

INSURING THE ONLY NEARSHORE SHALLOW BARRIER REEF SYSTEM IN THE CONTINENTAL U.S.

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I.	INTRODUCTION	165
II.	FLORIDA CORAL REEF VALUATION & RISK ASSESSMENT.....	168
III.	PARAMETRIC INSURANCE FOR ECOSYSTEM DAMAGES	171
IV.	CORAL REEF INSURANCE FUNDING OPTIONS	175
V.	WHO CAN PURCHASE CORAL REEF INSURANCE	180
VI.	RECOMMENDATIONS FOR A FLORIDA CORAL REEF INSURANCE PLAN	184
VII.	CONCLUSION.....	188

I. INTRODUCTION

Coral reefs provide billions of dollars in ecosystem services to coastal communities around the globe. Currently, coral reef ecosystem services face a growing number of threats, both anthropogenic and natural.¹ In fact, the only nearshore barrier coral reef tract in the continental United States is disappearing at an alarming rate.² The most widely pronounced threat to all coral reefs including the Florida Reef Tract is climate change and the resulting coral bleaching.³ Localized anthropogenic threats

1. See generally Catherine Awasthi & Ralph DeMeo, *The Fading Color of Coral: Anthropogenic Threats to Our Native Reefs*, 5 FLA. B.J. 38 (2020).

2. See generally NOAA CORAL REEF CONSERVATION PROGRAM, CORAL REEF CONDITION: A STATUS REPORT FOR FLORIDA'S CORAL REEF (2020), https://www.coris.noaa.gov/monitoring/status_report/docs/FL_508_compliant.pdf [hereinafter 2020 STATUS REPORT]; see also Toby A. Gardner et al., *Long-term region-wide Term Region-Wide Declines in Caribbean Corals*, 301 SCIENCE 958, 958 (2003) (noting “the average hard coral cover on reefs being reduced by 80% . . . in three decades”).

3. See NOAA, *How does climate change affect coral Does Climate Change Affect Coral Reefs?*, NATIONAL OCEAN SERVICE, <https://oceanservice.noaa.gov/facts/coralreef-climate.html> (last updated Feb. 26, 2021) (“Climate change is the greatest global threat to coral reef ecosystems.”); see also *Florida Keys National Marine Sanctuary*, NATL OCEANIC & ATMOSPHERIC ADMIN, <https://floridakeys.noaa.gov/corals/climatethreat.html> (last visited Nov. 13, 2021) (“All of these impacts can have negative consequences for the health and diversity of reefs around the world, including in the Florida Keys.”).

further include overfishing,⁴ coastal development,⁵ agricultural run-off,⁶ sewage⁷, dredging,⁸ and pollution.⁹

While anthropogenic-related factors pose the greatest threat to coral reefs long-term, increasing protections and resiliency to natural threats offer hope for their long-term survival. No management actions can “climate-proof” coral reef colonies. Yet, recent data indicates that hurricanes can cause both structural and biological damage to coral reef systems.¹⁰ In fact, reefs may lose between twenty to 60% of live coral cover after a category four to five hurricane.¹¹ With predicted increases in hurricane intensity driven by climate change,¹² now is the time for stakeholders to create and implement innovative solutions to critical storm restoration for coral. Furthermore, as a natural resource, Florida’s coral reef colonies provide millions of dollars in coastal protection, jobs, and tourism.¹³ However, no federal, state or, local regulations protect these resources from natural disasters that may cause significant and irreparable damage.¹⁴

In 2019, Mexico implemented a proactive insurance approach to protect and restore coral reef systems, which paid off after two powerful hurricanes caused catastrophic damage.¹⁵ It was the world’s first nature-based solution to protect a coral reef.¹⁶ In this

4. 2020 STATUS REPORT, *supra* note 2, at 2.

5. *Id.*

6. *Id.*

7. J. Carrie Futch et al., *Evaluation of sewage source and fate on southeast Florida coastal reefs*, 62 MARINE POLLUTION BULLETIN 2308, 2309 (2011).

8. *Threats to Coral Reefs*, ENV’T PROT. AGENCY, <https://www.epa.gov/coral-reefs/threats-coral-reefs> (last visited Nov. 13, 2021).

9. *Id.*

10. Toby A. Gardner et al., *Hurricanes and Caribbean Coral Reefs: Impacts, Recovery Patterns, and Role in Long-Term Decline*, 86 ECOLOGY 174, 174 (2005).

11. UNDRR United Nations Office for Disaster Risk Reduction, *The Nature Conservancy and the GovGovernment of Quintana Roo announce innovative financial Announce Innovative Financial Mechanism for Insuring and conserving coral Conserving Coral Reefs*, PREVENTION WEB (Mar. 9, 2018), <https://www.preventionweb.net/news/view/57410>. (reposting a press release from Nature Conservancy).

12. Terry Dinan, *Projected Increases in Hurricane Damage in the United States: The Role of Climate Change and Coastal Development*, 138 ECOLOGICAL ECON. 186, 186 (2017).

13. *Coral Reef Conservation Program*, FLA. DEP’T OF ENVTL PROTECTION, <https://floridadep.gov/rcp/coral> (last visited Nov. 13, 2021).

14. *See generally* Catherine Awasthi & Ralph DeMeo, *supra* note 1 (The article is a comprehensive overview of the statutes and regulations in place to protect Florida’s coral reef ecosystems. The article does not include laws to promote coral restoration following hurricanes, cold anomalies, and other natural events.); *see also infra* Part V for discussion on legislation enacted in 2021 that created resiliency funding in Florida.

15. Gloria Gonzalez, *Parametric Insurance Policy to Cover Mexico coral Coral Reef*, BUS. INS. (June 7, 2019), <https://www.businessinsurance.com/article/20190607/NEWS06/912328933/Parametric-insurance-policy-to-cover-Mexico-coral-reef>.

16. *Id.*

instance, a parametric insurance product is triggered if wind speeds reach a certain strength within a pre-defined covered area.¹⁷ Parametric policies insure a policyholder against the occurrence of a specific event by paying a set amount based on the magnitude of the event.¹⁸ The concept will be explained further in Part III.

Quintana Roo, a coastal Mexican state, almost immediately reaped the insurance policy's benefits since the state's government purchased the plan.¹⁹ The payouts offset the costs of repairing the insured, damaged reefs.²⁰ As it stands, insurance is understood to be a natural resource management tool that can shape behavior in ways that mitigate risks.²¹ Insurance provides financial incentives for owners to protect coastal properties from climate-driven storms.²² For example, a state may provide a tax deduction or insurance premium discount for installing hurricane-proof windows. Now, this novel, market-driven, nature-based insurance policy could mitigate coral reef destruction in the Florida Reef Tract. A 2020 feasibility study evaluated how best to fit the nature-based insurance policy into Florida's current regulatory framework as an effective solution to coral reef restoration and protection.²³

This Article explores developments to strengthen shoreline protection by examining the circumstances for insuring nature itself to preserve these fragile ecosystem services. The Article then advocates that pooling coastal community resources together to purchase a parametric insurance policy is feasible with additional contributions from private beneficiaries. Part II will clarify clear

17. The Nature Conservancy, *A REEF INSURANCE PRIMER: Hurricane Damages to reefs, Reefs, Repair and Restoration Options and Costs*, NATURE.ORG, https://www.nature.org/content/dam/tnc/nature/en/documents/Reef_insurance_primer.pdf [hereinafter *REEF INSURANCE PRIMER*] (last visited Oct. 25, 2021).

18. Daniel Brettler & Timothy Gosnear, *Parametric Insurance Fills Gaps Where Traditional Insurance Falls Short*, *INS. J.* (Jan. 9, 2020), <https://www.insurancejournal.com/news/international/2020/01/09/553850.htm>.

19. The Nature Conservancy, *World's First Coral Reef Insurance Policy Triggered by Hurricane Delta*, NATURE.ORG (Dec. 7, 2020), <https://www.nature.org/en-us/newsroom/coral-reef-insurance-policy-triggered>.

20. *Id.*

21. See California Dep't of Insurance, *Protecting Communities, Preserving Nature and Building Resiliency*, 3, <https://www.insurance.ca.gov/cci/docs/climate-insurance-report-07-22-2021.pdf> (last visited Nov. 13, 2021) ("Insurance can be an underappreciated cornerstone of community resilience. It not only supports recovery to climate disasters, but can also provide incentives for climate adaptation, such as incentives for fortifying homes or reducing risk in communities . . ."); see also *Risk Mitigation*, READY.GOV, <https://www.ready.gov/risk-mitigation> (last visited Nov. 13, 2021) ("Insurance is Financial Risk Mitigation").

22. See generally Fla. Dep't of Fin. Services, *Premium Discounts for Hurricane Loss Mitigation: A Guide for Consumers* (June 2019), <https://www.myfloridacfo.com/division/consumers/understandingcoverage/guides/documents/PremiumDiscountsForHurricaneLossMitigationGuide.pdf>.

23. Chris Bergh et al., *Insurance for Natural Infrastructure: Assessing the feasibility of insuring coral reefs in Florida and Hawai'i* 6, THE NATURE CONSERVANCY (2020).

values of risk and reef benefit. Next, Part III will expound on the coverage and limitations of coral reef parametric insurance payouts. Part IV will discuss coral insurance funding options. Part V will review current legal processes that dictate who can purchase parametric insurance for reefs. Finally, Part VI will provide concrete recommendations for how to utilize parametric insurance to protect Florida's coral reef ecosystems and coastal communities.

II. FLORIDA CORAL REEF VALUATION & RISK ASSESSMENT

A huge obstacle to investing in natural infrastructure such as coral reefs is the lack of consensus on valuation that natural ecosystems provide economically. Coral reefs are valuable both for intrinsic reasons and for anthropogenic values to coastal states and nations.²⁴ Intact and healthy coral reefs have high value as tourist attractions in Florida, which translates into local sales, income, and jobs. Additionally, coral reefs provide vital ecosystem services to Florida coastal communities such as erosion prevention, flood protection, and fish nurseries.²⁵

Coral reefs undeniably contribute to Florida's economy. Starting with tourism and sales, the National Oceanic and Atmospheric Association ("NOAA") estimated in a 2020 report that Florida's coral reefs have an asset value of \$8.5 billion, generating \$4.4 billion in local sales, \$2 billion in local income, and 70,400 jobs.²⁶ Florida's coral reef ecosystems also provide the state with market goods such as the sixty-nine million pounds of commercial food fish landings worth over \$197 million in dockside value in 2020.²⁷ Unfortunately, reef systems damaged by hurricanes are significantly quieter and attract 40% fewer juvenile fish when compared to the soundscape of healthy reefs.²⁸ Some fish and coral larvae rely on sounds of clapping shrimp and other fish to locate and

24. See generally Robin K Craig, *Taking Steps Toward Marine Wilderness Protection? Fishing and Coral Reef Marine Reserves in Florida and Hawaii*, 34 MCGEORGE L. REV. 155, 160 (2003) (discussing the intrinsic value provided by coral reefs). See generally 2020 STATUS REPORT, *supra* note 2 (discussing the idea that nature has economic value for the services it provides to people).

25. Curt D. Storlazzi et al., *Rigorously Valuing the Role of U.S. Coral Reefs in Coastal Hazard Risk Reduction: U.S. Geological Survey Open-File Report 2019-1027*, at 42 (U.S. Dep't of Interior, U.S. Geological Survey) (2019), <https://doi.org/10.3133/ofr20191027>.

26. 2020 STATUS REPORT, *supra* note 2, at 2.

27. *The Economic Impacts of Saltwater Fishing in Florida*, FLA. FISH AND WILDLIFE CONSERVATION COMM'N, <https://myfwc.com/conservation/value/saltwater-fishing/>. (last updated Sept. 2021).

28. Timothy A. C. Gordon et al., *Habitat degradation negatively affects auditory settlement Degradation Negatively Affects Auditory Settlement Behavior of Coral Reef Fishes*, 115 PNAS 5193, 5193 (2018).

fully develop on nearby coral reefs.²⁹ This implication results in fewer fish overall, with repercussions for Florida's fishing industry.³⁰

Further, coral reefs off of Florida's coast provide ecosystem services to the state of enormous value: habitat provision for diverse species,³¹ shoreline protection,³² and flood mitigation.³³ Many of these values are hard to ascertain by market mechanisms,³⁴ but shoreline protection and flood mitigation values can be determined. One study estimates that reefs protect over \$560 million worth of building infrastructure from storm-related flooding each year.³⁵ In fact, healthy reefs can absorb 97% of wave energy from hurricanes—providing buffer for shorelines and helping protect people and property.³⁶ Moreover, degraded reefs have trouble keeping pace with changing environmental conditions.³⁷ This makes it difficult for reefs to reduce wave energy and prevent erosion, essentially lowering overall benefits to coastal communities where damage would increase.³⁸

In this risk analysis, it is also important to note that Florida's coral reefs are particularly vulnerable due to other anthropogenic threats such as sedimentation and sewage runoff.³⁹ Aside from

29. Mark J. A. Vermeij et al., *Coral Larvae Move toward Reef Sounds*, 5 PLOS ONE e10660, e10660 (2010).

30. Kayelyn R. Simmons et. al, *Hurricane impacts on coral reef soundscape*, 16 PLOS ONE e025846, e025847 (2021) (“Long-term habitat degradation and the persistent decline in the three-dimensional structure of coral reefs can have cascading consequences for reef fish diversity, fisheries, and ecosystem services.”).

31. See *Value of Reefs*, REEF RESILIENCE NETWORK, <https://reefresilience.org/value-of-reefs/> (last visited No. 13, 2021).

32. *Id.*

33. NOAA, Office of Coastal Management, *Peer-to-Peer Case Study: Post-Disaster Coral Reef Assessment and Restoration Set Important Precedent for Coastal Comms.*, DIGITALCOAST, at para. 8 (July 15, 2020), <https://coast.noaa.gov/digitalcoast/training/corals.html>.

34. Loretta Burke et al., *Reefs at Risk Revisited* 77, WORD RESOURCE INSTITUTE (2011) (“Estimating such values is not easy. . . .”); see also James Salzman, *Creating Markets for Ecosystem Services: Notes from the Field*, 80 N.Y.U. L. REV. 870 (2005) (“[F]ully private markets are difficult to establish for most ecosystem services.”).

35. Storlazzi et al., *supra* note 25, at 17–18 (results indicate the total value of coastal infrastructure and economic activity protected from flooding by coral reef ecosystems is approximately \$809,752,090).

36. 2020 STATUS REPORT, *supra* note 2, at 2.

37. Calina Zepeda et al., *Guidance Document for Reef Management and Restoration to Improve Coastal Protection* 4, THE NATURE CONSERVANCY (Dec. 2018).

38. See *id.*

39. See Coral Reef Conservation and the Reauthorization of the National Marine Sanctuaries Act: Hearing Before the Subcommittee on Oceans and Fisheries of the Committee on Commerce, Science, and Transportation, 106th Cong., 1st Sess. 75 (1999); see also Fred Grimm, *Florida's coral reefs dying from global warming, sewage and official negligence*, SUN-SENTINEL (Aug. 10, 2018), <https://www.sun-sentinel.com/opinion/fl-op-column-fred-grimm-coral-reef-damage-20180810-story.html>.

being more vulnerable, Florida's corals are less resilient than many reefs in the Caribbean.⁴⁰ Resilient coral ecosystems will maintain their critical functions and biodiversity after major hurricanes,⁴¹ while less resilient corals may never recover.⁴² Even more, an outbreak of coral disease has led to mass Florida coral mortality since 2014, and scientists have yet to isolate the cause.⁴³ When comparing that knowledge with the research indicating that coral cover is reduced by 20-50% with 160 knot-windspeeds (a category five hurricane),⁴⁴ a huge concern arises regarding post-storm coral reef recovery in Florida.

Scholars have discussed what has been deemed a negative feedback loop impacting the valuation and management of coral reef ecosystems. Essentially, "the ecosystems that protect people from natural disasters, such as storms, can themselves be damaged by these very same events."⁴⁵ However, California has recently begun to explore whether insurance for ecosystems may solve both the lack of incentive for protecting nature and the inability to restore ecosystems following disasters. As discussed in Part VI,⁴⁶ Florida lawmakers should explore California's legislative approach to incentivize protecting ecosystem services.⁴⁷

Coral reefs are also deemed "public goods,"⁴⁸ of which it is not possible to exclude anyone from enjoying their benefits.⁴⁹ Scholars have identified this category of goods as presenting additional problems in identifying economic values.⁵⁰ Consequently, researchers conclude that losing critical coral reef services will continue unless stakeholders can accurately quantify their economic value.⁵¹ Coastal governments must then integrate those values into policy and management decisions.⁵² Therefore, the

40. Deborah L. Santavy et al., *Resilience of Florida. Keys Coral Communities Following Large-Scale Disturbances*, 3 DIVERSITY 628, 638 (2011).

41. *Id.* at 629.

42. Gardner et al., *supra* note 10, at 183.

43. Erinn M. Muller et al., *Spatial Epidemiology of the Stony-Coral-Tissue-Loss Disease in Florida*, 7 FRONTIERS MARINE SCI. 163, 163 (2020).

44. *REEF INSURANCE PRIMER*, *supra* note 17, at 2.

45. Carolyn Kousky & Sarah E. Light, *Insuring Nature*, 69 DUKE L.J. 323, 327 (2019).

46. *See infra* Part VI.

47. Cal. Ins. Code § 12922.5 (West 2020).

48. Robert Costanza et al., *Changes in the Global Value of Ecosystem Services*, 26 GLOBAL ENVTL. CHANGE 152, 154 (2014) (noting that ecosystem services tend to be public goods).

49. *See id.*

50. Kousky & Light, *supra* note 45, at 326.

51. Storlazzi et al., *supra* note 25, at 2.

52. *See id.*

above data provides a valuation and foundation to help reduce the risk to, and increase the resiliency of, Florida's coral reefs.

III. PARAMETRIC INSURANCE FOR ECOSYSTEM DAMAGES

Insurance is a nuanced risk management tool to protect ecosystem services from large-scale disasters largely because stakeholders are only now understanding this approach is feasible.⁵³ Simply put, insurance buyers pay a premium to guarantee access to funds if the insured assets suffer damage covered by a particular policy.⁵⁴ The two main types of insurance are indemnity-based and parametric, with indemnity-based payouts covering the actual dollar amount of sustained loss. Conversely, parametric insurance provides for payouts of pre-agreed amounts based on the characteristics of a particular “triggering” hazard event.⁵⁵

Thus far, natural infrastructure⁵⁶ has successfully been restored through a parametric insurance model designed to cover hurricane-related damage to coral reefs.⁵⁷ By its nature, parametric insurance allows for rapid relief and recovery funding, which is ideal for coastal areas susceptible to strong storms.⁵⁸ Even with the parametric approach, determining the actual coral loss following strong storms is a challenging process.⁵⁹ However, parametric insurance focuses on the hazard rather than the lost asset and allows for protections “which could not be served by indemnity insurance.”⁶⁰ Still, scholars have noted that “basis risk” is the primary shortfall of parametric insurance, where the payout will not match actual damages sustained.⁶¹ For example, hurricane-

53. Bergh et al., *supra* note 23, at 47.

54. Kousky & Light, *supra* note 45, at 375.

55. Bergh et al., *supra* note 23, at 14–16.

56. The term “natural infrastructure” refers to naturally occurring landscape features and/or nature-based solutions that promote, use, restore or emulate natural ecological processes. See *Natural infrastructure strengthens our climate resilience*, ENV'L DEFENSE FUND, <https://www.edf.org/ecosystems/natural-infrastructure-strengthens-our-climate-resilience> (last visited Nov. 13, 2021).

57. Bergh et al., *supra* note 23 at 16.

58. Nigel Brook et. al., *Parametric Insurance: closing the protection gap*, at 7, (Clyde & Co LLP 2018).

59. See generally *Changes in Storm Patterns*, REEF RESILIENCE NETWORK, <https://reefresilience.org/stressors/climate-and-ocean-change/changes-in-storm-patterns/> (last visited Nov. 13, 2021) (Outlining the direct physical impacts (coral breakage) and indirect impacts (smothered corals) of which would be assessed following strong storms.).

60. Bergh et al., *supra* note 23, at 16.

61. Kousky & Light, *supra* note 45, at 359 (quoting J. David Cummins, David Lalonde & Richard D. Phillips, *The Basis Risk of Catastrophic-Loss Index Securities*, 71 J. FIN. ECON. 77, 80–81 (2004)).

damaged coral may cost much more to repair than allotted by the parametric insurance contract. If the reef was covered by a traditional indemnity policy, the damage would be covered,⁶² but the premium would likely go up in response.⁶³

Parametric insurance for hurricanes is defined by three elements: a parameter (wind speed), a polygon where the wind speed must occur, and a payout.⁶⁴ The Nature Conservancy (“TNC”) helped to set triggering thresholds as part of the first ever coral reef insurance parametric policy for Quintana Roo, Mexico.⁶⁵ Using the Mexico parameters as a model, an insurance company set similar parameters for a proposed plan off of the Miami-Dade coast.⁶⁶ In that payout proposal, windspeeds of one hundred knots would trigger a payout equivalent to 60% of the coverage amount, and windspeeds of at least 160 knots would trigger a payout equivalent to 100%.⁶⁷

In terms of coverage, TNC presented a set of additional risks that insurance experts considered insurable under a coral reef parametric insurance policy for both Florida and Hawaii.⁶⁸ Those risks included marine heatwaves and cold-water anomalies triggered by set sea-surface temperatures, and stormwater runoff triggered by measured precipitation volume.⁶⁹ Conversely, ocean acidification, oil spills, and wastewater discharge are considered uninsurable risks.⁷⁰ The underlying presumption of these *insurable* risks is that, following the triggering events, there are measurable thresholds that indicate whether the insurer must fund restoration actions.⁷¹

62. *Id.* at 363 (“[A]n indemnity policy would compensate for the actual damage to an ecosystem or to natural capital.”).

63. See Michael Evans, *Does homeowners insurance go up after a claim?*, COVERAGE (June 30, 2020) (discussing how filing a claim with a typical homeowners insurance policy may increase a premium).

64. See Brook et al., *supra* note 58, at 9.

65. Similarly, the Caribbean Catastrophe Risk Insurance Feasibility (“CCRIF”) is the world’s first multi-country risk pool providing parametric insurance. CCRIF offers parametric insurance policies for tropical cyclones, earthquakes, excess rainfall, and damage to fisheries (in development for fisheries). However, these payouts are not for ecosystem services directly.

66. See Bergh et al., *supra* note 23, at 37.

67. See *id.*

68. See *id.* at 22.

69. *Id.*

70. *Id.* at 23.

71. See *id.* (The graphic indicates that insurable risks require a correlation between a parameter and coral damage to establish a threshold at which an insurance payout would be triggered.).

To explain the concept of insurable risks further, the risks “are neither influenced by nor carry a moral hazard.”⁷² A risk has a moral hazard “when a party [can] increase its exposure to risk because the risk is insured, or because someone else bears the cost of the risk.”⁷³ Therefore, the solution of creating a coral reef insurance policy focuses on the parts of the risk caused by external events such as hurricanes and heavy rainfalls. For the insurer, parametric insurance provides specific scientific pricing, as well as a lower claims management cost due to the pre-set parameters and payout amounts.⁷⁴ This scheme is therefore commercially viable for the insurance industry.⁷⁵

For the beneficiaries, the concept of risk-pooling for catastrophe insurance is more feasible than coastal governments relying on rainy day or fixed emergency savings funds for many reasons.⁷⁶ First, natural catastrophe events do not respect borders and the damage caused to coral’s ecosystem services can impact a number of beneficiaries.⁷⁷ Second, restoration activities are costly.⁷⁸ These activities justify the need to pay insurance premiums and further justify the need to pool the risk among beneficiaries. As the TNC revealed, an immediate response effort to repair reefs can range from \$100,000 to \$150,000.⁷⁹ If corals are also reattached or nursery-grown corals transplanted, the cost estimate increases

72. Willis Towers & the MAR Fund, *Sustainability of Rapid Response Reef Financing* 6 (Oct. 21, 2019), <https://marfund.org/en/wp-content/uploads/2020/02/Sustainability-of-Rapid-Response-Reef-Risk-Financing-in-the-MAR-Region.pdf>.

73. *Id.*

74. See Nigel Brook et al., *supra* note 56.

75. *Id.*

76. Rainy day funds have limitations such as withdrawal rules and funds must be repaid while risk-pooling for insurance allows flexibility to access funds while also diversifying portfolios to lowers overall costs for pooled entities. Cf. The World Bank, *What Makes Catastrophe Risk Pools Work: Lessons for Policymakers* (Nov. 14, 2017) with *Briefing Book: The State of State (and Local) Tax Policy*, TAX POLICY CENTER, <https://www.taxpolicycenter.org/briefing-book/what-are-state-rainy-day-funds-and-how-do-they-work> (last visited Nov. 13, 2021).

77. See Neils Holm-Nielson, *So-called natural disasters are not unpredictable*, WORLD BANK BLOGS (Apr. 17, 2021), <https://blogs.worldbank.org/latinamerica/so-called-natural-disasters-are-not-unpredictable>; see also Vikrant Panwar & Subir Sem, *Economic Impact of Natural Disasters: An Empirical Re-examination*, 13 J. OF APPLIED ECON. RES. 109, 110 (2019) (“However, the direct damages (human deaths, injuries, property losses, etc.) caused by the initial impact of natural disasters may lead to indirect damages (of potential wages and capital) at the macro level . . .”).

78. See REEF INSURANCE PRIMER, *supra* note 17, at 4.

79. *Id.*

to a few million USD per hectare.⁸⁰ Finally, major hurricanes are unpredictable and, as stated before, are forecasted to occur more frequently.⁸¹

Florida has thirty-five coastal counties with five counties located along parts of the Florida Reef Tract: Martin, Palm Beach, Broward, Miami-Dade, and Monroe.⁸² Of the seven major hurricanes (category three or higher) to strike Florida over the past twenty years, six of them traveled along the reef tract, impacting coral off of more than one county.⁸³ Seven major hurricanes may seem like a low risk not justifying the cost of an insurance policy, yet, pooling the risk between the five coastal counties diffuses the cost of a coral insurance premium. In contrast, if one county of the five paid into a coral emergency fixed savings account annually to cover coral damaged directly off of that county's coast, that one county is assuming the risk of a major hurricane that may never hit directly. Taxpayers would be more likely to find a misallocation of funds with the approach of setting aside a large amount of operating capital for a speculative catastrophic event. Therefore, coastal government pooling is more practicable.

For context, the government-purchased Quintana Roo policy offers a payout of up to \$3.8 million when triggered and the policy paid out \$800,000 following Hurricane Delta in October 2020.⁸⁴ This payout allowed coral rescue crews to stabilize 1,200 coral colonies and transplant almost 9,000 broken coral fragments in the first two weeks following the storm.⁸⁵ TNC estimated the response effort helped to protect the region's nearly \$10 billion tourism industry.⁸⁶ Additionally, research revealed that the infrastructure near sites protected by a coral reef system sustained less harm than neighboring, unprotected areas.⁸⁷ A triage brigade-style restoration response implemented up to sixty days after the storm will greatly

80. Bergh et al., *supra* note 23, at 33.

81. *See infra* Part II.

82. When referring to "coastal counties" or "coastal governments" the terms cover only these five counties for purposes of purchasing coral reef insurance, as they are directly located on portions of the Florida Reef Tract.

83. Search Historical Hurricanes by Location, NOAA HISTORICAL HURRICANE TRACKS, <https://coast.noaa.gov/hurricanes>; then search "Florida."

84. *World's First Coral Reef Insurance Policy Triggered by Hurricane Delta*, *supra* note 19 (numbers as of Mar. 2, 2021).

85. *Id.*

86. *Insuring Nature to Ensure a Resilient Future*, THE NATURE CONSERVANCY (Dec. 8, 2020), <https://www.nature.org/en-us/what-we-do/our-insights/perspectives/insuring-nature-to-ensure-a-resilient-future>.

87. *Id.*

increase the chances for the coral to survive.⁸⁸ This further indicates that proper post-disaster funding will help restore critical coral reef ecosystems.

Considering this analysis, those involved with creating and implementing the coral insurance plan hope it will “encourage the conservation of a valuable natural asset and create a scalable new market for the insurance industry.”⁸⁹ This parametric, nature-based insurance policy revealed a changing value amongst stakeholders where a group of beneficiaries of a public good collaborated to insure an ecosystem, of which no one owns.

IV. CORAL REEF INSURANCE FUNDING OPTIONS

Funding a parametric insurance policy for Florida’s valuable coral reef ecosystems will not be an easy task. While the Quintana Roo policy is predominately funded by taxes collected from local beach hotels, Florida does not have a tax scheme of a similar scale.⁹⁰ Yet, the rationale for hotel taxes paying into a collective coral reef policy pot was that the hotels are the local entities dependent on tourism. The hotels are most at risk when reefs are harmed. That same case can be made for Florida, where interlocal, pooled agreements present the most feasible option to insure coral reefs.

In further detail, TNC signed an agreement with the state government and the Puerto Morelos Hotel Owners Association to develop the Coastal Zone Management Trust (“the Trust”).⁹¹ The Trust fund contracts services for ongoing reef restoration and resiliency needs, and purchases parametric catastrophe insurance, which mitigates the harm of a triggering event.⁹² All in all, the Trust has demonstrated how public beneficiaries and private capital can be used together to protect natural infrastructure that shelters coastal communities.⁹³

Creating a similar, practicable fund for Florida’s coral reef damage will require facilitating pooling contracts between coastal governments and changes to the state’s legal framework regarding

88. *REEF INSURANCE PRIMER*, *supra* note 17, at 3.

89. *World’s First Coral Reef Insurance Policy Triggered by Hurricane Delta*, *supra* note 19.

90. Florida tax schemes include the option to levy a municipal resort tax. See Fla. Dept. of Revenue, *Local Option Taxes: Transient Rental Taxes/Tourist Development Taxes*, https://floridarevenue.com/taxes/taxesfees/Pages/local_option.aspx. (However, the tax is limited to spending for “tourism promotion activities, capital construction and maintenance of convention and cultural facilities, and relief of ad valorem (property) taxes used for those purposes.”) (last visited Nov. 16, 2021).

91. *Id.* at 4.

92. *Id.* at 5.

93. See discussion *infra* pp. 7–11.

taxes. First, interlocal agreements among the five coastal counties to pool local resources together to purchase joint insurance plans present the best option to fund insurance purchases.⁹⁴ The Florida Interlocal Cooperation Act of 1969 permits local governmental units to cooperate with other localities on a basis of mutual advantage.⁹⁵ Essentially, local governments can enter a contract to pursue a joint project that may not have been feasible on an individual basis. These contracts would require local government funding or issuance of bonds but remains a feasible idea.⁹⁶

As for taxes as a funding source, Florida counties may collect Tourism Development Taxes (“TDT”) on rentals or hotels where revenues “may be used for capital construction of tourist-related facilities, tourist promotion, and beach and shoreline maintenance.”⁹⁷ However, the approved uses for these tax dollars vary according to the particular levy.⁹⁸ Although this existing source of funding is currently used to fund shoreline protection, the TDTs would require legislative authority to use the funds to purchase coral reef insurance.⁹⁹ This source of funding presents the highest revenue-generating capability, however, a local government referendum approval is required first to levy the tax.¹⁰⁰ Even more, the tourism development council within each county that levies TDTs must then approve a plan by ordinance enacted by a majority vote plus one vote from the board of county commissioners.¹⁰¹ Therefore, reappropriating these taxes to purchase coral reef insurance would likely require complicated negotiations.

Reallocation of local government infrastructure sales taxes is another potential money source. These particular county sales taxes present a medium revenue-generating capability to purchase natural insurance but would require legislative amendments and

94. See *supra* notes 72–76, 90 and accompanying text (Florida’s current tax regime not providing for usable hotel surtaxes for insurance and the cost-benefit of risk-pooling together provide a reasonable basis for choosing interlocal agreements as a suitable option to fund a coral reef insurance policy.).

95. FLA. STAT. § 163.01(2) (2021).

96. FLA. STAT. § 163.01(7)(d) (2021).

97. See Local Option Taxes, *supra* note 90.

98. *Id.* (“The revenues may be used for capital construction of tourist-related facilities, tourist promotion, and beach and shoreline maintenance; however, the approved uses vary according to the particular levy.”) (Navigate to ‘Transient Rental Taxes/Tourist Development Taxes dropdown.’).

99. See FLA. STAT. § 125.0104(5) (2012); see also FLA. LEGIS. COMM. ON INTERGOVERNMENTAL REL., *Issue Brief: Utilization of Local Option Tourist Taxes by Florida Counties in Fiscal Year 2009-2010* (2009), available at <http://edr.state.fl.us/Content/local-government/reports/localopttourist09.pdf>.

100. FLA. STAT. § 125.0104(3)(d) (2012).

101. *Id.* §125.0104(3)(n).

referendums to levy the tax or reallocate funds.¹⁰² There are competing uses for funds collected from these discretionary taxes. However, coastal cities depending on healthy coral reefs should begin to incorporate “natural” infrastructure into their overall plan for restoration and protection.

Additionally, Florida voters approved the Florida Water and Land Conservation Initiative as a constitutional amendment in 2014 to guarantee funding for the Florida Land Acquisition Trust Fund (“LATF”).¹⁰³ The amendment dedicated 33% of net revenues from the existing excise tax on documents, such as deeds and other documents that transfer real property, to the fund until 2035.¹⁰⁴ The LATF supports the restoration and management of “conservation lands.”¹⁰⁵ In 2018, the Southeast Florida Coral Reef Ecosystem Conservation Area (“CRECA”) was established to provide state protection for portions of the Florida Reef Tract that do not fall within the Florida Keys National Marine Sanctuary (“FKNMS”).¹⁰⁶ Therefore, the coral reefs within the Southeast Florida CRECA likely fall under “conservation lands” subject to receive LATF support. Further, the state helps to manage the remainder of the federally protected reef tract within the FKNMS.¹⁰⁷ The Florida Department of Environmental Protection (“FDEP”) thus has statutory authority to allocate LATF money to coastal governments to purchase a coral reef insurance plan that would conserve and protect the Florida Reef Tract.

Document stamp taxes as a source to fund coral reef insurance premiums appears practicable at first: as more people buy homes in Florida, more document taxes could help fund coastal government insurance premiums. However, this revenue stream is not without controversy. Several lawsuits followed the passage of Amendment 1 in 2014, where environmental groups argued that funds authorized were misallocated.¹⁰⁸ In 2021, Florida’s governor signed a trio of

102. *Discretionary Sales Surtax*, FLA. DEP’T. OF REVENUE, <https://floridarevenue.com/taxes/taxesfees/Pages/discretionary.aspx> (The counties use the funds to pay for local authorized projects).

103. FLA. CONST. art. X, § 28.

104. *Id.*

105. *Id.*

106. *Coral ECA: Kristin Jacobs Coral Reef Ecosystem Conservation Area*, FLA. DEP’T. OF ENVTL. PROT., <https://floridadep.gov/rcp/coral/content/coral-eca-southeast-florida-coral-reef-ecosystem-conservation-area> (last modified Aug. 21, 2021).

107. *Fla. Keys Nat’l Marine Sanctuary*, FLA. DEP’T. OF ENVTL. PROT., <https://floridadep.gov/rcp/fknms> (last visited Apr. 9, 2021).

108. *See Olivia v. Fla. Wildlife Fed’n, Inc.*, 281 So. 3d 531, 539 (Fla. 1st DCA 2019) (holding that LATF revenue is not restricted to land purchased by the state after 2015, reversing a circuit court opinion, remanding for further review to determine if money was, in fact, misallocated).

bills into law impacting resiliency funding.¹⁰⁹ First, Senate Bill 2514 established a resiliency fund within FDEP.¹¹⁰ Next, Senate Bill 2512 directed a portion of Florida's document tax revenue go toward the newly established "Resilient Florida Trust Fund."¹¹¹ Finally, Senate Bill 1954 required FDEP to allocate up to \$100 million annually from the fund to coastal government resiliency projects and planning grants.¹¹² Looking ahead, coral reef insurance premiums would likely fit into the category of future projects to receive Resilient Florida Trust funding.

Florida also collects vessel registration fees¹¹³ and enforces the Coral Reef Protection Act ("CRPA") by collecting civil penalty fees.¹¹⁴ Governments could request both be used to purchase insurance. Currently, the CRPA uses fines collected from those who damage coral reefs by vessel groundings or cable fractures to restore and protect injured reefs.¹¹⁵ To reallocate the civil penalty fees to purchase reef insurance, FDEP would need to go through rulemaking. Similarly, Florida Statute § 328.72 (2019) would need to be amended so that a local board of county commissioners could use the vessel fee proceeds to purchase insurance.¹¹⁶ These sources of revenue are less likely than county taxes to generate revenue but should be explored, nonetheless.¹¹⁷

The concept of purchasing insurance for Florida's coral reef systems is a proactive approach to risk management, mitigating the potential harm to a valuable asset. With that in mind, the

109. S.B. 1954, 2021 Reg. Sess. (Fla. 2021) (Established the Resilient Florida Grant Program within the Department of Environmental Protection); S.B. 2514, 2021 Reg. Sess. (Fla. 2021) (Created the Resilient Florida Trust Fund within the Department of Environmental Protection); S.B. 2512, 2021 Reg. Sess. (Fla. 2021) (Added a distribution to the newly created Resilient Florida Trust Fund to be used for the new Resilient Florida Program).

110. S.B. 2514, 2021 Reg. Sess. (Fla. 2021).

111. *Documentary Stamp Tax Distribution: Analysis and Fiscal Impact Statement on S.B. 2512*, 2021 Fla. Leg., Reg. Sess. 1 (2021) (statement by the Professional Staff of the Comm. on Gov't Oversight & Accountability: "It will create a transfer of \$141.1 million to the Resilient Florida Trust Fund . . .").

112. FLA. STAT. § 380.093(5)(i) (2021).

113. *Vessel Titling and Registrations*, FLHSMV, <https://www.flhsmv.gov/motor-vehicles-tags-titles/vessels/vessel-titling-registrations/> (last visited Nov. 13, 2021).

114. *See generally*, Fla. Dep't. of Env'tl. Prot., *Florida's Coral Reef Protection Act* (2016), <https://floridadep.gov/sites/default/files/coral-reef-protection-052016.pdf>.

115. *Id.*

116. *See* FLA. STAT. § 328.72(15) (2019) ("Such moneys to be returned to the counties are for the sole purposes of providing, maintaining, or operating recreational channel marking and other uniform waterway markers, public boat ramps, lifts, and hoists, marine railways, boat piers, docks, mooring buoys, and other public launching facilities; and removing derelict vessels . . .").

117. While county taxes require local referendums, state-collected fees would require a much more rigorous process of statutory rulemaking to allocate funds to insurance payments. *See discussion infra* pp. 11–13.

Florida Association of Counties released a 2020-2021 federal policy statement supporting more disaster recovery investment geared toward mitigation programs and partnerships between local and federal governments to increase resiliency to disasters.¹¹⁸ FEMA pre-disaster grant programs provide incentives to state and local governments to rebuild stronger and more proactively.¹¹⁹ With the aforementioned benefits of coral reef ecosystems to providing resilient coastlines, coastal governments should also include spending for coral reef insurance in required plans.

On the same note, FEMA disaster relief following storms could also be allocated to coastal governments to purchase coral reef insurance. Presently, FEMA's Natural and Cultural Resources support function provides a framework for responding to disasters.¹²⁰ Following Hurricanes Irma and Maria in 2017, Puerto Rico submitted a recovery plan to Congress under this support function that, for the first time, "requested that disaster recovery funds be used to assess the impacts of their natural resources."¹²¹ FEMA assigned the National Oceanic and Atmospheric Administration ("NOAA") to conduct coral reef damage assessment and perform emergency restoration activities which included reattaching corals, all with federal funding.¹²² This example illustrates the possibility that expanding the scope of FEMA's Natural and Cultural Resources support functions to allow local governments to purchase coral insurance policies to respond to future disasters could be a last-resort funding structure.

Public insurance pools are also an option providing funding to purchase coral reef insurance. In these quasi-to fully governmental insurance programs, the government sometimes acts as the insurer and at other times as a reinsurer.¹²³ The most popular example is the National Flood Insurance Program.¹²⁴ In Florida, the legislature established Citizens Property Insurance Corporation to help insure new homeowners in high-risk areas who cannot find windstorm

118. FLA. ASS'N OF COUNTIES, *FAC Federal Policy Committee 2021-2021 Adopted Policy Statements 2* (Dec. 2, 2020), https://www.fl-counties.com/sites/default/files/2020-11/Federal%20Policy%20Committee%20%281%29_0.pdf.

119. *Hazard Mitigation Assistance Grants*, FED. EMERGENCY MGMT. AGENCY, <https://www.fema.gov/grants/mitigation> (Last updated Oct. 12, 2021).

120. FED. EMERGENCY MGMT. AGENCY, *National Disaster Recovery Framework 2* (Sept. 2011), https://www.fema.gov/pdf/recoveryframework/natural_cultural_resources_rsf.pdf.

121. Peer to Peer Review, *supra* note 33, at para. 7.

122. *Id.*

123. Veronique Bruggeman et al., *The Government as Reinsurer of Catastrophe Risks?*, 35 THE GENEVA PAPERS ON RISK AND INSURANCE 369, 370 (2010).

124. *See generally*, Carolyn Kousky, *Financing Flood Losses: A Discussion of the National Flood Insurance Program*, 21 RISK MGMT. & INS. REV. 11 (2018).

insurance through private providers.¹²⁵ With the private insurance approach, Florida could create, by statute, a similar coral reef insurance pool for coastal communities to purchase premiums after adopting coral reef emergency response plans.

Finally, the Nature Conservancy assessed the potential for private entities to support a privately capitalized trust fund for purchasing coral reef insurance at the state or local level.¹²⁶ TNC discovered a potential revenue-generating mechanism already in discussion among insurance companies, where ten of the sixty-five companies surveyed expressed interest in “using a voluntary contribution based on commission gained from flood insurance business to repair coral reefs.”¹²⁷ As Florida leads the nation in the development of the private flood insurance market, this would generate immense revenue for purchasing coral insurance.¹²⁸ In sum, by pooling and reallocating funds from beneficiaries, requesting particular federal funds for mitigation plans, and facilitating private sector engagement, Florida could create a funding scheme to purchase reef insurance.

V. WHO CAN PURCHASE CORAL REEF INSURANCE

Stakeholder engagement for creating and implementing a feasible and successful coral reef insurance policy is crucial. In a 2020 coral reef insurance feasibility study, teams from the Nature Conservancy conducted outreach to stakeholders like local reef managers, policy-makers, business owners, government agencies, hotel owners, and insurance and financial industry leaders.¹²⁹ Outreach in Florida specifically included presenting a modified insurance model similar to that of Quintana Roo’s policy to 20 public and private entities, including multiple counties in southeast Florida as well as state and federal agencies.¹³⁰ TNC reported that stakeholders expressed a clear interest in the approach.¹³¹

In Florida, many public and private entities have an insurable interest in reefs. With that interest, coastal governments are legally

125. See FLA. STAT. § 627.351(2) (2020).

126. Bergh et al., *supra* note 23, at 34.

127. *Id.*

128. Insurance Information Institute, *Facts + Statistics: Flood Insurance*, INSURANCE INFORMATION INSTITUTE, INC., <https://www.iii.org/fact-statistic/facts-statistics-flood-insurance> (last modified 2021).

129. Bergh et al., *supra* note 23, at 19.

130. *Id.*

131. *Id.*

entitled to purchase insurance as beneficiaries.¹³² Under Florida Statutes § 627.405(2) (2016), any public or state agency or organization legally responsible for protecting coral reefs is also legally entitled to purchase insurance to protect the asset from degradation. Therefore, Florida state government, which is effectively charged with maintaining the reefs on behalf of citizens, local governments, and industries (e.g., tour operators and hotels that derive benefits from reefs) can purchase insurance for coral reefs.¹³³

All stakeholders benefitting from the ecosystem services of coral reefs are interested in transferring the risk of storm damage. However, TNC explained in a 2019 natural resources insurance guide that the entity that buys insurance and holds the policy must have the financial capacity to buy it or collect funding from other interested parties.¹³⁴ Generally, only one entity can buy an insurance policy.¹³⁵ Therefore, Florida would have to work with stakeholders to establish a trust similar to the Coastal Zone Management Trust, which was established in part by Quintana Roo's government.¹³⁶ That trust would collect and manage the funds.

Aside from creating a trust for purchase, a parametric coral reef insurance policy would require obtaining permits and licenses to effectively implement the covered response efforts. In its 2020 coral reef insurance feasibility study, TNC reported three tiers of potential coral reef damage responses requiring specific permits or regulatory authorizations prior to response-to-threat events.¹³⁷ In order to reattach, collect, and transplant coral (tier one), response teams must consult federal agencies, apply for specific permits, and obtain at least one state license.¹³⁸

First, an Essential Fish Habitat consultation is required with NOAA because relocating or replanting damaged coral could alter the biological balance of Florida's fish habitats.¹³⁹ Additionally, because much of Florida's coral reef is located within the Florida

132. FLA. STAT. § 627.405(2) (2016) ("Insurable interest" is any "actual, lawful, and substantial economic interest in the safety or preservation of the subject of the insurance free from loss, destruction, or pecuniary damage or impairment.").

133. Bergh et al., *supra* note 23, at 19.

134. Fernando S. Fajardo et. al., *Guide on How to Insure a Natural Asset* 21 (2019), <https://media.coastalresilience.org/MAR/Guide%20on%20How%20to%20Insure%20a%20Natural%20Asset.pdf>.

135. *Id.*

136. *Id.*

137. Bergh et al., *supra* note 23, at 31.

138. *Id.*

139. *Consultations for Essential Fish Habitats*, NOAA FISHERIES, <https://www.fisheries.noaa.gov/national/habitat-conservation/consultations-essential-fish-habitat>.

Keys Marine Sanctuary, 15 CFR Part 922 requires a National Marine Sanctuary (“NMS”) Permit for regulated activities including any type of subsurface salvage or recovery operation involving removal, collection, or movement of a Sanctuary resource.¹⁴⁰ Therefore, if damaged coral needs salvaging to regrow in a nursery, a NMS permit is required.¹⁴¹ Permits are granted when there is a need for “recovery operations in connection with an air or marine casualty;”¹⁴² but more importantly, “no permit is required for the conduct of any activity *immediately and urgently necessary* for the protection of life, property or the environment.”¹⁴³ Therefore, it is implied that a permit to salvage and restore coral damaged following a hurricane may not be necessary.

At the state level, Florida Fish and Wildlife Commission will need to issue a Special Activity License (“SAL”) to similarly salvage and transplant broken coral.¹⁴⁴ A SAL to relocate coral will only be issued to qualified individuals from specialized scientific institutions with demonstrated experience conducting successful relocation activities, or an agency staff member with similar experience.¹⁴⁵ Further, because a portion of Florida’s coral reefs are located within a state park, an additional collection permit may be required from the Florida Department of Environmental Protection.¹⁴⁶ This permit would be required to extract damaged coral from John Pennekamp State Park in order to ensure preservation.

A tier-two response effort, as demonstrated by TNC, could include removing debris, sediment, and rubble from damaged reef sites.¹⁴⁷ If a hurricane triggers these actions, response efforts would require permits in addition to those required for tier-one responses. First, another consultation is needed with NOAA to determine if threatened coral or marine mammals would be harassed or harmed, constituting a “take” under Section 7 of the Endangered Species Act (“ESA”) and under the Marine Mammal Protection Act (“MMPA”). “Take” is defined under the ESA as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct”¹⁴⁸ pertaining to listed species and similarly

140. 15 CFR § 922.61 (2007); 15 CFR § 922.73 (2009).

141. *Id.*

142. 15 CFR § 922.62 (2007).

143. *Id.* (emphasis added).

144. FLA. ADMIN. CODE r. 68B-8.001.

145. *Id.* at 68B-8.006(2)(c-e) (2009).

146. *See generally*, FLA. ADMIN. CODE r. 62D-2.01 (2007).

147. Bergh et al., *supra* note 23, at 31.

148. 16 U.S.C. § 1532 (2006).

under the MMPA pertaining to marine mammals.¹⁴⁹ Currently, two stony coral species found along the Florida Keys Reef Tract are listed as “threatened” under the ESA: staghorn coral and elkhorn coral.¹⁵⁰

At the state level, tier-two response actions would require consultation with the Department of State Division of Historical Resources and an Environmental Resource Permit (“ERP”) from FDEP.¹⁵¹ First, due to the potential to disturb and alter sediment in a state park (state lands), response teams would need to consult the Compliance and Review Section of the Division of Historical Resources.¹⁵² Sediment disturbance could also prompt the need to obtain an ERP, as restoration efforts to salvage nearshore coral could lead to alteration of nearby wetlands.¹⁵³

Finally, the only tier-three response effort indicated in the TNC 2020 feasibility study was artificial reef construction.¹⁵⁴ FDEP regulates the construction of artificial reefs in state waters and requires a general permit.¹⁵⁵ Application fees can reach up to \$14,000 for fifty or more acres (twenty hectares) of artificial reef.¹⁵⁶ Florida has 90,000 hectares of coral reef tract¹⁵⁷, so depending on the extent of damage, constructing artificial reefs should be reserved for irreparable post-disaster damage to coral reef ecosystems. Not all of these licenses and permits could be necessary; however, consultations should be completed with each required federal and state agency when creating a coral reef disaster response plan to ensure response actions are not hindered. Additionally, it is critical to factor in the costs of all consultations, permitting applications, and licenses into the purchase price of a proposed coral reef insurance plan.

149. 16 U.S.C. § 1362 (2003).

150. Endangered and Threatened Wildlife and Plants, 79 F.R. 53851 (Sept. 10, 2014) (to be codified at 50 C.F.R. pt. 223).

151. See *Envtl. Resource Permitting Coordination, Assistance, Portals*, FLA. DEP’T OF ENVTL PROTECTION (last visited Nov. 13, 2021).

152. FLA. STAT. § 253.04 (2013).

153. FLA. ADMIN. CODE r. 62-330.020(2)(a) (2018).

154. Bergh et al., *supra* note 23, at 31.

155. FLA. ADMIN. CODE r. 62-330.600 (2013).

156. FDEP South District, *Environmental Resource Permitting for Artificial Reefs*, FDEP (Feb. 17, 2015), at 10, <https://nmsfloridakeys.blob.core.windows.net/floridakeys-prod/media/archive/sac/othermaterials/20150217ahdep.pdf>.

157. *Conserving Florida’s Coral Reef*, FLA. DEP’T OF ENVTL PROTECTION, <https://floridascoralreef.org/> (last visited Nov. 13, 2021) (350 miles is equal to 90,649 hectares.).

VI. RECOMMENDATIONS FOR A FLORIDA CORAL REEF INSURANCE PLAN

At this point, creating and implementing a coral reef insurance policy to protect Florida's valuable ecosystem is legally and technically feasible. The following recommendations will first address how to best approach funding to purchase a Florida coral reef insurance policy. Next, recommendations will address the development of a rapid response plan that must be completed before purchasing an insurance premium. Additionally, this section will discuss why Florida lawmakers should consider adopting a similar insurance code provision recently implemented in California for natural resource assessment.

First, Florida government representatives, reef managers, community foundations, hotels, and tourism industries (beneficiaries) along the coast should take action to create a trust fund similar to Mexico's Trust Fund. The trust fund would collect money from stakeholders such as county governments via interlocal contracts or tourism taxes and purchase a one-year parametric insurance plan. The plan would provide funds for immediate hurricane restoration to restore coral specifically in the Florida Reef Tract. The above research shows that an investment in a natural parametric insurance policy ensures accountability and transparency.¹⁵⁸ All parties know the stakes ahead of time and payouts of set amounts are triggered by set parameters. Scholars have noted that insuring ecosystems with third-party firms helps to avoid dilemmas whereby government promises disaster relief or restoration funds but does not deliver.¹⁵⁹

Although an ecosystem service district would need to be established by Florida's legislature,¹⁶⁰ the concept of creating a coral reef conservation district ("CRCDD") amongst coastal governments should be explored. The reef conservation district could be the entity in charge of the coral reef trust fund. Currently, Florida has fifty-eight Soil and Water Conservation Districts.¹⁶¹ The districts are non-taxing and organized by local citizens to promote natural resource conservation collectively. Similarly, the CRCDD would play a coordinating function across the five coastal counties that have coral reef ecosystems that contribute to their economy in any

158. *See supra* Part V.

159. Kousky & Light, *supra* note 45, at 372.

160. FLA. STAT. § 582.02 (2015).

161. ASSOCIATION OF FLORIDA CONSERVATION DISTRICTS, <https://afcd.us/>.

form.¹⁶² This way the “free-rider” issue could be avoided, where coastal counties refuse to pay into the coral reef trust yet still benefit from restoration efforts following triggering storms.

Another important note about the Coastal Zone Management Trust Fund is that it is governed by a technical committee and a scientific committee that oversees spending.¹⁶³ That spending includes conservation projects, aside from the annual insurance premiums.¹⁶⁴ Florida should take a similar approach to governance and spending. Notably, the Florida Keys region is a world leader in coral reef restoration and conservation—but with a hefty price tag.¹⁶⁵ NOAA announced in December 2019 a plan to restore seven iconic reefs in a two-phase mission,¹⁶⁶ with the first phase predicted to take five to seven years and cost \$97 million.¹⁶⁷ In 2020, the scientists spearheading the restoration at Mote Marine Lab reported breakthroughs in their efforts to make coral reefs more self-sustaining.¹⁶⁸ Therefore, like the Quintana Roo plan, the funds collected for a trust should also help fund these continued coral restoration efforts as a resiliency strategy to help minimize damage that the parametric plan would have to cover when a storm does trigger a payout. The proposed insurance plan should include spending for coral reef maintenance.¹⁶⁹

For revenue options, promoting interlocal agreements among the five coastal counties with the largest dependence on coral reef ecosystem services for flood protection and tourism is the most practicable option. A pooling together of local resources provides a more attractive and approachable method of trust fund contributions.¹⁷⁰ The aforementioned coral reef conservation district could then manage the trust fund spending and facilitate the government agreements. Contracts between Florida’s coastal

162. *See generally*, James Rasband et al., NATURAL RESOURCES LAW AND POLICY 75 (3d ed. 2016).

163. *Launch of the Coastal Zone Management Trust*, THE NATURE CONSERVANCY, https://thought-leadership-production.s3.amazonaws.com/2018/03/08/14/23/46/1ac3a4be-11d2-4651-9d98-50326d81e1b8/TNC_Mexico_CoastalManagementTrust_Factsheet.pdf at 3.

164. *Id.*

165. NOAA, *Restoring Seven Iconic Reefs*, FISHERIES.NOAA.GOV, <https://www.fisheries.noaa.gov/southeast/habitat-conservation/restoring-seven-iconic-reefs-mission-recover-coral-reefs-florida-keys>.

166. *Id.*

167. Tiffany Duong, *NOAA Launches \$97 Million Targeted Mission to Save Fla. Reef Tract*, KEYS WEEKLY (Dec. 12, 2019), <https://keysweekly.com/42/7-iconic-reefs/>.

168. Mote Marine Lab. & Aquarium, *Coral Reef Restoration*, MOTE <https://mote.org/research/program/coral-reef-restoration>.

169. Bergh et al., *supra* note 23, at 50.

170. Risk-pooling is a method to diversify an investors portfolio and share the costs and risk with others in the pool. *See supra* note 76 and accompanying text.

counties can also include terms to revisit an insurance spending agreement if there are future financial strains on individual governments.

The second-best option would be to reallocate Tourist Development Taxes. Local government referendums would be required to levy this additional tax and approvals required by local tourist development authorities to reallocate existing annual spending plans. This legislative authorization does not guarantee all the funds generated by TDTs will support reef conservation. Yet there is a higher chance the taxes will generate enough revenue to purchase annual coral reef insurance premiums, especially if coastal counties agree to raise the TDTs slightly and direct that increase to a trust fund.¹⁷¹ This scheme provides a legislative incentive for a reliable coral reef insurance funding source.

Further, these county taxes and interlocal funding agreements should be pooled with funding from private industries like commercial fishing companies and cruise companies because they also rely on healthy reef systems for revenue. In fact, Carnival, Royal Caribbean, and Norwegian all have headquarters in Miami, Florida.¹⁷² It would also be worthwhile for coastal governments to hold interest meetings with coastal property owners to propose a tax specifically designated to fund an annual coral reef insurance premium. Conversely, coastal property owners may argue against funding coral reef restoration tied to the tourism industry specifically, due to the dilemma of overcrowding associated with Florida tourist destinations. Hence, coastal governments would need to emphasize the infrastructure and erosion protection that coral reef ecosystems provide to coastal homeowners.

At this point, document stamp taxes do not appear to provide a reliable source of funding for a coral reef insurance plan.¹⁷³ Nevertheless, the trio of resiliency-based legislation enacted in 2021 both created a resiliency trust fund and directed a portion of Florida's document stamp tax revenue to those funds,¹⁷⁴ which could soon play a critical role in funding coral reef insurance premiums. As stated in Part II of this Article, it is clear that coral reefs protect shorelines.¹⁷⁵ Insuring coral reef ecosystems against natural catastrophe damage would fit directly within the bounds of

171. TDTs appear to be the most feasible way to generate funds for coral reef insurance for two main reasons. First, they can be limited in scope to cover premiums, Second, TDTs require minimal governmental action compared to other funding sources, *See supra* notes 97–100, 116 and accompanying text.

172. Cruise, PORT MIAMI <https://www.miamidade.gov/portmiami/cruise.asp>.

173. *See supra* note 108 and accompanying text.

174. *See supra* notes 109–113 and accompanying text.

175. *See discussion supra* Part II.

the three-part infrastructure plan intended to help mitigate the impacts of sea-level rise on coastal communities.¹⁷⁶

Next, there must be a rapid response plan in place to ensure a swift and efficient storm damage assessment and restoration. When the TNC helped to establish the Coastal Zone Management Trust Fund, there were developed protocols in place on post-storm response to guarantee coastal protection.¹⁷⁷ TNC has already developed a protocol that described the organization required to coordinate response efforts.¹⁷⁸ Phases include planning and preparation conducted annually before hurricane season to re-train response teams and renew any necessary permits, methods, or roles to conduct a rapid coral damage assessment.¹⁷⁹ Florida can adopt this rapid response plan.

Likewise, Florida should also adopt a section to the state's insurance code to create incentives for investment in natural infrastructure similar to section 12922.5, California Statutes (2018). The legislative history of California's Senate Bill 30 indicated that the American Insurance Company ("AIC") supported the innovative approach to insuring natural infrastructure because of California's "new normal" of experiencing devastating wildfires.¹⁸⁰ SB 30 indicated by its language that the state has "environmental features that can mitigate damage from climate-related events" and legislators believe innovative insurance can protect the resources to protect coastal communities.¹⁸¹ Therefore, the AIC would likely offer similar support for a Florida bill to create a natural resiliency section of the state's insurance code, as much of the state may have its own new normal: more climate-related hurricanes and coral bleaching. Florida lawmakers could take the language of California's SB 30 and tailor it to climate-driven issues threatening the state's coastal communities.

Lastly, the coral reef systems off of Florida's coast are even more susceptible to storm-related damage due to other harmful factors that weaken coral resiliency.¹⁸² This final recommendation is to create a parametric insurance plan that also covers marine heatwaves and cold-water anomalies. NOAA reported that severe marine heatwaves are common and have resulted in an

176. SB 2512, SB 2514, and SB 1954 went into effect in July 2021.

177. Bergh et al., *supra* note 23, at 30.

178. *See generally*, Zepeda, et al., *supra* note 37.

179. Fajardo et al., *supra* note 134, at 26.

180. *Insurance: Climate Change: Hearing Before the Senate Comm. on Insurance*, 115th Cong. 614 (Cal. 2018) (statement of Senator Steven Glazer).

181. CAL. INS. CODE § 12922.5 (West 2018).

182. *See* discussion *supra* note 39 and accompanying text.

unprecedented uptick in coral reef mortality.¹⁸³ In fact, scientists have discovered marine heatwaves cause even more extreme damage than mass bleaching on coral reefs.¹⁸⁴ Degree Heating Weeks (“DHW”) is the measurement to indicate a marine heatwave has occurred.¹⁸⁵ Similarly, cold water anomalies are insurable risks,¹⁸⁶ and, although they are less frequent, they are not less harmful.¹⁸⁷ Unfortunately, the cold-water anomaly of January 2010 caused the worst coral mortality on record for the Florida Reef Tract.¹⁸⁸ Therefore, a set DWH parameter would trigger an insurance payout to allow for responses to both hot and cold temperature-related harms.

VII. CONCLUSION

In conclusion, Florida’s Coral Reef has lost all but 2% of its living coral cover in recent decades and is struggling to survive amid growing environmental pressures.¹⁸⁹ Losing Florida’s coral reefs could result in cascading effects to coastal communities with a dependence on ecosystem services for flood control, erosion control, protection, and tourism. All in all, the goal of this coral reef insurance plan is to protect coastal communities from destructive storms fueled by accelerating climactic shifts.¹⁹⁰ There is a possibility that Florida’s coastal governments may pay higher premiums in the future to help insurers cope if the state experiences more triggering storms. However, as it stands, the TNC 2020 feasibility study indicated there is both interest amongst crucial stakeholders in implementing a Florida coral reef resiliency insurance plan and a successful model to structure a comparable parametric policy.¹⁹¹ Extending coverage to measurable temperature-driven harm is also in Florida’s best interest in order to build more resilient coral colonies.

183. William P. Leggat et al., *Rapid Coral Decay is Associated with Marine Heatwave Mortality Events on Reefs*, 29 CURRENT BIOLOGY 2723, 2723 e.4 (2019).

184. *Id.*

185. Alexander J. Fordyce et al., *Marine Heatwave Hotspots in Coral Reef Environments: Physical Drivers, Ecophysiological Outcomes, and Impact Upon Structural Complexity*, 6 FRON. MAR. SCI. 1, 2 (2019).

186. *See supra* note 69 and accompanying text.

187. Diego Lirman et al., *Severe 2010 Cold-Water Event Caused Unprecedented Mortality to Corals of the Fla. Reef Tract and Reversed Previous Survivorship Patterns*, 6 PLOS ONE e23047, (2011) (Discussing how the worst coral mortality on record for the Florida Reef Tract was caused by cold temperatures.).

188. *Id.*

189. Coral Reef Restoration, *supra* note 168.

190. *See discussion supra* Parts II, III, IV.

191. *See discussion supra* Parts IV, V.