PROTECTING COASTAL COMMUNITIES AND MARINE BIODIVERSITY UNDER THE COASTAL ZONE MANAGEMENT ACT

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"In pushing other species to extinction,
humanity is busy sawing off the limb on which it perches."[1]

ABSTRACT

Accelerating biodiversity loss and climate change pose significant threats to humanity. The two crises are inextricably linked and must be addressed together. Factors that increase one increase the other, and factors that mitigate one will mitigate the other. The global community has embarked on an ambitious plan to conserve 30% of land and ocean by 2030 by employing nature-based solutions that conserve biodiversity while reducing carbon emissions. In the United States, the federal Coastal Zone Management Act will play a pivotal role in achieving this initiative because it applies to both land-based and ocean-based resources and permits coastal states to take a lead role in addressing issues impacting its coastal zone.

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1. ELIZABETH KOLBERT, THE SIXTH EXTINCTION: AN UNNATURAL HISTORY 268 (2014).

I. INTRODUCTION

Extinction is a normal part of life that occurs periodically at expected background rates.[2] As new species capable of exploiting changing ecological niches emerge, older species disappear.[3] Approximately 98% of all life forms that have ever existed on Earth are now extinct.[4] During some periods, however, the rate of extinction far exceeds expected background rates due to some combination of environmental or ecological stressors.[5] Earth has experienced five mass extinction events, each of which resulted in the extinction of at least 75% of all species within a relatively short period of time.[6] Each event was precipitated by rapid and dramatic changes in climate and fundamental physical or chemical changes to land and oceans not unlike changes observed today.[7] Each of these events, however, occurred before humans appeared on Earth.

The rate of extinction today far exceeds expected background rates, leading many scientists to conclude that Earth is approaching a sixth mass extinction event.[8] Approximately one million animal and plant species are at risk of extinction in the coming decades due to habitat loss, climate change, and other factors.[9] Human activities have altered natural systems to an

2. *See* Hannah Ritchie, *There Have Been Five Mass Extinctions in Earth's History*, OUR WORLD IN DATA (Nov. 30, 2022), https://ourworldindata.org/mass-extinctions [https://perma.cc/S4ZS-N8F2].

3. *Id.*

4. Tammana Begum, *What Is Mass Extinction and Are We Facing a Sixth One?*, NAT. HIST. MUSEUM, https://www.nhm.ac.uk/discover/what-is-mass-extinction-and-are-we-facing-a-sixth-one.html [https://perma.cc/3RKR-LJJU] (Feb. 21, 2023).

5. Ritchie, *supra* note 2.

6. *Id.* (noting that the five mass extinction events in Earth's history include the following periods: End Ordovician (444 million years ago ("mya")); Late Devonian (360 mya); End Permian (250 mya); End Triassic (200 mya); and End Cretaceous (65 mya)). Mass extinction events are defined as periods with much higher extinction rates than normal. *Id.* In a mass extinction at least 75% of species go extinct within a relatively short period of time. *Id.*

7. *See id.*

8. *See* Gerardo Ceballos et al., *Accelerated Modern Human-Induced Species Losses: Entering the Sixth Mass Extinction*, SCI. ADVANCES, June 19, 2015, at 1, 1.

9. *See* SANDRA DIAZ ET AL., THE GLOBAL ASSESSMENT REPORT ON BIODIVERSITY AND ECOSYSTEM SERVS. – SUMMARY FOR POLICYMAKERS 12, 24 (2019), https://zenodo.org/records/3553579/files/ipbes_global_assessment_report_summary_for_policymakers.pdf?download=1 [perma.cc/3WM6-2EWV].

unparalleled degree across all spatial scales causing species to decline faster today than at any time in human history.[10] Climate change is accelerating the loss by warming areas faster than species can adapt and by forcing seasons to change in ways that impact species migration, mating, and other events.[11] Sea level rise will fundamentally alter coastal ecosystems and drive further species loss.[12]

Climate change and biodiversity loss present interrelated crises for humanity.[13] Both affect human health and well-being by negatively impacting food and water supplies, decreasing storm protection, limiting economic growth, and other matters.[14] Living organisms and systems affect climate through the production and absorbance of gases, and climate dictates where and how species can survive.[15] Factors that drive climate change drive biodiversity loss and factors that drive biodiversity loss drive climate change.[16] Moreover, actions that mitigate one tend to mitigate the other.[17] Thus, both problems must be addressed together.

Biodiversity provides significant economic benefits. Approximately 50% of global GDP, $44 trillion in economic value, depends on natural resources.[18] Biodiversity is also humanity's strongest natural defense against climate change.[19] Protecting natural habitats can decrease biodiversity loss and help tackle the climate crisis.[20] Ocean and coastal ecosystems provide over 90% of the living space for species on Earth and play critical roles in climate

10. *Id*. at 10–11.

11. *See, e.g.*, Peter A. Cotton, *Avian Migration Phenology and Global Climate Change*, 100 PROC. NAT'L ACAD. SCIS. U.S. 12219, 12219 (2003).

12. *See* Qiang He, *A Drowned Future for Coastal Ecosystem*, 621 NATURE 44, 44–45 (2023), https://www.nature.com/articles/d41586-023-02595-5 [perma.cc/7Y4B-VRUC].

13. Biodiversity is the collective term used to describe the variety of life on Earth in all its forms, from the smallest genes to the largest ecosystems.

14. *See* H.-O. Pörtner et al., *Overcoming the Coupled Climate and Biodiversity Crises and Their Societal Impacts*, SCI., Apr. 21, 2023, at 1, 1.

15. Kimberly Lightle, *The Biosphere/Climate Connection*, OHIO STATE UNIV., BEYOND WEATHER & THE WATER CYCLE, https://beyondweather.ehe.osu.edu/issue/we-depend-on-earths-climate/the-biosphereclimate-connection [https://perma.cc/J5MM-4N8S].

16. Pörtner et al., *supra* note 14.

17. *See id*.

18. CELINE HERWEIJER ET AL., WORLD ECON. F., NATURE RISK RISING: WHY THE CRISIS ENGULFING NATURE MATTERS FOR BUSINESS AND THE ECONOMY 8 (Janet Hill & Floris Landi eds., 2020).

19. *Biodiversity - Our Strongest Natural Defense Against Climate Change*, UNITED NATIONS CLIMATE ACTION, https://www.un.org/en/climatechange/science/climate-issues/biodiversity [https://perma.cc/KZH2-7H6Q] [hereinafter *Biodiversity*].

20. *See id.*

mitigation and resilience.[21] Protecting these biologically diverse systems must be a global priority.[22]

In 2022, the United Nations Convention on Biological Diversity released a plan to reverse nature's rapid decline.[23] The Kunming-Montreal Global Biodiversity Framework (GBF) is based on the belief that conserving 30% of the planet's land and 30% of its water can protect roughly 75% of Earth's species and slow climate change through natural carbon sequestration.[24] More than 190 countries signed the agreement that includes twenty-three targets for urgent action over the decade to 2030.[25] Target three of the GBF seeks to conserve 30% of land and water by 2030.[26] The United States did not sign the agreement and remains one of the only countries without a national biodiversity strategy.[27] However, the Biden Administration has adopted a plan to conserve 30% of the nation's land and water by 2030.[28] The America the Beautiful Challenge prioritizes nature-based solutions to simultaneously address climate change and biodiversity loss.[29] The public-private grant program developed to allow investment in locally led ecosystem restoration

21. *See* Cristiana Paşca Palmer, *Marine Biodiversity and Ecosystems Underpin a Healthy Planet and Social Well-Being*, UNITED NATIONS CHRONICLE (May 2017), https://www.un.org/en/chronicle/article/marine-biodiversity-and-ecosystems-underpin-healthy-planet-and-social-well-being [https://perma.cc/3YGK-BBTP].

22. *IMPAC5 Will Be Informed by Five Themes and Three Cross-Cutting Streams*, FIFTH INT'L MARINE PROTECTED AREAS CONG., https://www.impac5.ca/congress-details/program/themes-and-streams/ [https://perma.cc/3FV8-RAE9].

23. *See* U.N. Conference of the Parties to the Convention on Biological Diversity, *Kunming-Montreal Global Biodiversity Framework: Draft Decision Submitted by the President*, U.N. Doc. CBD/COP/15/L.25 (Dec. 18, 2022), https://www.cbd.int/doc/c/e6d3/cd1d/daf663719a03902a9b116c34/cop-15-l-25-en.pdf [perma.cc/G6DS-S3XP].

24. *See id.* at 4, 9 ("An average of around 25 per cent of species in assessed animal and plant groups are threatened . . . [but] [n]ature can be conserved, restored and used sustainably while other global societal goals are simultaneously met through urgent and concerted efforts fostering transformative change.").

25. *The Kunming-Montreal Global Biodiversity Framework Explained*, WORLD WILDLIFE FUND (Oct. 1, 2023), https://wwf.panda.org/wwf_news/?9995891/The-Kunming-Montreal-Global-Biodiversity-Framework-explained [https://perma.cc/5AB2-K7JU].

26. U.N. Conference of the Parties to the Convention on Biological Diversity, *supra* note 23, at 9.

27. Phoebe Weston & Patrick Greenfield, *The US Touts Support for Biodiversity – but at Cop15, It Remains on the Sidelines*, THE GUARDIAN (Dec. 17, 2022, 15:15 EST), https://www.theguardian.com/environment/2022/dec/17/cop15-us-biodiversity-cbd [perma.cc/QRC6-EEUZ].

28. *Id.*; Exec. Order No. 14008, Tackling the Climate Crisis at Home and Abroad, 86 Fed. Reg. 7619, 7627 (Jan. 27, 2021).

29. *See generally America the Beautiful Challenge*, THE NAT'L FISH & WILDLIFE FOUND., https://www.nfwf.org/programs/america-beautiful-challenge [https://perma.cc/6LTW-5P9B] (describing the specific actions taken by the America the Beautiful challenge to aid conservation and restoration).

projects.[30] Achieving this goal requires a whole of government approach and new uses of existing statutory authority.

The National Oceanic and Atmospheric Administration (NOAA) is the lead federal agency charged with studying and reporting on the ocean, atmosphere, and coastal regions of the United States.[31] NOAA has several existing authorities to conserve or restore ocean, coastal, and Great Lakes areas, including the National Marine Sanctuaries Act, Magnuson-Stevens Act, Endangered Species Act, Marine Mammal Protection Act, Coastal Zone Management Act, and others.[32] Each will play an important role in achieving the goal of preserving 30% of the ocean and coastal waters.[33] This article considers how the federal Coastal Zone Management Act may be utilized to reduce biodiversity loss and mitigate the impacts of climate change on coastal and marine systems. With the limited prospects of new legislation addressing climate change and the U.S. Supreme Court actively dismantling the environmental administrative state, the federal Coastal Zone Management Act is uniquely poised to become an effective tool to address both crises.[34]

Section II of this article examines the rapid decline in biodiversity worldwide and in the United States and explains the potential impacts of unmitigated biodiversity loss on humanity. Section III explores the current and projected impacts of climate change on ocean and coastal systems with an emphasis on changes that impact coastal ecosystems. Section IV examines key provisions of the federal Coastal Zone Management Act that may be used to protect vulnerable ecosystems and their inhabitants while simultaneously mitigating climate change. Section V recommends changes needed to coastal zone management at both the state and federal levels to address biodiversity loss and climate change.

30. *Id.*

31. *See About Our Agency*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., https://www.noaa.gov/about-our-agency [https://perma.cc/E55P-2EPT] (May 2, 2024).

32. *See NOAA's Existing Marine Conservation Authorities*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., https://www.noaa.gov/america-the-beautiful/noaas-existing-marine-conservation-authorities [https://perma.cc/W7XH-LE7T] (May 18, 2024).

33. *Marine Protected Areas: Conserving America's Oceans and Coasts*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., https://marineprotectedareas.noaa.gov/ [https://perma.cc/G7LM-4L3U] [hereinafter *Conserving Oceans and Coasts*].

34. Eric S. Laschever, *The Coastal Zone Management Act in Its Sixth Decade: An Unsung Cornerstone in the Nation's Response to Climate and Ocean Change*, 51 COASTAL MGMT. 231, 231 (2023).

II. ACCELERATING BIODIVERSITY LOSS

Human activities continue to alter Earth's biosphere to an unparalleled degree across all spatial scales.[35] These changes are driving biodiversity loss at a rate faster than at any time in recorded history.[36] By some estimates, the rate of extinction today is ten to one hundred times faster than the rate of extinction in pre-human times.[37] One comprehensive, long-term study found that between 1970 and 2018, there was an average 69% decline in wildlife populations around the world.[38] The extent of the decline varies regionally.[39] Latin America, for example, has experienced a 94% decline in average population abundance.[40] Today, biodiversity loss is driven primarily by land and coastal use change, climate change, pollution, overexploitation, and invasive species.[41] Each of these drivers are the result of human activities.[42] Sea level rise, elevated storm intensity, ocean acidification, and other related impacts will place increasing pressure on species and system as climate change advances.[43] If society is unable to limit climate warming below the international target of 1.5°C, climate change will become the dominant cause of biodiversity loss.[44]

Biodiversity plays a critical role in human health and well-being, economic growth, and food security, among other critical areas.[45] It provides clean air, distributes fresh water, regulates the climate, provides pollination and pest control, and reduces the impact of natural hazards.[46] More than 75%

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35. *Introduction to the GBF*, CONVENTION ON BIOLOGICAL DIVERSITY (Feb. 21, 2024), https://www.cbd.int/gbf/introduction [https://perma.cc/MZ8V-U63E]. The biosphere is comprised of those parts of Earth where life exists. Kim Rutledge et al., *Biosphere*, NAT'L GEOGRAPHIC, https://education.nationalgeographic.org/resource/biosphere/ [https://perma.cc/6VLA-CHA6] (Oct. 19, 2023).

36. DIAZ ET AL., *supra* note 9, at 10, 12.

37. *Is the Rate of Biodiversity Loss Increasing or Decreasing?*, THE ROYAL SOC'Y, https://royalsociety.org/news-resources/projects/biodiversity/is-the-rate-of-biodiversity-loss-increasing-or-decreasing/ [https://perma.cc/3JA2-E9M5].

38. *See* ROB ALKEMADE ET AL., WORLD WILDLIFE FUND, LIVING PLANET REPORT 2022: BUILDING A NATURE POSITIVE SOCIETY 4 (Rosemunde Almond et al. eds., 2022).

39. *See id.*

40. *Id.*

41. *See Is the Rate of Biodiversity Loss Increasing or Decreasing?*, *supra* note 37.

42. *See The Five Biggest Threats to Our Natural World . . . and How We Can Stop Them*, THE GUARDIAN (July 24, 2023, 8:00 EDT), https://www.theguardian.com/environment/2021/oct/14/five-biggest-threats-natural-world-how-we-can-stop-them-aoe [https://perma.cc/NQ3V-598L].

43. *See id.*

44. Kate Whiting, *6 Charts That Show the State of Biodiversity and Nature Loss - and How We Can Go 'Nature Positive'*, WORLD ECON. F. (Oct. 17, 2022), https://www.weforum.org/agenda/2022/10/nature-loss-biodiversity-wwf/ [https://perma.cc/L77E-QQRS].

45. DIAZ ET AL., *supra* note 9, at 12.

46. *Id.* at 10.

of global food crops rely on animal pollination.[47] Natural systems serve as sinks for anthropogenic carbon emissions, sequestering approximately 60% of global anthropogenic emissions.[48] But human activities continue to destroy these natural protective mechanisms.[49] The current annual rate of resource consumption exceeds the planet's ability to sustainably regenerate itself.[50] Loss of biodiversity within a system decreases overall system resilience to other environmental stressors.[51]

A. Marine and Coastal Zone Biodiversity

The global ocean covers more than 70% of Earth's surface and provides more than 99% of its habitable space.[52] Coastal ecosystems at the land-sea interface are among the most valuable ecosystems on the planet.[53] These biologically diverse areas provide an abundance of valuable natural resources and critical ecosystem services of enormous value to humans, such as water purification, nursery habitat, storm protection, and carbon sequestration.[54] Marine biodiversity is a critical aspect of all three pillars of sustainable development—economic, social, and environmental.[55] The relentless human migration to the shoreline and overexploitation of marine and coastal resources has placed increasing pressure on vulnerable estuaries, marshes, mangroves, sea grasses, and coral reefs.[56] As a result of human activities, the biodiversity of marine and coastal habitats is experiencing rapid change that compromises their ability to provide critical ecosystem services.[57] More than half of the ocean is exploited by industrial fishing, more than 90% of

47. *Id.*
48. *Id.*
49. *See id.* at 12.
50. Joe McCarthy & Erica Sánchez, *The World Is Using Natural Resources Faster Than Ever Before*, GLOB. CITIZEN (July 30, 2019), https://www.globalcitizen.org/en/content/overshoot-day-natural-resources/ [perma.cc/8TKW-7VF2].
51. *See* Bradley J. Cardinale et al., *Biodiversity Loss and Its Impact on Humanity*, 486 NATURE 59, 59 (2012), https://www.nature.com/articles/nature11148 [perma.cc/P67M-DG2B].
52. TED Ed, *Just How Big Is the Ocean?*, SMITHSONIAN MUSEUM OF NAT. HIST. OCEAN FIND YOUR BLUE (June 24, 2013), https://ocean.si.edu/planet-ocean/seafloor/just-how-big-ocean [perma.cc/Y4VB-MTGM].
53. *See* Michael J. Osland et al., *Migration and Transformation of Coastal Wetlands in Response to Rising Seas*, SCI. ADVANCES, July 1, 2022, at 1, 1.
54. *See id.*
55. Palmer, *supra* note 21.
56. *See generally id.* (providing an example of a valuable marine ecosystem through the mangroves ecosystem and discussing how increasing human population near the coast will affect these natural resources).
57. *See* James E. Herbert-Read et al., *A Global Horizon Scan of Issues Impacting Marine and Coastal Biodiversity Conservation*, 6 NATURE ECOLOGY & EVOLUTION 1262, 1267 (2022), https://www.nature.com/articles/s41559-022-01812-0 [perma.cc/JU8Q-K5N6].

commercial fish stocks are fished at or beyond maximum sustainable levels, one-third of all fish stocks are overfished, half of the world's coral reef systems have been destroyed, and further loss is projected as sea temperatures rise.[58] The number of ocean dead zones—areas in which levels of oxygen are too low to support most marine life—have increased four-fold in the last fifty years.[59] More than 400 dead zones exist and more are forming as a result of pollution run off and other factors.[60] Ocean warming, acidification, freshening, and other impacts of climatic changes are accelerating these changes.[61]

Almost 48% of all coastal regions have been heavily impacted by anthropogenic activities.[62] Only 16% of the world's coastlines experience low anthropogenic pressure.[63] In most countries, more than 50% of the coastline is already degraded.[64] Moreover, in almost half of these countries, protected coastal areas continue to face significant human pressures.[65] Offshore protections are also limited. Fully protective marine protected areas (MPAs) prohibit harmful extractive activities or other damaging practices to protect and sustain sensitive habitats and biodiversity.[66] Areas fully protected have well-documented outcomes, including increased fish diversity and biomass.[67] Unfortunately, these MPAs are not sufficiently widespread to prevent biodiversity loss.[68] Approximately 8% of the global ocean is covered by MPAs, but only 3% is fully or highly protective MPAs.[69] Most MPAs provide for mixed use and lack the regulations, characteristics, and management

58. HERWEIJER ET AL., *supra* note 18, at 9.

59. *Id.* at 11.

60. *See id.*

61. *See* Herbert-Read et al., *supra* note 57, at 1262.

62. Brooke A. Williams et al., *Global Rarity of Intact Coastal Regions*, CONSERVATION BIOLOGY, Aug. 2022, at 1, 1.

63. *Id.*

64. *Id.*

65. *Id.*

66. *See Conserving Oceans and Coasts*, *supra* note 33.

67. John W. Turnbull et al., *Evaluating the Social and Ecological Effectiveness of Partially Protected Marine Areas*, 35 CONSERVATION BIOLOGY 921, 921 (2021).

68. Dan Bacher, *Marine Protected Areas Aren't Enough to Save the Oceans*, RED GREEN & BLUE (July 29, 2011), https://redgreenandblue.org/2011/07/29/marine-protected-areas-arent-enough-to-save-the-oceans/ [https://perma.cc/KN8K-MTGK].

69. *Marine Protected Areas,* PROTECTED PLANET, https://www.protectedplanet.net/en/thematic-areas/marine-protected-areas [https://perma.cc/EL4Z-VZ2F] ("The global coverage of marine protected areas (MPAs) is 8.35%."); *see* Sarah Gibbens, *Less Than 3 Percent of the Ocean Is 'Highly Protected',* NAT'L GEOGRAPHIC (Sept. 25, 2019), https://www.nationalgeographic.com/environment/article/paper-parks-undermine-marine-protected-areas [perma.cc/M4W3-LTCU].

critical to ensuring they successfully safeguard marine life.[70] Studies have shown that these partially protected areas may be no better at protecting biodiversity than open areas.[71] Although countries, including the United States, continue to declare new MPAs, there is a declining emphasis on creating fully protective MPAs.[72] Most MPAs in the United States are considered "mixed-use" and allow for a variety of activities within their boundaries.[73]

In the United States, nearly 1,000 MPAs cover approximately 26% of all U.S. marine waters.[74] These MPA's are intended to protect marine species and ecosystems, but only 3% completely prohibit extraction of living resources.[75] Almost all of the U.S. MPA protection is located in the central and western Pacific.[76] Hawaii, American Samoa, Guam, Northern Marianas, and Pacific remote islands are strongly protected by MPAs.[77] If those areas are removed, roughly 0.01% of continental federal waters and 1.05% of continental state waters are strongly protected under state or federal MPAs.[78] With limited exceptions, state and territorial waters remain open to extractive activities.[79] More is needed to protect marine and coastal biodiversity.

B. Climate Change, Ocean Warming, and Sea Level Rise

Atmospheric greenhouse gas concentrations have risen steadily since the beginning of the Industrial Revolution, primarily through emissions from the

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70. *See generally* Jane Lubchenco & Kirsten Grorud-Colvert, *Making Waves: The Science and Politics of Ocean Protection*, SCI. MAG., Oct. 23, 2015, at 382, 383 (discussing a disconnection between political discussions and the scientific knowledge required for the success of MPAs).

71. *See* Turnbull et al., *supra* note 67, at 927 (concluding that partially protected areas act as red herrings in marine conservation because they create an illusion of protection and consume scarce conservation resources yet provide little or no social or ecological gain over open areas).

72. *See* Joachim Claudet et al., *Underprotected Marine Protected Areas in a Global Biodiversity Hotspot*, ONE EARTH, Apr. 24, 2020, at 380, 381; National Geographic Soc'y, *Marine Protected Area*, NAT'L GEOGRAPHIC, https://education.nationalgeographic.org/resource/marine-protected-area/ [https://perma.cc/K5J9-5ZAN] (Jan. 22, 2024).

73. *What Are Marine Protected Areas?,* NAT'L MARINE SANCTUARY FOUND. (Sept. 9, 2019), https://marinesanctuary.org/blog/what-are-marine-protected-areas/ [perma.cc/A3XP-VRN8].

74. *See Conserving Oceans and Coasts*, *supra* note 33.

75. *See id.*

76. MARINE CONSERVATION INST., SEASTATES 2021: MARINE PROTECTION IN AMERICA'S OCEAN (2021), https://marine-conservation.org/wp-content/uploads/2021/01/SeaStates_US_2021_final_sm.pdf [perma.cc/6HVV-FXW6].

77. *See id.*

78. *Id.*

79. *See id.*

combustion of fossil fuels.[80] Global temperatures have risen in parallel with the release of greenhouse gases.[81] Carbon dioxide (CO_2), the second most abundant greenhouse gas in Earth's atmosphere, has become a direct proxy for measuring climate change.[82] At the dawn of human civilization, Earth's atmosphere contained about 275 parts per million (ppm) of CO_2.[83] In the early 1980s, a consensus emerged that atmospheric concentrations of above 350 ppm CO_2 would be "too high to maintain the climate to which humanity, wildlife, and the rest of the biosphere are adapted."[84] As of March 2024, Earth's atmosphere contained 420.73 ppm CO_2.[85] The climate-driven effects that scientists have long predicted are now evident.[86] Glaciers and ice sheets are becoming unstable, phenological mismatch of interacting species is increasing, changes in precipitation are augmenting drought conditions, terrestrial and marine heatwaves are increasing, and coastal communities continue to lose land to advancing seas.[87]

As part of the Paris Agreement in 2015, nations aimed to limit the long-term temperature increase to no more than 1.5°C above preindustrial levels.[88]

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80. *See Climate Change Indicators: Atmospheric Concentrations of Greenhouse Gases*, ENV'T PROT. AGENCY, https://www.epa.gov/climate-indicators/climate-change-indicators-atmospheric-concentrations-greenhouse-gases [perma.cc/CGL6-WMUX].

81. *Climate Science Basics*, 350, https://350.org/science/ [perma.cc/2RWF-TMP9] (explaining that approximately 99% of scientists agree that climate change is being caused by human greenhouse gas emissions).

82. Owen Mulhern, *A Graphical History of Atmospheric CO2 Levels Over Time*, EARTH.ORG (Aug. 12, 2020), https://earth.org/data_visualization/a-brief-history-of-co2/ [perma.cc/P7EA-5JUA]. Water vapor is the most abundant greenhouse gas. *Id.* However, it does not last long enough in the atmosphere to change the long-term temperature of earth. Aaron Krol, *Why Do We Blame Climate Change on Carbon Dioxide, When Water Vapor Is a Much More Common Greenhouse Gas?*, CLIMATE PORTAL MASS. INST. OF TECH. (Nov. 3, 2023), https://climate.mit.edu/ask-mit/why-do-we-blame-climate-change-carbon-dioxide-when-water-vapor-much-more-common-greenhouse [https://perma.cc/ELU5-YP2U].

83. *Why 350?*, MN350 https://mn350.org/understanding350/ [perma.cc/NJX8-377E].

84. *See* Andrew C. Revkin, *Back to 1988 on CO_2, Says NASA's Hansen*, N.Y. TIMES BLOG: DOT EARTH (Mar. 19, 2008, 7:52 AM), https://archive.nytimes.com/dotearth.blogs.nytimes.com/2008/03/19/back-to-1988-on-co2-says-nasas-hansen/ [https://perma.cc/F6MG-2C3A].

85. *See generally Daily CO_2*, CO_2-EARTH, https://www.co2.earth/daily-co2 [perma.cc/82Z5-24HT] (displaying daily changing values for the CO_2 level in Earth's atmosphere on a particular day).

86. *See* Nate G. McDowell et al., *Predicting Chronic Climate-Driven Disturbances and Their Mitigation*, 33 TRENDS IN ECOLOGY & EVOLUTION 15, 16 (2018).

87. *See* Ove Hoegh-Guldberg et al., *Impacts of 1.5ºC of Global Warming on Natural and Human Systems*, *in* GLOBAL WARMING OF 1.5°C, 175, 177, 197, 216, 223 (Jose Antonio Margeno et al. eds., 2018), https://www.ipcc.ch/site/assets/uploads/sites/2/2022/06/SR15_Chapter_3_LR.pdf [https://perma.cc/Y7YV-EMGJ].

88. Paris Agreement to the United Nations Framework Convention on Climate Change art. 2, Dec. 12, 2015, T.I.A.S. No. 16-1104, https://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_english_.pdf [perma.cc/QPW7-QEVU].

Scientists agree that exceeding this temperature threshold could trigger several tipping points that "may lead to abrupt, irreversible, and dangerous impacts with serious implications for humanity."[89] The World Meteorological Organization (WMO) recently confirmed that 2023 was the warmest year on record, and that the 2023 annual average global temperature was 1.45 ± 0.12°C above pre-industrial levels.[90] The change represents the largest annual increase in the 144-year record.[91] While this data represents only a single year, the ten hottest years ever recorded have occurred in the last decade.[92] According to the Intergovernmental Panel on Climate Change (IPCC), each of the last four decades has been successively warmer than any decade that preceded it since 1850.[93] The impacts are profound. In 2023, deadly heatwaves spread through the northern hemisphere; Canada and Hawaii experienced devastating wildfires, and Korea, South Africa, and China, experienced record-breaking rains.[94] Experts predict that 2024 may be even hotter as land and ocean warming accelerates.[95]

More than 90% of the heat trapped in the Earth's atmosphere by greenhouse gases is stored in the ocean.[96] As a result, the ocean has acted as a buffer against global heating.[97] By one estimate between 1971 and 2018, the

89. *See* David I. Armstrong McKay et al., *Exceeding 1.5°C Global Warming Could Trigger Multiple Climate Tipping Points*, SCI., Sept. 9, 2022, at 1, 1.

90. Press Release, World Meteorological Org., WMO Confirms that 2023 Smashes Global Temperature Record (Jan. 12, 2024), https://wmo.int/news/media-centre/wmo-confirms-2023-smashes-global-temperature-record [perma.cc/N9D7-W8TP].

91. *See* James Hansen et al., *Global Warming Acceleration: Causes and Consequences*, COLUM. UNIV. 1 (Jan. 12, 2024), https://www.columbia.edu/~jeh1/mailings/2024/AnnualT2023.2024.01.12.pdf [perma.cc/DW7U-QGUN].

92. *2023 Was the World's Warmest Year on Record, By Far*, NAT'L OCEANIC & ATMOSPHERIC ADMIN. (Jan. 12, 2024), https://www.noaa.gov/news/2023-was-worlds-warmest-year-on-record-by-far [perma.cc/VFB3-KX8V].

93. RICHARD P. ALLAN ET AL., INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2021: THE PHYSICAL SCIENCE BASIS: SUMMARY FOR POLICYMAKERS 5 (Valérie Masson-Delmotte et al. eds., 2021), https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf [perma.cc/V8ZS-AGWR].

94. Wesley Morgan, *'It's Not Game Over – It's Game On': Why 2024 is an Inflection Point for the Climate Crisis*, THE CONVERSATION (Jan. 22, 2024, 2:04 PM), https://theconversation.com/its-not-game-over-its-game-on-why-2024-is-an-inflection-point-for-the-climate-crisis-221497 [perma.cc/WFC2-F7TT].

95. *See* Scott Sutherland, *After 2023's Astounding New Global Heat Record, 2024 May Be Even Worse*, THE WEATHER NETWORK (Jan. 13, 2024, 8:00 AM), https://www.theweathernetwork.com/en/news/climate/impacts/2023-was-the-worlds-hottest-year-on-record-by-a-wide-margin [perma.cc/4G88-49YT].

96. *See* Xiaoying You, *Oceans Break Heat Records Five Years in a Row*, 625 NATURE 434, 434 (2024), https://www.nature.com/articles/d41586-024-00081-0 [perma.cc/3V6W-ZFL5].

97. *See* INT'L UNION FOR CONSERVATION OF NATURE, ISSUES BRIEF: OCEAN WARMING (2017), https://www.iucn.org/resources/issues-brief/ocean-warming [https://perma.cc/TF33-S532].

ocean gained 396 zettajoules of heat—the equivalent of more than twenty-five billion Hiroshima atomic bombs.[98] This heat gain has accelerated.[99] Since 1993, the rate of ocean warming has more than doubled.[100] From 2020-2022, the Pacific Ocean saw three consecutive La Niña events, which are typically associated with ocean cooling.[101] Yet, in 2021 and 2022, ocean temperatures exceeded previous record maximums.[102] In 2023, ocean temperature climbed even higher, peaking before an El Niño event that typically drives warming.[103] The incidents of harmful marine heatwaves also doubled.[104]

The IPCC found climate change has altered marine, terrestrial, and freshwater ecosystems all around the world.[105] These changes have contributed to biodiversity decline at the species and ecosystem levels.[106] At current temperatures ecosystems are at high risk due to coral reef bleaching, marine heatwaves, and other factors.[107] As global temperatures surpass 1.5°C, coral reefs, kelp forests, seagrass meadows, and other habitat forming ecosystems will undergo irreversible phase shifts due to marine heatwaves.[108] If Earth warms beyond 2°C, risks of local extirpation, extinction, and ecosystem collapse escalate rapidly.[109] The risk is particularly high for marine species inhabiting ocean and coastal ecosystems due to longer and more frequent marine heatwaves.[110] These changes are expected to work

98. Graham Readfearn, *Oceans Have Been Absorbing the World's Extra Heat. But There's a Huge Payback*, THE GUARDIAN (May 14, 2023, 16:30 EDT), https://www.theguardian.com/environment/2023/may/15/oceans-have-been-absorbing-the-worlds-extra-heat-but-theres-a-huge-payback [perma.cc/MQ7F-B8E5].

99. *Id.*

100. Nerilie Abram et al., *Summary for Policymakers*, *in* THE OCEAN AND CRYOSPHERE IN A CHANGING CLIMATE: A SPECIAL REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 3, 9 (H.-O. Pörtner et al. eds., 2019), https://www.ipcc.ch/site/assets/uploads/sites/3/2019/12/SROCC_FullReport_FINAL.pdf [https://perma.cc/J8EF-WRN6].

101. *See* Tao Geng et al., *Increased Occurrences of Consecutive La Niña Events Under Global Warming*, 619 NATURE 774, 774 (2023), https://www.nature.com/articles/s41586-023-06236-9 [perma.cc/Y627-KNE6].

102. *See* Roxana Bardan, *NASA Analysis Confirms 2023 as Warmest Year on Record*, NAT'L AERONAUTICS & SPACE ADMIN. (Jan. 12, 2024), https://www.nasa.gov/news-release/nasa-analysis-confirms-2023-as-warmest-year-on-record/ [perma.cc/GZ76-6JHU].

103. *See id.*

104. Abram et al., *supra* note 100.

105. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, SIXTH ASSESSMENT REPORT WORKING GROUP II – IMPACTS, ADAPTATION AND VULNERABILITY: FACT SHEET-BIODIVERSITY 1 (2022), https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_Biodiversity.pdf [perma.cc/6BU7-GFUR] [hereinafter IPCC BIODIVERSITY].

106. *See id.*

107. *Id.*

108. *Id.* at 2.

109. *Id.*

110. *See id.*

synergistically with other existing stressors such as overexploitation, nutrient enrichment, pollution, and invasive species to reduce resilience and drive systems to surpass ecological tipping points.[111]

While there is some evidence that global greenhouse gas emissions may peak in 2024 and then start falling, the current rate of decline is insufficient to stave off the worst impacts of climate change.[112] According to one report, to limit global warming to 1.5ºC countries will need to triple renewables, eliminate new fossil fuel plans, double energy efficiency, accelerate the electrification of energy demand sectors, halt deforestation, and slash methane emissions by over 30%.[113]

C. Sea Level Rise

Sea level is the average height of the sea as measured with respect to some reference surface.[114] It changes over time, sometimes abruptly. For example, since the end of the last ice age 20,000 years ago, sea level has risen over 400 feet to reach its current level.[115] Approximately 15,000 years ago, continental glaciers retreated, and sea level began to rise.[116] If ice contained in existing ice sheets and glaciers melted, sea level would rise an additional 212-230 feet and flood every coastal city on the planet.[117]

Sea level does not rise uniformly across the earth.[118] A multitude of factors influence isostatic (local) and eustatic (global) changes in level.[119] Isostatic changes result from factors that cause the local lithosphere to rise or fall, such as tectonic activity, glaciation, sediment compaction, or other

111. *See id.* at 3.

112. *See generally* CLAIRE FYSON ET AL., CLIMATE ANALYTICS, WHEN WILL GLOBAL GREENHOUSE GAS EMISSIONS PEAK? 1 (2023), https://ca1-clm.edcdn.com/assets/When-will-global-greenhouse-gas-emissions-peak.pdf?v=1700638534 [perma.cc/BJW7-2SCW] (discussing international efforts of governments to combat worsening climate impacts that could occur by 2024 or 2025).

113. *See id.* at Summary 4.

114. *See* ORRIN H. PILKEY & ROB YOUNG, THE RISING SEA 37–38 (2009).

115. *See* JOHN ENGLANDER, MOVING TO HIGHER GROUND: RISING SEA LEVEL AND THE PATH FORWARD 8–10 (Girl Friday Prods. ed., 1st ed. 2021).

116. *How Does Present Glacier Extent and Sea Level Compare to the Extent of Glaciers and Global Sea Level During the Last Glacial Maximum (LGM)?*, U.S. GEOLOGICAL SURV., https://www.usgs.gov/faqs/how-does-present-glacier-extent-and-sea-level-compare-extent-glaciers-and-global-sea- [https://perma.cc/4234-9X5Z].

117. *How Would Sea Level Change if All Glaciers Melted?*, U.S. GEOLOGICAL SURV., https://www.usgs.gov/faqs/how-would-sea-level-change-if-all-glaciers-melted [https://perma.cc/VGX3-QXVJ]; *see* ENGLANDER, *supra* note 115, at 33.

118. *See Is Sea Level the Same All Across the Ocean?*, NAT'L OCEANIC & ATMOSPHERIC ADMIN. (Jan. 4, 2021), https://oceanservice.noaa.gov/facts/globalsl.html [https://perma.cc/BRN6-B2WW].

119. *See* PILKEY & YOUNG, *supra* note 114, at 32–33.

movements that change the weight of the crust.[120] Because these factors differ regionally, sea level may rise in one area and fall in another.[121] For example, in coastal areas subject to land compaction or subsidence, relative sea level rises.[122] In other areas, land compacted by glaciation rebounds as warming melts the ice and removes added weight from the lithosphere.[123] In these areas, sea level is falling.[124] In the United States, sea level is rising along states bordering the Gulf of Mexico and along the eastern seaboard to the mid-Atlantic, but is falling in Alaska and parts of the Pacific Northwest due to one or more of these factors.[125]

Eustatic sea level rise results from tectonic activity that adds space to ocean basis to accommodate more water and through changes in the volume of water in the ocean basin.[126] Today, eustatic sea level rise is largely driven by the addition of water from glacial melting and from thermal expansion of water.[127] This water primarily comes from ice on land, but groundwater depletion also moves water from the land to the ocean. [128]

Sea level rise is unstoppable. Past warming of the ocean has already committed Earth to considerable future sea level.[129] Even with meaningful efforts to stop planetary warming, excess heat stored in the ocean will continue to melt ice sheets for centuries.[130] Without efforts to significantly reduce greenhouse gas emissions, ocean temperature will rise causing glaciers and ice sheets to melt faster and water to thermally expand.[131] As the ice disappears, massive quantities of greenhouse gases sequestered in the perennially-froze ground (permafrost) will be released back into the atmosphere through microbial decomposition creating a dangerous feedback loop that accelerates warming.[132] The northern permafrost region soils contain 1,460-1,600 billion metric tons of organic carbon, roughly double the amount

120. *Id.* at 32.
121. *See id.*
122. *See id.*
123. *See id.*
124. *Id.*
125. *See* Rebecca Lindsey, *Climate Change: Global Sea Level*, CLIMATE.GOV (Apr. 19, 2022), https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level [https://perma.cc/C2C5-Y2F9].
126. *See* PILKEY & YOUNG, *supra* note 114, at 33.
127. *See id.*
128. *See* ENGLANDER, *supra* note 115, at 26.
129. *See id.* at 14.
130. *See id.*
131. *See* Lindsey, *supra* note 125.
132. *See* Renée Cho, *What Lies Beneath Melting Glaciers and Thawing Permafrost?*, COLUM. CLIMATE SCH.: STATE OF THE PLANET (Sept. 13, 2022), https://news.climate.columbia.edu/2022/09/13/what-lies-beneath-melting-glaciers-and-thawing-permafrost/ [https://perma.cc/MQ4G-S32U].

currently contained in the atmosphere.[133] Due to arctic amplification, the world warms faster in the far north.[134] Currently, arctic regions are warming four times faster than the global average.[135]

Global mean sea level has risen about eight to nine inches since 1880, and the rate is accelerating.[136] Sea level rose approximately 1.4mm each year during the twentieth century.[137] Beginning in 1993, the rate increased to 1.8mm per year.[138] Between 2011 and 2020, the rate increased to 4.5mm per year.[139] In 2023, the rate increased to 7.6mm.[140] While the 2023 rate was influenced by an El Niño event, the upward trend continues.[141] Under current rates, global mean sea level will rise by another twenty centimeters by 2050, doubling the amount of change in the next three decades compared to the previous 100 years.[142]

Under conservative models, regardless of emissions scenarios, sea level is projected to rise along the U.S. coastline, on average, ten to twelve inches by 2050.[143] This change is equivalent to the rise measured between 1920 and 2020.[144] Local sea levels may rise up to two feet by 2100.[145]

With increased warming local sea level could rise along the contiguous U.S. by more than seven feet by 2100 and by more than twelve feet by 2150.[146] Even half this rise would cause catastrophic harm to human populations and

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133. T. Schuur, *Arctic Report Card: Update for 2019: Permafrost and the Global Carbon Cycle*, NAT'L OCEANIC & ATMOSPHERIC ADMIN. (Nov. 22, 2019), https://arctic.noaa.gov/report-card/report-card-2019/permafrost-and-the-global-carbon-cycle/ [https://perma.cc/2HPK-V4V5].

134. *See* Mika Rantanen et al., *The Artic Has Warmed Nearly Four Times Faster Than the Globe Since 1979*, 3 COMMC'NS EARTH & ENV'T, Aug. 11, 2022, at 1, 2, https://doi.org/10.1038/s43247-022-00498-3 [https://perma.cc/U9J2-WBBQ].

135. *See id.*

136. Lindsey, *supra* note 125.

137. *Id*.

138. Anny Cazenave et al., *The Rate of Sea Level Rise*, 4 NATURE CLIMATE CHANGE 358, 358 (2014).

139. *See* Press Release, World Meteorological Org., Rates and Impacts of Climate Change Surges Dramatically in 2011-2020 (Dec. 5, 2023), https://wmo.int/news/media-centre/rate-and-impact-of-climate-change-surges-dramatically-2011-2020 [https://perma.cc/98UQ-MWT5].

140. *See* Jet Propulsion Lab'y, *NASA Analysis Sees Spike in 2023 Global Sea Level Due to El Niño*, NAT'L AERONAUTICS & SPACE ADMIN. (Mar. 21, 2024), https://www.nasa.gov/earth/oceans/nasa-analysis-sees-spike-in-2023-global-sea-level-due-to-el-nino/ [https://perma.cc/DZ34-SUPW].

141. *See id*.

142. *Id*.

143. *See* WILLIAM V. SWEET ET AL., GLOBAL AND REGIONAL SEA LEVEL RISE SCENARIOS FOR THE UNITED STATES, at xii (2022), https://cdn.oceanservice.noaa.gov/oceanservice/prod/hazards/sealevelrise/COVER-CREDITS-TOC-FIGURES.pdf [https://perma.cc/6W4F-GRXF].

144. *Id.*

145. *See id.* at 21.

146. *See id.*

the environment and result in fundamental alteration to coastlines everywhere.[147] However, these estimates assume that the larger ice sheets in Greenland and Antarctica remain intact, even though there is increasing evidence that the melt rate of glaciers and ice sheets is accelerating.[148]

Sea level rise will vary regionally along U.S. coasts.[149] Many coastal communities will experience profound shifts in coastal flooding, shoreline erosion, and storm surge as sea level rises.[150] The impacts of flooding will be substantial because almost 30% of the U.S. population lives in relatively high population-density coastal areas.[151] Major flooding events are expected to occur five times as often in 2050 relative to today.[152] Rising seas threaten trillions of dollars in infrastructure such as homes, roads, bridges, sewage treatment plants, subways, water supplies, and others.[153]

CO_2 emissions, ocean temperature, and sea level all move together.[154] Changes in one causes changes in the others.[155] However, if the world ceased all greenhouse gas emissions immediately, sea level will continue to rise for centuries.[156] This is because the primary drivers of sea level rise, melting of glaciers and ice sheets and thermal expansion of the ocean, have a centuries-long time lag.[157] Thus, sea level rise is inevitable and the impact will be felt most heavily by low-lying coastal communities.[158] As seas rise, coastal communities will experience increased coastal erosion and flooding, submergence of coastal land, increased saltwater intrusion, and fundamental alterations of coastal habitat and ecosystems.[159] The amount of additional rise largely depends on steps taken now to curb greenhouse gas emissions.[160] The

147. *See* ENGLANDER, *supra* note 115, at 40.
148. *See id.* at 39–40.
149. *See* SWEET ET AL., *supra* note 143, at 15.
150. *See id.* at 2.
151. *See* Lindsey, *supra* note 125.
152. *See* SWEET ET AL., *supra* note 143, at 40.
153. *See* Lindsey, *supra* note 125.
154. *See* ENGLANDER, *supra* note 115, at 12.
155. *See Short-Lived Greenhouse Gases Cause Centuries of Sea Level Rise*, NAT'L AERONAUTICS & SPACE ADMIN. (Jan. 13, 2017), https://science.nasa.gov/earth/climate-change/greenhouse-gases/short-lived-greenhouse-gases-cause-centuries-of-sea-level-rise/ [https://perma.cc/RR7Y-T389].
156. *Id.*
157. Karen McVeigh, *'It's Absolutely Guaranteed': The Best and Worst Case Scenarios for Sea Level Rise*, THE GUARDIAN (June 26, 2023, 1:00 EDT), https://www.theguardian.com/environment/2023/jun/26/its-absolutely-guaranteed-the-best-and-worst-case-scenarios-for-sea-level-rise [https://perma.cc/5MPQ-CBF4].
158. *See id.*
159. *See* IPCC BIODIVERSITY, *supra* note 105, at 2.
160. *See id.*

impacts of sea level rise on coastal communities and ecosystems will depend upon how well communities implement mitigation and adaptation plans.[161]

D. Coastal Wetland Migration

Coastal wetlands at the interface between land and sea, including salt marshes, freshwater marshes, seagrass beds, mangrove swamps, and forested swamps, are among the most valuable ecosystems on the planet due to their support of biodiversity and provision of critical ecosystem services.[162] They are some of the most biologically diverse ecosystems on Earth.[163] These areas play a critical role in sequestering greenhouse gases in plants and soil and are crucial for healthy marine estuaries, which generate approximately half of commercially harvested seafood in the United States.[164] Human activities, development, and natural processes, such as erosion and inundation from sea level rise and storms, have destroyed or damaged significant segments of coastal wetlands in the United States.[165] Accelerating sea level rise will cause further loss.[166] However, coastal wetlands can migrate horizontally or vertically in response to changing conditions, such as sea level rise.[167] This natural resilience is driven by "the availability of accommodation space, which is the vertical and lateral space available for sediment filling, organic matter accumulation, and wetland establishment in response to rising seas."[168] Studies suggest wetland gains are possible in some areas despite sea level rise where coastal wetlands have sufficient accommodation space.[169] One study demonstrated that with no further destruction of coastal wetlands, sharp reductions in greenhouse gas emissions, and high growth rates, coastal

161. *See id.*

162. *See* Osland et al., *supra* note 53.

163. *See* G. Carleton Ray, *Ecological Diversity in Coastal Zones and Oceans*, *in* BIODIVERSITY 36, 37 (E. O. Wilson & Frances M. Peter eds., 1988).

164. *See* Office of Habitat Conservation, *Coastal Wetland Habitat*, NAT'L OCEANIC & ATMOSPHERIC ADMIN. FISHERIES, https://www.fisheries.noaa.gov/national/habitat-conservation/coastal-wetland-habitat [https://perma.cc/4KHF-LF28] (Feb. 26, 2024).

165. *See id.*

166. *See* Osland et al., *supra* note 53, at 4.

167. "[R]esilience of global wetlands is primarily driven by the availability of accommodation space, which is strongly influenced by the building of anthropogenic infrastructure in the coastal zone and such infrastructure is expected to change over the twenty-first century." Mark Schuerch et al., *Future Response of Global Coastal Wetlands to Sea-Level Rise*, 561 NATURE 231, 231 (2018), https://doi.org/10.1038/s41586-018-0476-5 [https://perma.cc/BQU2-PZLY].

168. *See* Osland et al., *supra* note 53.

169. *See* Schuerch et al., *supra* note 167, at 232.

wetlands may increase by 25% by 2100.[170] This could generate an additional $222 billion in ecosystem service.[171] Alternatively, if existing wetlands are developed, emissions increase, and sea level rise exceeds projections due to ice sheet loss, 97% of coastal wetlands could be lost along with $732 billion in ecosystem services.[172] Unfortunately, in many areas accommodation is impeded by anthropogenic constraints imposed on landward migration, but some of these restraints can be removed with effective planning.[173]

Because some increase in sea level is inevitable regardless of future emission trajectories, planners must consider strategies that accommodate the landward migration of wetlands and coastal species to compensate for seaward loss.[174] They must also consider how such changes may impact valuable upland systems that also provide valuable ecological and societal benefits.[175] Where effective, accommodation can mitigate some loss of biodiversity and ecosystem services.[176] But due to regional differences in geomorphology, climate, and management of coastal lands, accommodation will not work everywhere.[177] For example, there is more area available for wetland migration along the low-lying coastal plains of the northern Gulf of Mexico and the southern to mid-Atlantic coasts, and less along the steep topographies of the Pacific and northern Atlantic coasts.[178]

The five states with the highest potential for wetland loss due to sea level rise are Louisiana (29%), Florida (25%), North Carolina (10%), Texas (8%), and South Carolina (7%).[179] Together, these areas account for 79% of the total potential wetland loss.[180] However, these states also have the most potential for wetland migration—Louisiana (27%), Florida (23%), North Carolina (16%), Texas (9%), and South Carolina (7%).[181] Florida and Louisiana are home to one-half of the thirty estuaries with the highest potential for wetland migration.[182] In some areas, landward migration will be impeded by topographic limitations that impact adjacent wetlands.[183] For example, in the

170. *Vulnerability & Resilience of U.S. Coastal Wetlands to Sea Level Rise*, CLIMATE CENTRAL (June 8, 2022), https://www.climatecentral.org/report/vulnerability-and-resilience-of-u-s-coastal-wetlands-to-sea-level-rise [perma.cc/ZW89-NQJB].

171. *Id.*

172. *Id.*

173. *See id.*

174. *See* Osland, *supra* note 53, at 4–5.

175. *See id.*

176. *See id.*

177. *See id.*

178. *Id.*

179. *Id.*

180. *Id.*

181. *Id.*

182. *Id.*

183. *Id.*

Florida Everglades, mangrove forests can move landward as seas rise, but at the expenses of freshwater marshes blocked by topographic barriers that restrict their migration into low-lying uplands.[184] Tradeoffs of this kind must be considered in planning. Tools are now available to simulate potential impacts of long-term sea level rise on wetlands and shorelines.[185] For example, the Sea Level Affecting Marshes Model (SLAMM) simulates the key processes involved in wetland conversion and shoreline modification during long-term sea level rise.[186]

Wetland migration will impact upland and freshwater wetlands to different degrees depending on location.[187] Protecting coastal ecosystems where possible can slow climate change, reduce biodiversity loss, and build ecosystem resilience.[188] For humanity to address climate change and all its potential impacts, it is not enough to focus on reducing emissions because significant change is already locked in based on past human activities. Planners must focus on reducing emissions while maintaining the integrity of the biosphere and planning for accommodation and retreat. Currently, there is no federal agency charged directly with protecting the health and resilience of U.S. coastal systems and no program to develop strategies to support landward accommodation.[189] Without a dedicated regulatory framework to address the impacts of sea level rise on coastal ecosystems, planners should consider using tools available under the federal Coastal Zone Management Act to simultaneously address climate change and biodiversity loss.

III. COASTAL ZONE MANAGEMENT ACT

The United States coastline extends over 95,000 miles adjacent to the Atlantic, Pacific, and Arctic oceans as well as the Gulf of Mexico, Caribbean Sea, and the Great Lakes.[190] In recent decades, humans have increasingly migrated to coastal communities to enjoy the variety of environmental,

184. *Id.*

185. *E.g.*, *Sea Level Affecting Marshes Model (SLAMM)*, U.S. CLIMATE RESILIENCE TOOLKIT, https://toolkit.climate.gov/tool/sea-level-affecting-marshes-model-slamm [perma.cc/9KMV-TU3L] (May 10, 2024, 12:16 PM).

186. *Id.*

187. *See* Osland, *supra* note 53, at 2–3.

188. *See* IPCC BIODIVERSITY, *supra* note 105, at 3.

189. *See Pending Legislation: Hearing on S. 2194, S. 3069, S. 3767 and S. Before the Senate Comm. on Env't & Pub. Works*, 117th Cong. (2022) (statement of Stephen Guertin, Deputy Dir. for Pol'y, U.S. Fish & Wildlife Serv.), https://www.doi.gov/ocl/pending-legislation-53 [https://perma.cc/FZ3V-RHY2].

190. *See Oceans and Coasts,* NAT'L OCEANIC & ATMOSPHERIC ADMIN., https://www.noaa.gov/education/resource-collections/ocean-coasts [perma.cc/B5MZ-7HT4] (Sept. 8, 2021).

recreational, economic, cultural, and aesthetic benefits the coast provides.[191] Despite making up only 10% of the nation's land mass (excluding Alaska), coastal counties are home to 40% of the nation's population.[192] Today, more than 128 million people live in coastal counties.[193] The coastal zone plays a crucial role in supporting economic activities and global trade.[194] Coastal counties produce almost $10 trillion in goods and services each year.[195] Communities on the coasts also support more than fifty-four million jobs in the fishing, tourism, real estate, defense, and other industries.[196] More than $1 trillion worth of property is located within 700 feet of the coast.[197] Increasing coastal hazards put people and property at greater risk. Coastal areas face permanent inundation and flooding threats from sea level rise, intense rains, high tide flooding, and severe storms.[198] Despite these increasing risks, some reports suggest that people will continue to migrate to the coast.[199]

The Coastal Zone Management Act (CZMA) of 1972 was the first coastal zone management law in the world.[200] It was enacted to protect the nation's coastal environment from increasing and conflicting demands upon the lands and waters of the coastal zone occasioned by population growth and economic development.[201] Congress recognized that coastal zone habitats are ecologically fragile and vulnerable to destruction by human activities.[202]

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191. *Coastline America*, U.S. CENSUS BUREAU (June 21, 2019), https://www.census.gov/library/visualizations/2019/demo/coastline-america.html [perma.cc/XS6K-GAVX]; *Making the Sea Change: Why More Americans are Moving to the Coast*, SOCIAL TRENDS (Apr. 24, 2024), https://sites.psu.edu/socialtrends/2024/04/24/making-the-sea-change-why-more-americans-are-moving-to-the-coast/ [https://perma.cc/Q3MP-2L96].

192. *Climate Change Impacts on Coasts*, EPA, https://www.epa.gov/climateimpacts/climate-change-impacts-coasts [perma.cc/5MD7-DE3P] (Nov. 16, 2023).

193. *Economics & Demographics*, OFF. FOR COASTAL MGMT., NAT'L OCEANIC & ATMOSPHERIC ADMIN., https://coast.noaa.gov/states/fast-facts/economics-and-demographics.htm [perma.cc/N2CH-56UE] (Aug. 9, 2024).

194. *See id.*

195. *Id.*

196. *Id.*; Elizabeth Fleming et al., NAT'L OCEANIC & ATMOSPHERIC ADMIN., *Coastal Effects*, *in* 2 FOURTH NATIONAL CLIMATE ASSESSMENT: IMPACTS, RISKS, AND ADAPTATION IN THE UNITED STATES 322, 324 (Michael Kruk et al. eds., 2018), https://nca2018.globalchange.gov/chapter/coastal [perma.cc/HHH5-VVYG].

197. Fleming et al., *supra* note 196, at 329–30.

198. *See id.* at 323.

199. *E.g.*, Keely Swan, *Despite Sea-Level Rise Risks, Migration to Some Threatened Coastal Areas May Increase,* PRINCETON UNIV. (Feb. 17, 2021, 11:00 AM), https://www.princeton.edu/news/2021/02/17/despite-sea-level-rise-risks-migration-some-threatened-coastal-areas-may-increase [https://perma.cc/CF5A-TR4V].

200. *See generally* Coastal Zone Management Act of 1972, 16 U.S.C. §§ 1451-1466.

201. 16 U.S.C. § 1451(a)-(c).

202. *Id.* § 1451(d).

Through the CZMA, Congress sought to balance the competing interests and meet the challenge of continued growth in the coastal zone.[203]

The CZMA created three national programs: the National Estuarine Research Reserve System, the Coastal and Estuarine Land Conservation Program (CELCP), and the National Coastal Zone Management Program.[204] Because land use is a local matter, Congress chose to incentivize state and local management of coastal resources in conformance with minimum national standards rather than exert federal control over coastal resource management.[205] Under the CZMA, the term "coastal zone" broadly includes "coastal waters (including the lands therein and thereunder) and the adjacent shorelands (including the waters therein and thereunder), including islands, transitional and intertidal areas, salt marshes, wetlands, and beaches."[206] The zone "extends inland from the shorelines only to the extent necessary to control shorelands, the uses of which have a direct and significant impact on the coastal waters, and to control those geographical areas which are likely to be affected by or vulnerable to sea level rise."[207] States retain flexibility in identifying the scope of their coastal zone subject to the Act.[208]

The CZMA established broad national polices related to the coastal zone.[209] It has been amended eleven times, most recently in 2009, but its core policies remain unchanged.[210] These include:

> 1. to preserve, protect, develop, and, if possible, restore or enhance coastal resources;
>
> 2. to encourage and assist states and territories to effectively exercise their development and management responsibilities in the coastal zone, giving full consideration to ecological, cultural, historic, and aesthetic values as well as the needs for compatible economic development;
>
> 3. to encourage the preparation of special area management plans to protect significant natural resources, support reasonable coastal-

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203. *Coastal Zone Management Act,* OFF. FOR COASTAL MGMT., NAT'L OCEANIC & ATMOSPHERIC ADMIN., https://coast.noaa.gov/czm/act/ [https://perma.cc/LWJ8-DEQE].

204. *Id.*

205. *See* 16 U.S.C. § 1451(i).

206. *Id.* § 1453(1).

207. *Id.*

208. *See id.* § 1455(d)(2)(A).

209. *See* THE CTR. FOR URB. & REG'L STUDS. OF THE DEP'T OF CITY & REG'L PLAN., THE UNIV. OF N.C. AT CHAPEL HILL, EVALUATION OF THE NATIONAL COASTAL ZONE MANAGEMENT PROGRAM 6 (1991).

210. *See* Omnibus Public Land Management Act of 2009, Pub. L. No. 111-11, 123 Stat. 991.

> dependent economic growth, and improve protection of life and property;
>
> 4. to encourage the participation and cooperation of the public, state and local governments, interstate and other regional agencies, and federal agencies to carry out CZMA;
>
> 5. to encourage coordination and cooperation with and among appropriate federal, state, and local agencies, and international organizations, in collection, analysis, and dissemination of coastal management information and research; and
>
> 6. to respond to changing circumstances affecting the coastal environment and resources and their management by encouraging states and territories to consider ocean uses that may affect the coastal zone.[211]

Thirty-five states and territories are eligible to participate in the voluntary program—today, thirty-four coastal states participate in the program.[212] Alaska withdrew in 2011.[213]

A. State Management Program

States that choose to participate in the program must create a coastal management program (CMP) that adheres to minimum national standards.[214] While each participating state retains flexibility to craft programs that address the unique needs within the state, each program must include minimal national requirements pursuant to CZMA section 306 and NOAA regulations.[215] The

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211. EVA LIPIEC, CONG. RSCH. SERV., R45460, COASTAL ZONE MANAGEMENT ACT (CZMA): OVERVIEW & ISSUES FOR CONG. 2 (2019).

212. *What Is Coastal Zone Management?,* NAT'L OCEANIC & ATMOSPHERIC ADMIN. NAT'L OCEAN SERV., https://oceanservice.noaa.gov/facts/czm.html [https://perma.cc/M8UR-JBXZ] (June 16, 2024).

213. Alaska Coastal Management Program Withdrawal from the National Coastal Management Program Under the CZMA, 76 Fed. Reg. 39857, 39857–58 (July 1, 2011).

214. *See* Coastal Zone Management Act of 1972, 16 U.S.C. § 1454.

215. *See id.* § 1455(b)(2). The requirements include:

> (A) An identification of the boundaries of the coastal zone subject to the management program. (B) A definition of what shall constitute permissible land uses and water uses within the coastal zone which have a direct and significant impact on the coastal waters. (C) An inventory and designation of areas of particular concern within the coastal zone. (D) An identification of the means by which the State proposes to exert control over the land uses and water uses referred to in subparagraph (B), including a

Secretary of Commerce must approve a state's CMP if it complies with the national standards.[216] Once approved, the state may receive two significant benefits of membership—grants and technical aid, and a right to review proposed federal actions and federally authorized and funded activities for consistency with the state's approved coastal policies.[217]

B. Grants and Technical Assistance

States participating in the CZMA are eligible to receive grants and technical assistance from NOAA.[218] The Secretary of Commerce may make a grant to a coastal state if the management program of the coastal state meets all applicable requirements of the Act.[219]

Section 306 of the CZMA authorizes the Secretary to award administrative grants to states to support the management and administration of the state's CMP.[220] Under section 306A, the Secretary may award grants for coastal resource improvement.[221] These grants are provided to assist that state in preserving or restoring valuable coastal resources, redeveloping of urban waterfronts and ports, expanding public access to beaches and other coastal areas, and regulating aquaculture facilities in the coastal zone.[222] Section 307A authorizes the Secretary to award grants to promote coastal and estuarine land conservation.[223] These grants are used to protect coastal lands

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list of relevant State constitutional provisions, laws, regulations, and judicial decisions. (E) Broad guidelines on priorities of uses in particular areas, including specifically those uses of lowest priority. (F) A description of the organizational structure proposed to implement such management program, including the responsibilities and interrelationships of local, areawide, State, regional, and interstate agencies in the management process. (G) A definition of the term "beach" and a planning process for the protection of, and access to, public beaches and other public coastal areas of environmental, recreational, historical, esthetic, ecological, or cultural value. (H) A planning process for energy facilities likely to be located in, or which may significantly affect, the coastal zone, including a process for anticipating the management of the impacts resulting from such facilities. (I) A planning process for assessing the effects of, and studying and evaluating ways to control, or lessen the impact of, shoreline erosion, and to restore areas adversely affected by such erosion.

Id. § 1455(d)(2); *see also* 15 C.F.R. § 923.25 (2024).

216. 16 U.S.C. § 1454.

217. *See id.* §§ 1455, 1456(c).

218. *Id.* § 1455.

219. *Id.* § 1455(b).

220. *Id.* § 1455.

221. *Id.* § 1455a.

222. *Id.*

223. *Id.* § 1456-1.

that are ecologically important or possess other coastal conservation values.[224] To date, more than 110,000 acres of threatened coastal and estuarine land has been purchased or subject to conservation easements under this grant provision.[225]

Section 308 established the Coastal Energy Impact Program (CEIP) that provides coastal states and local governments in such states with federal financial assistance to meet certain needs that result from specified energy development activities.[226] Grants are intended to help states pay for new infrastructure, land use changes, environmental impacts, and other changes to the coastal zone related to offshore energy facilities.[227]

Section 309 authorizes NOAA to provide coastal zone enhancement grants to support specific activities that promote the continuous improvement of state coastal programs in specified areas of national significance.[228] These include protecting and enhancing wetlands, addressing hazards, improving coastal access, reducing marine debris, developing procedures to address the secondary effects of coastal development, working with special area management plans, planning for ocean resources, and facilitating energy-related activities and aquaculture facilities.[229] Importantly, section 309 explicitly lists as an objective activities tied to coastal development or redevelopment and requires states to anticipate and manage the effects of potential sea level rise.[230] Every five years, participants update their coastal priorities under this program to ensure that they are continuously adapting and improving.[231] NOAA is required to periodically review and evaluate participants' performance in implementing their programs.[232] NOAA may withhold or withdraw financial assistance if a participant does not comply with its approved program.[233]

Section 315 of the CZMA established the National Estuarine Research Reserve System.[234] This partnership program between NOAA and the coastal

224. *The Coastal & Estuarine Land Conservation Program,* OFF. FOR COASTAL MGMT., NAT'L OCEANIC & ATMOSPHERIC ADMIN., https://coast.noaa.gov/czm/landconservation/ [https://perma.cc/4QQ2-MWEZ].

225. *Id.*

226. *See* 16 U.S.C. § 1456a.

227. *See id.*

228. *See* § 1456b.

229. *Id.*

230. *Id.*

231. OFF. FOR COASTAL MGMT., NAT'L OCEAN SERV., NAT'L OCEANIC & ATMOSPHERIC ADMIN., COASTAL ZONE MANAGEMENT ACT SECTION 309 PROGRAM GUIDANCE: 2021 TO 2025 CYCLE 1 (2019), https://coast.noaa.gov/data/czm/media/Sect-309_Guidance_2021-2025.pdf [perma.cc/Z7AW-PV3W] [hereinafter CZMA SECTION 309 PROGRAM GUIDANCE].

232. 16 U.S.C. §1458.

233. *Id.*

234. *Id.* § 1461.

states consists of a network of thirty coastal sites covering nearly 1.4 million acres of estuaries and is designed to protect and study estuarine systems.[235]

C. NCZMP and Federal Consistency Requirement

Section 307 of the CZMA provides participating states with a limited ability to preempt federal actions that impact the state's coastal zone.[236] Direct federal agency activities that have reasonably foreseeable effects on coastal uses or resources must be carried out in a manner that is consistent to the maximum extent practicable with the enforceable policies of approved state management programs.[237] Before acting, the federal agency must submit a consistency determination to the state explaining how the actions are consistent with state coastal policies.[238] If the state objects to the federal agency's consistency determination, the state may request mediation to resolve the issue.[239] The federal agency cannot proceed with the activity over a state agency's objection unless:

> (1) the federal agency has concluded that under the "consistent to the maximum extent practicable" standard described in section 930.32 consistency with the enforceable policies of the management program is prohibited by existing law applicable to the Federal agency and the Federal agency has clearly described, in writing, to the State agency the legal impediments to full consistency . . . or (2) the Federal agency has concluded that its proposed action is fully

235. *National Estuarine Research Reserves Overview*, OFF. FOR COASTAL MGMT., NAT'L OCEANIC & ATMOSPHERIC ADMIN., https://coast.noaa.gov/nerrs/about/ [https://perma.cc/F5EP-88M4].

236. *See* 16 U.S.C. § 1456(c).

237. *Id.* § 1456(c)(1)(A); 15 C.F.R. § 930.32 (2024) ("The term 'consistent to the maximum extent practicable' means fully consistent with the enforceable policies of management programs unless full consistency is prohibited by existing law applicable to the Federal agency."); 15 C.F.R. § 930.11(h) ("'The term "enforceable policy" means State policies which are legally binding through constitutional provisions, laws, regulations, land use plans, ordinances, or judicial or administrative decisions, by which a State exerts control over private and public land and water uses and natural resources in the coastal zone,' 16 U.S.C. 1453(6a), and which are incorporated in a management program as approved by OCRM either as part of program approval or as a program change under 15 CFR part 923, subpart H."); 15 C.F.R. § 930.31(a) ("The term 'Federal agency activity' means any functions performed by or on behalf of a [f]ederal agency in the exercise of its statutory responsibilities. . . . 'Federal agency activity' does not include the issuance of a federal license or permit to an applicant or person . . . ."); 15 C.F.R. § 930.11(g) ("The term 'effect on any coastal use or resource' means any reasonably foreseeable effect on any coastal use or resource resulting from a Federal agency activity or federal license or permit activity.").

238. 16 U.S.C. § 1456(c).

239. *Id.* § 1456(h).

> consistent with the enforceable policies of the management program, though the state agency objects.[240]

Any applicant for a required federal license or permit to conduct an activity inside or outside of the coastal zone affecting any land or water use or natural resource of the coastal zone must certify that the proposed activity is consistent with the state's approved coastal management plan.[241] A state can review the consistency determination and object to the project.[242] If the state objects, the federal agency cannot issue the license or permit unless the Secretary overrides the state's objection.[243] The Secretary may override the state's objection if the Secretary determines that the activity is consistent with the objectives of the CZMA (Ground 1); or the activity is otherwise necessary in the interest of national security (Ground 2).[244]

Section 930.121 of the Code of Federal Regulations states:

> A federal license or permit activity, or a federal assistance activity, is "consistent with the objectives or purposes of the [CZMA]" if it satisfies each of the following three requirements:
>
> (a) The activity furthers the national interest as articulated in § 302 or § 303 of the Act, in a significant or substantial manner,
>
> (b) The national interest furthered by the activity outweighs the activity's adverse coastal effects, when those effects are considered separately or cumulatively.
>
> (c) There is no reasonable alternative available which would permit the activity to be conducted in a manner consistent with the enforceable policies of the management program….[245]

A federal activity is "necessary in the interest of national security" if a national defense or other national security interest would be "significantly impaired" if the proposed federal activity were not to proceed as planned.[246]

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240. 15 C.F.R. § 930.43(d)(1)-(2).

241. 16 U.S.C. § 1456(c)(3)(A); 15 C.F.R. § 930.51 ("The term 'federal license or permit' means any authorization that an applicant is required by law to obtain in order to conduct activities affecting any land or water use or natural resource of the coastal zone and that any Federal agency is empowered to issue to an applicant.").

242. 16 U.S.C. § 1456(c)(3)(A); 15 C.F.R. § 930.6(b).

243. 15 C.F.R. §§ 930.55, 930.64.

244. 16 U.S.C. § 1456(c)(3)(A).

245. 15 C.F.R. § 930.121 (2024).

246. *Id.* § 930.122.

Although interstate conflict is not specifically addressed in the CZMA, courts have held that a state with an approved coastal management plan may prevent a federally approved activity from occurring in another state if that activity affects any natural resources, land use, or water uses in the coastal zone of the objecting state unless the Secretary of Commerce overrides the objection.[247] No federal agency activity is categorically exempt from this requirement.[248]

In addition to the consistency provisions of the CZMA, federal agencies must also comply with the National Environmental Policy Act (NEPA).[249] That Act "requires federal agencies to assess the environmental effects of their proposed actions prior to making decisions."[250] Most agencies use NEPA as a framework to coordinate or demonstrate compliance with other laws, including the CZMA consistency requirements.[251] Since approval of the first coastal management program in 1978, states have reviewed tens of thousands of federal licenses or permit activities, outer continental shelf oil and gas activities, and federal financial assistance activities for consistency.[252] Of these, approximately 95% have been approved.[253] In those instances where a state has objected to the certification, and the non-federal applicant appeals the state's objection to the Secretary of Commerce, the results are mixed.[254] Of the 152 secretarial appeals filed to date, thirty-four were dismissed or overridden on procedural grounds; sixty-eight were withdrawn and/or settled, and fifty resulted in a decision by the Secretary.[255] In those appeals, the Secretary overrode the state's objection seventeen times and upheld the state's objection thirty-three times.[256] These results demonstrate that the appeals process provides real protection for a state impacted by federal activities that affect its coastal zone.[257] States have successfully used the consistency requirement to stop energy projects that are both harmful to natural resources

247. *See, e.g.*, City of Va. Beach v. Brown, 858 F. Supp. 585, 587–88 (E.D. Va. 1994) (holding coastal states must submit to NOAA for approval of a state's proposal to review federal actions occurring wholly within another state); 15 C.F.R. § 930.152.

248. *See* 15 C.F.R. § 930.152.

249. *See* National Environmental Policy Act, 42 U.S.C. § 4321.

250. *What Is the National Environmental Policy Act?*, U.S. ENV'T PROT. AGENCY, https://www.epa.gov/nepa/what-national-environmental-policy-act [https://perma.cc/HSF3-55PK] (July 15, 2024).

251. LINDA LUTHER, CONG. RSCH. SERV., RL33152, THE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA): BACKGROUND AND IMPLEMENTATION (2011).

252. OFF. FOR COASTAL MGMT., NAT'L OCEANIC & ATMOSPHERIC ADMIN., APPEALS TO THE SECRETARY OF COMMERCE UNDER THE COASTAL ZONE MANAGEMENT ACT (CZMA) (2022) [perma.cc/FB42-HQ4N].

253. *Id.*

254. *Id.*

255. *Id.*

256. *Id.*

257. *See id.*

and contribute to climate change.[258] But the Secretary has also overridden state objections to exploration activities tied to offshore energy development.[259]

In 2021, the Secretary of Commerce upheld the Oregon Department of Land Conservation and Development's (DLCD) objection to the Jordan Cove Energy Project, L.P. (JCEP) and Pacific Connector Gas Pipeline, LP (PCGP) consistency certification regarding the proposed construction and operation of a liquefied natural gas export terminal in Coos Bay, Oregon, and an associated 229-mile natural gas pipeline and compressor station.[260] The project required a license from the Federal Energy Regulatory Commission (FERC) and a permit from the U.S. Army Corps of Engineers.[261] FERC issued a Final Environmental Impact Statement as required under NEPA, then issued a conditional authorization order conditioned on completion of other requirements.[262] DLCD objected to the project after determining that it would have adverse effects on Oregon's scenic and aesthetic resources, endangered and threatened species, critical habitats and ecosystems, fisheries resources, commercial and recreational fishing and boating, commercial shipping and transportation, and cultural resources.[263] JCEP and PCGP requested that NOAA override the state's objection based solely on a Ground 1 analysis which allows the Secretary to override the state's objection if the Secretary finds that the proposed activity is consistent with the objectives or purposes of the CZMA.[264] To override under Ground 1, the Secretary must first determine whether the activity furthers the national interest "in a significant or substantial manner."[265] Next, the Secretary must find that the national interest furthered by the activity outweighs the activity's adverse coastal effects, "when those effects are considered separately or cumulatively."[266] Finally, the Secretary must find that there is no reasonable alternative available that would allow the activity to be conducted "in a manner consistent with the enforceable policies of the [state's coastal] management program."[267]

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258. *See id.*

259. Tim Eichenberg & Jack Archer, *The Federal Consistency Doctrine: Coastal Zone Management and "New Federalism*," 14 ECOLOGY L. Q. 9, 12–13 (1987).

260. Decision and Findings in the Consistency Appeal of Jordan Cove Energy Project, L.P. and Pac. Connector Gas Pipeline, LP, from an objection by the Or. Dep't of Land Conservation and Dev. (Sec'y of Com. Feb. 8, 2021), https://coast.noaa.gov/data/czm/consistency/appeals/fcappealdecisions/mediadecisions/jordancove.pdf [perma.cc/JRT7-SY6P] [hereinafter Jordan Cove].

261. *See id.*

262. *Id.*

263. *Id.*

264. *Id.*; Coastal Zone Management Act of 1972, 16 U.S.C. § 1456(c)(3)(A).

265. 15 C.F.R. § 930.121.

266. Jordan Cove, *supra* note 260.

267. *Id*. (alteration in original).

If any of these elements are not met, the Secretary must uphold the state's objection.[268] The Secretary denied the appeal here after finding that the record was insufficient to adequately assess the project's adverse coastal effects to endangered and threatened species, cultural and historic resources, and other interests protected under the state's approved coastal management plan.[269] As such, the national interest furthered by the Project could not be balanced against its adverse coastal effects and element 1 was not met.[270]

In 2020, the Secretary of Commerce overturned South Carolina's objection to WesternGeco's plan to conduct seismic surveys in federal waters off South Carolina's coast to locate oil and gas deposits.[271] The activity required a permit from the federal Bureau of Ocean Energy Management (BOEM). BOEM conducted an Environmental Impact Statement as required under NEPA, but did not approve the permit request prior to the appeal.[272] South Carolina objected to WesternGeco's certification after determining that the seismic surveys would have adverse effects on recreation and commercial fisheries and sea turtles.[273] In overriding the state's objection on Ground 1, the Secretary found that the proposed survey was consistent with the objectives of the CZMA.[274] As to element 1, the Secretary found that data collection related to oil and gas exploration and development would further the national interest in developing the resources of the nation's coastal zone because it helps the nation attain greater energy efficiency through informed siting of major energy facilities.[275] As to element 2, the Secretary found that the national interest of the project outweighed any adverse coastal effects.[276] Specifically, the Secretary found that short-term, minor, limited, and localized adverse effects are outweighed by the national interest of informed decision-making on energy development.[277] As to element 3, the Secretary found that there was no reasonable alternative available that would allow the project to proceed in a manner consistent with the enforceable policies of the management program.[278]

These appeals show that the CZMA may be used strategically as a shield and a sword to help coastal states protect their natural resources and fight

268. *Id.*
269. *Id.*
270. *Id.*
271. Decision and Findings in the Consistency Appeal of WesternGeco from an objection by the State of S.C. (Sec'y of Com. June 15, 2020), https://coast.noaa.gov/data/czm/consistency/appeals/fcappealdecisions/mediadecisions/westerngeco-scappeal.pdf [perma.cc/5DFD-B9K5].
272. *Id.*
273. *Id.*
274. *Id.*
275. *Id.*
276. *Id.*
277. *Id.*
278. *Id.*

climate change.[279] The balancing mechanism employed by the CZMA helps ensure that states taking critical steps to protect coastal resources will be supported at the federal level.[280] It also shows that states interested in promoting renewable offshore energy will find federal support for such activities because energy efficiency and energy independence are identified as important national interests.[281] The CZMA does not distinguish between renewable and non-renewable energy development.[282] It does, however, require states to address hazards resulting from sea level rise which is inextricably linked to the use of dirty, non-renewable forms of energy.[283] The CZMA can be an effective tool for states to protect natural systems in ways that decrease biodiversity loss and mitigate climate change by siting clean, renewable energy facilities offshore.

Section 6217 of the Coastal Zone Reauthorization Act of 1990 created the Coastal Nonpoint Pollution Control Program.[284] Although not part of the CZMA, the Act is linked to the CZMA because it requires each state participating in the CZMA to develop and implement management measures to reduce nonpoint source pollution runoff to the coastal zone.[285] The program establishes a set of management measures for states to use in controlling runoff from five main sources: agriculture, forestry, urban areas, marinas, and hydromodification (shoreline and stream channel modification).[286]

D. CZMA Funding

Annual funding to states with an approved coastal management program is distributed through sections 306 (program implementation and administration), 306A (coastal resource improvement), and 309 (program enhancement).[287] Congress appropriates a set amount for CZMA awards, and NOAA calculates total funding for each state using a formula based on

279. *See, e.g.*, *id.*; Jordan Cove, *supra* note 260.

280. *See* OFF. FOR COASTAL MGMT., NAT'L OCEANIC & ATMOSPHERIC ADMIN., DEP'T OF COM., CZMA FEDERAL CONSISTENCY OVERVIEW: SECTION 307 OF THE COASTAL ZONE MANAGEMENT ACT OF 1972 (2020), https://coast.noaa.gov/data/czm/consistency/media/federal-consistency-overview.pdf [https://perma.cc/7E2C-RLYY].

281. *See* Coastal Zone Management Act, 16 U.S.C. § 1451(j).

282. *See* Courtney B. Johnson, *Advances in Marine Spatial Planning: Zoning Earth's Last Frontier*, 29 J. ENV'T L. & LITIG. 191, 199 (2014).

283. *See* 16 U.S.C § 1451(l).

284. Coastal Zone Act Reauthorization Amendments of 1990, Pub. L. No. 101-508, § 6217(a)(1), 104 Stat. 1388 (1990).

285. *Id.*

286. *See id.* § 6217(a)(3).

287. *See* 16 U.S.C. § 1455; *id.* § 1455a; *id.* § 1456b.

shoreline mileage and population.[288] The funding is divided between section 306 and section 309 grants.[289] The CZMA requires that between 10% and 20% of the section 306/309 appropriation be directed toward section 309 grants to a maximum of $10 million.[290] There is no separate funding allocated for section 306A projects, but a state may use up to 50% of its section 306 funding for section 306A projects.[291] Under section 309, a portion of the annual allocation is reserved for special projects using a competitive system.[292] Congress initially provided limited funding for section 6217 programs, but no longer does so.[293] States are now required to implement these programs using funds provided under section 319 of the Clean Water Act.[294] If a state has not submitted an approvable coastal nonpoint program under section 6217, NOAA may withhold 30% of that state's section 306/306A allocation to the states with approved coastal nonpoint programs.[295]

States submit applications for annual CZMA funding and NOAA awards funding using cooperative agreements that ensure funded tasks are completed.[296] The funding mechanism is controversial because it requires NOAA to provide each state with a base amount and a proportional share of funding based on a state's shoreline miles and coastal population.[297] This is intended to promote equity between coastal states and drive effective coastal management, but it creates problems for states with longer coastlines or larger populations.[298] Based on a congressionally mandated cap per state, NOAA must redistribute funds from states whose proportional share would have exceeded the cap to other states whose grant amount is under the cap.[299] As a result, states with longer shorelines or larger coastal populations may not receive an appropriate amount of funding while states with shorter shorelines

288. U.S. GOV'T ACCOUNTABILITY OFF., GAO-08-1045, COASTAL MGMT. ZONE: MEASURING PROGRAM'S EFFECTIVENESS CONTINUES TO BE A CHALLENGE 15 (2008), https://www.gao.gov/assets/gao-08-1045.pdf [perma.cc/B5ZQ-34R7].

289. *See Digital Coast CZMA 101: Funding and Cooperative Agreements*, OFF. FOR COASTAL MGMT., NAT'L OCEANIC & ATMOSPHERIC ADMIN., https://coast.noaa.gov/elearning/coopagree/ [https://perma.cc/T4AM-VX5Z] (Aug. 30, 2024) [hereinafter *CZMA 101*].

290. CZMA SECTION 309 PROGRAM GUIDANCE, *supra* note 231, at 9.

291. *See CZMA 101*, *supra* note 289.

292. *Id.*

293. *See* NAT'L OCEANIC & ATMOSPHERIC ADMIN. & ENV'T PROT. AGENCY, COASTAL NONPOINT POLLUTION CONTROL PROGRAM: PROGRAM DEV. AND APPROVAL GUIDANCE (1993), https://coast.noaa.gov/data/czm/pollutioncontrol/media/6217progguidance.pdf [perma.cc/F6AP-59T8].

294. *See id.*

295. *See* Coastal Zone Management Act, 16 U.S.C. § 1445b(c)(3).

296. *See CZMA 101*, *supra* note 289.

297. U.S. GOV'T ACCOUNTABILITY OFF., *supra* note 288, at "Highlights."

298. *See id.*

299. *Id.*

or smaller coastal populations may receive more than their proportional need. The Table below reflects this problem.

State	2021 Population[300]	Shoreline Statute Miles[301]	2021 CZMA Section 306/306A Base Allocation[302]
California	39,237,836	3,427	$2,466,000.00
Georgia	10,799,566	2,344	$2,466,000.00
Florida	21,781,128	8,436	$2,466,000.00
Louisiana	4,627,098	7,721	$2,466,000.00
South Carolina	5,193,266	2,876	$2,466,000.00
Texas	29,527,941	3,359	$2,466,000.00

In 2021, California had almost eight times the population of South Carolina and almost one-third more shoreline miles, yet both states received the same baseline amount.[303] Similarly, Florida had double the population of Georgia and almost four times the shoreline miles, yet both states received the same baseline amount.[304] Louisiana had more than twice the shoreline miles of Texas, but one-seventh its population, yet each state received the same base amount.[305]

Although authorizations of appropriations have expired, Congress continues to provide funding for CZMA grant programs.[306] Funding has continued even during periods of intense deregulatory efforts and budget

300. Press Release, Kristina Barrett, U.S. Census Bureau, New Vintage 2021 Population Estimates Available for the Nation, States, and Puerto Rico (Dec. 21, 2021), https://www.census.gov/newsroom/press-releases/2021/2021-population-estimates.html [perma.cc/2JTK-TGAG]; *South Carolina*, USA FACTS, https://usafacts.org/data/topics/people-society/population-and-demographics/our-changing-population/state/south-carolina/?endDate=2022-01-01&startDate=2021-01-01 [https://perma.cc/J65S-QEFU]; *Louisiana*, USA FACTS, https://usafacts.org/data/topics/people-society/population-and-demographics/our-changing-population/state/louisiana/?endDate=2022-01-01&startDate=2021-01-01 [https://perma.cc/J9F9-3RZM].

301. OFF. FOR COASTAL MGMT., NAT'L OCEANIC & ATMOSPHERIC ADMIN., SHORELINE MILEAGE OF THE UNITED STATES, https://coast.noaa.gov/data/docs/states/shorelines.pdf [perma.cc/VRT6-T97L].

302. OFF. FOR COASTAL MGMT., NAT'L OCEANIC & ATMOSPHERIC ADMIN., FY 2021 ALLOCATIONS FOR CZMA SECTIONS 306/306A AND 309, https://coast.noaa.gov/data/czm/media/fy21-funding-guidance.pdf [perma.cc/797B-V29G] [hereinafter FY 2021 ALLOCATIONS] (The 2021 allocations reflect the most recent publicly available data. According to a representative at NOAA's OCM, NOAA continues to use the same calculation methodology to award base funding.).

303. *Id.*; Barrett, *supra* note 300; *South Carolina*, *supra* note 300.

304. FY 2021 ALLOCATIONS, *supra* note 302; Barrett, *supra* note 300.

305. FY 2021 ALLOCATIONS, *supra* note 302; *Louisiana*, *supra* note 300.

306. LIPIEC, *supra* note 211, at 6.

cuts.[307] For example, despite the Trump Administration's efforts to significantly decrease NOAA funding between 2017-2019, funding for the CZMA increased slightly from $69,542,136 in 2017 to $75,316,937 in 2019.[308]

In 2023, Congress allocated $81 million through the Act's grant provisions to implement coastal management programs in the thirty-four participating states and territories.[309] State, territorial, and local governments, and other partners contributed another $66 million.[310] Additional money was provided through the Bipartisan Infrastructure Law to support restoration and conservation projects through the National Coastal Zone Management Program and National Estuarine Research Reserve System.[311]

The CZMA was last reauthorized in 1996.[312] Since then, pressures on coastal systems from human activities, climate change, and sea level rise have increased.[313] Although the CZMA was amended to encourage states to develop plans to address erosion and sea level rise, states are not actually required to do so.[314] States are only required to take steps to address these issues "as the state's planning process indicates is necessary."[315] NOAA's Office for Coastal Management uses available grant funds to entice states to protect and restore coastal resources,[316] but much more is needed.

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307. *See generally* CTR. FOR URB. & REG'L STUDS. OF THE DEP'T OF CITY & REG'L PLAN., THE UNIV. OF N.C. AT CHAPEL HILL, *supra* note 209, at iii.

308. Memorandum from the U.S. Dep't of Com., Nat'l Oceanic & Atmospheric Admin. Off. for Coastal Mgmt. on FY 2017 Draft Funding Guidance and Allocations Coastal Zone Management Act Sections 306/306A and 309 (June 2, 2017), https://coast.noaa.gov/data/czm/media/fy17-funding-guidance.pdf [perma.cc/YEG9-ZGLL]; Memorandum from the U.S. Dep't of Com., Nat'l Oceanic & Atmospheric Admin. Off. for Coastal Mgmt. on FY 2019 Draft Funding Guidance and Allocations Coastal Zone Management Act Sections 306/306A and 309 (Apr. 4, 2019), https://coast.noaa.gov/data/czm/media/fy19-funding-guidance.pdf [perma.cc/D6JH-XN4G].

309. OFF. FOR COASTAL MGMT., NAT'L OCEANIC & ATMOSPHERIC ADMIN., NOAA'S NATIONAL COASTAL ZONE MANAGEMENT PROGRAM FUNDING SUMMARY (2023), https://coast.noaa.gov/data/czm/media/funding-summary.pdf [perma.cc/L2BB-TUPL].

310. *Id.*

311. *See generally Bipartisan Infrastructure Law Awards*, OFF. FOR COASTAL MGMT., NAT'L OCEANIC & ATMOSPHERIC ADMIN., https://coast.noaa.gov/funding/infrastructure.html [perma.cc/QV7E-QNKP] (Aug. 9, 2024).

312. Coastal Zone Management Act, 16 U.S.C. § 1464.

313. *See Climate Change Impacts on Coasts*, ENV'T PROT. AGENCY, https://www.epa.gov/climateimpacts/climate-change-impacts-coasts [https://perma.cc/43BK-CYPA].

314. *See* OFF. FOR COASTAL MGMT., NAT'L OCEANIC & ATMOSPHERIC ADMIN., COASTAL ZONE MANAGEMENT ACT OVERVIEW, https://coast.noaa.gov/data/digitalcoast/pdf/czma-overview.pdf [https://perma.cc/93QE-HEHU].

315. 15 C.F.R. § 923.25(c) (2024).

316. *See generally Funding Opportunities*, OFF. FOR COASTAL MGMT., NAT'L OCEANIC & ATMOSPHERIC ADMIN., https://coast.noaa.gov/funding/ [https://perma.cc/93QE-HEHU].

IV. RECOMMENDATIONS

The Coastal Zone Management Act was enacted to create a partnership between the federal government and state governments to preserve, protect, develop, and restore the coastal zones of the United States.[317] This included protecting natural resources, managing coastal development, improving coastal water quality, controlling non-point source (NPS) pollution, and providing public, recreational access to the coasts.[318] The Act has helped states improve public access and use of coastline, but it has done little to slow coastal development.[319] Today, the careful balance Congress sought to achieve between protecting natural resources and promoting coastal development has tipped strongly in favor of development. As other nations respond to the risk of sea level rise by limiting or preventing new coastal development, the U.S. continues to do little to slow development along the coastline.[320] This is, in part, caused by the Catch-22 structure of municipal funding. Local governments derive significant tax revenue from *ad valorem* property taxes and depend on it for their budgeting and fiscal planning.[321] Thus, local governments have a strong incentive to allow development even if that development may prove harmful later. For coastal cities seeking to find solutions to address sea level rise, taxes obtained from development provide a primary funding mechanism. This revenue, in turn, allows local governments to improve and enhance infrastructure, including protection against sea level rise.[322] To avoid this Hobson's choice, local governments need additional assistance from the state and federal government. Restructured, the CZMA can provide that essential assistance. Toward that end, the following recommendations are provided.

A. Congress Should Revise CZMA Funding Structure to Address State Risk

Under the current funding structure, Congress appropriates a set amount for CZMA awards, and NOAA calculates funding for each state using a

317. 16 U.S.C. § 1452(1).

318. *See id.* § 1452(2)(A)-(C), (E).

319. *See* CTR. FOR URB. & REG'L STUD. OF THE DEP'T OF CITY & REG'L PLAN., THE UNIV. OF N.C. AT CHAPEL HILL, *supra* note 209, at 60.

320. *See* Kenneth J. Bagstad et al., *Taxes, Subsidies, and Insurance as Drivers of United States Coastal Development*, 63 ECOLOGICAL ECON. 285, 293 tbl.2 (2006).

321. *See* Charles W. Goldner, Jr., *State and Local Government Fiscal Responsibility: An Integrated Approach*, 26 WAKE FOREST L. REV. 925, 930 (1991).

322. *See generally* Laurie Reynolds, *Taxes, Fees, Assessments, Dues, and the Get What You Pay for Model of Local Government*, 56 FLA. L. REV. 373, 385 n.54 (2004).

formula based on shoreline mileage and population.[323] Congress should change this calculation to reflect differences in each state's relative risk to sea level rise and biodiversity loss. Congress should also remove the per-state cap on funding as it penalizes states that have greater urgency related to both issues and rewards states that do not face the same risks. For example, Florida has the second longest coastline in the country and is among the most exposed states in the country to sea level rise and coastal storms.[324] Florida is also part of the North American Coastal Plain, a global biodiversity hotspot.[325] Yet, Florida receives the same base section 306/306A funding as Maine, which has less than half the shoreline miles, less risk from sea level rise, and less risk of biodiversity loss.[326] Similarly, California receives the same base section 306/306A funding as Massachusetts even though California has more imperiled species than any state, has more than twice as many shoreline miles as Massachusetts, has the largest coastal population, and is at greater risk from sea level rise.[327] While most states receive more in federal services than what they pay in federal taxes, residents of California receive less in federal services than what they pay in federal taxes.[328] California and Florida both rank among states least dependent upon federal aid but rank second and third, respectively, in the national marine economy.[329] These states face elevated risks to their coastal zones and contribute more to the national economy than other states that receive similar CZMA funding but face lower risks.[330] These examples show that the current approach to CZMA funding, which was developed to promote equity among states, is, in fact, inequitable. NOAA should reevaluate its current CZMA funding framework to provide funding

323. *See* U.S. GOV'T ACCOUNTABILITY OFF., *supra* note 288, at 15.

324. FLA. CLIMATE CTR., FLA. STATE UNIV., SEA LEVEL RISE, https://climatecenter.fsu.edu/topics/sea-level-rise [perma.cc/8JKT-MDPT].

325. Reed Noss, *Announcing the World's 36th Biodiversity Hotspot: The North American Coastal Plain* (2016), CRITICAL ECOSYSTEM P'SHIP FUND, https://www.cepf.net/stories/announcing-worlds-36th-biodiversity-hotspot-north-american-coastal-plain [perma.cc/65DB-DFF5].

326. FY 2021 ALLOCATIONS, *supra* note 302; *see also* Catrin Einhorn & Nadja Popovich, *This Map Shows Where Biodiversity Is Most at Risk in America*, N.Y. TIMES (Mar. 3, 2022), https://www.nytimes.com/interactive/2022/03/03/climate/biodiversity-map.html [perma.cc/T9ZN-WKJK].

327. FY 2021 ALLOCATIONS, *supra* note 302; *see also* Einhorn & Popovich, *supra* note 326.

328. *See* LEGIS. ANALYST'S OFF., THE CAL. LEGISLATURE'S NONPARTISAN FISCAL & POL'Y ADVISOR, FEDERAL SPENDING IN CALIFORNIA (2017), https://lao.ca.gov/Publications/Report/3531/2 [https://perma.cc/BJ6N-ETBY].

329. OFF. FOR COASTAL MGMT., NAT'L OCEANIC & ATMOSPHERIC ADMIN., NOAA REGIONAL AND STATE REPORT ON THE U.S. MARINE ECONOMY (2023), https://coast.noaa.gov/data/digitalcoast/pdf/econ-report-regional-state.pdf [perma.cc/ER44-759S].

330. *See id.*

based on assessed risk from sea level rise and biodiversity loss and request that Congress remove the per-state cap.[331]

B. Protect Blue Carbon Systems and Provide for Accommodation

To limit biodiversity loss and mitigate the most severe impacts of climate change, society must find ways to rapidly reduce the emission of carbon dioxide into the atmosphere. Doing so will require using all available resources, including natural systems that sequester carbon.[332] Blue carbon is the carbon stored in coastal and marine ecosystems, such as mangroves, tidal marshes, forested tidal wetlands, peatlands, and seagrass meadows.[333] These systems sequester and store more carbon per unit area than terrestrial forests.[334] Although these systems occupy less than 5% of global land area and less than 2% of the ocean, they store roughly 50% of all carbon buried in ocean sediments.[335] Intact, these systems provide important co-benefits, including supporting fisheries, improving water quality, and protecting communities from flooding.[336] When they decay or are degraded, these coastal systems release three major greenhouse gases—carbon dioxide, methane, and nitrous oxide—back into the atmosphere.[337] Despite the enormous value these systems provide, human activities continue to drive declines.[338] Each year, approximately 450 million metric tons of carbon dioxide—equivalent to the emissions from more than ninety-seven million cars—is released from the destruction of coastal wetlands.[339] In the United States, wetland loss continues due to development, sea level rise, subsidence,

331. *See generally* U.S. GOV'T ACCOUNTABILITY OFF., *supra* note 288.

332. *See* Johannes Lehmann, *Biological Carbon Sequestration Must and Can Be a Win-Win Approach*, 97 CLIMATE CHANGE 459, 460 (2009).

333. INT'L UNION FOR CONSERVATION OF NATURE [IUCN], BLUE CARBON (2017), https://www.iucn.org/resources/issues-brief/blue-carbon [perma.cc/T9ST-2NWF].

334. *Id.*

335. C.M. Duarte et al., *Major Role of Marine Vegetation on the Oceanic Carbon Cycle*, 2 BIOGEOSCIENCES 1, 1 (2005), https://bg.copernicus.org/articles/2/1/2005/ [perma.cc/F63J-WUMA].

336. *U.S. States Play Major Role Boosting, Expanding 'Blue Carbon*,*'* THE PEW CHARITABLE TRUSTS, https://www.pewtrusts.org/en/research-and-analysis/articles/2021/09/24/us-states-play-major-role-boosting-expanding-blue-carbon [perma.cc/PF6G-MKHJ] (June 20, 2024) [hereinafter *Expanding 'Blue Carbon'*].

337. *Coastal 'Blue Carbon': An Important Tool for Combating Climate Change*, THE PEW CHARITABLE TRUSTS, https://www.pewtrusts.org/en/research-and-analysis/issue-briefs/2021/09/coastal-blue-carbon-an-important-tool-for-combating-climate-change [perma.cc/44M9-MCQY] (Oct. 1, 2021).

338. *See* James E. Herbert-Read et al., *A Global Horizon Scan of Issues Impacting Marine and Coastal Biodiversity Conservation*, 6 NATURE ECOLOGY & EVOLUTION 1262, 1266 (2022).

339. *Expanding 'Blue Carbon*,*' supra* note 336.

and other factors.[340] These changes place humans at greater risk from the impacts of climate change and sea level rise and drive further biodiversity loss.[341] Under current scenarios, most of the remaining U.S. coastal wetlands could be lost by 2100.[342] However, because coastal wetlands can migrate inland, the U.S. could reduce coastal wetland loss significantly through more effective land conservation. By reducing greenhouse gas emissions and setting aside land for wetland landward migration, the U.S. could reduce losses of coastal wetlands to less than 20% by 2100.[343] States with the greatest potential for landward accommodation, Louisiana, Florida, North Carolina, Texas, and South Carolina, are all part of the North American Coastal Plain—a global biodiversity hotspot.[344] Thus, protecting coastal ecosystems will also address biodiversity loss.[345] Protecting these systems also ensures that sequestered carbon is not released back into the atmosphere to accelerate climate change.[346]

The CZMA has several mechanisms to help states preserve blue carbon systems. First, as amended, the Act encourages each state to address the impacts of climate change and sea level rise in its coastal management plan.[347] Section 306A authorizes the Secretary of Commerce to provide grants to eligible coastal states to assist with the preservation or restoration of areas of conservation or ecological value.[348] This Coastal Resource Improvement Program should be restructured to focus primarily on actions to protect and restore natural systems.

Section 307A authorizes the Secretary of Commerce to make competitive grants to coastal states to acquire property or interest in property that will further the goals listed in a state's CMP.[349] Because these grants are aimed at land conservation, Congress should increase funding and focus grant awards on wetlands that have the highest capacity of landward migration. States would be encouraged to plan and set aside the land needed as the wetlands migrate landward. Because a certain amount of sea level rise will occur in the

340. *See* Clarisa Diaz et al., *US Coastal Wetlands Are Rapidly Disappearing. Here's What It'll Take to Save Them*, PULITZER CTR. (Mar. 3, 2023), https://pulitzercenter.org/stories/us-coastal-wetlands-are-rapidly-disappearing-heres-what-itll-take-save-them [perma.cc/B6SX-USZE].

341. *See generally id.*; *see also Biodiversity*, *supra* note 19.

342. Diaz et al., *supra* note 340.

343. *Id.*

344. *See* Osland et al., *supra* note 53, at 2; Noss, *supra* note 325.

345. *See* Noss, *supra* note 325.

346. *See* INST. FOR CARBON REMOVAL L. & POL'Y, EXPLAINER: CARBON REMOVAL 1 (2020), https://www.american.edu/sis/centers/carbon-removal/upload/carbon-removal-explainer_icrlp_accessible.pdf [https://perma.cc/GMT6-RUZ7].

347. *See* Coastal Zone Management Act, 16 U.S.C. § 1451(l).

348. *Id.* § 1455a(b).

349. *Id.* § 1456-1.

coming decades regardless of emissions scenarios,[350] it makes little economic sense to spend funds to protect wetlands without providing accommodation space.

Section 309 authorizes the Secretary of Commerce to provide competitive grants to eligible coastal states for development and implementation of coastal zone enhancement objectives.[351] This provision expressly provides for the "[p]rotection, restoration, or enhancement of the existing coastal wetlands base, or creation of new coastal wetlands."[352] Unlike the other grants, no state cost share is required for these grants.[353] As states respond to climate change and sea level rise, they must be required to include steps to protect biodiversity. Priority consideration should be given to actions that enhance the coastline while also addressing sea level rise and biodiversity loss.

Although many coastal ecosystems will be impacted as sea level rises over time, steps should be taken now to address existing stressors, including pollution. Chemical pollution and coastal eutrophication have already impacted biodiversity.[354] Climate change will act synergistically with these existing stressors to augment the harm.[355] Each state eligible for CZMA funding must establish a Coastal Nonpoint Pollution Control Program. Congress should reinstate funding for this program to help states better address nonpoint source runoff that continues to degrade coastal systems. By reducing pollution entering coastal systems, flora and fauna within the system will become more resilient to climatic changes and be better able to migrate as seas rise.

Tying funding under the CZMA to actions that address sea level rise and biodiversity loss is consistent with protections afforded under the federal Endangered Species Act.[356] Approximately 233 federally listed endangered and threatened species in the United States are threatened by sea level rise.[357] The U.S. Fish and Wildlife Service is required to consider assisted migration—including passively or actively moving endangered or threatened species to areas outside their currently occupied ranges—to address sea level

350. *See* Christina Nunez, *Sea Levels Are Rising at an Extraordinary Pace. Here's What to Know.*, NAT'L GEOGRAPHIC (Apr. 10, 2023), https://www.nationalgeographic.com/environment/article/sea-level-rise-1 [https://perma.cc/9NY2-BGA].

351. 16 U.S.C. § 1456b.

352. *Id.* § 1456b(a)(1).

353. *Id.* § 1456b(e).

354. NAT'L RSCH. COUNCIL, UNDERSTANDING MARINE BIODIVERSITY 30 (1995).

355. *See id.* at 25.

356. *See* 16 U.S.C §1535(d).

357. CTR. FOR BIOLOGICAL DIVERSITY, DEADLY WATERS: HOW RISING SEAS THREATEN 233 ENDANGERED SPECIES 1 (2013), https://www.biologicaldiversity.org/campaigns/sea-level_rise/pdfs/Sea_Level_Rise_Report_2013_web.pdf [perma.cc/Y92E-Q67F].

rise.[358] Some coastal endangered species, such as sea turtles, will suffer from the loss of transitional habitat between land and sea as seas rise.[359] Leaving space or corridors for species movement landward will be essential to preserve these species.[360] Similarly, leaving space for wetlands to migrate is essential to their long-term preservation.[361] Leaving undeveloped space, or restoring previously damaged space, will protect coastal systems and the species that inhabit coastal areas. Doing so will also limit lawsuits that will inevitably arise as protected species are caught in the coastal squeeze resulting from coastal development and shoreline armoring.

C. Increase Ocean Renewable Energy Resources

Globally, greenhouse gas emissions reached their highest levels in 2023.[362] Current levels are now about one-third higher than the levels needed to limit global warming to the 1.5°C target set in the Paris Agreement.[363] But there is evidence that emissions may have peaked, as more countries transition to renewable energy.[364] The velocity of change, however, is insufficient.[365] To avoid the worst impacts of climate change, society must move faster to reduce greenhouse gas emissions. This requires the fifty-two high-emitting countries, including the United States, that collectively account for two-thirds of global emissions, to decrease emissions as rapidly as possible.[366] The CZMA can help expedite emissions reductions.

The CZMA requires each participating state to consider energy development in their coastal management plans.[367] Historically, this centered on oil and gas development in state and federal waters.[368] However, nothing

358. Jaclyn Lopez, *Biodiversity on the Brink: The Role of "Assisted Migration" in Managing Endangered Species Threatened With Rising Seas*, 39 HARV. ENV'T L. REV. 157, 157 (2015).

359. *Information About Sea Turtles: Threats from Climate Change*, SEA TURTLE CONSERVATORY, https://conserveturtles.org/information-sea-turtles-threats-climate-change/ [https://perma.cc/Q7WT-2LZ5].

360. *See 5 Ways Corridors Help Wildlife Survive and Thrive*, CTR. FOR LARGE LANDSCAPE CONSERVATION, https://largelandscapes.org/news/5-ways-corridors-help-wildlife/ [https://perma.cc/F79L-F2GW].

361. *See* Diaz et al., *supra* note 340.

362. Homi Kharas & Wolfgang Fengler, *Have We Reached Peak Greenhouse Gas Emissions?*, WORLD ECON. F. (Dec. 8, 2023), https://www.weforum.org/agenda/2023/12/peak-greenhouse-gas-emissions/ [perma.cc/65J8-TF84].

363. *Id.*

364. *Id.*

365. *Id.*

366. *Id.*

367. Coastal Zone Management Act, 16 U.S.C. § 1452(2)(D).

368. *See* Sierra B. Weaver, *Local Management of Natural Resources: Should Local Governments Be Able to Keep Oil Out*, 26 HARV. ENV'T L. REV. 231, 237–38 (2002).

in the CZMA prohibits shifting the focus to clean, renewable energy technologies.[369] Doing so will promote energy development while protecting the environment.

The U.S. has been slow to transition to renewable energy primarily due to special interest lobbying by the oil and gas industries and concerns that such a transition is prohibitively expensive and economically harmful.[370] Despite these obstacles, investment in renewables continues to increase.[371] In 2022, federal subsidies and incentives to support renewable energy were almost five times higher than those for fossil energy.[372] In the first half of 2023, approximately 25% of the electricity generated in the United States was generated by renewables, including hydropower.[373] This movement toward renewable energy is promising, but it is insufficient. To achieve U.S. greenhouse gas reduction targets, the U.S. must double its 2023 renewable energy installation rates.[374]

Currently, wind, solar, biomass, waste-to-energy, geothermal, and hydro dominate land-based renewable energy resources in the United States.[375] Comparatively little effort has been made in the U.S. to harness offshore energy resources. For example, by the end of 2023, global offshore wind power exceeded 67,000 megawatts.[376] Of this, China produced more than 30,000 megawatts of power while the U.S. produced only forty-two megawatts of power.[377] This is just a fraction of the potential energy that may

369. *See* Rusty Russell, *Neither Out Far Nor In Deep: The Prospects for Utility-Scale Wind Power in the Coastal Zone*, 31 B.C. ENV'T AFF. L. REV. 221, 238 n.101, 239–40 (2004).

370. *See* Leah C. Stokes, Power Politics: Renewable Energy Policy Change in US States 18, 29, 42, 72 (June 29, 2015) (Ph.D. dissertation, Massachusetts Institute of Technology) (on file with DSpace@MIT, digital repository of MIT Libraries).

371. *Investment in Clean Energy This Year Is Set to Be Twice the Amount Going to Fossil Fuels*, INT'L ENERGY AGENCY 50 (June 6, 2024), https://www.iea.org/news/Investment-in-clean-energy-this-year-is-set-to-be-twice-the-amount-going-to-fossil-fuels [perma.cc/Z3QU-JADS].

372. *Renewable Energy Still Dominates Energy Subsidies in FY 2022*, INST. FOR ENERGY RSCH. (Aug. 9, 2023), https://www.instituteforenergyresearch.org/fossil-fuels/renewable-energy-still-dominates-energy-subsidies-in-fy-2022/ [perma.cc/66Z8-PMAH].

373. Lori Bird & Joseph Womble, *State of the US Clean Energy Transition: Recent Progress, and What Comes Next*, WORLD RES. INST. (Feb. 7, 2024), https://www.wri.org/insights/clean-energy-progress-united-states [https://perma.cc/4LG6-7C3F].

374. *Id.*

375. *See* BLOOMBERG NEW ENERGY FIN., SUSTAINABLE ENERGY IN AMERICA 2024 FACTBOOK (2024), https://assets.bbhub.io/professional/sites/24/2024-BCSE-BNEF-Sustainable-Energy-in-America-Factbook.pdf [perma.cc/PVD8-K2MP].

376. Christopher Niezrecki, *Why US Offshore Wind Power Is Struggling – The Good, the Bad and the Opportunity*, THE CONVERSATION (May 9, 2024, 8:34 AM), https://theconversation.com/why-us-offshore-wind-power-is-struggling-the-good-the-bad-and-the-opportunity-228983 [https://perma.cc/D9HD-7PSQ].

377. *Id.*

be harnessed off the U.S. coastline.[378] Total offshore wind energy potential for the United States is approximately 4,249 gigawatts.[379] Harnessing wind energy offshore has several advantages to land-based capture and should be encouraged. Turbines can be taller, winds over oceans blow more regularly, and the winds are generally stronger because they are unimpeded by mountains or other obstacles.[380] Yet, significant obstacles remain. The complicated and uncertain approval process used to site offshore wind projects has limited efforts to develop commercial offshore wind energy projects.[381] Several large offshore wind projects were recently canceled in New Jersey, Massachusetts, and Connecticut due to supply chain issues, higher interest rates, and a failure to obtain adequate tax credits.[382] To date, the Department of Interior has only approved two commercial scale offshore wind projects.[383] Recently, however, the Department has taken steps to streamline the approval process and has announced it will complete the review of at least sixteen plans to construct and operate commercial, offshore wind energy facilities, which would generate more than twenty-two gigawatts of clean energy for the nation.[384]

Even less effort has been made to harness U.S. offshore marine kinetic energy despite its enormous potential. Because the ocean is constantly moving and has different temperatures and salinities in different areas, energy can be extracted from waves, currents, and thermal and salinity gradients and converted into useful mechanical or electrical energy.[385] Unlike other forms

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378. *See* Xurxo Costoya et al., *On the Suitability of Offshore Wind Energy Resource in the United States of America for the 21st Century*, APPLIED ENERGY, Mar. 15, 2020, at 1, 2.

379. *See* ANTHONY LOPEZ ET AL., NAT'L RENEWABLE ENERGY LAB'Y, OFFSHORE WIND ENERGY TECHNICAL POTENTIAL FOR THE CONTIGUOUS U.S. at16 (2022), https://www.nrel.gov/docs/fy22osti/83650.pdf [perma.cc/Z9MM-MWCE] (adding Fixed-Bottom (GW) value of 1,476 and Floating (GW) Value of 2,773 is equivalent to 4249 gigawatts).

380. *See Global Ocean Wind Energy Potential,* EARTH OBSERVATORY, NAT'L AERONAUTICS & SPACE ADMIN., https://earthobservatory.nasa.gov/images/8916/global-ocean-wind-energy-potential [perma.cc/NFR9-S5FY].

381. *See* Niezrecki, *supra* note 376.

382. Jennifer McDermott et al., *Offshore Wind Projects Face Economic Storm. Cancellations Jeopardize Biden Clean Energy Goals*, AP NEWS (Nov. 4, 2023), https://apnews.com/article/offshore-wind-orsted-cancellation-biden-new-jersey-3f2ff7c9832210ce862f6e7179fae439 [perma.cc/LJ4T-VCXZ].

383. Press Release, U.S. Dep't of Interior, Interior Department Takes Steps to Strengthen Offshore Clean Energy Development (Jan. 12, 2023), https://www.doi.gov/pressreleases/interior-department-takes-steps-strengthen-offshore-clean-energy-development [perma.cc/2SKG-D6M6].

384. *See id.*

385. OFF. OF ENERGY EFFICIENCY & RENEWABLE ENERGY, U.S. DEP'T OF ENERGY, *APPENDICES*, *IN* POWERING THE BLUE ECONOMY: EXPLORING OPPORTUNITIES FOR MARINE RENEWABLE ENERGY IN MARITIME MARKETS 157, 158 (Apr. 2019), https://www.energy.gov/sites/default/files/2019/09/f66/73355-Appendices.pdf [hereinafter POWERING THE BLUE ECONOMY].

of renewable energy, such as wind or solar, ocean energy resources (wave, tidal, and ocean thermal energy) are highly predictable and provide stable, reliable clean energy.[386] Fully utilized, marine energy harnessed off the U.S. coast could provide approximately 6,400 terawatt-hours (TWh).[387] By comparison, the U.S. generated 4,178 TWh of electricity in 2023.[388] Because more than 40% of the U.S. population lives in the coastal zone, marine kinetic energy is well situated to power coastal communities.[389] Yet, the U.S. has fallen behind in this renewable energy sector as well. Europe currently leads the world in ocean energy projects with three times the operating capacity of all other countries combined.[390] Active projects produced ninety-three gigawatt-hours (GWh) of energy in 2023.[391] The U.S. has responded by increasing its yearly budget for ocean energy for the third year in a row, bringing the total funding over the last five years to $520 million.[392] California and Oregon have also adopted laws to boost the development of ocean renewable energy.[393] Changes to the national electrical grid may also encourage offshore development.

The Federal Energy Regulatory Commission (FERC) recently reformed its planning processes and its grid interconnection rule to speed access to the nation's aging electrical grid.[394] Among other changes, this rule will require grid operators to identify needs twenty years into the future, plan for changes in energy mix from non-renewable to renewable, and plan for the new transmission access needed for renewable energy sources to achieve the nation's zero carbon goal.[395]

Congress has provided significant new funding to the clean energy sector through the Inflation Reduction Act, Infrastructure Investment and Jobs Act,

386. Kim Rutledge et al., *Tidal Energy*, NAT'L GEOGRAPHIC, https://education.nationalgeographic.org/resource/tidal-energy/ [perma.cc/E47R-YAQP] (Oct. 19, 2023).

387. LEVI KILCHER ET AL., NAT'L RENEWABLE ENERGY LAB'Y, MARINE ENERGY IN THE UNITED STATES: AN OVERVIEW OF OPPORTUNITIES 11 (2021), https://www.nrel.gov/docs/fy21osti/78773.pdf [https://perma.cc/45CN-N46R].

388. *What Is U.S. Electricity Generation By Energy Source?*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/tools/faqs/faq.php?id=427&t=2 [perma.cc/2KSX-QDSR] (Feb. 29, 2024).

389. *Economics and Demographics*, *supra* note 193.

390. OCEAN ENERGY EUR. [OEE], OCEAN ENERGY: STATS AND TRENDS 2023 16 (Apr. 2024), https://www.oceanenergy-europe.eu/wp-content/uploads/2024/05/Ocean-Energy-Stats-and-Trends-2023.pdf [perma.cc/JF3T-DP5N].

391. *Id.* at 12.

392. *Id.* at 16.

393. S. 605, 2023 Leg., Reg. Sess. (Cal. 2023); *see* H.B. 3375, 81st Leg. Assemb., Reg. Sess. (Or. 2021).

394. *See* Building for the Future Through Electric Regional Transmission Planning and Cost Allocation, 89 Fed. Reg. 49280, 49280 (June 11, 2024) (to be codified at 18 C.F.R. pt. 35).

395. *See id.* at 49284, 49289, 29292.

and CHIPs Act.[396] The Inflation Reduction Act of 2022 will provide $370 billion in clean energy and climate investments over the next ten years that will support renewable energy projects and protect natural climate solutions.[397] The Infrastructure Investment and Jobs Act provides significant investments in clean energy technology supply chains to help the nation transition to renewable energy and increase U.S. competitiveness in the global clean energy market.[398] The CHIPS Act provides investment in zero-carbon technology in America and establishes a new federal office to organize clean-energy innovation.[399] These changes will help, but more is needed.

The CZMA can play an important role in the development of renewable offshore energy resources. The CZMA empowers participating states and local governments to impede offshore energy developments that contribute to sea level change, biodiversity loss, and other impacts to the coastal zone.[400] Opponents of oil and gas development have used the consistency requirement to object to federal projects at different stages of development.[401] States should continue to utilize this limited preemptive power over federal activities to force a transition to renewable energy technology. Doing so is consistent with the CZMA because the Act encourages states to address the impacts of sea level rise.[402] As coastal communities face increasing challenges from sea level rise, states may find it increasingly hard to reject efforts to develop renewable energy as inconsistent with the state's CMP where the projects mitigate the risks.

But states also must provide pathways that promote the transition. While most Americans agree that the U.S. should prioritize the development of renewable energy over fossil fuel sources, states updated their approved CMPs to specifically include state consistency review for offshore wind projects on the Outer Continental Shelf.[403]

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396. *See* SEAN CHURCH ET AL., AM. UNIV. DIPL. LAB, U.S. DEP'T OF STATE, THE IMPACT OF THE US INFLATION REDUCTION ACT ON GLOBAL CLEAN ENERGY SUPPLY CHAINS 6 (2023).

397. Justin Badlam et al., *The Inflation Reduction Act: Here's What's in It*, MCKINSEY & CO. (Oct. 24, 2022), https://www.mckinsey.com/industries/public-sector/our-insights/the-inflation-reduction-act-heres-whats-in-it#/ [perma.cc/DH97-4PFZ].

398. *See* Infrastructure Investment and Jobs Act, Pub. L. No. 117-58, 135 Stat. 429 (2022).

399. *See* CHIPS and Science Act of 2022, Pub. L. No. 117-167, 136 Stat. 1366.

400. *See* Coastal Zone Management Act, 16 U.S.C. § 1451(c)-(e), (g), (i), (l).

401. *See, e.g.*, Blanco v. Burton, No. Civ.A. 06-3813, 2006 WL 2366046, at *11–12 (E.D. La. Aug. 14, 2006) (holding planned OCS lease sale inconsistent with Louisiana's CMP as argued by the state).

402. 16 U.S.C. § 1451(l).

403. See Lauren Perkins, Note, *Hope on the Horizon for Offshore Wind Development: An Examination of the Regulatory Framework Rhode Island Navigated to Make the Nation's First Offshore Wind Farm a Reality, and the Implication for California's Ability to Adopt a Similar Approach Under the Coastal Zone Management Act*, 9 SAN DIEGO J. CLIMATE & ENERGY L. 265, 287–88, 294 (2018).

States should utilize section 309 of the CZMA to facilitate offshore renewable energy. Section 309 encourages each participating coastal state to continually improve its CMP in one of the nine enhancement areas, including the development of policies to facilitate the siting of energy related facilities and activities.[404] The most common program changes include revised regulations, legislation, and procedural guidance.[405] Section 309 specifically lists wind, wave, tidal, and ocean thermal energy as types of energy facility siting projects subject to the program.[406] States should use this grant program to reevaluate policies and regulations that unnecessarily impede the implementation of nearshore and offshore renewable energy projects.

Although section 309 establishes nine enhancement areas, OCM may designate one or more enhancement areas as "areas of national importance."[407] Emissions from fossil fuels are driving ocean warming, which is contributing to sea level rise, coastal flooding, and intense storms that place coastal communities in increasing peril.[408] OCM should recognize renewable energy siting as an area of national importance. OCM currently recognizes addressing "coastal hazards" as an enhancement area of national importance,[409] but much of the coastal hazards communities face are caused by emissions from the combustion of fossil fuels and the resulting impacts of climate change such as sea level rise.[410] OCM should reevaluate its current policy and focus on the underlying cause of coastal hazards by taking action to eliminate harmful emissions. By identifying the siting of renewable energy projects as an area of national significance, OCM would encourage a transition to renewables.

Individual states should work with the federal government to increase offshore renewable energy development by reducing unnecessary regulatory hurdles that impede progress. The federal government has already taken significant steps to facilitate a transition to renewables by updating the nation's electrical grid requirements, investing billions in clean energy, and opening offshore areas for renewable energy projects.[411] Section 309 provides direct incentives to develop state policies that facilitate the siting of renewable energy related facilities and activities.[412] Doing so will also help protect the

404. *See* 16 U.S.C. § 1456b(a)(8)-(9).

405. CZMA SECTION 309 PROGRAM GUIDANCE, *supra* note 231, at 3–4.

406. *See id.* at 47.

407. *Id.* at 5.

408. *See* FREDERIC R. SIEGEL, ADAPTATIONS OF COASTAL CITIES TO GLOBAL WARMING, SEA LEVEL RISE, CLIMATE CHANGE AND ENDEMIC HAZARDS, at vii (2019).

409. CZMA SECTION 309 PROGRAM GUIDANCE, *supra* note 231, at 1.

410. *See* SIEGEL, *supra* note 408 (describing how global warming and climate change have increased the risk of coastal flooding).

411. *See generally* Uma Outka, *The Renewable Energy Footprint*, 30 STAN. ENV'T L.J. 241 (2011).

412. *See* CZMA SECTION 309 PROGRAM GUIDANCE, *supra* note 231, at 1.

natural resources of the coastal zone—a core goal of the CZMA. Countries that have seen reduced emissions have invested heavily in renewable energy sources, among other improvements.[413] These countries have also shown that economic growth is not stifled by policies that reduce emissions.[414] The CZMA provides a useful tool to facilitate the transition.

D. Strategically Implement MPAs to Reduce Biodiversity Loss

Marine Protected Areas that prohibit extractive and destructive activities are effective tools to protect marine biodiversity.[415] Currently, approximately 8.2% of the ocean is covered by marine protected areas (MPAs), but only 2.9% are fully or highly protected.[416] A 2024 study analyzing 100 of the world's largest MPAs reported that MPAs are not adequately protecting biodiversity due to slow implementation of management strategies and failure to restrict the most impactful activities.[417] According to the study, "only one-third of the area designated within these MPAs provides a level of protection that is likely to yield meaningful conservation benefits."[418] Moreover, more than 30% of the area within these MPAs remains open to industrial or other highly impactful activities.[419] The low level of protection results, in part, from perceived tradeoffs between protection and extraction that lead to conflict.[420] Conservation outcomes can be improved by upgrading partially protected areas to higher levels of protection, including conversion to fully protected areas in high-priority areas. Strategic ocean conservation of high-priority areas can improve biodiversity, mitigate climate change, and improve food security.[421]

While MPAs are typically created to address national priorities, emerging evidence suggests that a globally coordinated effort to conserve ocean resources will result in higher efficiency and lower biodiversity loss while restricting smaller segments of the ocean.[422] In one major study, researchers calculated the cumulative biodiversity benefit of protecting areas under three strategies: (1) systematic expansion of MPAs considering global priorities; (2)

413. Kharas & Fengler, *supra* note 362.

414. *Id.*

415. Sarah E. Lester et al., *Biological Effects Within No-Take Marine Reserves: A Global Synthesis*, 384 MARINE ECOLOGY PROGRESS SERIES 33, 34 (2009).

416. *The Marine Protection Atlas*, MARINE CONSERVATION INST., https://mpatlas.org/ [https://perma.cc/VL6Q-X623].

417. *Id.*

418. *Id.*

419. *Id.*

420. Enric Sala et al., *Protecting the Global Ocean for Biodiversity, Food and Climate*, 592 NATURE 397, 397 (2021).

421. *Id.*

422. *Id.* at 407–08.

systematic expansion of MPAs within Exclusive Economic Zones and the high seas considering only national priorities; and (3) random allocation of MPAs.[423] The authors conclude that a globally coordinated effort could achieve 90% of the maximum possible biodiversity benefit using less than half the ocean area needed for protection strategies based solely on national priorities.[424] Through the use of strategic and efficient prioritization for MPAs, regulators could reconcile conflicting objectives that currently impede the effectiveness of MPAs.[425]

MPAs do not account for how species move between political borders.[426] Thus, even if one country protects a species, those benefits are lost if the species moves into an area that is less protected.[427] Moreover, because climate change is causing range shifts in the distribution of marine species it is also reducing the effectiveness of established MPAs.[428] Ocean conditions, such as marine heatwaves, do not stop at the boundary of MPAs.[429] Establishing regional MPAs that expand across political borders may help integrate climate change into MPAs and improve their effectiveness.[430] The Marine Protected Areas (MPA) Federal Advisory Committee should be reestablished to advise NOAA and the Department of the Interior on ways to strengthen the nation's system of MPAs.[431]

Most coastal estuaries and wetlands are not covered by highly protective MPAs.[432] States should collaborate with the federal government to create additional highly protected coastal MPAs under the CZMA in coastal biodiversity hotspots, including the North American Coastal Plane.[433] States

423. *Id.* at 400–01.

424. *Id.* at 398.

425. *Id.* at 401.

426. *See* ALEX CAVEEN ET AL., THE CONTROVERSY OVER MARINE PROTECTED AREAS: SCIENCE MEETS POLICY 12 (2014).

427. *See id.*

428. *Id.* at 127.

429. *See* Chrissy Sexton, *Marine Protected Areas Were Not Designed for Climate Resilience*, EARTH.COM (Oct. 26, 2023), https://www.earth.com/news/marine-protected-areas-were-not-designed-for-climate-resilience/ [https://perma.cc/FC6C-VVA2].

430. *See* Katie Jewett, *How to Design Marine Protected Areas That Keep Pace with Climate Change*, STAN. REP. (Oct. 26, 2023), https://news.stanford.edu/stories/2023/10/marine-protected-areas-climate-change [https://perma.cc/PXD9-VMD3].

431. The Committee was terminated through Executive Order in 2019. *See* Miranda Green, *White House Eliminates Advisory Boards for Marine Life, Invasive Species,* THE HILL (Oct. 1, 2019, 4:35PM ET), https://thehill.com/policy/energy-environment/463893-white-house-eliminates-advisory-boards-overseeing-marine-life/.

432. *See generally* Richard T. Kingsford et al., *Wetlands: Conservation's Poor Cousins*, 26 AQUATIC CONSERVATION: MARINE & FRESHWATER ECOSYSTEMS 892 (2016).

433. In addition to the Coastal Zone Management Act, the major federal authorities for MPAs include the National Marine Sanctuaries Act, National Park Service Organic Act, National Wildlife Refuge System Administration Act, and the Antiquities Act.

should also use section 309 program funds to establish Special Area Management Plans to prepare and plan for sea level rise and to facilitate wetland migration in areas that have the greatest potential for landward migration. These actions will reduce biodiversity loss and protect natural resources that mitigate the impacts of sea level rise and climate change.

V. CONCLUSION

As climate change advances and seas rise, the U.S. coastline will be fundamentally reshaped.[434] Millions of people and trillions of dollars of real property will face increasing risks from coastal flooding and more intense storms.[435] Coastal ecosystems that provide critical ecosystem services may be lost to the sea, and biodiversity loss will accelerate.[436] In the absence of a national policy framework to address climate change and its associated impacts of sea level rise and ocean warming, the federal Coastal Zone Management Act, if revised, can play a pivotal role in protecting coastal development, preserving coastal ecosystems, and reducing biodiversity loss.

434. *See New Report Details How Rising Sea Levels Will Reshape U.S. Coastlines Over Next 30 Years*, CAL. OCEAN PROT. COUNCIL, CA.GOV, https://opc.ca.gov/2022/02/new-report-details-how-rising-sea-levels-will-reshape-u-s-coastlines-over-next-30-years/ [https://perma.cc/NBS2-CU9N].

435. *See, e.g.*, V. Lynn Hammett et al., *The Devastating Impact of Storm Surge on Coastal Communities: A Case Study on Florida's Low Income Housing Tax Credit Projects*, REAL EST. ISSUES, Oct. 18, 2018, at 3.

436. *See* Diaz et al., *supra* note 340.