other than a brief acknowledgement that ecosystem services are "driven by solar energy,"[5] Daily takes energy for granted.

A survey by leading scientists of the history of the idea of ecosystem services contains but one oblique mention of energy: "[a]n energy-based approach to ecosystems studies" (emergy or embedded energy concepts of ecology) in "Odum's classic textbook in 1953."[6] According to Mooney and Ehrlich, by no later than 1981 the name of the field as "ecosystem services" was established and the list of nature's services that comprised the field was complete[7]:

- Pest Control
- Insect Pollination
- Fisheries
- Climate Regulation
- Soil Retention
- Flood Control
- Soil Formation
- Cycling of Matter
- Composition of the Atmosphere
- Maintenance of Soil Fertility
- Maintenance of a Genetic Library

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3. *See, e.g.,* Gretchen C. Daily, *Introduction: What are Ecosystem Services?, in* NATURE'S SERVICES: SOCIETAL DEPENDENCE ON NATURAL ECOSYSTEMS 3 (Gretchen C. Daily ed., 1997).

4. *Id.* at 3-4. The list is comprised of (1) purification of air and water, (2) mitigation of floods and droughts, (3) detoxification and decomposition of wastes, (4) generation and renewal of soil and soil fertility, (5) pollination of crops and natural vegetation, (6) control of the vast majority of potential agricultural pests, (7) dispersal of seeds and translocation of nutrients, (8) maintenance of biodiversity, from which humanity has derived key elements of its agricultural, medicinal, and industrial enterprise, (9) protection from the sun's harmful ultraviolet rays, (10) partial stabilization of the climate, (11) moderation of temperature extremes and the force of winds and waves, (12) support of diverse human cultures, and (13) providing aesthetic beauty and intellectual stimulation that lifts the spirit.

5. *Id.*

6. Harold A. Mooney & Paul R. Ehrlich, *Ecosystem Services: A Fragmentary History, in* NATURE'S SERVICES: SOCIETAL DEPENDENCE ON NATURAL ECOSYSTEMS 13 (Gretchen C. Daily ed., 1997).

7. *Id.* at 14—15.

The collection, concentration and storage of solar energy is not on the list.

Similarly, the important, provocative 1997 article by Robert Costanza et al.[8] that presented an estimated monetary value of the earth's ecosystem services contributions to human welfare does not include energy collection and storage services among the seventeen categories of ecosystem services and goods analyzed:

1. Gas regulation — Regulation of atmospheric chemical composition
2. Climate regulation — Regulation of global temperature precipitation, and other biologically mediated climatic processes at global or local levels
3. Disturbance regulation — Capacitance, damping and integrity of ecosystem response to environmental fluctuations
4. Water regulation — Regulation of hydrologic flows
5. Water supply — Storage and retention of water
6. Erosion control and sediment retention — Retention of soil within an ecosystem
7. Soil formation — Soil formation processes
8. Nutrient cycling — Storage, internal cycling, processing and acquisition of nutrients
9. Waste treatment — Recovery of mobile nutrients and removal or breakdown of excess or xenic nutrients and compounds
10. Pollination — Movement of floral gametes
11. Biological control — Trophic-dynamic regulations of populations
12. Refugia — Habitat for resident and transient populations
13. Food production — That portion of gross primary production extractable as food
14. Raw materials — That portion of gross primary production extractable as raw materials
15. Genetic resources — Sources of unique biological materials and products
16. Recreation — Providing opportunities for recreational activities

8. Robert Costanza et al., *The Value of the World's Ecosystem Services and Natural Capital*, 387 NATURE 253, 254 (1997).

17. Cultural — Providing opportunities for non-commercial uses

Fossil fuels are not mentioned as an ecosystem good.

Nor does the legal literature on ecosystem services address ecosystem services that made fossil fuels. Although some 375 law related articles mention "ecosystem services," no article uses "fossil fuels" and "ecosystem services" in the same sentence, only two use the terms in the same paragraph, and only ten use "ecosystem services" and "energy" in the same sentence.[9] Only one article even mentions an analytical link between ecosystem services and fossil fuels. That article, which analyzes the relationship between sustainable development and national security, uses the example of fossil fuel use by the United States as a case study in the security—sustainable development discussion.[10] Even the groundbreaking work in the *Stanford Environmental Law Journal* devoted to ecosystem services only mentions fossil fuels once, and then only in a footnote that places fossil fuels on the non-renewable side of the natural capital ledger.[11]

The most recent major work on ecosystems services is the Millennium Ecosystem Assessment (MEA), a monumental global study of the state of the world's ecosystems. MEA defines *ecosystem services* as "the benefits people obtain from ecosystems . . . includ[ing] provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation, and disease; supporting services such as soil formation and nutrient cycling; and cultural services . . . ."[12] Although fuels are not mentioned in the definition, the study does include a chapter on Timber, Fuel, and Fiber. However, this discussion is limited to biomass fuels (firewood, charcoal, etc.) as the relevant ecosystem services. Fossil fuels are only mentioned as the world's primary source of fuel, which renewable fuels must compete with and replace when "the availability of fossil fuels declines,"[13] and that "[b]urning fossilized biomass (fossil fuels)" releases carbon into the

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9. Westlaw search of TP-ALL database by author on 24 January 2007.

10. Sanford E. Gaines, *Sustainable Development and National Security*, 30 WM. & MARY ENVTL. L. & POL'Y REV. 321, 357 (2006) ("In other words, the United States fully uses not only the ecosystem services of the United States itself but takes an equal amount of the world's ecosystem services from the peoples of other countries.").

11. Geoffrey Heal et al., *Protecting Natural Capital Through Ecosystem Service Districts*, 20 STAN. ENVTL. L.J. 333, 334 n.1 (2001).

12. MILLENNIUM ECOSYSTEM ASSESSMENT, VOL. 1, ECOSYSTEMS AND HUMAN WELL-BEING: CURRENT STATES AND TRENDS: FINDINGS OF THE CONDITION AND TRENDS WORKING GROUP 27 (Rashid Hassan et al. eds., 2005).

13. *Id.* at 260—61.

atmosphere.[14]

To be sure, the adverse effects of burning fossil fuels have significant impact on the ecosystem services. These externalities have been well studied and documented,[15] drive environmental regulation,[16] and are the subject of much ongoing concern.[17] However, except for the brief discussion of biomass in the MEA, the fundamental ecosystem service of providing usable energy to society is missing from ecosystem services literature and discussion. Without understanding this ecosystem service we cannot hope to deeply understand current energy based ecosystem challenges, to knowledgeably analyze and critique current law and policy, or to develop effective, durable solutions. At present we cannot even adequately articulate, or even envision, what the law and policy of energy ecosystem services should be.

As this Article will attempt to show, the current international and national energy laws are fundamentally flawed from an ecosystem service perspective. These flaws underlie some of the most challenging threats ecosystems and human society face. By failing to recognize the enormous public ecosystem services values embedded in fossil fuels, we have not questioned the prevailing national sovereignty—private property legal paradigm that controls the law and policy of fossil energy. These embedded ecosystem services values follow the laws of physics and thermodynamics; the existing legal paradigm does not. In our world, dominated by the intensive use of fossil fuels, we ignore these energy ecosystem services (and the laws of physics) at our grave peril.

Why have we so studiously avoided the energy ecosystem services question? For all of us, the role of fossil fuels is so deeply and finely woven into our lives that we do not see it. We simply take it for granted, until a storm knocks out the power—then all we care about is that the company we send our monthly check to fixes the problem, and fast. All most of us know about electricity is that it comes out of an outlet in the wall and is controlled by an on/off switch. Most of us do not know the basic science of how electricity is generated, the fundamental properties of electricity, or how the electricity in our house or office was made, let alone what energy

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14. *Id.* at 360.

15. *See, e.g.*, RICHARD L. OTTINGER ET AL., ENVIRONMENTAL COSTS OF ELECTRICITY (1990).

16. *See, e.g.*, Clean Air Act regulation of sulfur dioxide emissions from coal-burning electric power plants to mitigate acid precipitation, 42 U.S.C. §§ 7651—7651o (1990), and motor vehicle emissions and fuel standards, 42 U.S.C. §§ 7521—7554 (1990); and the Oil Pollution Act, 33 U.S.C. §§ 2701—2761 (1990).

17. For instance, the ongoing debate over how to address carbon dioxide emissions from the combustion of fossil fuels, the most significant driver of global warming.

source was used to generate it. All we care about is that the electricity is always available, that it is inexpensive, that we don't get electrocuted using it, that a power generating station is not in our backyard, and that working in a coal mine or on an offshore oil rig is hard, dangerous work. For gasoline, diesel fuel, aviation fuel, and heating oil we know that a hose is used to move it from a supply tank to the user's tank, that refineries have something to do with making the fuels, that we do not have one in our backyard, and that spills of oil from tanker ships are bad. All we care about is that the fuel is low-cost and limitlessly available.

Even preeminent ecosystem scholars take energy for granted[18], or perhaps feel so daunted by the prospect of addressing energy ecosystem services, that they give up.[19] It is hard to question a paradigm that allows us to easily use a few gallons of petroleum,[20] which nature spent a hundred million years manufacturing, when those few gallons contain "the energy equivalent of the work a [person] could do in one year."[21]

II. ENERGY AND HUMAN SOCIETY

Beginning with the discovery of fire, the history of the improvement of human welfare is the story of the human ability to harness energy, almost all of which is the product of ecosystem services. At first, all human activity was driven by human muscle, which got its energy from plant and animal food. The beneficial effects of the efficiency gained by exploiting the earth's storehouses energy have been dramatic:

> Simply harnessing oxen, for example, multiplied the power available to a human being by a factor of 10. The invention of the vertical waterwheel increased productivity by another factor of 6; the steam engine increased it by yet another order of magnitude. The

18. *See*, Comm. On Assessing & Valuing the Services of Aquatic & Related Terrestrial Ecosystems, Nat'l Research Council, VALUING ECOSYSTEM SERVICES: TOWARD BETTER ENVIRONMENTAL DECISION-MAKING 17 (2004) (omitting energy from the list of life support functions ecosystems provide).

19. *See, e.g.,* EDITH BROWN WEISS ET AL., INTERNATIONAL ENVIRONMENTAL LAW AND POLICY 758 (2d ed. 2007) ("While technically hydrocarbons are renewable, the time scale of hundreds of thousands of years makes them nonrenewable" in the context of legal regimes for renewable resources. The authors also note that hydrocarbons raise the question of what legal obligations we have towards future generations in our present use of fossil fuels. Readers are referred to the philosophical materials that introduce the book.).

20. We still rate our car and truck engines by horsepower, a subtle reminder of where we would be without petroleum.

21. JOSE GOLDEMBERG ET AL., ENERGY FOR A SUSTAINABLE WORLD 5 (1988).

> use of motor vehicles greatly reduced journey times and expanded human ability to transport goods to markets.
>
> Today the ready availability of plentiful, affordable energy allows many people to enjoy unprecedented comfort, mobility, and productivity. In industrialised countries, people use more than 100 times as much energy, on a per capita basis, as humans did before they learned to exploit the energy potential of fire.[22]

More than ninety-four percent of society's usable energy is derived from ecosystem services; and in countries that do not derive energy from nuclear power, ecosystem services account for one hundred percent of all energy used.[23] Moreover, in our fervor to maximize our use of fossil fuels, we blithely harm a wide range of ecosystems despite the valuable services they provide.

At every step along the path, from locating the energy to using it, the law is blind both to the ecosystem services that made the energy available in a useful, concentrated form, and to the external costs we impose in obtaining and using the energy. Our laws and our market-based system of economics are not consistent with the unbendable laws of thermodynamics—entropy *always* increases when energy is used, or as my grandfather would say, "there is no free lunch." Yet, when it comes to fossil fuel energy, we pretend it is free and inexhaustible, and that disposing of the low value energy after we use it is free. If ever there existed a fundamental market failure, this is it. So, we overuse fossil fuels with reckless abandon. And, why not? It is virtually free, and because the price of using it does not include the ecosystem service of concentrating solar energy into fuel or the human health and environmental costs inflicted by our vast efforts to obtain, transport and use the energy, the rational economic person would be irrational not to exploit such a low priced good.

Unfortunately, we face increasingly compelling evidence that

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22. UNITED NATIONS DEVELOPMENT PROGRAMME, WORLD ENERGY ASSESSMENT: ENERGY AND THE CHALLENGE OF SUSTAINABILITY 3 (Jose Goldemberg et al. eds., 2000) [hereinafter WORLD ENERGY ASSESSMENT).

23. I do not include nuclear power as an ecosystem service because radioactive materials were not produced by ecosystems. Fuel grade uranium is a product of remarkable human ingenuity—a few nations have the technical expertise to concentrate the trace amounts of U235 in U238 into fuel pellets containing fuel grade uranium (about three percent U235). Whether one considers geothermal power to be an ecosystem service depends on whether geologic phenomena such as volcanoes are within the definition of ecosystems. Except for a few special locales, such as Iceland, geothermal energy is so small a portion of the world's energy use that how it is categorized is irrelevant.

the current rate of consumption of fossil fuels—sources of energy derived from natural processes of decay and compression of once living plants and animals—while improving the quality of life, is beginning to significantly change the world's environment. Ironically, the rapid release of CO_2 represents humanity's global attempt to exploit part of the carbon cycle metabolism that created our fossil fuels. However, our experiment accelerates the process about a million fold. The rate at which society consumes fossil fuels far outstrips the time it took for fossil fuels to be created. Over the last century or two, by burning fossil fuels, we have released carbon into the atmosphere that had been slowly removed by nature over tens to hundreds of millions of years.[24] In a little more than a century we have consumed about 1.5 trillion barrels of oil, about half of the total supply of oil.[25]

While the presence of some greenhouse gases in the atmosphere is necessary, the increase in their concentration since the Industrial Revolution is rapidly changing the global climate and the world's ecosystems. The essence of the global warming problem is that the current rate of burning fossil fuels releases enormous quantities of CO_2 into the atmosphere with relative suddenness.[26] Fossil fuel formed when the carbon that the earth removed from the atmosphere over millions of years and stored underground as the remains of ancient plants and animals that had been buried under conditions of enormous pressure over such long periods of time that the carbon comprising their structures was converted into coal, oil, or natural gas.[27] Fossil fuels are renew-

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24. Since 1950, the nations of the world have emitted some 780 billion tons of carbon dioxide; of this amount the U.S. has contributed 212 billion tons and Europe 292 billion tons. WORLD RESOURCES INSTITUTE, UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, CLIMATE AND ATMOSPHERE 2005, *available at* http://earthtrends.wri.org/pdf_library/data_tables/cli1_2005.pdf.

25. GOODSTEIN, *supra* note 1, at 24-30; KENNETH S. DEFFYES, HUBBERT'S PEAK: THE IMPENDING WORLD OIL SHORTAGE (2001).

26. For instance, the United States annually burns about a billion short tons of coal, or about 2030 Tg CO2 Eq., to make electricity, about 2390 Tg CO2 Eq. of petroleum for transportation, heating, and industry, and 1200 Tg CO2 Eq of natural gas. U.S. ENVTL. PROT. AGNCY, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990—2000 2-3—2-4, fig.2-2 (2002). *Tg CO2 Eq*. (teragrams — trillion grams - carbon dioxide equivalent) is the international standard established by the Intergovernmental Panel on Climate Change (IPCC) for reporting fossil fuel use and greenhouse gas emissions. *Id.* at 1—10, 21. *See also,* REVISED 1996 IPCC GUIDELINES FOR NATIONAL GREENHOUSE GAS INVENTORIES (1997).

27. Humans also consume other carbon-based sources of energy, especially wood. Large portions of developing countries rely on wood for fuel, either directly, or after converted into charcoal. In those regions, so much wood is used so inefficiently as fuel that demand for wood far exceeds the rate that forests can be regenerated. However, compared to fossil fuels, forest can be regrown in a relatively short time (decades to a century for forests compared to tens of millions of years for fossil fuels). WORLD ENERGY ASSESSMENT, *supra* note 22, at 65—68, 370.

able solar fuels; it just takes tens or hundreds of millions of years for the used fuels to be replaced.

Today, the world annually burns about 3.4 billion tons of oil, 4.5 billion tons of coal (2.22 billion tons of oil equivalent), natural gas in an amount equivalent to 2.02 billion tons of oil; and wood and other forms of traditional biomass at a rate equivalent to 0.9 billion tons of oil. Taken all together, the burning of these forms of collected, mostly ancient, sources of energy accounts for more than eighty-nine percent of all human energy use[28] and releases about 6.3 ± 0.4 billion tons of carbon dioxide into the atmosphere annually;[29] carbon dioxide "is the dominant human-influenced greenhouse gas" and accounts for about sixty percent of the atmosphere's increased heat trapping over the past 150 years.[30]

Although this consumption of our energy capital (fossil fuels) has allowed the developed world[31] to prosper,[32] securing and burning fossil fuels is not a harmless, cost-free activity.[33] Ecosystems are harmed by oil exploration and drilling, by oil spills associated with the transportation of oil from wellhead to end use, by oil refineries located along ocean and river coastal zones, by coal mining (both surface strip mining and underground), by electricity transmission lines, emissions from coal-fired power plants, coal trains, etc. Some of the pollutants created by burning fossil fuels are in-

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28. *Id.* at 6 tbl.1, 34-35. Large hydro supplies about 2.2%, renewables (wind, geothermal, small hydroelectric dams, photovoltaic, modern biomass, etc) supply about 2.2%, and the remaining major source of energy is from nuclear power plants, which supply about 6.5% of our primary energy consumption.

29. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC), CLIMATE CHANGE 2001: THE SCIENTIFIC BASIS 39 tbl.2 (J.T. Houghton et al. eds., 2001) [hereinafter IPCC, CLIMATE CHANGE 2001].

30. *Id.* at 39.

31.

> [T]raditional electricity, based on central—station generation and a monopoly franchise, has been successful enough to make electricity services such as electric light, electric motive power, and electronics essential to modern industrial society. However, traditional electricity has failed to reach one-third of humanity . . . . Its key technologies — large dams, coal-fired and nuclear power generation, and long high-voltage transmission lines — all face increasingly severe financial and environmental problems.

UNITED NATIONS DEVELOPMENT PROGRAMME (UNDP), ENERGY FOR SUSTAINABLE DEVELOPMENT: A POLICY AGENDA 9 (Thomas B. Johansson & Jose Goldemberg eds., 2002).

32. This consumption of capital is problematic if we do not reinvest the wealth generated by this capital consumption in the development of replacement energy sources for the future. Unfortunately, even complete replacement of the energy capital is impossible because it takes additional energy to organize low value (high entropy) energy into a useful form.

33. Nor is burning wood or charcoal harmless. The indoor pollution from using wood for heating and cooking and the increasing shortage of locally available of wood increases poverty and diminishes public health. WORLD ENERGY ASSESSMENT, *supra* note 22, at 69.

herently harmful and impose external costs on society.[34] Other emissions from fossil fuel combustion, such as carbon dioxide (CO_2), are themselves benign.[35] However, in the atmosphere, CO_2, together with water vapor,[36] methane,[37] nitrous oxide,[38] and other trace gases,[39] have the ability to trap heat in the atmosphere. The

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34. Sulfur in fossil fuels, when burned, is emitted as SO2 (sulfur dioxide), which causes adverse respiratory effects and can be converted into acidic compounds that fall to the earth as acid precipitation. High temperature combustion results in the creation of nitrogen oxides (NOx), which can be noxious in their own right, and when combined with volatile organic compounds, humidity, and sunlight can result in ground level (tropospheric) ozone (O3), the major component of smog, with its adverse health effects. Burning fossil fuels can also release soot and fine particulates, which pose a health risk to people with asthma, and which can carry heavy metals, SO2, mercury, and carcinogens into human lungs. These pollutants also have adverse effects on the health and viability of ecosystems worldwide.

Each of these pollutants has a different mechanism, range, and scale of action. For instance, some pollutants, such as mercury and other heavy metals, are directly toxic and long lasting. Other pollutants, such a tropospheric ozone and acid precipitation, result from the interaction of fossil fuel emissions with other atmospheric influences and chemicals to produce adverse regional effects, which may last only hours, days or months until the emissions or atmospheric conditions abate, but many may be transported in the air for long distances causing damage far from their source of burning. RICHARD L. OTTINGER ET AL., ENVIRONMENTAL COSTS OF ELECTRICITY (1989); WORLD ENERGY ASSESSMENT, *supra* note 22, at 63—85.

35. The carbon cycle and CO2 are central components in the web of life. In very simplistic terms, CO2 is released when we metabolize our food to obtain the energy to live. Green plants use CO2 in photosynthesis to create carbohydrates, cellulose, and other woody or fibrous structures and release oxygen, which animals and plants use to convert food into energy. Some of the carbon is absorbed by the oceans, and some is stored in soil. The remainder, about half of the original emissions, remains in the atmosphere for up to 200 years. The carbon cycle, in its rich complexity, is described in I.C. Prentice et al., *The Carbon Cycle and Atmospheric Carbon Dioxide*, *in* IPCC, CLIMATE CHANGE 2001, *supra* note 29, at 185-213.

36. Water vapor is the largest natural contributor to the greenhouse effect, but the amount of water vapor in the atmosphere is not directly affected by anthropogenic emissions of water vapor. However, human activity can increase atmospheric water vapor concentration indirectly by the emission of other greenhouse gases, such as carbon dioxide that warm the atmosphere, thereby increasing the rate of evaporation; this increased evaporation increases water vapor, which further accelerates global warming. WORLD ENERGY ASSESSMENT, *supra* note 22, at 86.

37. Methane (CH4), the major component of natural gas, is anthropogenically released into the atmosphere from coal mining, leaking natural gas pipelines, ruminant livestock such as cows, rice paddies, and solid waste facilities.

38. Nitrous oxide, N2O, is produced both naturally in soil and water, and by human activity in agriculture, energy, industrial, and waste management activities. According to the U.S. EPA, "agricultural soil management accounted for 70 percent of U.S. N2O emissions" in 2000 and "[f]rom 1990 to 2000, emissions from this source increased by 11 percent as fertilizer consumption, manure production, and crop production rose." U.S. ENVTL. PROT. AGNCY, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2000, ES-20 (2002) [hereinafter GREENHOUSE GAS INVENTORY]. N2O is also produced when fuels are burned at high temperatures, in the manufacture of adipic and nitric acid, and in the context of management of human and animal wastes. N2O accounts for 6.1% of US greenhouse gas emissions. *Id.* at ES-4. Globally, "the atmospheric concentration of nitrous oxide has increased by 16 percent since 1750, from a pre industrial value of about 270 ppb to 314 ppb in 1998, a concentration that has not been exceeded during the last thousand years." *Id.* at 5.

39. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride

greater the concentration of greenhouse gases in the atmosphere, the more heat is trapped, and the warmer the earth becomes.[40]

III. CLIMATE CHANGE THREATS TO ECOSYSTEM SERVICES

The precise breath and depth of potential loss of biodiversity and ecosystem resilience due to global warming remains subject to scientific inquiry. But that global warming is adversely affecting biodiversity is now well recognized. The Convention on Biological Diversity *Ad Hoc Technical Expert Group on Biological Diversity and Climate Change* catalog of ecosystem modifications associated with global warming includes: (1) changes in the timing of periodic biological phenomena (e.g., flowering, breeding, and migration), (2) changes in species distribution, (3) changes in the form and structure (morphology), behavior, and physiology of many birds, plants and insects, (4) enlargement of the range, frequency, and intensity of pests and diseases, (5) altered patterns of precipitation, floods, droughts, water temperature, stream flows, and water quality which will adversely affect "biodiversity and the goods and services ecosystems provide," (6) modifications in the length of growing seasons and alteration of species composition in high northern latitude ecosystems, (7) increased mortality of adult penguins, (8) alterations of weather and temperature sensitive coastal and marine ecosystems such as coral reefs, some fish populations, and Pacific and Arctic marine birds and mammals.[41]

Of course, independent of climate change, biodiversity is already decreasing because of human activity. Ecosystems are already stressed by human population growth, ever more intense land-use patterns and associated ecosystem loss, pollution stresses, and the invasive human spread of exotic species into new ecosystems. Climate change is yet an additional significant pres-

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(SF6). HFCs are non-ozone depleting chemicals that are used as a replacement for stratospheric ozone depleting chemicals known as halocarbons (CFCs, HCFCs, methyl chloroform, carbon tetrachloride, bromine halons, methyl bromine, and hydrobromofluorocarbons) that are regulated under the Montreal Protocol on Substances that Deplete the Stratospheric Ozone Layer and its Amendments. *See* 26 I.L.M. 1550 (1987); UNEP/OzL.Pro.2/3 (Annexes I,II,III) (1990); and Copenhagen Amendment to the Montreal Protocol, 32 I.L.M. 874 (1993). PFCs and SF6 are emitted by aluminum smelting, semiconductor manufacturing, electric power transmission and magnesium casting. Taken together, HFCs, PFCs, and SF6 are trace gases that only contribute a very small portion of global warming; however, these powerful greenhouse gases have extremely long lifetimes in the atmosphere and are being emitted in growing quantities. GREENHOUSE GAS INVENTORY, *supra* note 38 at 5-6.

40. IPCC, CLIMATE CHANGE 2001 *supra* note 29, at 87-90.

41. CONVENTION ON BIOLOGICAL DIVERSITY, SUBSIDIARY BODY ON SCIENTIFIC, TECHNICAL AND TECHNOLOGICAL ADVICE, BIOLOGICAL DIVERSITY AND CLIMATE CHANGE 31-32 (Sep. 30, 2003).

sure on already stressed ecosystems.[42]

The Technical Expert Group predicts that ecosystem services will be lost due to climate change, and with it human welfare will suffer due to global warming driven ocean warming, sea-level rise, and increased frequency in intense storms that will endanger the very existence of some coastal communities and threaten other coastal communities (those not destroyed) with the loss of the benefits of marine biodiversity, fisheries, and shoreline protection. Wetlands (ranging from reefs, atolls, estuaries and mangroves, to prairies, tropical and boreal forests, and polar and alpine ecosystems) are "natural systems especially vulnerable to climate change because of their limited adaptive capacity, and are likely to undergo significant and irreversible change."[43] The panel also expects presently eroding beaches and barriers to erode further as the climate changes and sea level rises.

One could drill down still further to evaluate potential biodiversity impacts by regions. For instance, Africa's important biodiversity will be threatened by climate change.[44] Much of Africa is forest (five million km^2), and trees and shrubs (twelve million km^2). Semi-arid and sub humid woodlands and savannahs are at risk from reduced rainfall (increased fires) and more intense land use due to population pressure. Global warming will adversely affect ecosystem services such as water regulation, carbon sequestration, soil fertility, and habitat formation.

Sub-Saharan Africa contains unique ecosystems whose flora and fauna face risk from climate change. Critical flora biomes include Cape Floral Kingdom, Madagascar, Cameroon, and mountain habitats from Ethiopia to South Africa. Important fauna in danger includes savannah and forest species (ninety percent of the world's antelope and gazelle species are in Africa) and birds, whose habitat and migratory patterns are in danger from climate change. Biodiversity in Africa is an important source of food, fiber, shelter, fuel, medicine, and income from tourism. Climate change will affect the major mammal migrations in east and southern Africa, as well as bird migration. Important heat-sensitive African habitats, such as the mountain habitat that runs from Ethiopia to South Africa at elevations above 2000 meters and the Cameroon mountain habitats will be impaired as temperature increases. The South African Cape floral kingdom, with 7300 species of which about

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42. *Id.* at 33-35.

43. *Id.* at 37.

44. The following summary of African biodiversity impacts is taken from David R. Hodas, *Climate Change and Land Use in Africa, in* LAND USE LAW FOR SUSTAINABLE DEVELOPMENT 45, 54 (Nathalie J. Chalifour et al eds., 2007)

sixty-eight percent only exist there, will be changed by rainfall patterns, warming and the potential appearance of fires due to reduced rain.

IV. THE LEGAL CHALLENGE

From an ecosystems services perspective, the use of fossil fuels represents a profound market failure. Not only are the fossil fuel production services taken as a gift, they also receive significant economic and tax subsidies,[45] but major environmental externalities are not captured in the price. By comparison, the cost of electricity generated by photovoltaic or wind power includes the cost of collecting the solar energy and converting it into electricity. Now that's a tough hurdle to overcome. The challenge for the law is how to minimize the market failure.

V. ENERGY COLLECTION AND CONCENTRATION

The fundamental elements of energy ecosystem services are the collection, concentration and storage of solar energy. In theory, fossil fuels could be renewable resources of energy—if we used the fuels at a rate no faster than the rate at which the earth manufactures replacement fuels. Suppose the earth held about three trillion barrels of petroleum and it takes one million years to make a barrel of oil (actually it takes about one hundred million years). Then we could use three million barrels of oil annually forever. In actuality, we now use almost eighty-four million barrels per day (about thirty billion barrels per year), and have already used about 1.5 trillion barrels since about 1900.[46] At current rates (assuming demand does not rise in developing and developed nations, and that price increases do not reduce demand—silly, but handy assumptions) the last drop of the remaining 1.5 trillion barrels will be used up in about fifty years. In other words, in about 150 years human society will have consumed the supply of petroleum that it took the earth's ecosystems about one hundred million years to make. Additionally, during those 150 years we will have released

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45. *See* Roberta F. Mann, *Waiting to Exhale: Global Warming and Tax Policy*, 51 AM. U.L. REV. 1135 (2002); Roberta F. Mann, *On the Road Again: How Tax Policy Drives Transportation Choice*, 24 VA. TAX REV. 587 (2005); Roberta F. Mann, *Another Day Older and Deeper in Debt: How Tax Incentives Encourage Burning Coal and the Consequences for Global Warming*, 20 GLOBAL BUS. & DEV. L.J. (forthcoming 2007); Doug Koplow & John Dernbach, *Federal Fossil Fuel Subsidies and Greenhouse Gas Emissions: A Case Study of Increasing Transparency for Fiscal Policy*, 26 ANN. REV. ENERGY ENVTL. 361 (2001).

46. *See* Energy Information Administration, Basic Petroleum Statistics, http://www.eia.doe.gov/neic/quickfacts/quickoil.html (lasted visited July 5, 2007).

to the atmosphere the carbon that the earth's ecosystems removed a hundred million years ago, a release that is and will continue to overwhelm the earth's ecosystem service of climate and temperature regulation.

A parallel story could be told for coal, with the major difference being that the supply size varies and our rate of use is lower than oil, so the gift of coal will last at current usage rates for hundreds of years instead of decades. Coal is primarily used today to fire steam generation in electric power plants.[47] It faces serious transportation challenges in that it must be shipped over land by rail, an infrastructure that in the United States is near its limit. Also, mining and burning coal results in very serious adverse environmental and human health effects, running from black lung and other pulmonary diseases, to acid precipitation and global warming, to mining's impact on land and water resources.[48]

What has lead to this situation? Quite simply, the cost of fossil fuels does not include the cost of collecting, concentrating, and storing solar energy into a useable form. In contrast, if one were to harness the potential solar energy in water power, the collection and storage costs must be paid by us up front in the form of a hydroelectric dam. The same is true for wind power (a form of solar energy), photovoltaic and other form of renewable energy. The financial cost of constructing facilities to capture the solar power must be paid for by the developer with funds obtained in a competitive capital market. As a result the cost of these renewable energy facilities, although dropping as technology improves, remains higher than the cost of fossil fuels. This difference is especially wide in the transportation sector, where liquid fuels such a gasoline dominate the market. The cost of storing electric energy in a motor vehicle battery is many magnitudes greater than the cost of the stored solar energy in gasoline. Remember, the cost of energy storage in gasoline is zero, because nature did it. Except for hydroelectric dams, which have their own problems, current forms of renewable energy, such as wind generated electricity, must be used instantaneously.[49] So the cost of fossil fuels, which

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47. *See e.g.* Energy Information Administration, How Coal is Used, http://www.eia.doe.gov/kids/energyfacts/sources/non-renewable/coal.html (last visited July 5, 2007).

48. *See e.g.,* Union of Concerned Scientists, How Coal Works, http://www.ucsusa.org/clean_energy/coalvswind/brief_coal.html (last visited July 5, 2007).

49. New technologies such as plug-in hybrid vehicles which are charged by plugging the car into an electric outlet and have the capability of going about forty miles using the battery alone are promising and may help bridge the electricity storage gap. However, the cost and weight of large lithium ion batteries needed for the new technology to store the energy remains prohibitively expensive, and will require a new generation of battery technology to be viable. *See* JAMES KLIESCH & THERESE LANGER, PLUG-IN HYBRIDS: AN ENVIRONMENTAL AND ECONOMIC PERFORMANCE OUTLOOK T061 (American Council for an Energy

does not include the cost of making the resource, nor the external cost of global warming (except partially in the E.U.) or the external costs of residual pollution after existing environmental laws are met (assuming they are met, and that countries have environmental laws) is broadly subsidized by the earth's ecosystem services. In contrast, wind and other solar power includes the full cost of collecting the energy and has little if any adverse environment effects—essentially all costs of production and use are internalized in these sources of renewable energy. Hence the true cost of energy is reflected in renewable energy, and is far higher than using fossil fuels.

VI. THE NATIONAL SOVEREIGNTY — PRIVATE PROPERTY ENERGY LAW PARADIGM

If fossil fuels are an ecosystem gift, which no person made, who owns (or should own) the product of these ecosystem services? Ownership and control of ecosystem goods and services is a legal problem across the spectrum of this field. With respect to fossil fuels, as natural resources they are owned by the sovereign nation whose land happens to sit above the reserve, and exploitation rights within our neoclassical market system flows to the property owner. A nation may either control and own the resource itself, as in the case of Saudi Arabia and many other nations, or they allocate the rights to private property owners that own the land above the resource. National and state law may permit owners to further rationalize their interests by separating the property into different alienable interests—surface, mineral, etc.[50] In all cases the

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Efficient Economy 2006) (a copy of the report is available for purchase at www.aceee.org).

50. Marla E. Mansfield & James E. Hickey Jr., *Oil*, *in* ENERGY LAW AND POLICY FOR THE 21ST CENTURY 7-7—7-8 (2000)

> Unless otherwise stated, a conveyance of land includes the minerals in the land. A deed, however, may convey minerals separately or by reservation or exception remove them from a grant. When one of these activities has taken place, it is said that the minerals are severed from the surface. Generally, if the minerals are truly severed, then two estates in land are created. One is the surface estate and the other the mineral estate. The owner of a mineral estate has the right to develop the minerals, the right of access and use of the surface for this purpose, and the right to lease the minerals and receive the proceeds of a mineral lease.

Id. The same general doctrine applies to coal, although there is the added question of who owns the right to have the surface supported when the coal is removed. *See* Pa. Coal Co. v. Mahon, 260 U.S. 393 (1922); Keystone Bituminous Coal Ass'n v. DeBenedictis, 480 U.S. 470 (1987) (describing the support estate under Pennsylvania law and the operation of the takings clause under the 14th Amendment to the Constitution with respect to state regulations affecting the support estate). More recently, the question of who owns the coal-bed methane released during mining has been disputed. *See, e.g.*, Carbon County v. Union Reserve Coal

owner, be it governmental or private, has received a gift from the earth and is not charged for the cost of making the fossil fuel.[51] The seller's cost is the cost of getting the resource out of the ground, processing it, and then shipping it to customers. The selling price is a function of this cost and perceived consumer demand. Depending on where the petroleum is located, the cost of getting it out of the ground can be very low.

Once used, the petroleum is gone; it is not a renewable resource. Unlike forests, we cannot plant coal or oil seedlings that will grow into harvestable resources in decades or a century. In contrast, in the timber industry, the original trees may have been a gift of ecosystem services, but the subsequent new growth is paid for by the timber company that plants and grows the replacement trees—in theory, a true "cycle." To be sure, the timber industry may cause serious harm to forest ecosystems, biodiversity, and water ecosystems, and in some regions of the world forests may be cut without any reforestation effort, but, when regulated effectively, forestry can be sustainable.[52]

Well, one could say, are not fossil fuels treated as any other below ground mineral, such as gold, copper or diamonds? Do we also need to question the underlying national sovereignty—private property for these minerals too? No, at least not from an ecosystem services perspective, because hard rock minerals are fundamentally different than fossil fuels. First, the energy in fossil fuels is a central pillar of modern society; without fossil fuels we would be in the horse and ox driven society and economy of the middle ages. Energy is essential for life, gold and diamonds are not (except in jewelry ads). Second, the matter comprising gold and other minerals does not disappear when used; rather it simply is transformed into a different shape. Gold dust is routinely recovered and melted back into gold. Gold is not concentrated energy. However, coal, when burned, disappears, leaving only pure carbon and

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Co., 898 P.2d 690 (Mont. 1995); Amoco Prod. Co. v. S. Ute Indian Tribe, 526 U.S. 865 (1999).

51. Ironically, the oil industry and many oil lawyers refer to the process of getting oil out of the ground as "producing" oil. They also refer to the one-way trip from discovery of oil in the ground to burning it by the consumer as a "fuel cycle." The cycle is not closed by considering the process of capturing the carbon and transforming it back into petroleum. The fact that the circle is broken is not mentioned, nor is the fact that the metaphor is inapt. *See, e.g.*, Mansfield & Hickey, *supra* note 50, at 7-1—7-4 (explaining that the oil and natural gas "fuel cycle" consists of "production . . . comprised of exploration (prospecting), drilling and recovery;" transportation of the "produced" oil or natural gas to a processing facility or refinery for removal of contaminants and refining into various petroleum products; transportation and distribution of the products to the end user; and finally, the use of the product (heating, motor vehicle fuel, electricity generation, feedstock for the organic chemical industry, etc.)).

52. *See* MILLENNIUM ECOSYSTEM ASSESSMENT, *supra* note 12, at 243—55, 585—621 (reviewing the state of forest ecosystems and the problems they face.).

whatever other elements were in the coal, such as sulfur or mercury. The energy in the lump of coal has been released and has dissipated from a low entropy state to one of high entropy. The energy has changed from being concentrated and useable, to a diffuse, disorganized state, radiating out into the universe. Gone forever. To capture that radiating energy and concentrate it back into a useable form of a lump of coal will require using energy—more energy than the replacement lump of coal will contain. To keep going, society must burn more fossil fuel or capture some of the energy sent to us from the sun and organize that energy into a useable form.

This analysis suggests that society has a considerable public stake in the use of the world's fossil fuel resource. This public interest derives from the ecosystem services that created the fossil fuel—ecosystem services which no one owns and which are not reflected in any market signal. Fossil fuels are almost entirely subsidized by ecosystem services. This price subsidy has led to overuse and waste of the resource in the free market, which would not be occurring if the price of the fossil fuels included the cost of its manufacture.[53]

So, if fossil fuels are so critical to human society's well-being, and ephemeral due to the laws of thermodynamics, why are they treated as private goods? Because we have designed our energy laws using a private property model for allocating ownership rights. At the international level, the principle of national sovereignty grants ownership of fossil fuels to the nation within whose territory the resources are located. Each nation then chooses how it wishes to allocate and exploit its resources. The United States uses a modified law of capture private property model established by state laws subject only to state regulation designed to prevent the waste and overdrilling that ruined oil fields when oil reserves resided under more than one owner's property, and every owner was pumping as hard as he or she could.[54] In other countries the

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53. Interestingly, neoclassical economics was elaborated within the scientific paradigm of mid-19th century physics. However when the early 20th century revolution in physics occurred (quantum mechanics, relativity, etc.) neoclassical economics retained its belief and basis in the abandoned paradigms. This "strange marriage between economic theory and mid-19th century physics" assumes that all resources are inexhaustible or replaceable by other resources or technology, and that there are no biophysical limits to the growth of the market system. ROBERT L. NADEAU, THE WEALTH OF NATURE: HOW MAINSTREAM ECONOMICS HAS FAILED THE ENVIRONMENT 8—11 (2003). Needless to say, the laws of thermodynamics and entropy are not matters of concern within the neoclassical economic system.

54. Mansfield & Hickey, *supra* note 50, at 7-9 — 7-13 (explaining at 7-9 — 7-10 that the pure rule of capture "induced mass production that not only lowered the price of the product, but forced expenditures on wells that were not required to drain the reservoir efficiently. Moreover, when the only concern of any particular developer is speedy recovery to

nation retains ownership.[55] Ultimately, however, the paradigm is grounded in the idea of national sovereignty over underground natural resources. This paradigm selects the winners and losers in the fossil fuel game, dominates global geopolitics, shapes the global economy, has led to a world addicted to the benefits of fossil fuel, supports dictatorships across the globe, supports terrorism, causes the United States to maintain the 7th fleet in the Arabian Sea, looms in the background of the Iraq war, and has been a matter over which terrible wars have been fought.[56] All of this, and more, from failing to account for the ecosystem services embedded in fossil fuels.

VII. THE ORIGIN AND LIMITS(?) OF NATIONAL SOVEREIGNTY

The concept of national sovereignty did not exist until the ending of the ferocious[57] and horribly bloody[58] religious conflict between Catholics and Protestants known as the Thirty Years War with the Treaties of Westphalia in 1648, which, for the first time (based on the ideas of Hugo Grotius and Hobbes) "acknowledged the sovereign authority of Europe's individual princes and nations."[59] The idea of a nation state within an international law context was born. Among the elements of sovereignty that have evolved with the doctrine is a nation's control over the development of the natural resources located within the state's territory. This right of national sovereignty is routinely reiterated in inter-

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avoid oil or gas 'capture' by another, reservoir energy is not conserved. Recovery of the maximum amount of the resource is therefore impossible. Because of [this]… physical and economic waste, limitations on the Rule of Capture arose.").

55. Disputes over ownership status of oil can create serious conflicts, such as in Iraq, where the major oil fields are in the north (Kurds) and south (Shiites) but not in central Iraq, where most of the Sunis reside.

56. For a stark exposition of the dangers we face see NATIONAL COMMISSION ON ENERGY POLICY & SECURING AMERICA'S FUTURE ENERGY, OIL SHOCKWAVE: OIL CRISIS EXECUTIVE SIMULATION (2005), *available at* http://www.energycommission.org/files/contentFiles/oil_ shockwave_report_440cc39a643cd.pdf.

57. About twenty percent of Europe's population may have perished as a result of the war. DAVID J. BEDERMAN, INTERNATIONAL LAW FRAMEWORKS 2 (2001), *reprinted in* BURNS H. WESTON ET AL., INTERNATIONAL LAW AND WORLD ORDER 35 (4th ed. 2006).

58. Hugo Grotius' ideas were motivated by disgust with the slaughter in the wars:

> Throughout the Christian world I observed a lack of restraint in relation to war, such as even barbarous races should be ashamed of; I observed that men rush to arms for slight causes, or no cause at all, and that when arms have once been taken up there is no longer any respect for law, divine or human; it is as if, in accordance with a general decree, frenzy had openly been let loose for the committing of all crimes.

MARK W. JANIS, AN INTRODUCTION TO INTERNATIONAL LAW 162 (3d ed. 1999) (quoting from H. Grotius, *De Jure Belli ac Pacis Libri Tres* 20 (Kelsey trans. 1913)).

59. JANIS, *supra* note 58 at 167.

national environmental law treaties. For instance, the United Nations Framework Convention on Climate Change notes in its preamble that "States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies . . . ."[60] The Convention of Biological Diversity explicitly recognizes the sovereign rights of States over their natural resources.[61]

Since the 1960s, many nonbinding United Nations documents have declared a nation's sovereign right to exploit its own natural resources. For instance, in 1962, in response to concerns of nations that had recently emerged from colonial status that their natural resources were being exploited by foreign corporations, the U.N. General Assembly adopted a resolution espousing a concept of permanent sovereignty over natural resources, which acknowledged "the inalienable right of all countries to exercise permanent sovereignty over their natural resources in the interest of their national development . . . ."[62] A few years later, Principle 21 of the 1972 Stockholm Declaration declared that "States have, in accordance with the Charter of the United Nations and the principle of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies . . . ."[63] Twenty years later, Principle 2 of the Declaration signed by the nations of the world at the 1992 United Nations Conference on Environment and Development reaffirmed States' "sovereign right to exploit their own resources."[64]

However, starting with the 1972 Stockholm Declaration, this seemingly absolute right to exploit resources has become conditioned by countervailing obligations and responsibilities. For instance, 1972 Stockholm Principle 21, 1992 Rio Declaration Principle 2, and the U.N. Framework Convention on Climate Change preamble, after declaring the right, continue by subjecting States to "the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction."[65]

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60. United Nations Framework Convention on Climate Change, May 9, 1992, 1771 U.N.T.S. 107.

61. United Nations Convention on Biological Diversity, June 5, 1992, 1760 U.N.T.S. 79, 31 I.L.M.

62. Permanent Sovereignty over Natural Resources, G.A. Res. 1803, U.N. GAOR, at 15, 17th Sess., Supp. No.17, U.N. Doc. A/5217 (Dec. 14, 1962).

63. Stockholm Declaration of the United Nations Conference on the Human Environment, 11 I.L.M. 1416, 1420 (1972) [hereinafter Stockholm Declaration].

64. Rio Declaration on Environment and Development, 31 I.L.M. 874 (1992) [hereinafter Rio Declaration].

65. *Id.* at 877.

Furthermore, in the Stockholm Declaration, it is hard to reconcile Principle 21's sovereignty over resources with the general duty earlier announced in Principle 5 that "[t]he non-renewable resources of the earth must be employed in such a way as to guard against the danger of their future exhaustion and to ensure that benefits from such employment are shared by all mankind."[66] Similarly, the 1992 Rio Declaration follows the sovereign right over resources with the explicit limitation in Principle 3 that "[t]he right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations" and in Principle 8 that "States should reduce and eliminate unsustainable patterns of production and consumption . . . ."[67] Thus national sovereignty over natural resources is not absolute, but is subject to the general duty not to harm other nations, and the duty (which has been enforced in courts)[68] to preserve natural resources for future generations.[69]

National sovereignty may also be subject to the obligation to protect the common heritage of humanity and the need to protect matters of common concern to humanity, such as the atmosphere and biodiversity.[70] For instance, the Climate Change Convention begins by "[*a*]*cknowledging* that change in the Earth's climate and its adverse effects are a common concern of humankind."[71] Similarly, the Convention on Biological Diversity affirms in its preamble "that the conservation of biological diversity is a common concern of humankind," although the following sentence reaffirms that "States have sovereign rights over their own biological resources."[72]

So, as our world gets smaller, and the consequences of our burning fossil fuels becomes greater, it is unclear what national

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66. Stockholm Declaration, *supra* note 63, at 1418.

67. Rio Declaration, *supra* note 64, at 877.

68. *See, e.g.*, Minors Oposa v. Sec'y of the Dep't of the Env't and Natural Res., 33 I.L.M. 173 (1994) (Phil.) (granting standing to some children to sue on their own behalf and on behalf of future generations to bring a case to cancel a timber license and to ban new ones on the grounds the licenses would allow destruction of most of the remaining forests in the Philippines); Waweru v. Republic of Kenya (2006) (Kenya), *as reprinted and discussed in* EDITH BROWN WEISS ET AL., INTERNATIONAL ENVIRONMENTAL LAW AND POLICY 73—74 (2d ed. 2007) ("The High Court of Kenya (the country's second highest court) . . . applied the principle of intergenerational equity to a case of water pollution.").

69. *See* EDITH BROWN WEISS, IN FAIRNESS TO FUTURE GENERATIONS: INTERNATIONAL LAW, COMMON PATRIMONY AND INTERGENERATIONAL EQUITY 26 (1989).

70. *See* Nico Schrijver, *Permanent Sovereignty Over Natural Resources Versus the Common Heritage of Mankind*, *in* INTERNATIONAL LAW AND DEVELOPMENT 87, 95—101 (De Waart et al. eds., 1998), *reprinted in* DAVID HUNTER ET AL., INTERNATIONAL ENVIRONMENTAL LAW AND POLICY 486—489 (3d ed. 2007).

71. United Nations Framework Convention on Climate Change, *supra* note 60, at 851.

72. United Nations Convention on Biological Diversity, *supra* note 61, at 822.

sovereignty over natural resources means, especially with respect to fossil fuels. There is no agreement over energy and sovereignty. Neither the 1992 Rio Declaration nor Agenda 21, the detailed, extensive document outlining a global action plan to achieve sustainable development, mention fossil fuels. Energy issues were too contentious: "Disputes over fuels, especially between oil exporting and importing nations, made it difficult at UNCED to negotiate a comprehensive or meaningful chapter in Agenda 21 regarding energy."[73] In the fifteen years since the Climate Change Convention was signed the world has yet to make much progress in agreeing on how to address the global warming externalities from burning fossil fuels. Nor has any meaningful agreement on sustainable energy emerged from meetings of the Commission on Sustainable Development devoted exclusively to the issue.

Deep inside each of us, we all recognize that the use of fossil fuels is now an issue of such international scope that no nation can honestly say that its use of fossil fuels does not adversely effect nations and people beyond its borders. However, the use of energy is so valuable to each of us, that we do not want to give up unlimited control over that right. Instead, we exploit the ecosystem services embedded in the fuels, keeping all the benefits to ourselves and sharing all the consequences with the rest of the world.

Perhaps we are reaching another paradigm changing moment, as occurred in 1648, when Europe, after decades of war, abandoned the previous legal paradigm of feudalism and church-based rule, for the modern idea of national sovereignty. We may be entering another "Grotian moment," a period of "uncertainty and controversy when one framework of world order is being challenged by an alternative framework."[74] In other words, the time has come for us to value the ecosystem services that manufactured fossil fuels, and to find a legal mechanism to internalize that value into the marketplace, either as a cost on the resource or a countervailing subsidy for renewable energy alternatives that seek to harness solar energy and convert it into a usable form. The task of valuation, design of policy instruments, and development, implementation and enforcement of legal regimes that capture these ecosystem services is too huge to address here. Instead, I will try to be practical, and provide at least a small lesson from past field work that might serve as one model, among many, for how to think

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73. Nicholas A. Robinson, *Implementing Agenda 21 Internationally Through Environmental Law*, *i*n AGENDA 21: EARTH'S ACTION PLAN ANNOTATED xxxiv (Nicholas Robinson ed., 1993).

74. BURNS H. WESTON ET AL., INTERNATIONAL LAW AND WORLD ORDER 1269 (4th ed. 2006).

about incorporating ecosystem service values into energy decision-making.

VIII. VALUING FOSSIL FUEL ECOSYSTEM SERVICES

This essay has its roots in work I began in 1988 in attempting to identify all of the environmental externalities caused by the coal-generated electricity industry, all the laws that attempted to internalize those externalities, and what portion of the adverse impact of coal-fired electricity remained externalities after the laws were complied with (assuming that compliance occurs). Needless to say, the outline was extensive, and I am sure, incomplete. This exercise was my introduction into an even larger project—to identify all the environmental costs of generating electricity from all the methods by which electricity could be generated. This was not to be a purely academic exercise, but was to be compiled into a book that would be a resource for the New York Public Service Commission (NY PSC), which wanted to evaluate all new power plant proposals by comparing the full environmental cost of competing approaches—and then choosing that which presented the lowest cost, adding financial and environmental costs together. In my naiveté, I agreed to be a member of the project team. I was to be both an editor and author. As an author, I was assigned the task of identifying and justifying the environmental cost of emitting a ton of CO_2. A year later *Environmental Costs of Electricity* was in print.[75] The NY PSC used it in reforming its integrated resource planning process (IRP), and like a wildfire, the idea spread across the nation, being adopted by well over twenty states in the next few years. The usual rounds of litigation challenging the various state regulatory decisions ensued, but by and large, the state public service agencies prevailed in their argument that they were not engaged in environmental regulation but in prudent economic analysis of future risk to improve the accuracy of the values of the externalities from $0.00. It looked like the idea of internalizing the external environmental costs of electricity was becoming an idea whose time had come. And then, almost out of the blue, some regulators in California decided that electricity markets should be deregulated. Almost in a flash, states across the nation deregulated the generation of electricity, utilities sold off their generating facilities, and the idea of integrated resource planning faded into the background.

About a decade has passed since the electricity deregulation

75. RICHARD L. OTTINGER ET AL., ENVIRONMENTAL COSTS OF ELECTRICITY (1990).

project began. It has not proven to be the miracle panacea it was touted to be. California suffered an energy crisis. Competition did not emerge, so today many states are discovering that electricity prices are higher than they would have been with regulation. We now have a national energy system that is market driven in virtually all respects. Although I am oversimplifying, public values such as ecosystem services, system reserve capacity, security, equity, and internalizing environmental externalities have largely vanished from the legal and economic decision-making template. IRP, if not gone, is weak. The Federal Energy Regulation Commission has a hands-off policy at the federal level. State Public Service Commissions have little left to regulate since most generating assets have been sold off or spun out of the regulatory arena. A few states, such as California and New York have remained diligent and creative, and are reaping the rewards.[76] But, as a nation we face daunting energy challenges. Unfortunately, there is little law or policy to address how we might move towards a sustainable energy system.

What does this have to do with ecosystem services? Virtually all energy used by human society was transformed into its useful concentrated form by ecosystem services, and virtually all efforts to obtain, transport, and utilize energy has significant local, regional, national and global ecosystem consequences. Therefore we must think in terms of systems: legal, economic, and ecological. Energy is integral to society:

> Modern forms of energy empower human beings in countless ways: by reducing drudgery, increasing productivity, transforming food, providing illumination, transporting water, fuelling transportation, powering industrial and agricultural processes, cooling or heating rooms, and facilitating electronic communications and computer operations, to name

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76. *See* OFFICE OF ATMOSPHERIC PROGRAMS, U.S. EVNTL. PROT. AGENCY, CLEAN ENERGY-ENVIRONMENT GUIDE TO ACTION: POLICIES, BEST PRACTICES, AND ACTION STEPS FOR STATES (April 2006), *available at* http://www.epa.gov/cleanenergy/pdf/gta/guide_action_full.pdf, Arthur H. Rosenfeld, *The Art of Energy Efficiency: Protecting the Environment with Better Technology*, 24 ANN. REV. ENERGY & ENV'T 33, 33-42 (1999), *available at* http://www.energy.ca.gov/commission/commissioners/rosenfeld_docs/2000-10_ROSENFELD_AUTOBIO.PDF; Audrey B. Chang et al., *Energy Efficiency in California and the United States*, *in* CLIMATE CHANGE SCIENCE AND POLICY (Schneider, Rosencranz & Mastrandrea, eds., forthcoming 2007), *available at* http://energy.ca.gov/2007publications/CEC-999-2007-007/CEC-999-2007-007.PDF. *See also* NEW YORK STATE ENERGY RESEARCH AND DEV. AUTH., PLANNING NEW YORK'S ENERGY FUTURE: A THREE YEAR STRATEGIC OUTLOOK 2004-2007 (2004), *available at* http://text.nyserda.org/publications/strategicplan.pdf.

just some of them.[77]

We face enormous challenges as developing nations seek to expand energy use and bring modern energy services to the two billion people who have no electricity, while we must protect human health and the environment from the consequences of using fossil fuels and keep the world's economy and politics free from the disaster that ecosystem subsidized fossil fuels threaten. We must evaluate all aspects of our social and economic policies from an energy ecosystems services perspective. We can start with one piece - electricity. Now that 'electricity deregulation 1.0' has been tried, we need a new legal model, not just a tinkered upgrade.

77. Thomas B. Johansson & Jose Goldemberg, *Overview and Policy Agenda, in* ENERGY FOR SUSTAINABLE DEVELOPMENT: A POLICY AGENDA 1 (Thomas B. Johansson & Jose Goldemberg eds., 2000).

TRADING IN ECOSYSTEM SERVICES: CARBON SINKS AND THE CLEAN DEVELOPMENT MECHANISM

DENNIS D. HIRSCH*

I. INTRODUCTION

One reason that ecosystem services are declining is that people can consume them for free.[1] Valuable services such as water filtration, pollination and climate stabilization[2] are public goods in the sense that they cannot be provided to an individual without simultaneously being provided to all.[3] The inability to fence others off from these services makes it impossible to charge a price for enjoying them. This leads to wasteful consumption of ecosystem services and removes the incentive to invest in providing more ecosystem services.[4] The result is the depletion of ecosystem services.

If part of the problem is that people can consume ecosystem services for free, then part of the solution may lie in finding ways to make them pay for the privilege.[5] Ideally, the price should be equivalent to the value that the service provides to society. It should rise as the ecosystem and associated services become

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1. James Salzman, *Creating Markets for Ecosystem Services: Notes from the Field*, 80 N.Y.U. L. REV. 870, 882 (2005) [hereinafter Salzman, *Notes*]; JAMES SALZMAN & BARTON H. THOMPSON, JR., ENVIRONMENTAL LAW AND POLICY 16 (2003). There are other reasons that ecosystem services are declining, including the structural mismatch between ecosystem and political timeframes; however, the fact that ecosystem services are often public goods is one of the main causes of their depletion.

2. *See* Robert Costanza et al., *The Value of the World's Ecosystem Services and Nat. Capital,* 387 NATURE 253, 256 (1997) (estimating the global value of ecosystem services at $33 trillion per year including $1.692 trillion for water supply, $117 billion for pollination, and $684 billion for climate regulation); James Salzman, *Valuing Ecosystem Services,* 24 ECOLOGY L.Q. 887 (1997) (discussing literature on the valuation of ecosystem services).

3. SALZMAN & THOMPSON, *supra* note 1, at 15.

4. *Id.* at 16.

5. Salzman, *Notes*, *supra* note 1, at 884 ("a key challenge in implementing an ecosystem services approach lies in creating a market where none exists").

scarcer and should fall as they become more abundant. This would better signal to society the need to conserve and invest in ecosystem services. For the reasons just described, the market alone will not achieve this. Government or some other non-market actor will need to lend a hand.[6]

Government can charge for the consumption of ecosystem services in at least three ways. It can require those who harm ecosystems to pay a fee equivalent to the associated loss in ecosystem services.[7] It can pay a subsidy to those who act to conserve and/or restore ecosystems and the services they provide.[8] Or, it can use a trading approach. Under this third method a government would require a reduction in the overall amount of environmental harm, award entitlements to create this harm such that the aggregate amount of these rights equals the reduced level of environmental harm, and then allow these entitlements to be traded.[9] Those who can improve their environmental performance at the least cost will tend to do so and will trade away their rights to cause the harm. Those who find it more expensive to improve will tend to purchase entitlements. The result should be that the lower-cost actors end up making the bulk of the environmental improvements, thereby allowing society to achieve its environmental goals at less expense.[10] In the pollution control area, the best-known initiative of this type is the Acid Rain Trading Program under which utilities and other emitters can trade permits to emit sulfur dioxide (SO_2).[11]

While many have come to accept trading as a useful way to control pollution, fewer embrace it as a way to protect ecosystem services. In their leading article on the topic, Professors Salzman and Ruhl argue that ecosystem goods often are not fungible in the way that tons of SO_2 or other pollutants are.[12] They maintain

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6. *Id.* at 884-85 (government can step in to correct market failure).

7. *Id.* at 885 (discussing use of taxes and fees as an environmental regulatory instrument); SALZMAN & THOMPSON, *supra* note 1, at 45. For example, government could require those who destroy a wetland to pay a fee equivalent to the value of the water filtration, flood protection, species habitat, and other services that the wetland provides. One problem with this approach is that it will often be difficult to assess in monetary terms the amount of damage to the ecosystem service and so to charge the correct fee. *Cf.* NAT'L RES. COUNCIL COMMITTEE ON ASSESSING AND VALUING THE SERVICES OF AQUATIC AND RELATED TERRESTRIAL ECOSYSTEMS, VALUING ECOSYSTEM SERVICES 1 (2005) (illustrating methods used to value ecosystem services).

8. For example, government could pay farmers to preserve wetlands on their property rather than to drain them for agricultural use. Farmers who decide to drain their wetland would pay a "price" equivalent to the opportunity cost of foregoing the subsidy. Salzman, *Notes, supra* note 1, at 886; *see also id.* at 892-899 (discussing Australian and Costa Rican initiatives which use payments to enhance the provision of ecosystem services).

9. SALZMAN & THOMPSON, *supra* note 1, at 45.

10. *Id.*

11. *See* 42 U.S.C. § 7651 (1990).

12. *See* James Salzman & J.B. Ruhl, *Currencies and Commodification of Environ-*

that, absent rigorous and costly administrative review, it is often impossible to tell whether one acre of wetlands, critical habitat, or other ecosystem-based good provides the same environmental functions as another. Programs that would allow trading in wetlands and other habitats accordingly face a Hobson's choice between robust markets in ill-defined goods, and anemic markets in more rigorously reviewed (and hence far more costly) commodities. Trading in ecosystem services founders on the horns of this dilemma.

The current article offers a fresh look at ecosystem service trading. It argues that Salzman and Ruhl's concerns about fungibility apply only to one category of such trades and do not govern another important branch of these transactions. For Salzman and Ruhl, the Wetlands Mitigation Banking Program (WMBP) is the paradigmatic ecosystem trading initiative.[13] The WMBP awards credits to those who restore wetlands or create new ones, and allows them to store these credits in a mitigation "bank."[14] Developers who fill wetlands, and are legally required to replace them, can purchase the banked wetlands credits and use them to meet the mitigation requirement.[15] The WMBP thus promotes a market in which one ecosystem service, i.e. the service that the new wetland provides, replaces another, i.e. that which the filled wetland provided. We refer to these as ecosystem service for ecosystem service (ESS for ESS) trades. Salzman and Ruhl provide great insight into this category of ecosystem service transactions.

They say less about programs in which an ecosystem service takes the place of pollution reduction technology. An example would be the Kyoto Protocol's Clean Development Mechanism (CDM). Under this initiative, developing countries can gain greenhouse gas (GHG) removal "credits" by expanding forests that soak up carbon and remove it from the atmosphere.[16] They can then trade these credits to developed countries that can use them to meet their binding GHG emission reduction commitments under the Kyoto Protocol.[17] In the absence of this trading opportunity these developed nations would, in many cases, have sought to

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mental Law, 53 STAN. L. REV. 607, 665 (2000).

13. *See id.* at 648-57 (2000) (describing and discussing the WMBP).

14. *See id.* at 654; ENVTL. L. INST., WETLAND MITIGATION BANKING 3 (1993).

15. Salzman & Ruhl, *supra* note 12, at 654-55; Royal C. Gardner, *Banking on Entrepreneurs: Wetlands, Mitigation Banking, and Takings*, 81 IOWA L. REV. 527, 581-87 (1996); Federal Guidance for the Establishment, Use and Operation of Mitigation Banks, 60 Fed. Reg. 58,605 (Nov. 28, 1995).

16. Alexander Gillespie, *Sinks and the Climate Change Regime: The State of Play,* 13 DUKE ENVTL. L. & POL'Y F. 279, 279 (2003).

17. For a more complete description of this program see *infra* notes 30-32, 49-54 and accompanying text.

achieve these GHG reductions by installing new pollution control or energy efficiency technologies. The CDM allows them to purchase ecosystem-based GHG removal credits instead. In other words, it allows parties to use ecosystem services in place of technology-based services. We refer to these as ecosystem service for technology-based service (ESS for TBS) trades. In dollar terms, ESS for TBS trades are quite significant. While still in its infancy, the CDM has already accounted for approximately $400 million in carbon sequestration-based credits.[18]

This article will describe the Clean Development Mechanism and will set out some of the different views about this young program. It will then show that Salzman and Ruhl's framework for thinking about ecosystem service trades, which is so fundamental to any assessment of ESS for ESS trades, does not shed nearly as much light on the CDM or on other ESS for TBS trading systems. This article will provide an alternative framework that spells out the potential benefits, and risks, of ESS for TBS trading.

The article will proceed as follows. Part II will further describe carbon sinks and how they can generate tradable credits under the CDM. Part III will explore the policy debate over the CDM program. It will set out the arguments for, and against, trading in carbon sink-based credits. As will become clear, this debate has relevance for ESS for TBS trading more generally and so is worth describing in some detail. Finally, Part IV will draw on the CDM experience to develop broader lessons about ecosystem services trading. It will explore ESS for TBS exchanges as a separate category of ecosystem service trading, will explain in more detail how they differ from ESS for ESS exchanges and, drawing on the CDM experience, will map out a new analytical framework for evaluating them.

II. CARBON SINK TRADING UNDER THE CLEAN DEVELOPMENT MECHANISM

The 1992 United Nations Framework Convention on Climate Change (UNFCCC) is the broad international agreement that es-

18. Sebastian Scholz & Ian Noble, *Generation of Sequestration Credits under the CDM, in* LEGAL ASPECTS OF IMPLEMENTING THE KYOTO PROTOCOL MECHANISMS: MAKING KYOTO WORK 265, 282-83 (David Freestone & Charlotte Streck, eds., 2005) [hereinafter LEGAL ASPECTS OF KYOTO]. The dollar value is difficult to measure since the price per ton for sequestration credits varies widely at this early stage of the market. The estimate of $400 million is based on the 2004 announcement of the Brussels Region Government of Belgium that it had invested in a carbon sink project in the Democratic Republic of Congo and Cote D'Ivoire at prices of between $10 and $20 per ton. Gillespie, *supra* note 16, at 283.

tablishes the effort to stabilize the climate.[19] It requires signatory nations to commit themselves to stabilizing greenhouse gas (GHG) emissions "at a level that would prevent dangerous anthropogenic interference with the climate system."[20] At a 1997 meeting in Kyoto, Japan, the parties to the UNFCCC reached a supplemental agreement known as the Kyoto Protocol.[21] This document requires developed nations that are parties to the UNFCCC to reduce their GHG emissions by a specified percentage from their 1990 level.[22] These obligations, which are to be achieved by 2012, are set out in Annex B of the Kyoto Protocol[23] and the nations with GHG reduction commitments are known as "Annex B Parties." The commitments range from the European Union nations' collective agreement to achieve an eight percent reduction, to Iceland's agreement to limit itself to a ten percent increase.[24] Overall, the Annex B Parties commit to a 5.2 percent reduction from the 1990 levels.[25]

A. The Clean Development Mechanism

Annex B Parties will achieve most of their required reductions by installing energy efficiency measures or other GHG reduction technologies at facilities located within their own borders. However, the drafters of the Kyoto Protocol considered the fact that it would sometimes be possible to achieve the reductions more cheaply in other nations and that a ton of reductions achieved anywhere in the world would make essentially the same contribution to climate stabilization.[26] After much debate, the drafters of the Kyoto Protocol decided to allow Annex B parties to purchase the rights to emissions reductions achieved in other nations and use them to meet their own GHG reduction commitments. The Kyoto Protocol sets up three "flexibility mechanisms" to facilitate this trade in emissions allowances or credits. These are International Emission Trading,[27] Joint Implementation[28] and the Clean

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19. U.N. Framework Convention on Climate Change, May 9, 1992, S. TREATY DOC. No. 102-38 (1992), 1771 U.N.T.S. 108 [hereinafter UNFCCC].

20. *Id.* art. 2.

21. Kyoto Protocol to the U.N. Framework Convention on Climate Change, Dec. 10, 1997, UN Doc. FCCC/CP/1997/7/Add.2, *reprinted in* 37 I.L.M. 22 (1998) [hereinafter Kyoto Protocol].

22. *Id.* art. 3(1).

23. *Id.* Annex B.

24. *Id.*

25. David Freestone, *The UN Framework Convention on Climate Change, the Kyoto Protocol, and the Kyoto Mechanisms, in* LEGAL ASPECTS OF KYOTO, *supra* note 18, at 1, 10.

26. *Id.* at 13.

27. Kyoto Protocol, *supra* note 21, at art. 17 (mechanism allowing Annex B Parties to transfer Kyoto emissions rights—known as Assigned Amount Units (AAU)—to one another); *see* Rutger de Witt Wijnen, *Emissions Trading under Article 17 of the Kyoto Protocol,*

Development Mechanism.[29]

The Clean Development Mechanism (CDM) focuses on emissions reduction projects in developing nations that are parties to the UNFCCC.[30] The CDM awards emission reduction credits to such projects where they reduce GHG below baseline levels.[31] It then allows Annex B Parties to purchase the rights to these credits and use them to meet their emission reduction obligations. In essence, the CDM allows Annex B Parties to invest in GHG reduction projects in developing nations as an alternative to installing energy efficiency or other GHG reduction technologies at home. In this way, it seeks to promote technology transfer to, and sustainable development in, developing nations.[32]

B. Carbon Sinks, the Climate Regime and the CDM

One of the major issues facing the negotiators of the UNFCCC and, later, the Kyoto Protocol was whether GHG removals achieved through carbon sinks should have equal status with GHG emission reductions achieved through technology-based measures such as energy efficiency projects. A carbon sink is a process, activity, or mechanism that removes GHG or GHG precursors from the atmosphere and then stores them.[33] The two main carbon sinks are forests and oceans.[34] They are part of a global carbon cycle in which carbon shifts among four great carbon stores—the geological, the oceanic, the terrestrial and the atmospheric reservoirs.[35] The key goal of climate change initiatives is to reduce the amount of carbon in the atmospheric store and increase the amount that is sequestered in one of the other three reservoirs.

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in LEGAL ASPECTS OF KYOTO, *supra* note 18, at 403 (providing a more detailed description of the mechanism allowing transfer of Kyoto emission rights).

28. Kyoto Protocol, *supra* note 21, at art. 6 (mechanism allowing one Annex B Party to invest in an emissions reduction project in another Annex B Party and then acquire the emissions reduction credits, known as Emissions Reduction Units (ERU)); Charlotte Streck, *Joint Implementation: History, Requirements, and Challenges*, *in* LEGAL ASPECTS OF KYOTO, *supra* note 18, at 126 (providing a detailed description of Emission Reduction Units).

29. Kyoto Protocol, *supra* note 21, at art. 12.

30. *Id.*; Maria Netto & Kai-Uwe Barani Schmidt, *CDM Project Cycle and the Role of the UNFCCC Secretariat*, *in* LEGAL ASPECTS OF KYOTO, *supra* note 18, at 175.

31. U.N. Framework Convention on Climate Change, *Report of the Conference of the Parties on its Seventh Session, Held at Marrakesh from 29 October to 10 November 2001, Decision 17/CP.7, Draft Decision*, ¶¶ 43-48, U.N. Doc FCCC/CP/2001/13/Add.2 [hereinafter Marrakesh Accords]; *see* Rutger de Witt Wijnen, *Emissions Trading under Article 17 of the Kyoto Protocol, in* LEGAL ASPECTS OF KYOTO, *supra* note 18, at 406, 408.

32. Netto & Barani Schmidt, *supra* note 30, at 176.

33. Gillespie, *supra* note 16, at 279.

34. Yadvinder Mahli, Patrick Meir & Sandra Brown, *Forests, Carbon and Global Climate*, 360 PHIL. TRANSACTIONS: MATHEMATICAL, PHYSICAL AND ENGINEERING SCIENCES 1567, 1569 (2002).

35. *Id.*

Forests and oceans remove carbon from the atmosphere through photosynthesis.[36] Each year, forest and oceans exchange twenty-five times more carbon with the atmosphere than is released by human activities.[37] In forest ecosystems, trees and other plants carry out the photosynthesis and store the carbon as biomass in vegetation or in soils,[38] which is where two-thirds of terrestrial carbon is sequestered.[39] Activities that affect the amount of biomass in forests and other terrestrial ecosystems accordingly have the potential to remove significant amounts of carbon from, or add carbon to, the atmosphere.[40] In oceans, phytoplankton carry out the photosynthesis.[41] They draw carbon dioxide (CO_2) from ocean water which is replaced by CO_2 from the atmosphere, thereby lowering the atmospheric carbon stock.[42]

There was much debate over the role that carbon sinks would play in the UNFCCC and the Kyoto Protocol.[43] Nations with large forests, including the United States, argued strongly in favor of including GHG removals though carbon sinks as a recognized means of meeting GHG reduction obligations.[44] Other nations objected to the idea due to the perceived uncertainties surrounding this method and argued that the international agreements should focus exclusively on emissions and not on sinks.[45] The debate led to the collapse of the Sixth Conference of the Parties to the UNFCCC, held at the Hague in 2000, where the United States walked out due to disagreement over the sinks issue.[46]

Ultimately, the UNFCCC adopted a comprehensive approach that encompassed "all relevant sources, sinks and reservoirs of greenhouse gases and adaptation."[47] The Kyoto Protocol has somewhat narrowed this scope by excluding oceans and by recognizing, for emission reduction purposes, only those sink removals achieved through land-use change and forestry practices, specifically "afforestation, reforestation and deforestation."[48]

The Clean Development Mechanism reflects this narrowing of

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36. *Id.*
37. *Id.*
38. *Id.* at 1571.
39. ROGER A. SEDJO, BRENT SOHNGEN & PAMELA JAGGER, *Carbon Sinks in the Post-Kyoto World in* CLIMATE CHANGE ECONOMICS AND POLICY: AN RFF ANTHOLOGY 4 (Michael E. Tolman ed.,1998).
40. Mahli et al., *supra* note 34, at 1572.
41. *Id.* at 1582; *see also* Gillespie, *supra* note 16, at 280.
42. Gillespie, *supra* note 16, at 280.
43. *Id.* at 284-301 (summarizing this debate).
44. *Id.* at 285.
45. *Id.*
46. *Id.* at 288.
47. *Id.* at 285; UNFCCC, *supra* note 19, art. 3(3).
48. Kyoto Protocol, *supra* note 21, at art. 3(3); Gillespie, *supra* note 16, at 281.

scope. For credit production purposes, the CDM recognizes only those sink activities that involve afforestation or reforestation.[49] The CDM does not acknowledge other terrestrial or oceanic sinks, nor does the CDM recognize carbon storage through forest preservation or improved forest management. The CDM defines the baseline for reforestation purposes as the state of a nation's forests in 1990.[50] It awards GHG removal credits for projects that enhance these forests beyond baseline levels and that meet certain other program criteria.[51] These include requirements related to monitoring,[52] an "additionality" requirement under which the developing country must demonstrate that the afforestation or reforestation project would not have occurred but for the CDM project,[53] as well as other project requirements. The CDM established an institution, the CDM Executive Board, whose functions include reviewing all CDM projects to make sure that they meet the requirements imposed by the CDM.[54] Once the Executive Board certifies a project's GHG reductions or removals, it issues the corresponding Certified Emission Reduction (CER) credits. Annex B Parties can then acquire these credits for use in meeting their Kyoto commitments.

III. ARGUMENTS FOR AND AGAINST CARBON SINK TRADING

There has been a fierce debate over the inclusion of carbon sinks in the UNFCCC and Kyoto Protocol in general, and in the CDM baseline-credit trading scheme in particular. Proponents of including carbon sinks in the CDM have argued that carbon sinks often reduce atmospheric GHG for less cost than comparable technology-based measures.[55] Consequently, carbon sinks present an opportunity for cost savings that will make it easier for countries to participate in the climate stabilization effort.

Proponents also cite the environmental co-benefits of reducing carbon through forest sinks rather than through energy efficiency or other technology-based measures. They explain that ecosystems such as forests or peat bogs, which have the greatest potential as

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49. Marrakesh Accords, *supra* note 31, at Decision 17/CP.7, ¶ 7(a).

50. Scholz & Noble, *supra* note 18, at 268.

51. *See* Marrakesh Accords, *supra* note 31, at Annex ¶¶ 35-63 (setting out requirements used in sink-based and technology-based CDM projects).

52. *Id.* at ¶¶ 53-60.

53. *Id.* at ¶¶ 43.

54. *Id.* at ¶¶ 5-19 (establishing the Executive Board and defining its role).

55. Roger A. Sedjo & Michael Toman, *Can Carbon Sinks Be Operational? RFF Workshop Summary*, Resources for the Future Discussion Paper 01-26, at 1-2 (July 2001) (reflecting a strong sentiment from workshop participants that "sinks could be relatively inexpensive and effective for carbon management").

carbon sinks, also tend to be rich in biodiversity and to play an important role as species habitat.[56] Thus, the protection of climate through the use of carbon sinks can have a positive effect on another of the world's most pressing environmental problems, the loss of biodiversity. Critics respond that monoculture plantings can often produce the quickest carbon sink returns and that the CDM may accordingly lead to replacement of biodiversity-rich old growth and heterogeneous forests with biodiversity-poor monoculture plantations.[57] Proponents agree that such unintended consequences would be detrimental, but contend that they can be addressed by implementing additional rules or incentives.[58]

In addition to biodiversity, proponents point to other important co-benefits of expanding forests such as watershed protection, water purification, soil rehabilitation, recreational opportunities and the increase in aesthetic values.[59] Proponents also cite the benefits to poor people in the developing countries where CDM projects are necessarily located. These benefits include income that the sale of the carbon sink credits will generate,[60] as well as opportunities for additional food and timber, cash income from employment in the projects,[61] and the potential for forest-based tourism with associated jobs and income. Benefits to the poor create a positive feedback loop with biodiversity since poverty is often one of the root causes of biodiversity loss through overuse of forest resources.[62]

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56. Izabella Koziell & Ian R. Swingland, *Collateral Biodiversity Benefits Associated with 'Free-Market' Approaches to Sustainable Land Use and Forestry Activities*, 360 PHIL. TRANSACTIONS: MATHEMATICAL, PHYSICAL AND ENGINEERING SCI. 1807, 1811 (2002). "The fact that such 'carbon-rich' areas are also 'biodiversity-rich' offers some potential for simultaneous action on biodiversity and carbon issues." *Id.*

57. *See, e.g.,* Greenpeace, *Sinks in the CDM: After the Climate, Biodiversity Goes Down the Drain*, 2 (Dec. 19, 2003) (expressing concern that CDM projects will result in "[l]arge scale plantations with non-native monocultures, possibly using genetically modified organisms and displacing local inhabitants").

58. Roger A Sedjo, *Harvesting the Benefits of Carbon "Sinks,"* 133 RESOURCES 10, 11-12 (1998) [hereinafter Sedjo, *Harvesting*].

59. Sandra Brown et al., *Changes in the Use and Management of Forests for Abating Carbon Emissions: Issues and Challenges under the Kyoto Protocol,* 360 PHIL. TRANSACTIONS: MATHEMATICAL, PHYSICAL AND ENGINEERING SCIENCES 1593, 1596 (2002) (citing "industrial wood and fuel production; traditional forest uses; protection of soil, water and biodiversity; recreation; rehabilitation of damaged lands"); Ian R. Swingland et al., *Preface*, 360 PHIL. TRANSACTIONS: MATHEMATICAL, PHYSICAL AND ENGINEERING SCIENCES 1563 (2002); Benoit Bosquet, *Specific Features of Land Use, Land-Use Change, and Forestry Transactions, in* LEGAL ASPECTS OF KYOTO, *supra* note 18, at 281, 286.

60. John O. Niles et al., *Potential Carbon Mitigation and Income in Developing Countries from Changes in Use and Management of Agric. and Forest Lands*, 360 PHIL. TRANSACTIONS: MATHEMATICAL, PHYSICAL AND ENGINEERING SCIENCES 1621 (2002).

61. Bosquet, *supra* note 59, at 286.

62. Koziell & Swingland, *supra* note 56, at 1808; Ian R. Swingland et al., *Preface*, 360 PHIL. TRANSACTIONS: MATHEMATICAL, PHYSICAL AND ENGINEERING SCIENCES 1563 (2002).

Given these major benefits, one might expect environmentalists and others to embrace carbon sink trading. Instead, many have greeted the idea with intense skepticism and have expressed a preference for technology-based CDM projects rather than sink-based ones.[63] This criticism is rooted in a number of key concerns. First, critics maintain that it is often difficult to define an accurate baseline for the size and quality of heterogeneous forests, many of which tend to exist in a patchwork rather than a fully continuous state.[64] Critics also claim that it is more difficult to measure and continuously monitor CO_2 removals from sinks than from energy efficiency measures. They point out that, in contrast to facility-based energy efficiency projects, carbon sinks tend to be spread out over a wide geographic area and can only be observed through sampling and modeling. Proponents respond that adequate measurement and monitoring technologies exist and could be required by international protocols.[65] For example, they cite the development of remote-sensor technologies for measuring forests, including the use of satellites, low-flying planes and Global Positioning System devices.[66] Used in combination, these technologies can produce three-dimensional images that can be used to measure the height and crown diameter of individual trees in order to arrive at estimates of biomass.[67] Proponents also cite principles of "forest inventory, soil sampling, and ecological surveys" that they claim are well-tested.[68] They assert that trade in carbon sinks under the CDM will lead to improvements in these monitoring methods and technologies.

Critics point out that it is often difficult to assess what a "business as usual" scenario would be with respect to forests, and so to determine whether a carbon sink is truly "additional."[69] Forests are varied and diverse environments that are in a continual state of change due to both human and natural causes. Identifying how such a resource would have developed in the absence of a carbon sink project is a challenging task. Critics also raise questions

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63. *See e.g.,* Greenpeace, *supra* note 57, at 4 (calling for greater investment in "new energy saving/efficiency technologies" rather than in carbon sink projects).

64. Sedjo & Toman, *supra* note 55, at 3-4; Sedjo, *Harvesting*, *supra* note 58, at 11.

65. Sedjo & Toman, *supra* note 55, at 2 (obstacles to credible use of sinks are "mainly technical and can be overcome.").

66. Sandra Brown, *Measuring, Monitoring, and Verification of Carbon Benefits for Forest-Based Projects*, 360 PHIL. TRANSACTIONS: MATHEMATICAL, PHYSICAL AND ENGINEERING SCIENCES 1672 (2002) (describing tools and techniques for measuring and monitoring forests); Sedjo & Toman, *supra* note 55, at 2 (describing remote sensing technologies).

67. Brown, *supra* note 66, at 1675.

68. Sedjo & Toman, *supra* note 55, at 2.

69. Sedjo, *Harvesting*, *supra* note 58, at 11.

about the "permanence" of sink-related reductions.[70] They argue that a ton of CO_2 prevented through an energy efficiency measure or plant shutdown is gone forever, whereas carbon sinks only soak up carbon so long as the forest is maintained. If a forest burns, or illegal logging takes place, the CO_2 will be released.[71] Proponents respond that the permanence problem is overstated and that while individual forest sinks may come and go the "objective is to increase the aggregate amount of forest sinks" over time and that this can be monitored and achieved.[72] The CDM program itself seeks to respond to the permanence concern by requiring parties to recertify forest sinks every five years and to replace the credits they generate every sixty years.[73]

Critics further raise the problem of "leakage." This refers to the situation where a CDM project's protection of one forest increases the pressure to exploit another forest that is outside the CDM project boundaries. This can undermine the apparent gains from the CDM project itself.[74] The proponents of carbon sink trading acknowledge that this is a significant issue, although they claim that it can be addressed through use of a countrywide baseline and monitoring of overall changes from that benchmark.[75] This seems like a daunting task, especially in developing countries where governance structures tend to be weak and relatively opaque.

Finally, critics argue that the availability of low-cost reductions from sink-based projects would remove the pressure on developed nations to come up with new technologies to improve energy efficiency.[76] This will ultimately hurt developing countries that would lose out on the opportunity to benefit from these technological developments. These critics argue that the Kyoto Parties should be required to employ technology-based solutions and should not be able to rely on sinks. Proponents respond that carbon sink projects are not intended to replace energy efficiency technologies but rather to provide some cost-effective breathing room while these technologies are being developed.[77] They point out that, under the

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70. Sedjo & Toman, *supra* note 55, at 3.
71. Scholz & Noble, *supra* note 18, at 269.
72. Sedjo & Toman, *supra* note 55, at 3.
73. Scholz & Noble, *supra* note 18, at 269-270.
74. *Id.*, at 274; Sedjo & Toman, *supra* note 55, at 4.
75. Sedjo & Toman, *supra* note 55, at 4.
76. Sandra Brown et al., *supra* note 59, at 1594 (2002); Bosquet, *supra* note 59, at 285-86. *See also* David Driesen, *Free Lunch or Cheap Fix: The Emissions Trading Idea and the Climate Change Convention,* 26 B.C. ENVTL. AFF. L. REV. 1 (1998) (arguing that GHG emissions trading in general will have the effect of dampening innovation in environmental technologies).
77. Roger A. Sedjo, *Forest 'Sinks' as a Tool for Climate-Change Policymaking,* 143

Marrakesh Accords, parties can use credits from sinks-based CDM projects to cover only one percent of their base year emissions.[78] To meet their Kyoto commitments, parties will accordingly need to rely on technology-based solutions as well.[79] This should give the parties sufficient incentive to engage in technology development.

IV. LESSONS FOR ECOSYSTEM SERVICES TRADING

Can the carbon sink trading experience teach us any general lessons about trading in ecosystem services? As mentioned above, it is useful to begin this inquiry by distinguishing between two types of ESS exchanges.[80] In the first category are those trading systems in which one ecosystem service is purchased so that another may be built upon, or otherwise damaged (ESS for ESS trades). In the second are programs that allow the purchaser of an ecosystem service to substitute it for a technology-based service (ESS for TBS trades). The ESS for TBS nature of the Clean Development Mechanism is at the heart of the policy debate over this program. It is at the center of the proponents' argument that afforestation and reforestation are a cost-effective solution because they cost less than technology-based solutions.[81] It is also at the root of the critics' objection that the availability of low-cost carbon sink credits will prevent innovation in energy efficiency technologies.[82]

New York City's decision to comply with federal drinking water standards by acquiring lands and taking other steps to protect the Catskills watershed, rather than by building a $6-8 billion water filtration plant, is another example of exchanging an ecosystem service provided by the land (the watershed) for a technology-based service (the filtration plant).[83] This arrangement differs from the CDM in that it constitutes a single regulatory "deal" and does not create an active market with many traders. But the government's decision to allow New York City to purchase an ecosys-

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RESOURCES 21, 23 (2001) (describing sinks as "a temporary low-cost mitigation strategy that can buy humanity three to five decades to make the more fundamental adjustments") [hereinafter Sedjo, *Policymaking*]; Bosquet, *supra* note 59, at 286; Mahli et al., *supra* note 34, at 1588.

78. Marrakesh Accords, *supra* note 31, at ¶ 7(b).

79. Bosquet, *supra* note 59, at 285 ("sinks cannot flood the market so long as the 1 percent rule . . . remain[s] in place").

80. *See supra* notes 13-18 and accompanying text.

81. *See supra* note 55 and accompanying text.

82. *See supra* notes 76-79 and accompanying text.

83. For an in-depth description of this project see James Salzman, Barton H. Thompson & Gretchen C. Daily, *Protecting Ecosystem Services: Science, Economics and Law*, 20 STAN. ENVTL. L. J. 309, 315-16 (2001).

tem service and use it in place of a technology-based service is, in substance, quite similar to the Kyoto Protocol decision to allow Party nations to purchase carbon sink credits and substitute them for energy efficiency projects at home.

As was briefly sketched out above, Professors Salzman and Ruhl, in their insightful article on environmental trading markets (ETM),[84] have created a very useful analytical framework for thinking about ESS for ESS trades. A fuller description of their contribution is warranted here. Salzman and Ruhl explain that the success of an ETM largely depends on the fungibility of the environmental goods being traded (e.g. a ton of emissions, a wetland). If these commodities are not equivalent then the environmental effects of the trade remain unknown.[85] They demonstrate that wetland mitigation trades present significant problems with respect to fungibilities of "type."[86] Each wetland provides a unique basket of services that may include water purification, groundwater recharge, flood control and species habitat.[87] To know whether the wetland being purchased and preserved offers equivalent ecosystem services to the one being built upon it is necessary to evaluate and compare their contributions in each of these service areas. As Salzman and Ruhl demonstrate, this is a complex and expensive endeavor that is fraught with uncertainty. The result is that "practical constraints . . . in terms of costs, time demands, and complexity—have prevented wetland mitigation banking from ensuring currency adequacy."[88] Regulators have largely thrown up their hands and relied on pure acreage as a measure of trading equivalency. This does not ensure that environmental protection goals will be met.[89] The complexity and cost involved in constructing "apples to apples" comparisons in ESS for ESS trades represent a major hurdle for this type of trading program.

As illustrated by carbon sink trading, fungibility of type is not as large an obstacle when ecosystem services are substituting for

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84. Salzman & Ruhl, *supra* note 12.

85. *Id.* at 611.

86. *Id.* at 629, 662-63. They also demonstrate issues with respect to fungibilities of space, *id.* at 627, and time, *id.* at 630. By fungibilities of space, Salzman and Ruhl refer to the fact that the location at which the environmental good is provided can affect its impact on human health and the environment. An example would be a trading program in which a group of nearby facilities buy up a large number of emission rights and then increase their own emissions to the point that they create a local emissions "hotspot." *Id.* at 627-28. By fungibilities of time, they refer to situations in which the environmental good that is being purchased, and the one that it is replacing, are provided at different time periods. For example, a reduction in ozone-forming pollutants during the winter is far less environmentally beneficial than the same reduction during the summer ozone season. *Id.* at 630.

87. *Id.* at 612, 657.

88. *Id.* at 665.

89. *Id.*

technology-based services (ESS for TBS exchanges). Carbon sinks and energy efficiency projects are largely fungible with respect to the one service at issue—the removal of GHG from the atmosphere.[90] It is true that forest carbon sinks, like wetlands and other ecosystem services, provide a basket of services. They provide not only carbon removal but also species habitat, watershed protection, water filtration, timber resources (if properly managed), recreational opportunities and aesthetic pleasures.[91] In these respects, they are not fungible with energy efficiency projects which generally offer none of these benefits.

Yet in the ESS for TBS trading context these differences appear, not as an obstacle, but as a socially beneficial surplus from the trade itself. The purchaser is paying for carbon removal. But the trade also produces other co-benefits to human society and the environment. These co-benefits are directly linked to the fact that the trade is for an *ecosystem* service since it is in the nature of ecosystems to provide such baskets of services. This "co-benefit surplus" should be a consistent feature of ESS for TBS trades. It is present when a developing country's expansion of a forest replaces an Annex B Party's installation of energy efficiency technology. It is equally present when New York City relies on land preservation and conservation in place of a water filtration plant to clean its water supply. However, the surplus does not usually emerge from ESS for ESS trades since both the resource that the buyer is damaging, and the one that the seller is protecting, potentially offer all the services in the basket. In the ESS for ESS context, the multi-service nature of ecosystems results in complexity and cost rather than a social surplus. The co-benefit surplus is one of the primary arguments in favor of including carbon sink trading under Kyoto. This could be generalized into an argument in favor of trading systems that involve the substitution of ecosystem services for technology-based services.

Drawing on Professor Jonathan Wiener's work, another virtue of the co-benefit surplus is that it should help to secure the "Voluntary Assent" needed to draw developing countries into the climate change regime.[92] Professor Wiener argues that the traditional discourse about the relative merits of environmental regulatory tools has always assumed that the state or some other such actor would

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90. Some fungibility issues arise from the Kyoto Protocol's decision to recognize six GHG's and to translate them into carbon dioxide equivalents. But these issues are not unique to carbon sinks and affect trades that involve purely technology-based measures. They cannot be said to constitute a problem inherent to *ecosystem services* trading.

91. *See supra* notes 56-62 and accompanying text.

92. Jonathan Baert Wiener, *Global Environmental Regulation: Instrument Choice in Legal Context,* 108 YALE L. J. 677 (1999).

have the power to implement and enforce the chosen method.[93] That premise does not hold in the international arena, which is based on consensus and voluntary assent.[94] These conditions favor regulatory systems that can efficiently encourage voluntary participation.[95] Weiner argues that where regulated parties (in this context, nations) can choose whether or not to participate in the regulatory scheme this changes the calculus in ways that favor economic incentive systems over command-and-control methods, and trading approaches over subsidies or pollution taxes.[96]

In the specific context of international ecosystem services trading—such as carbon sink trading under the CDM—the co-benefit surplus would seem to bolster Wiener's account of the virtues of trading. Co-benefits such as water purification, flood control, species habitat and recreational opportunities tend to be localized. This means that the developing country will generally capture more of these co-benefits than the purchasing developed nation.[97] So long as this does not result in purchasing countries demanding a large price discount it should provide developing nations with more of an incentive to engage in the international climate regime than would a trading system that limited itself to technology-based solutions. This should help to secure their voluntary assent to and participation in the international effort.

The carbon sink example also demonstrates that there are significant risks posed by trading systems that allow ecosystem services to replace technology-based services. As explained above, carbon sink removals are harder to measure and monitor than technology-based GHG reductions.[98] This stems, in part, from the fact that these sinks are ecosystem services that must necessarily be spread out over wide areas and do not lend themselves to continuous emissions monitoring at the stack. While there is some progress being made in this area through remote sensing and other technologies, carbon sinks will always be at a disadvantage when it comes to counting and accountability. This downside will probably be true of many ecosystem services when they are compared to their technology-based counterparts.[99] The difficulties in

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93. *Id.* at 683.
94. *Id.*
95. *Id.* at 742-55.
96. *Id.* at 780.
97. The purchasers, as members of a global society, also benefit from species preservation and from the increased income and stability in the developing nation; however, it is the developing host nation that captures the majority of this co-benefit surplus.
98. *See supra* notes 64-68 and accompanying text.
99. *Cf.* Salzman & Ruhl, *supra* note 12, at 612 (wetlands mitigation program "can suffer from a lack of accountability (or, more accurately, a lack of countability)").

measuring and monitoring carbon sinks may also make these projects more prone to "leakage" than technology-based alternatives. While pollution control measures can create leakage (customers shift from the higher-priced pollution reducer to the high polluting, cheaper competitor), it should be easier to track and monitor such shifts in demand, and therefore to address them. Shifting use of forestlands will likely prove more difficult to track.

Carbon sinks also exacerbate the problem of emission reduction "permanence." A technology-based solution, such as an energy efficiency project that stops a ton of pollutant from being emitted to the atmosphere, permanently prevents pollution. A carbon sink's GHG benefit exists only so long as the forest remains healthy and sound. Again, this lesson can probably be generalized to ESS as a whole which, as natural systems, are more subject to variation and change over time than a piece of technology. Carbon sinks also present uncertainties with respect to their efficacy in removing GHG from the atmosphere. Some models project that a rise in global temperatures may increase soil and plant respiration, thereby reducing forests' functionality as a carbon sink.[100] While these projections are highly questionable,[101] that very uncertainty may constitute the lesson. Ecosystems are more complex than technology and so can generate more uncertainties with respect to their ultimate environmental effects.

In sum, the carbon sink example suggests a theoretical framework for thinking about when ESS for TBS trading programs should be utilized as a supplement to TBS-only command-and-control or trading regimes. The first piece of this framework is the idea that ESS for TBS trades can yield cost savings and will generally produce a co-benefit surplus that is not available from TBS-only regimes. The second is that ESS for TBS exchanges create additional difficulties in the areas of measurement, monitoring, permanence, and leakage. These downsides, too, are directly linked to the fact that ecosystem services are being substituted for technology-based services. This suggests a rough formula: ESS for TBS exchanges should be incorporated into a trading regime only where the co-benefit surplus plus cost savings outweighs the difficulties associated with measurement, monitoring, permanence and leakage. Where the reverse is true, they should not be used. This is, in a nutshell, the debate over the use of carbon sinks that has played out over the past years in the context of the Clean Development Mechanism.

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100. Brown et al., *supra* note 59, at 1598-99.
101. *Id.*

Making this determination in the context of a given ESS for TBS trading opportunity will be an inexact science. However, it is possible to identify some factors that should be incorporated into the analysis. Policymakers should assess:

1. The nature and magnitude of the co-benefits associated with using an ecosystem rather than a technology-based service to accomplish environmental ends;

2. The potential cost savings associated with ecosystem services when compared to a technology-based approach;

3. Whether the regulatory system is part of national law where Unitary Fiat is the rule, or international law where Voluntary Assent is required;

4. Whether the co-benefits inure principally to the host nation, and whether this is likely to be a developing country;

5. The nature and extent of the measurement, monitoring, permanence and leakage difficulties;

6. The availability of technologies (e.g. remote sensing) that can lessen these difficulties;

7. The governance characteristics of the jurisdiction that would host the ecosystem service and its enforcement capabilities;

8. The nature of the technology-based alternatives and the degree of certainty and accountability that they offer.

While this is not an exhaustive list, it should assist with determining whether a given ESS for TBS trading scheme would yield important environmental and social benefits, or whether it would ultimately fail to deliver the environmental goods.