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Updated April 29, 2025

Congressional Research Service
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R48148

CRS REPORT
Prepared for Members and
Committees of Congress

SUMMARY

R48148

April 29, 2025

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Coastal Blue Carbon as a Carbon Dioxide Removal Approach: Selected Issues for Congress

Recent Congresses have shown increased interest in the ability of certain coastal and marine ecosystems to reduce atmospheric carbon dioxide (CO_2) levels. According to the National Oceanic and Atmospheric Administration (NOAA), the ocean absorbs about 31% of global CO_2 emissions released into the atmosphere. Coastal ecosystems provide benefits (also known as *ecosystem services*) to the human population, such as reducing coastal erosion and flooding and supporting recreation, tourism, and other activities. Certain coastal ecosystems—mangrove forests, tidal marshes, and seagrass meadows—naturally capture and store CO_2 (i.e., act as a carbon sink). Stakeholders have termed the CO_2 captured and stored in certain coastal ecosystems *coastal blue carbon*. Although coastal blue carbon ecosystems represent 1% of the ocean area, these ecosystems store an estimated 50% of all carbon stored in the ocean.

The scientific community's understanding of the potential carbon dioxide removal (CDR) capacity of coastal blue carbon ecosystems is incomplete. Research continues regarding these ecosystems' *carbon sequestration*, the rate at which the ecosystem can remove CO_2 from the atmosphere; *carbon storage*, the ecosystem's ability to store carbon and keep it from reentering the environment; and *durability*, the amount of time the ecosystem can store the carbon with a low risk of the carbon being reintroduced into the environment. Conversely, coastal blue carbon ecosystems also may serve as greenhouse gas sources if they are degraded or lost due to human activities or natural causes.

Stakeholders contend that improved mapping of coastal blue carbon ecosystems and additional research about the carbon stock and sequestration rates of mangrove forests, tidal marshes, and seagrass meadows are needed to better understand these ecosystems' current and potential CO_2 removal capacity. Mapping provides information about the present geographic coverage of a coastal blue carbon ecosystem. The ecosystem's geographic coverage, coupled with analysis of soil samples collected from the ecosystem, provides information about the sequestration and storage of the coastal blue carbon at the scale of study (e.g., local or regional).

Several federal agencies (e.g., Department of Energy, National Aeronautics and Space Administration, NOAA, National Science Foundation, U.S. Geological Survey) have supported coastal blue carbon science related to mapping and estimating coastal blue carbon storage and sequestration and have coordinated and collaborated on these efforts. Information from these efforts may inform policy decisions related to the conservation, restoration, and creation (or expansion) of coastal blue carbon ecosystems to preserve or grow their carbon sink capacity. Given competing priorities for a finite area of coastline, among other considerations, some stakeholders may question the relative priority of coastal blue carbon considerations in such areas.

Some Members of previous Congresses introduced legislation to address aspects of coastal blue carbon ecosystems. Issues for the 119th Congress related to coastal blue carbon ecosystems and science may include the federal government's past role in coastal blue carbon science, such as mapping ecosystems and estimating their CDR capacity; conserving, restoring, and creating these ecosystems; coordinating federal agency activities; and overseeing collaboration between federal and nonfederal entities. Issues also may include funding for coastal blue carbon science and related activities. In addition, recent executive branch actions may affect the kinds of issues that are of congressional interest related to blue carbon ecosystems and science. The Trump Administration has made or proposed changes to federal agency staffing and funding across the executive branch, the effects of which are still unclear. Congress may conduct oversight of or reverse, amend, or codify in statute the Administration's actions, including those that may directly or indirectly affect coastal blue carbon ecosystems as well as the science of these ecosystems and their associated CDR capacity.

Contents

Figures

Tables

Appendixes

Contacts

Coastal ecosystems provide benefits and services to the human population (known as *ecosystem services*).[1] One ecosystem service provided by certain coastal ecosystems is the ability to capture and store carbon dioxide (CO_2) from the atmosphere, thereby constituting a portion of the *global carbon cycle*.[2] Scientists have termed the CO_2 captured and stored in these ecosystems *coastal blue carbon*.[3] Coastal ecosystems that support coastal blue carbon—mangrove forests, tidal marshes,[4] and seagrass meadows[5]—are collectively referred to as *coastal blue carbon ecosystems*. Because the soils found in coastal blue carbon ecosystems can remove carbon from the atmosphere for hundreds to thousands of years, these ecosystems serve as an active natural *carbon sink*.[6] In addition to helping reduce atmospheric CO_2 levels, coastal blue carbon ecosystems provide additional ecosystem services, such as providing habitat for aquatic, terrestrial, and avian species; filtering rainfall and terrestrial runoff; protecting coastal communities from erosion and flooding; dampening storm surge events; and supporting recreation, tourism, and other activities.[7]

Some stakeholders contend that restoring existing or creating new coastal blue carbon ecosystems may help remove additional CO_2 from the atmosphere and mitigate climate change risks.[8] In general, the conservation, restoration, or creation of coastal blue carbon ecosystems as a carbon dioxide removal (CDR) approach is considered distinct from marine CDR (refer to the "Marine Carbon Dioxide Removal Approaches" textbox, below). The degradation and loss of coastal blue carbon ecosystems may return additional greenhouse gases (GHGs)—including CO_2, methane, and nitrous oxide—to the atmosphere. Human activities and natural causes may contribute to the alteration of coastal blue carbon ecosystems.[9] Coastal blue carbon ecosystem alteration also may affect other ecosystem services, such as species' habitat and use.[10] To prevent the degradation of coastal blue carbon ecosystems and to maintain their ecosystem services, including their ability to

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[1] National Academies of Sciences, Engineering, and Medicine (NASEM), "Chapter 2: Coastal Blue Carbon," in *Negative Emissions Technologies and Reliable Sequestration: A Research Agenda* (Washington, DC: The National Academies Press, 2019), p. 70 (hereinafter NASEM, "Chapter 2: Coastal Blue Carbon").

[2] National Oceanic and Atmospheric Administration (NOAA), "Fast Facts: Blue Carbon," https://perma.cc/F48G-4HNK. The *global carbon cycle* is the exchange, or flux, of carbon among the atmosphere, ocean, land surface, and living things. For an overview of the carbon cycle, see CRS Report R47214, *The Carbon Cycle: Key Component of the Climate System, with Implications for Policy*, by Jonathan D. Haskett.

[3] NOAA, "Understanding Blue Carbon," September 29, 2022, https://www.climate.gov/news-features/understanding-climate/understanding-blue-carbon, archived April 4, 2025, at https://perma.cc/NC9H-E23R (hereinafter NOAA, "Understanding Blue Carbon").

[4] *Tidal marsh* includes *salt marsh*, often used interchangeably. However, not all tidal marshes are salt marshes. Tidal marshes lie more inland and have lower salinity levels than salt marshes but are still under a tidal influence. Some stakeholders include salt marshes (because marsh salinity influences greenhouse gas fluxes) as part of coastal blue carbon ecosystems, whereas other stakeholders include tidal marshes generally. For example, see Maria Fernanda Adame et al., "All Tidal Wetlands Are Blue Carbon Ecosystems," *BioScience*, vol. 74, no. 4 (April 2024), pp. 253-268.

[5] *Seagrass bed* is another commonly used term. This report uses the term *seagrass meadows* to refer to this type of coastal blue carbon ecosystem.

[6] NOAA, "Protecting Coastal Blue Carbon Through Habitat Conservation," https://perma.cc/2PFH-96WB.

[7] Sarah Cooley et al., "Chapter 3: Oceans and Coastal Ecosystems and Their Services," in *Climate Change 2022: Impacts, Adaptation and Vulnerability*, eds. Hans-Otto Pörtner et al., 2022, p. 464 (hereinafter Cooley et al., "Chapter 3: Oceans and Coastal Ecosystems"); and NASEM, "Chapter 2: Coastal Blue Carbon," p. 48.

[8] For example, Nathalie Hilmi et al., "The Role of Blue Carbon in Climate Change Mitigation and Carbon Stock Conservation," *Frontiers in Climate*, vol. 3 (2021), pp. 1-18.

[9] For example, see National Aeronautics and Space Administration (NASA), "Mapping the Roots of Mangrove Loss," https://earthobservatory.nasa.gov/images/147142/mapping-the-roots-of-mangrove-loss.

[10] For example, the U.S. Fish and Wildlife Service (FWS) identified that manatees along the Atlantic Coast of Florida have experienced a large and ongoing mortality event associated with the loss of seagrass meadows and other environmental factors. FWS, *Budget Justification and Performance Information Fiscal Year 2025*, p. ES-23.

act as a carbon sink, various stakeholders have advocated for the protection, conservation, sustainable management, and restoration of these ecosystems.[11] Other stakeholders contend that coastal blue carbon ecosystems are "unlikely to resolve the present day climate crisis" and caution that such efforts to create new or maintain existing coastal blue carbon ecosystems "could tempt decisionmakers and managers to relax on the implementation of other mitigation actions."[12] Still others may argue that the coastlines where coastal ecosystems are located are better suited for uses unrelated to CDR efforts.

Some previous Administrations and some Members of Congress have increasingly turned their attention to coastal blue carbon to mitigate increases in atmospheric CO_2 concentrations. For example, the Biden Administration's *Ocean Climate Action Plan* stated that the sustainable management of coastal blue carbon ecosystems could reduce GHG concentrations while providing other co-benefits.[13] Under the Biden Administration, the United States incorporated blue carbon and coastal resiliency projects in its *Nationally Determined Contribution* (NDC),[14] voluntary action a country pledges to take to reduce its carbon emissions under the Paris Agreement.[15] Some Members have shown interest in conserving and restoring coastal blue carbon ecosystems and introduced legislation in previous Congresses directing certain federal agencies to conduct and support research aimed at estimating the potential CDR capacity of mangrove forests, tidal marshes, and seagrass meadows, among other related activities.[16]

This report focuses on coastal blue carbon and discusses the ecosystems that support it. The report also discusses the outstanding research gaps in understanding, conserving, and restoring existing coastal blue carbon ecosystems as well as creating new coastal blue carbon ecosystems as a CDR approach. Issues for the 119th Congress related to coastal blue carbon ecosystems and science may range from the federal government's past role in coastal blue carbon science—including mapping ecosystems and estimating their CDR; conserving, restoring, and creating these ecosystems; coordinating federal agency activities; and overseeing collaboration between federal and nonfederal entities—to funding for coastal blue carbon research and related activities. In addition, recent executive branch actions may affect the kinds of issues that are of

[11] For example, NOAA, "Coastal Wetland Habitat," https://www.fisheries.noaa.gov/national/habitat-conservation/coastal-wetland-habitat, archived April 4, 2025, at https://perma.cc/7CGN-2YP6.

[12] Erik Kristensen et al., "Predicting Climate Mitigation Through Carbon Burial in Blue Carbon Ecosystems—Challenges and Pitfalls," *Global Change Biology*, vol. 31 (2025), pp. 1-15, see p. 9. Hereinafter Kristensen et al., "Predicting Climate Mitigation Through Carbon Burial in Blue Carbon Ecosystems."

[13] White House Ocean Policy Committee, *Ocean Climate Action Plan: A Report by the Ocean Policy Committee*, March 2023, p. 47. Hereinafter White House Ocean Policy Committee, *Ocean Climate Action Plan*.

[14] The Biden Administration submitted the United States' Nationally Determined Contribution (NDC) to the U.N. Framework Convention on Climate Change (UNFCCC) secretariat on April 22, 2021. See *The United States of America Nationally Determined Contribution: Reducing Greenhouse Gases in the United States: A 2030 Emissions Target*, April 21, 2021, p. 5. The Trump Administration withdrew from the Paris Agreement in January 2025 (The White House, "Putting America First in International Environmental Agreements," January 20, 2025, https://www.whitehouse.gov/presidential-actions/2025/01/putting-america-first-in-international-environmental-agreements/). The Paris Agreement is a subsidiary agreement to the UNFCCC, which the United States ratified in 1992. For more information, see CRS Report R46204, *The United Nations Framework Convention on Climate Change, the Kyoto Protocol, and the Paris Agreement: A Summary*, by Richard K. Lattanzio.

[15] In 2013, the Intergovernmental Panel on Climate Change released guidance for how countries participating in the Paris Agreement should account for coastal blue carbon in their NDCs (NOAA, "Understanding Blue Carbon"). On January 20, 2025, President Trump directed the U.S. Ambassador to the United Nations to "immediately submit formal written notification of the United States' withdrawal from the Paris Agreement under the United Nations Framework Convention on Climate Change." Executive Order (E.O.) 14162 of January 20, 2025, "Putting America First in International Environmental Agreements," 90 *Federal Register* 8455, January 30, 2025.

[16] For example, H.R. 5457 and S. 2812 in the 118th Congress. CRS did not identify related bills introduced in the 119th Congress as of April 24, 2025.

congressional interest related to blue carbon ecosystems and science. The Trump Administration has made or proposed changes to federal agency staffing and funding across the executive branch, the effects of which are still unclear. Congress may conduct oversight of or reverse, amend, or codify in statute the Administration's actions, including those that may directly or indirectly affect coastal blue carbon ecosystems as well as the science of these ecosystems and their associated CDR capacity.

Marine Carbon Dioxide Removal Approaches

The Intergovernmental Panel on Climate Change's *Sixth Assessment Report* and the U.S. Global Change Research Program's *Fifth National Climate Assessment* identified that carbon dioxide removal (CDR) approaches are likely to be needed to mitigate rising atmospheric carbon dioxide (CO_2) and the impacts of climate change, in addition to an energy transition. Scientists have investigated how certain coastal ecosystems may mitigate rising atmospheric CO_2 levels by storing carbon in coastal vegetation and soils (i.e., *coastal blue carbon*) as well as how marine CDR (mCDR, also referred to as *ocean* or *ocean-based CDR*) approaches may augment the ocean's ability to take up atmospheric CO_2 in coastal and open water environments.

mCDR approaches are generally categorized as (1) those that increase the growth of marine plants to sequester CO_2 through marine *biological pathways* and (2) those that enhance ocean *alkalinity* (i.e., the ocean's ability to resist pH changes) in order to absorb more CO_2 through marine *chemical pathways* (for more information about mCDR, see CRS Report R48159, *Selected Potential Considerations with Respect to Marine Carbon Dioxide Removal: In Brief*, coordinated by Caitlin Keating-Bitonti). The National Oceanic and Atmospheric Administration (NOAA) has developed a strategy for CDR research that includes land-based approaches, ocean-based approaches, and coastal approaches (i.e., coastal blue carbon).

The mCDR approaches that augment marine biological pathways are as follows:

- *Biological Carbon Pump Enhancement* stimulates primary producers (i.e., microalgae) to take up CO_2 from the surface water. Once dead, the primary producers sink into the ocean, transporting carbon out of the surface ocean. A small portion of this carbon may be buried in ocean sediments. For more information about ocean fertilization, see CRS Report R47172, *Geoengineering: Ocean Iron Fertilization*, by Caitlin Keating-Bitonti.
- *Macroalgal Cultivation for Carbon Sequestration* uses fast-growing marine plants to take up CO_2 from surface waters through photosynthesis. Once dead, these plants must sink and be buried in ocean sediments for decades or longer to be an effective CDR approach.

The mCDR approaches that augment marine chemical pathways are as follows:

- *Direct Ocean Removal* uses technologies to remove and capture CO_2 directly from the ocean water by changing the pH of the treated water. The treated (decarbonized) water is returned to the ocean, where it can absorb more CO_2 from the environment.
- *Ocean Alkalinity Enhancement* increases seawater alkalinity to enhance the ocean's ability to absorb more atmospheric CO_2. This approach also has the co-benefit of mitigating *ocean acidification*. For more information about ocean acidification, see CRS Report R47300, *Ocean Acidification: Frequently Asked Questions*, by Caitlin Keating-Bitonti and Eva Lipiec.

In addition to mCDR and coastal blue carbon as a CDR approach, some experts have considered the natural ability of marine animals, such as fish, whales, and zooplankton, to take up carbon and "pump" it to the deep ocean (via the settling of feces and dead animal carcasses; e.g., whale fall). The transport of this carbon to the deep ocean and sediments would remove the carbon from the atmosphere for tens to hundreds of years due to the amount of time for ocean water mixing and circulation. Although some experts propose that collective carbon in these animals could be increased through protection and restoration of marine ecosystems (i.e., *wild blue biomass*) and through aquaculture (i.e., *farmed blue biomass*), its potential contribution to carbon mitigation efforts remains not completely understood.

Sources: Jessica N. Cross et al., *Strategy for NOAA Carbon Dioxide Removal Research: A White Paper Documenting a Potential NOAA CDR Science Strategy as an Element of NOAA's Climate Interventions Portfolio*, NOAA Special Report, May 2023; Steven J. Davis et al., "Chapter 32: Mitigation," in *Fifth National Climate Assessment*, eds. A. R. Crimmins et al., (Washington, DC), 2023, p. 32-21; Sarah Cooley et al., "Chapter 3: Oceans and Coastal Ecosystems and Their Services," in *Climate Change 2022: Impacts, Adaptation and Vulnerability*, eds. Hans-Otto Pörtner et al., 2022, p. 464; Jack J. Middleburg et al., "Understanding Alkalinity to Quantify Ocean Buffering," *Eos*, July 29, 2020, https://eos.org/editors-vox/understanding-alkalinity-to-quantify-ocean-buffering; and NOAA, "New System Uses Seawater to Capture and Store CO_2," https://research.noaa.gov/new-system-uses-seawater-to-capture-and-store-co2/, archived April 4, 2025, at https://perma.cc/N4P6-KPRG.

Use of Coastal Blue Carbon as a Carbon Dioxide Removal Approach

To determine the full potential of a system to take up and store carbon from the atmosphere, experts estimate the system's carbon storage and sequestration capacity and how long the system can keep the carbon from reentering the atmosphere. Coastal blue carbon ecosystems' capacity to sequester and store carbon is based on the ecosystems' condition. Carbon storage, sequestration, and durability are factors used to evaluate a CDR approach.

- *Carbon storage* refers to a system's ability to store carbon and keep it from reentering the environment.[17] Carbon storage is measured as the total carbon content of a carbon stock. A *carbon stock* (or *carbon pool*) is a system that has the capacity to store or release carbon. The coastal blue carbon stock is composed of the carbon stored in vegetated ecosystems, such as mangrove forests, tidal marshes, and seagrass meadows.
- *Carbon sequestration* refers to the process of removing CO_2 from the atmosphere and storing it in carbon stocks.[18] Carbon sequestration is measured as a rate of carbon uptake per year.
- The *durability* of a carbon stock refers to the amount of time the system can store carbon with a low risk that the removed carbon will be reintroduced into the environment (e.g., by a natural disaster).[19]

For several reasons, there is growing interest in the use of coastal blue carbon as a CDR approach. First, while coastal blue carbon ecosystems represent less than 2% of global ocean area, their sediments bury about 50% of all carbon stored in the ocean.[20] Second, these ecosystems sequester and store carbon at much higher rate per unit area than terrestrial ecosystems.[21] According to the *Fifth National Climate Assessment*, "Acre for acre, [coastal ecosystems such as mangroves, tidal marshes, and seagrass meadows] are estimated to store about twice as much carbon belowground than terrestrial vegetation."[22] Coastal blue carbon ecosystems primarily store carbon in marine soils, whereas forests primarily store carbon in above-ground plant material. Above-ground plant material is more susceptible to natural and human disturbances (e.g., fire), which release carbon into the atmosphere.[23] Third, the National Oceanic and Atmospheric Administration (NOAA) estimates the conservation, sustainable

[17] NOAA, "Coastal Blue Carbon," https://oceanservice.noaa.gov/ecosystems/coastal-blue-carbon/, archived April 4, 2025, at https://perma.cc/2ZN3-2R9Z. Hereinafter NOAA, "Coastal Blue Carbon."

[18] NOAA, "Coastal Blue Carbon."

[19] Cross et al., *Strategy for NOAA Carbon Dioxide Removal Research*, p. 20.

[20] For example, Carlos M. Duarte et al., "Major Role of Marine Vegetation on the Oceanic Carbon Cycle," *Biogeosciences*, vol. 2 (2005), pp. 173-180, see p. 178.

[21] Cross et al., *Strategy for NOAA Carbon Dioxide Removal Research*, p. 45.

[22] Christine L. May, "Focus on Blue Carbon," in *Fifth National Climate Assessment*, eds. Allison R. Crimmins et al. (Washington, DC: U.S. Global Change Research Program, 2023), p. F5-3. Hereinafter NCA5, "Focus on Blue Carbon."

[23] Peter I. Macreadie et al., "Blue Carbon as a Natural Climate Solution," *Nature Reviews Earth & Environment*, vol. 2 (2021), p. 826. Hereinafter Macreadie et al., "Blue Carbon as a Natural Climate Solution."

management, and restoration of coastal blue carbon ecosystems to have a lower cost per ton of CO_2 removed when compared with other CDR approaches that rely on modifying marine biological and chemical pathways.[24] Fourth, coastal blue carbon ecosystems provide additional co-benefits to coastal communities, including protection from storm surges and hurricane events, soil retention, biodiversity, and prevention of salt water intrusion.[25]

Conversely, there are several challenges associated with coastal blue carbon as a CDR approach. These challenges include establishing a scientific understanding of baseline natural carbon fluxes in these ecosystems, accounting for possible natural or anthropogenic disturbances of the carbon stock, and identifying sufficient coastal area to provide ecosystem benefits through conservation, restoration, and creation efforts.[26]

Coastal Blue Carbon Ecosystems

For coastal ecosystems to effectively sequester and store large amounts of carbon, they need to have rooted vegetation that is under a tidal influence.[27] The frequent (if not near-constant) flooding of these ecosystems, coupled with salty water, lowers oxygen levels, making it difficult for microorganisms to break down plant material.[28] These conditions allow carbon to accumulate rather than be released into the atmosphere. Three ecosystems that support such sequestration and storage are mangrove forests, tidal marshes, and seagrass meadows (**Figure 1**):

1. Mangrove forests are composed of salt-tolerant trees or shrubs that grow in the intertidal zones (i.e., the area between land and sea) of tropical, subtropical, and warm temperate regions.[29]
2. Tidal marshes are coastal marine wetlands with deep soils composed of mud and peat (i.e., a thick layer of decomposing plant material) that are flooded by tides.[30]
3. Seagrass meadows are composed of submerged flowering plants (not seaweed) with deep roots occurring in salty and brackish shallow coastal waters.[31]

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[24] Coastal blue carbon is estimated to cost $10-$50 per ton of CO_2 removed. Cross et al., *Strategy for NOAA Carbon Dioxide Removal Research*, p. 22.

[25] For instance, ocean alkalinity enhancement, a marine CO_2 removal approach, has a co-benefit of mitigating ocean acidification. Seagrass meadows also have been shown to buffer against ocean acidification. Ocean acidification can harm certain marine species and impact coastal fisheries and food supply for humans. Cross et al., *Strategy for NOAA Carbon Dioxide Removal Research*, p. 39. For more information about ocean acidification, see CRS Report R47300, *Ocean Acidification: Frequently Asked Questions*, by Caitlin Keating-Bitonti and Eva Lipiec.

[26] Nadine Mengis et al., "Counting (on) Blue Carbon—Challenges and Ways Forward for Carbon Accounting of Ecosystem-Based Carbon Removal in Marine Environments," *PLOS Climate*, vol. 2, no. 8 (2023), p. e0000148; and Read Porter et al., "Legal Issues Affecting Blue Carbon Projects on Publicly-Owned Coastal Wetlands," Restore America's Estuaries and the Marine Affairs Institute, February 2020, https://estuaries.org/wp-content/uploads/2022/06/Legal-Issues-Affecting-Blue-Carbon-Projects.pdf.

[27] Cooley et al., "Chapter 3: Oceans and Coastal Ecosystems," p. 464.

[28] NOAA, "Coastal Blue Carbon."

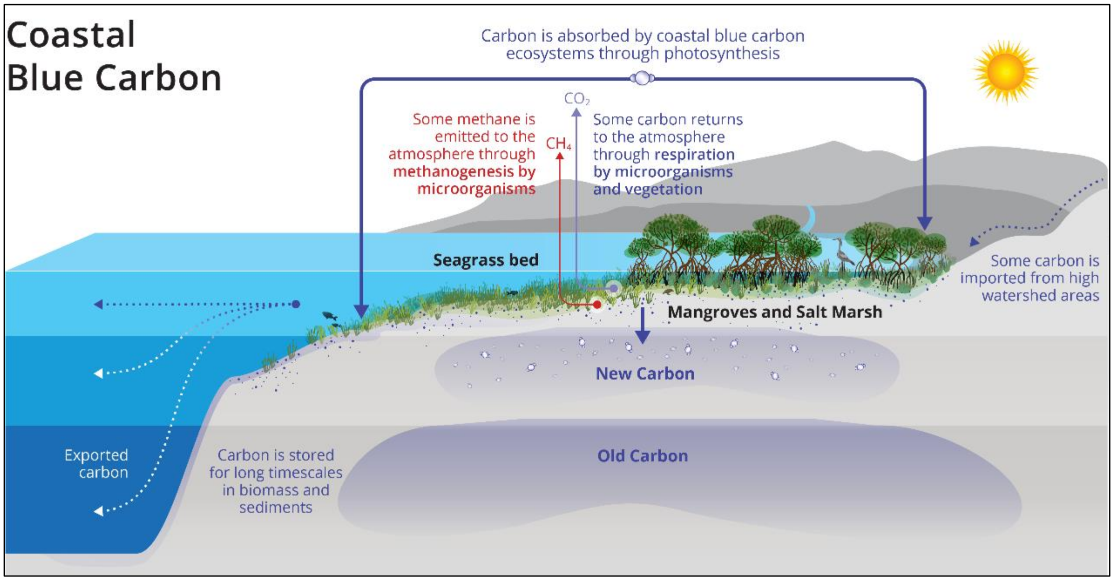
[29] Macreadie et al., "Blue Carbon as a Natural Climate Solution," p. 827.

[30] The salinity level of a marsh is negatively correlated to methane emissions (methane emissions tend to decrease as salinity increases) and can influence whether a particular marsh acts as a net carbon sink (sequestering more carbon than it emits) or source (emitting more carbon than it sequesters). Email correspondence with Nicholas Institute for Energy, Environment & Sustainability, Duke University, July 3, 2024; and NOAA, "What Is a Salt Marsh?," https://oceanservice.noaa.gov/facts/saltmarsh.html, archived April 4, 2025, at https://perma.cc/VMH8-U9U2.

[31] Panela L. Reynolds, "Seagrass and Seagrass Beds," *Smithsonian Institution*, https://ocean.si.edu/ocean-life/plants-algae/seagrass-and-seagrass-beds.

Plants remove CO_2 from the atmosphere via photosynthesis. The absorbed carbon is incorporated into the plant, increasing the plant's biomass. In coastal blue carbon ecosystems, plants sequester carbon in their biomass throughout their total lifespan, typically tens to hundreds of years.[32] When a plant dies, carbon from the plant is deposited in coastal marine soils and sediments.[33] Marine soils and sediments also can collect carbon derived from other areas in the watershed (**Figure 1**). Because the soils of coastal blue carbon ecosystems generally are anaerobic (i.e., containing little to no oxygen),[34] the accumulated carbon in plant material decomposes very slowly and can remain in the soil (i.e., stay out of the atmosphere) for hundreds to thousands of years.[35] Local factors such as ocean circulation, temperature, nutrients, and light can alter the amount and timescale of carbon storage in the soil.[36]

Figure 1. Coastal Blue Carbon Sequestration and Storage



Source: Jessica N. Cross et al., *Strategy for NOAA Carbon Dioxide Removal Research: A White Paper Documenting a Potential NOAA CDR Science Strategy as an Element of NOAA's Climate Interventions Portfolio*, NOAA Special Report, May 2023, p. 46.

Notes: CO_2 = carbon dioxide; CH_4 = methane. The figure illustrates how carbon is incorporated into plant biomass via *photosynthesis* and carbon returns to the atmosphere via *respiration* (Jörg Kruse et al., "Chapter 7: Soil Respiration and Soil Organic Matter Decomposition in Response to Climate Change," in *Developments in Environmental Science*, eds. R. Matyssek et al., (2013), pp. 131-149). Carbon also is imported by terrestrial runoff from high watershed areas and accumulates in the soils of the coastal blue carbon ecosystems.

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[32] Elizabeth Mcleod et al., "A Blueprint for Blue Carbon: Toward an Improved Understanding of the Role of Vegetated Coastal Habitats in Sequestering CO_2," *Frontiers in Ecology*, vol. 9, no. 10 (June 2011), p. 554. Hereinafter Mcleod et al., "Blueprint for Blue Carbon."

[33] NASEM, *Coastal Blue Carbon Approaches*, p. 2. In general, *soils* are characterized by a depth profile (known as horizons) reflecting the products of in situ weathering and are capable of supporting vegetation. *Sediments* are unconsolidated particles that have been removed from the place where they were originally weathered and redeposited elsewhere. Sediments can subsequently be weathered in situ to produce soils. See, "Soils, Sediments, and Geomorphology," in *The Archaeologist's Laboratory. Interdisciplinary Contributions to Archaeology*, eds. M. A. Jochim and R. S. Dickens (Boston, MA: Springer), p. 235.

[34] Macreadie et al., "Blue Carbon as a Natural Climate Solution," p. 826.

[35] Cross et al., *Strategy for NOAA Carbon Dioxide Removal Research*, p. 45.

[36] Mcleod et al., "Blueprint for Blue Carbon," p. 555.

Globally, these three ecosystems collectively occur as far north as Alaska and as far south as southern Australia.[37] The United States is 1 of 71 countries that have all three coastal blue carbon ecosystems.[38] The United States has one of the largest areas of seagrass meadows and tidal marshes in the world.[39] Coastal ecosystems associated with the Florida Everglades, San Francisco Bay, Chesapeake Bay, and the Pacific Northwest have potentially high carbon removal capacity and rates, according to scientists.[40]

Estimating Carbon Stocks and Sequestration in Coastal Blue Carbon Ecosystems

Estimates of the potential carbon removal capacity of coastal blue carbon ecosystems vary significantly because scientific understanding of how such removal works is uncertain.[41] To determine the potential carbon removal capacity of coastal blue carbon ecosystems and these ecosystems' contributions to climate mitigation efforts, scientists would need to measure the carbon stock and carbon burial rates (sequestration), as well as accurately map the geographic coverage, of existing coastal blue carbon ecosystems and areas for potential expansion or creation.[42]

Estimating Carbon Stock and Carbon Sequestration

Scientists estimate the carbon stock of a coastal blue carbon ecosystem by taking a vertical soil or sediment core (**Figure 2**) from a study site within the ecosystem. A vertical soil or sediment core reflects the carbon stock across a period of time at the site, with the surface layer reflecting the present-day accumulation of carbon material and the deeper layers reflecting older buried material. A sample collected from a specific depth in a vertical soil profile or sediment core represents the carbon stock at a specific point in time at the study location. Analyses of multiple samples taken from a core coupled with an age dating technique (e.g., *isotopic analysis*[43]) provides information about the rate of carbon burial, which may be extrapolated to estimate annual carbon sequestration rates of coastal blue carbon ecosystems (**Table 1**). Several federal agencies, including the National Aeronautics and Space Administration (NASA), NOAA, and the

[37] NOAA, "Understanding Blue Carbon."

[38] D. Herr and E. Landis, *Coastal Blue Carbon Ecosystems. Opportunities for Nationally Determined Contributions. Policy Brief*, The Nature Conservancy and International Union for Conservation of Nature, 2016, p. 6, https://www.nature.org/content/dam/tnc/nature/en/documents/BC_NDCs_FINAL.pdf. Hereinafter D. Herr and E. Landis, *Coastal Blue Carbon Ecosystems*.

[39] D. Herr and E. Landis, *Coastal Blue Carbon Ecosystems*, pp. 829-830.

[40] NCA5, "Focus on Blue Carbon," p. F5-3; and Christopher N. Janousek et al., "Blue Carbon Stocks Along the Pacific Coast of North America Are Mainly Driven by Local Rather Than Regional Factors," *Global Biogeochemical Cycles*, vol. 39 (2025), pp. 1-23, see. p. 19. Hereinafter Janousek et al., "Blue Carbon Stocks Along the Pacific Coast of North America."

[41] Mcleod et al., "Blueprint for Blue Carbon," p. 554; and NOAA, "Understanding Blue Carbon."

[42] NASEM, "Chapter 2: Coastal Blue Carbon," p. 48; and Macreadie et al., "Blue Carbon as a Natural Climate Solution," p. 827.

[43] *Isotopes* are members of a family of an element that all have the same number of protons but different numbers of neutrons. Some isotopic analyses can be used as radiometric dating methods. For example, "radiocarbon dating uses the decay of a radioactive isotope of carbon [carbon-14, made up of 6 protons and 8 neutrons] to measure time and date objects containing carbon-bearing material" (Irka Hajdas et al., "Radiocarbon Dating," *Nature Reviews Methods Primers*, vol. 1, no. 62 [September 9, 2021], pp. 1-26). Radiocarbon dating is a useful tool for determining the age of a specimen formed over the past 55,000 years. Department of Energy (DOE), "DOE Explains…Isotopes," https://www.energy.gov/science/doe-explainsisotopes.

National Science Foundation (NSF), have provided funding support for extramural research studying the carbon storage and sequestration of coastal blue ecosystems.[44]

Figure 2. Coastal Tidal Marsh Soil Core

Source: Photo by Genevieve Noyce, Smithsonian Environmental Research Center (SERC), "As Sea Level Rises, Wetlands Crank Up Their Carbon Storage," March 9, 2019, https://www.si.edu/newsdesk/releases/sea-level-rises-wetlands-crank-their-carbon-storage.

Notes: A vertical soil core collected from a Chesapeake Bay tidal marsh, located at SERC's Global Change Research Wetland. The surface layer (leftmost part of the core) reflects the present-day accumulation of carbon material and the deeper layers reflects older buried material. Scientists study vertical soil cores collected from coastal blue carbon ecosystems to estimate carbon stock and carbon sequestration rates.

Some scientists have used remote sensing technologies to analyze the carbon stock of wetland ecosystems.[45] These technologies provide an alternative method that is less time-consuming, labor-intensive, and costly compared with traditional field methods to quantify carbon stock from soil and sediment samples. Remote sensing technologies also may be applicable to coastal blue carbon ecosystems. For example, NASA's remote sensing systems have contributed observations to federal and nonfederal studies examining carbon stock and sequestration across local, regional, and global scales.[46]

Several studies have estimated the global annual carbon sequestration rates for mangrove forests, tidal marshes, and seagrass meadows (see **Table 1**). Estimates of global annual sequestration rates vary across the selected studies included in **Table 1**. Some researchers caution that published estimates of carbon sequestration in coastal blue carbon ecosystems may be considered "overestimates" because published estimates likely did not account for all relevant carbon sources and sinks.[47] In addition, these estimates may span an order of magnitude.

[44] DOE, *Carbon Dioxide Removal: Purpose, Approaches, and Recommendations, Draft for Public Comment*, January 16, 2025, p. 31. Hereinafter DOE, *Draft CDR Purpose, Approaches, and Recommendations*. For example, these agencies supported the research published in Kerryless Rogers et al., "Wetland Carbon Storage Controlled by Millennial-Scale Variation in Relative Sea-Level Rise," *Nature*, vol. 567 (2019), pp. 91-95.

[45] For example, Liangguan Jia et al., "Prediction of Wetland Soil Carbon Storage Based on Near Infrared Hyperspectral Imaging and Deep Learning," *Infrared Physics & Technology*, vol. 139 (June 2024).

[46] DOE, *Draft CDR Purpose, Approaches, and Recommendations*, p. 31.

[47] Kristensen et al., "Predicting Climate Mitigation Through Carbon Burial in Blue Carbon Ecosystems," p. 1.

The variability in the estimates of global annual sequestration rates draws into question how well scientists understand the potential carbon removal capacity of coastal blue carbon ecosystems. A better understanding of these ecosystems may lead to more accurate estimates, which in turn may better inform decisions regarding the conservation, restoration, and creation of coastal blue carbon ecosystems as a CDR strategy.

Table 1. Estimates of Global Geographic Coverage and Annual Carbon Sequestration Rates of Coastal Blue Carbon Ecosystems

Study	Geographic Area (millions of ha)	Annual Carbon Sequestration Rate (Mt C per year)
Mangrove Forests		
Christianson et al., 2022	8.3	93
Cooley et al., 2022	13.7	41
NASEM, 2017 (Mcleod et al., 2011)	13.8	31-34
Tidal Marshes		
Christianson et al., 2022	5.5	12-103
Cooley et al., 2022	5.5	13
NASEM, 2017 (Mcleod et al., 2011)	2.2-40.0	5-87
Seagrass Meadows		
Christianson et al., 2022	16.0	35-76
Cooley et al., 2022	16.0	35
NASEM, 2017 (Mcleod et al., 2011)	17.7-60.0	48-112

Sources: Anne B. Christianson et al., "The Promise of Blue Carbon Climate Solutions: Where the Science Supports Ocean-Climate Policy," *Frontiers in Marine Science*, vol. 9 (2022); Sarah Cooley et al., "Chapter 3: Oceans and Coastal Ecosystems and Their Services," in *Climate Change 2022: Impacts, Adaptation and Vulnerability*, eds. Hans-Otto Pörtner et al., 2022, p. 464; and National Academies of Sciences, Engineering, and Medicine (NASEM), "Chapter 2: Coastal Blue Carbon," in *Negative Emissions Technologies and Reliable Sequestration: A Research Agenda* (Washington, DC: The National Academies Press, 2019), p. 70.

Notes: ha = hectares (100 meters x 100 meters); Mt C = million metric tons (each metric ton is 1,000 kilograms) of carbon. The NASEM report uses estimates of the geographic areas and carbon burial rates published by Elizabeth Mcleod et al., "A Blueprint for Blue Carbon: Toward an Improved Understanding of the Role of Vegetated Coastal Habitats in Sequestering CO_2," *Frontiers in Ecology*, vol. 9, no. 10 (June 2011), pp. 552-560, see p. 555.

Mapping Coastal Blue Carbon Ecosystems

Federal agencies, academic researchers, and nongovernmental organizations have mapped coastal blue carbon ecosystems or provided funding to support mapping activities. Federal agencies that have mapped or funded mapping efforts include the Federal Emergency Management Agency (FEMA), NASA, NOAA, National Park Service (NPS), NSF, U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (FWS), and U.S. Geological Survey (USGS).[48]

[48] For more information about the U.S. government's role in coastal and ocean mapping, see CRS Report R47623, *Frequently Asked Questions: Mapping of U.S. Ocean and Coastal Waters*, coordinated by Caitlin Keating-Bitonti.

The geographic coverage of coastal blue carbon ecosystems can be estimated through field mapping surveys, analysis of aerial and satellite imagery, or a combination of these approaches. The approaches have different advantages and drawbacks. For example, field mapping can provide detailed, accurate, and reliable information about the coverage of an ecosystem, and these mapping efforts can be both time intensive and costly. Field mapping studies also tend to have a narrower geographic scope compared with studies that use aerial and satellite imagery to map larger areas. Some stakeholders contend that analysis of aerial and satellite imagery provides a more cost-effective, efficient alternative to field mapping,[49] and USGS researchers have demonstrated that satellite imagery can be used to accurately and reliably map coastal ecosystems.[50] At the same time, few satellites host the instruments required to map coastal blue carbon ecosystems at the spatial resolution necessary to differentiate between vegetation types, and those satellites may have competing research uses.[51]

In addition, new technology used for Earth observations, such as high-resolution imagery for coastal blue carbon mapping, can be costly and may take years to launch into space. Some stakeholders contend that uncrewed aerial vehicles (i.e., drones) may have greater flexibility compared with satellites. For example, as remote sensing technologies evolve, sensors may be updated or replaced more easily on drones compared with satellites.[52]

Collectively, coastal blue carbon ecosystems are estimated to cover 36-185 million hectares globally (or 89-457 million acres).[53] Incomplete mapping, low-quality mapping data, or outdated maps, among other factors, limit scientists' ability to more accurately estimate the areal coverage of these ecosystems (see **Table 1**). Of the three coastal blue carbon ecosystems, the geographic extent of mangrove forests is better known than that of tidal marshes and seagrass meadows.[54]

Estimating the Capacity of Coastal Blue Carbon Ecosystems to Store and Sequester Carbon

Researchers couple carbon stock and sequestration data with estimates of coastal blue carbon ecosystems' geographic coverage to estimate the potential carbon removal capacity of these ecosystems. Some experts have estimated that the coastal blue carbon ecosystems of the United States, Australia, and Indonesia have the largest potential carbon removal capacity due to their long coast lines (**Figure 3**).[55] Some Asian countries are estimated to have large potential carbon removal capacity because they contain large areas of mangrove forests and seagrass meadows.[56] Mangrove forests have high carbon removal capacity relative to seagrass meadows, because

[49] For example, U.S. Geological Survey (USGS), "Case Study: Monitoring Coastal Change via Satellite Imagery at Regional Scale in the Pacific Northwest," March 21, 2024, https://www.usgs.gov/programs/cmhrp/news/case-study-monitoring-coastal-change-satellite-imagery-regional-scale-pacific. Hereinafter USGS, "Case Study."

[50] USGS, "Case Study."

[51] Some propose a spatial resolution of 0.5 to 5 meters. For example, European Space Agency, "Coastal Blue Carbon," https://eo4society.esa.int/projects/coastal-blue-carbon/.

[52] Dana Lanceman et al., "Blue Carbon Ecosystem Monitoring Using Remote Sensing Reveals Wetland Restoration Pathways," *Frontiers in Environmental Science*, vol. 10 (2022).

[53] The large range is due to uncertainties in the distribution of seagrass meadows and tidal marshes. Macreadie et al., "Blue Carbon as a Natural Climate Solution," p. 827.

[54] Macreadie et al., "Blue Carbon as a Natural Climate Solution," p. 827, and Supplemental Data accompanying Brian Buma et al., "Expert Review of the Science Underlying Nature-Based Climate Solutions," *Nature Climate Change*, vol. 14 (February 20, 2024), pp. 402-406 (hereinafter Buma et al., "Expert Review of the Science").

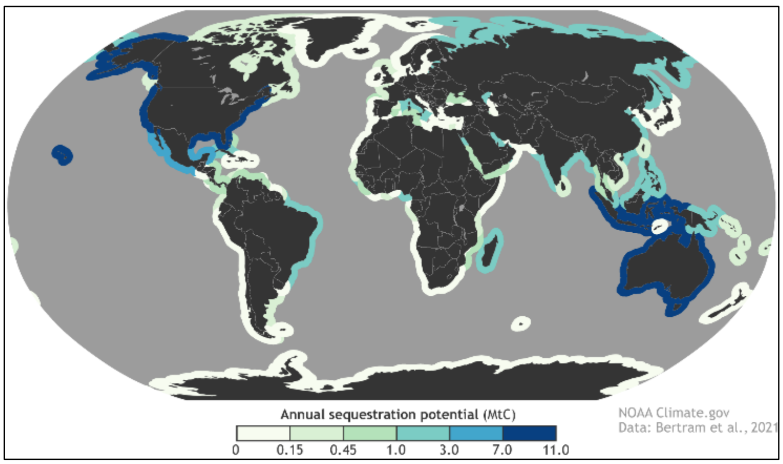
[55] Christine Bertram et al., "The Blue Carbon Wealth of Nations," *Nature Climate Change*, vol. 11 (August 2021), pp. 704-709. Hereinafter Bertram et al., "Blue Carbon Wealth."

[56] Bertram et al., "Blue Carbon Wealth." p. 705.

mangrove trees store carbon in both their wood and their leaves in addition to accumulating carbon in the soils in which they grow.[57] Although seagrass meadows have lower carbon removal capacity than mangrove forests and tidal marshes, seagrass meadows are estimated to have the greatest global areal coverage of the three coastal blue carbon ecosystems.[58]

Estimates of the capacity of coastal blue carbon ecosystems to store and sequester carbon may vary widely for two reasons. First, carbon stock and carbon sequestration rates are not uniform and may vary within a specific coastal blue carbon ecosystem due to variations in salinity, terrestrial nutrient runoff, elevation, sediment grain size, and the diversity and density of the vegetation, among other factors.[59] Second, as described above, estimates of the present-day geographic coverage of coastal blue carbon ecosystems have large uncertainties. Coupling these two estimates together to calculate potential carbon removal capacity of an ecosystem likely would mean that those removal capacity estimates also have large uncertainties. Relying on these removal capacity estimates for quantitative analysis may be misleading. Some stakeholders contend that a better understanding of the global distribution of coastal blue carbon ecosystems, as well as their distribution change over time, is needed to set a baseline for carbon stock and sequestration.[60]

Figure 3. Average Annual Coastal Blue Carbon Sequestration Potential by Country



Source: National Oceanic and Atmospheric Administration, "Understanding Blue Carbon," https://www.climate.gov/news-features/understanding-climate/understanding-blue-carbon, archived April 4, 2025, at https://perma.cc/NC9H-E23R.

Notes: Annual coastal blue carbon sequestration shown in megatonnes of carbon (MtC). Australia, the United States, Indonesia, and Mexico have the highest coastal blue carbon sequestration potential (Christine Bertram et al., "The Blue Carbon Wealth of Nations," Nature Climate Change, vol. 11 (2021), pp. 704-709, see Figure 1 on p. 706).

57 A study of coastal blue carbon ecosystems along the Pacific coast of North America identified that "[carbon] stocks were highest in woody-dominated tidal wetlands …, suggesting a need to increase conservation efforts on existing mangrove forests." Janousek et al., "Blue Carbon Stocks Along the Pacific Coast of North America," p. 19.

58 Chuancheng Fu et al., "Substantial Blue Carbon Sequestration in the World's Largest Seagrass Meadow," *Communications Earth & Environment*, vol. 4, no. 474 (December 13, 2023), pp. 1-9. Hereinafter Fu et al., "Substantial Blue Carbon Sequestration."

59 Mcleod et al., "Blueprint for Blue Carbon," p. 555; and Janousek et al., "Blue Carbon Stocks Along the Pacific Coast of North America," p. 1.

60 Atsushi Watanabe et al., *Blue Carbon Roadmap: Carbon Captured by the World's Coastal and Ocean Ecosystems*, The Innovation for Cool Earth Forum, p. 65. Hereinafter Watanabe et al., *Blue Carbon Roadmap*.

Federal Agency Policy and Authorities Related to Coastal Blue Carbon Ecosystem Science

Some Administrations have identified ways for federal agencies to support coastal blue carbon ecosystems science. For example, the Biden Administration's 2023 *Ocean Climate Action Plan* noted the benefit of coastal blue carbon ecosystems and identified priority actions, including supporting research and development initiatives for coastal blue carbon ecosystems; conducting research, exploration, and mapping to determine coastal blue carbon ecosystem potential; developing standards for coastal blue carbon ecosystem monitoring and management; and conserving and restoring coastal blue carbon ecosystems, among others.[61] The Biden Administration also released its *National Strategy for a Sustainable Ocean Economy*, which includes activities related to coastal blue carbon, among other actions, in June 2024.[62] More recently, the Trump Administration has made or proposed changes to federal agency staffing and funding, including at agencies that have previously supported coastal blue carbon ecosystems science.[63] It remains unclear whether—and, if so, how—federal agencies may continue to participate in and support such science moving forward.

Previous Congresses have directed agencies to work on science—including mapping, observations, monitoring, modeling, and research—indirectly and directly related to coastal blue carbon ecosystems. Congress has not used the term *blue carbon* in statute, in reference to coastal ecosystems and their potential carbon removal capacity.[64] They have directed multiple agencies to study the carbon cycle and carbon sequestration in coastal ecosystems. For example, previous Congresses have directed the National Science and Technology Council (NSTC), Committee on Environment, Subcommittee on Ocean Science and Technology to develop and periodically update a strategic research plan to include "modeling to predict changes in the ocean carbon cycle," among other topics related to ocean acidification.[65] As another example, the 110th Congress directed the Secretary of the Interior to complete a national assessment of

- the quantity of carbon stored in and released from ecosystems (i.e., any terrestrial, freshwater aquatic, or coastal ecosystem) and

[61] To be implemented by agencies such as DOE, FWS, NASA, the National Park Service, NOAA, and USGS. White House Ocean Policy Committee, *Ocean Climate Action Plan*, pp. 49-50.

[62] White House Ocean Policy Committee, *National Strategy for a Sustainable Ocean Economy*, June 2024, pp. 21-22.

[63] For examples of changes made or proposed by the Trump Administration, see E.O. 14154, "Unleashing American Energy"; DOE, "PF 2025-22 Adjusting Department of Energy Grant Policy for Institution of Higher Education (IHE)," https://www.energy.gov/management/pf-2025-22-adjusting-department-energy-grant-policy-institutions-higher-education-ihe; Valerie Volcovici, "White House Aims to Eliminate NOAA Climate Research in Budget Plan," April 11, 2025, Reuters, https://www.reuters.com/sustainability/climate-energy/white-house-proposes-eliminate-noaa-climate-research-budget-proposal-2025-04-11/; Timothy Gardner, "More Than 2,600 U.S. Energy Dept Staffers Accept Second Offer to Resign, Sources Say," April 10, 2025, Reuters, https://www.reuters.com/world/us/more-than-2600-us-energy-dept-staffers-accept-second-offer-resign-sources-say-2025-04-10/; and Zack Coleman, "Trump Moves to Hobble Major U.S. Climate Change Study," April 9, 2025, *Politico*, https://www.politico.com/news/2025/04/09/trump-moves-to-hobble-major-climate-study-00280405 (hereinafter Coleman, "Trump Moves to Hobble").

[64] Previous Congress have directed the Secretary of Defense, in coordination with other agency heads, to carry out a program on research, development, testing, evaluation, study, and demonstration of technologies related to blue carbon capture and direct air capture. The statute defines *blue carbon capture* as "the removal of dissolved carbon dioxide from seawater through engineered or inorganic processes, including filters, membranes, or phase change systems" (10 U.S.C. §4001 note). Under this definition, blue carbon ecosystems would not qualify as blue carbon capture.

[65] 33 U.S.C. §3704(c)(3). For example, see National Science and Technology Council, Committee on Environment, Subcommittee on Ocean Science and Technology, Interagency Working Group on Ocean Acidification, *Strategic Plan for Federal Research and Monitoring of Ocean Acidification*, September 2023.

- the annual flux of CO_2, nitrous oxide, and methane.[66]

With respect to the inclusion of ocean and coastal ecosystems in the national assessment, the law directed the Secretary of the Interior to work with the Secretary of Commerce, acting through the Under Secretary for Oceans and Atmosphere (also known as the NOAA Administrator).

In addition, previous Congresses have directed agencies, through authorizing legislation, to support science activities as part of programs focused on coastal ecosystems broadly. A congressionally mandated Department of Energy (DOE) report, *Carbon Dioxide Removal: Purpose, Approaches, and Recommendations*, released in January 2025, identified several broad federal statutes that may be applicable to marine CDR (mCDR; also referred to as ocean or ocean-based CDR) under certain situations (e.g., location of the proposed mCDR project).[67] Agencies such as NASA, NOAA, and USGS also have identified their activities and programs that can be and have been applied to mCDR and blue carbon-related research and activities under their existing authorities.[68]

Previous Congresses had increasingly directed agencies to support science activities related to coastal blue carbon sequestration or other related activities (i.e., "ocean-based carbon dioxide removal") in appropriations law and related report language. For example, in FY2024, the 118th Congress

- directed NOAA to use funds to support a "pilot program on blue carbon to advance NOAA's work to assess the carbon sequestration potential of various coastal habitats, account for regional differences, and identify some of the biophysical, social, and economic pathways and impediments to coastal blue carbon ecosystem protection, management, or restoration,"[69] and
- recognized "the benefits of a clear regulatory process for ocean carbon dioxide removal pathways" and provided funding to DOE to work with other federal agency and industry partners to "develop, test, and evaluate ocean-based carbon dioxide removal technologies."[70]

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[66] 42 U.S.C. §17272. Resulting reports include USGS, *Baseline and Projected Future Carbon Storage and Greenhouse-Gas Fluxes in Ecosystems in the Great Plains Region of the United States*, USGS Professional Paper 1787, 2011; USGS, *Baseline and Projected Future Carbon Storage and Greenhouse-Gas Fluxes in Ecosystems of the Western United States*, USGS Professional Paper 1797, 2012; USGS, *Baseline and Projected Future Carbon Storage and Greenhouse-Gas Fluxes in Ecosystems of the Eastern United States*, USGS Professional Paper 1804, 2014; and USGS, *Baseline and Projected Future Carbon Storage and Greenhouse-Gas Fluxes in Ecosystems of Alaska*, USGS Professional Paper 1826, 2016.

[67] The report identified the Coastal Zone Management Act of 1972 (16 U.S.C. §§1451 et seq.); Endangered Species Act of 1973 (16 U.S.C. §§1531 et seq.); Federal Ocean Acidification Research and Monitoring Act of 2009 (33 U.S.C. §§3701 et seq.); Integrated Coastal and Ocean Observation System Act of 2009 (33 U.S.C. §§3601 et seq.); Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§1801 et seq.); Marine Mammal Protection Act (6 U.S.C. §§1361-1423h); and Oceans Act of 2000 (33 U.S.C. §857-19 note) (DOE, *Draft CDR Purpose, Approaches, and Recommendations*, pp. 47-48, and 63). Congress directed the Secretary of Energy to establish a task force and prepare the report in P.L. 116-260, §5002.

[68] For example, NOAA's Ocean Acidification Program. Cross et al., *Strategy for NOAA Carbon Dioxide Removal Research*; and DOE, *Draft CDR Purpose, Approaches, and Recommendations.*

[69] "Explanatory Statement Submitted by Sen. Murray, Chair of the Senate Committee on Appropriations, Regarding H.R. 4366, Consolidated Appropriations Act, 2024," *Congressional Record*, vol. 170, No. 39 (March 5, 2024), p. S1401. Hereinafter "Explanatory Statement Regarding H.R. 4366," March 5, 2024.

[70] "Explanatory Statement Regarding H.R. 4366," March 5, 2024, p. S1575. The explanatory statement used but did not define the term *ocean-based carbon dioxide removal*. The term is not defined in statute or regulation, although the term *blue carbon capture* is defined in statute but does not encompass the concept described here.

Some federal agencies have utilized these authorizing and appropriation authorities to fund federal and nonfederal mCDR research, including DOE (e.g., Advanced Research Projects Agency–Energy, Water Power Technologies Office) and NOAA (e.g., Ocean Acidification Program, National Sea Grant College Program).[71]

In addition to science-related activities, previous Congresses have authorized federal agencies to have a role in conserving some existing coastal and marine ecosystems. For example, previous Congresses and federal agencies have created marine sanctuaries and refuges for various purposes, including habitat conservation, that may have the co-benefit of preserving coastal blue carbon.[72] As another example, the 118th Congress passed the Coastal Habitat Conservation Act of 2023 (P.L. 118-138) directing certain federal agencies to develop and implement monitoring protocols to track coastal ecosystem restoration. Previous Congresses also have authorized federal agencies to provide funding to nonfederal entities through grant programs to restore degraded ecosystems or prevent future land use changes of existing ecosystems.[73] These actions, when applied to coastal blue carbon ecosystems, may help these ecosystems remain a carbon sink and not a source. In many instances, carbon sequestration is not the main goal and often is secondary to habitat conservation for species or other benefits.

Federal Agency Research Coordination and Collaboration on Coastal Blue Carbon Ecosystems

Federal agencies have used their authorities to collaborate and coordinate with each other, and with other entities, on coastal blue carbon science-related activities. Federal agency collaboration can take different forms, including individual projects and larger working groups. For example, NOAA launched the Blue Carbon Inventory Project in 2020 to help partner countries incorporate coastal blue carbon ecosystems in their inventories of GHG emission sources and sinks, among other activities.[74] Project partners have included the Department of State (State), NASA, the Smithsonian Environmental Research Center (SERC), the U.S. Environmental Protection Agency (EPA), the U.S. Forest Service (FS), the U.S. Agency for International Development, and nonfederal organizations.[75]

Federal agencies also address coastal blue carbon science activities via working groups or committees, some of which include nonfederal entities. These groups and others sometimes work beyond blue carbon science questions and focus on conserving and restoring blue carbon ecosystems, among other activities.[76] The groups may be categorized into two types: those focused on the carbon cycle broadly, and those more specifically focused on coastal blue carbon

[71] DOE, *Draft CDR Purpose, Approaches, and Recommendations*, pp. 29, 46-47, and 63-65.

[72] For example, see NOAA, National Marine Sanctuaries, "About," https://sanctuaries.noaa.gov/about/, archived April 4, 2025, at https://perma.cc/R66W-TDE2; and FWS, "Mangroves on the Move: Wetland Habitats Responding to Changes in Climate," https://storymaps.arcgis.com/stories/ee2242de7aba4c27a62d21e6ec480f83.

[73] For examples of ecosystem restoration programs, see CRS Report R47263, *Ecosystem Restoration in the Infrastructure Investment and Jobs Act: Overview and Issues for Congress*, coordinated by Anna E. Normand and Pervaze A. Sheikh.

[74] NOAA Climate Program Office, *NOAA Blue Carbon Inventory Project*, 2023, https://perma.cc/XD7Q-8VL7. Hereinafter NOAA, *NOAA Blue Carbon Inventory Project.*

[75] NOAA, *NOAA Blue Carbon Inventory Project*.

[76] For example, NOAA is a partner in the International Partnership for Blue Carbon, which connects entities to "protect, sustainably manage and restore global coastal blue carbon ecosystems" (https://bluecarbonpartnership.org/the-partnership/blue-carbon-partner-organisations/).

ecosystems. Selected groups' memberships, goals, and establishment are described below, listed in the order of establishment (from oldest to youngest).

Carbon Cycle-Focused Working Groups and Committees

Federal agencies have participated in national and international-level interagency working groups (IWGs) and programs focused broadly on the carbon cycle, which include the following.

- **Carbon Cycle Interagency Working Group**. Established in 1998 by the U.S. Global Change Research Program (USGCRP),[77] the working group is composed of representatives from 15 federal agencies and departments and is "responsible for defining program goals, setting research priorities, and reviewing the progress of the research programs that contribute to carbon cycle science."[78] The working group established an Interagency Carbon Dioxide Removal Research Coordination Workstream in 2021.[79]
    - **Interagency Carbon Dioxide Removal Research Coordination Workstream**. The group seeks to advance interagency CDR research coordination and is working to compile information on "the feasibility, carbon removal potential, and risks and benefits of various carbon removal strategies."[80] It aims to prepare a high-level overview of how and where CDR science and development intersects with various agencies' missions.[81]
        - **U.S. Carbon Cycle Science Program**. Established by USGCRP in 1999, the program coordinates and facilitates carbon cycle science activities.[82] Funding for the program is provided by NASA; NOAA; the U.S. Department of Agriculture (USDA), including FS; and USGS.[83] The program launched the North American Carbon Program in 2002 and the Ocean Carbon and Biogeochemistry Program in 2006.
    - **North American Carbon Program**. The program is a scientific research program focused on carbon sources and sinks in North America and its

[77] Email correspondence with the U.S. Global Change Research Program (USGCRP), May 22, 2024. For more about the USGCRP, see CRS Report R48478, *U.S. Global Change Research Program (USGCRP): Overview and Considerations for Congress,* by Kathryn G. Kynett.

[78] Member agencies and departments include the Departments of Agriculture (USDA), Commerce (DOC), Defense (DOD), DOE, Health and Human Services, Homeland Security, Housing and Urban Development, the Interior (DOI), State, and Transportation, U.S. Environmental Protection Agency (EPA), NASA, National Science Foundation (NSF), Smithsonian Institution, and U.S. Agency for International Development (USAID). USGCRP, "Carbon Cycle Interagency Working Group," https://www.globalchange.gov/our-work/interagency-groups/cciwg, archived April 29, 2025, at https://perma.cc/4F7T-P96L. Hereinafter USGCRP, "CCIWG."

[79] USGCRP, "CCIWG;" and USGCRP, "CCIWG Interagency Carbon Dioxide Removal Research Coordination Workstream," https://www.globalchange.gov/our-work/interagency-groups/cciwg/icdrc, archived April 29, 2025, at https://perma.cc/9JUR-YF3Y. Hereinafter USGCRP, "CCIWG Workstream."

[80] The workstream includes members from DOC (National Institute of Standards and Technology [NIST] and NOAA), DOI (Bureau of Safety and Environmental Enforcement, FWS, and USGS), EPA, DOE, NASA, USAID, and USDA. USGCRP, "CCIWG Workstream."

[81] Cross et al., *Strategy for NOAA Carbon Dioxide Removal Research*, p. 79. In 2024, the White House Office of Science and Technology Policy stated that the group was working on an overview but did not identify a public release date (personal correspondence with the White House Office of Science and Technology Policy, May 7, 2024).

[82] U.S. Carbon Cycle Science Program (USCCP), "About the U.S. Carbon Cycle Science Program," https://www.carboncyclescience.us/about, archived April 29, 2025, at https://perma.cc/M7H5-LVAG. Hereinafter, USCCSP, "About."

[83] USCCSP, "About."

adjacent oceans.[84] Authors of its 2022 Science Implementation Plan included scientists from DOE, EPA, NASA, the National Institute of Standards and Technology (NIST), NOAA, USDA, USGS, nongovernmental organizations, academic institutions, and agencies of foreign countries.[85]

- **Ocean Carbon and Biogeochemistry Program**. The program aims to understand the ocean's role in the global carbon cycle and the responses of marine ecosystems to environmental changes by bringing together scientific disciplines and developing domestic and international partnerships.[86] Program Scientific Steering Members have included scientists from NASA, NOAA, and academic institutions.[87] Funding is provided by NASA and NSF.
  - **Marine Carbon Dioxide Removal Fast Track Action Committee (mCDR FTAC)**. Established by action of NSTC in 2023, the mCDR FTAC was charged with developing an implementation plan to advance federal research and a scaled testing program for mCDR and a U.S. mCDR initiative to coordinate public-private funded research, among other things.[88] The mCDR FTAC solicited input from the public on the development of an implementation plan to advance recommendations under the *Ocean Climate Action Plan* in February 2024.[89] In November 2024, the mCDR FTAC released the *National Marine Carbon Dioxide Removal Research Strategy*, in which it outlined six objectives to guide U.S. government efforts relating to mCDR research, including the creation of an IWG on mCDR. Blue carbon activities were not included in the strategy.[90] Under its charter, the committee disbanded on November 15, 2024.[91]

[84] North American Carbon Program, "Overview," https://www.nacarbon.org/nacp/overview.html.

[85] Christopher A. Williams et al., *2022 North American Carbon Program Science Implementation Plan*, 2023, p.158-159, https://opensky.ucar.edu/islandora/object/reports:81. Hereinafter Williams et al., *2022 North American Carbon Program Science Implementation Plan*.

[86] Ocean Carbon and Biogeochemistry Program (OCB), "About," https://www.us-ocb.org/about/, archived April 29, 2025, at https://perma.cc/GWC8-9EG2.

[87] OCB, "Scientific Steering Committee [SSC]," https://www.us-ocb.org/about/scientific-steering-committee/, archived April 29, 2025, at https://perma.cc/ZAN9-MN4X; and OCB, *OCB SSC Membership: Past and Present*, March 2017, https://www.us-ocb.org/wp-content/uploads/sites/43/2017/03/Previous-OCB-SSC-Members.pdf, archived April 29, 2025, at https://perma.cc/43BG-XELZ.

[88] The Marine Carbon Dioxide Removal Fast Track Action Committee (mCDR FTAC) is composed of representatives from DOC (including NOAA and NIST), DOE, DOI (including the Bureau of Safety and Environmental Enforcement, Bureau of Ocean Energy Management, and USGS), EPA, NASA, NSF, Office of Naval Research, Smithsonian Institution, Department of State, U.S. Army Corps of Engineers (USACE), and USDA. *Charter of the Marine Carbon Dioxide Removal Fast Track Action Committee of the Subcommittee on Ocean Science and Technology, National Science and Technology Council*, September 2023, https://www.noaa.gov/sites/default/files/2023-10/mCDR_FTAC_charter_2023_09_19_approved.pdf, archived April 4, 2025, at https://perma.cc/94F6-U84V. Hereinafter mCDR FTAC Charter, September 2023.

[89] NSF, "Marine Carbon Dioxide Removal Research Plan," 89 *Federal Register* 13755, February 23, 2024.

[90] mCDR FTAC, *National Marine Carbon Dioxide Removal Research Strategy*, November 2024. Hereinafter mCDR FTAC, *National Marine Carbon Dioxide Removal Research Strategy*.

[91] mCDR FTAC Charter, September 2023.

Coastal Blue Carbon-Focused Working Groups and Committees

Federal agencies have participated in regional, national, and international level working groups, networks, and committees focused on coastal blue carbon, including the following.

- **Blue Carbon Scientific Working Group**. Established by the nongovernmental organization Blue Carbon Initiative in 2011, the Blue Carbon Scientific Working Group is a group of scientists from the United States (including from NASA and SERC) and other countries.[92] The group's objectives are to create internationally applicable standards for quantifying and monitoring coastal blue carbon; to develop internationally acceptable standards for data collection, quality control, and archiving; and to identify priority research on coastal blue carbon dynamics, among other activities. The group co-founded and is supporting the Coastal Carbon Research Coordination Network.[93]
- **Coastal Carbon Research Coordination Network**. Established by SERC in 2017,[94] the Coastal Carbon Research Coordination Network partners with the U.S. Carbon Cycle Science Program (established by the USGCRP), USGS, and nongovernmental organizations to "advance the synthesis of coastal wetland carbon cycle data."[95] The network has been funded by NOAA, NSF, USGS, and the nongovernmental organization Pew Charitable Trusts.
- **Pacific Northwest Blue Carbon Working Group**. Established in 2014 by representatives from the South Slough National Estuarine Research Reserve (NERR), NERR Science Collaborative, FWS, and nongovernmental organization Environmental Science Associates, the working group aims to conduct research to quantify carbon sequestration rates for Pacific Northwest tidal wetlands, among other goals.[96] The Pacific Northwest Blue Carbon Working Group has included scientists, practitioners, and policymakers from the Bonneville Power Administration, DOE-funded entities, EPA, FWS, NOAA (and NOAA-funded entities), SERC, USGS, and nonfederal entities.[97]
- **Blue Carbon National Working Group**. Established by NOAA and the nongovernmental organization Restore America's Estuaries in 2015, the Blue Carbon National Working Group's objectives include increasing communication on blue carbon work at the local, regional, and national scales; improving coordination; and providing a platform for discussions of science needs, information gaps, and priorities.[98] The working group has comprised scientists

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[92] Blue Carbon Initiative, "Blue Carbon Scientific Working Group," https://www.thebluecarboninitiative.org/scientific-working-group. Hereinafter Blue Carbon Initiative, "Blue Carbon Scientific Working Group."

[93] Blue Carbon Initiative, "Blue Carbon Scientific Working Group."

[94] Email correspondence with Smithsonian Institution Office of Government Relations, November 10, 2019. The Smithsonian Institution Office of Government Relations noted that the project is conducted under 20 U.S.C. §41 and 20 U.S.C. §42.

[95] Smithsonian Environmental Research Center (SERC), "Coastal Carbon Network," https://serc.si.edu/coastalcarbon. Hereinafter referred to as SERC, "Coastal Carbon Network."

[96] Pacific Northwest (PNW) Blue Carbon Working Group, "Background," https://www.pnwbluecarbon.org/background and PNW Coastal Blue Carbon Working Group, *Biophysical Research Framework*, undated, p. 2, https://www.pnwbluecarbon.org/_files/ugd/43d666_5d46888c53094ffa91faf74084df9f25.pdf.

[97] PNW Coastal Blue Carbon Working Group, *Participants and Affiliations*, April 13, 2023, https://www.pnwbluecarbon.org/_files/ugd/43d666_bd4ce40f8cc54083ae9e40f7955369a9.pdf.

[98] Restore America's Estuaries (RAE), "Blue Carbon National Working Group," https://estuaries.org/coastal-blue-(continued...)

and practitioners from EPA, FS, FWS, NOAA, NOAA-funded entities (such as NERRs), SERC, USDA, USGS, and nonfederal entities.[99]

In April 2025, the Trump Administration canceled the contract with the firm responsible for coordinating the USGCRP and the federal agencies that participate in USGCRP activities, including its IWGs and congressionally mandated reports.[100] The mechanisms for federal agencies to continue collaboration efforts, including those related to the carbon cycle and coastal blue carbon, that were coordinated by USGCRP remain uncertain.

Issues for Congress

Previous Congresses have shown interest in the services provided by coastal ecosystems, including their ability to capture and store CO_2. For example, some Members of Congress introduced related bills in the 118th Congress, as described below and listed in **Table A-1**. As of April 24, 2025, Members of the 119th Congress had not introduced any coastal blue carbon-related bills.[101]

Topics for potential congressional consideration include issues related to mapping coastal blue ecosystems; conserving, restoring, and creating these ecosystems; and estimating their carbon sequestration and storage. Congress also may consider the level of federal investment in coastal blue carbon science and how to structure federal interagency coordination and collaboration on coastal blue carbon science. Activities of the Trump Administration also may shape congressional actions and interests related to blue carbon ecosystems. The Administration has made or proposed changes to federal agency staffing and funding (discussed in "Coordinating Federal Coastal Blue Carbon Science" and "Federal and Nonfederal Collaboration on Coastal Blue Carbon Science," below); the effects of these changes—if any—on federal coastal blue carbon activities remain unclear. In its deliberations over such Administration actions, Congress may consider whether to reverse, amend, or codify in statute actions relevant to congressional priorities.

Mapping Coastal Blue Carbon Ecosystems

Congress might consider addressing federal agencies' capacity to map coastal blue carbon ecosystems. Some experts contend that better estimates of coastal blue carbon ecosystems' carbon removal capacity will require accurate mapping of these ecosystems.[102] Furthermore, mapping of coastal blue carbon ecosystems can help stakeholders identify drivers of coastal blue carbon ecosystem loss (i.e., natural or human-driven) and prioritize whether (and, if so, where) to protect or restore these ecosystems. To address these issues, the Biden Administration released a January 2023 strategy to map various components of *natural capital*, including coastal ecosystems such as

carbon/bcn/ (hereinafter RAE, "Blue Carbon National Working Group"); and RAE, *Recommendations from the Blue Carbon National Working Group*, January 2016, https://estuaries.org/wp-content/uploads/2019/01/Blue-Carbon-National-Recommendations2015-6_FINAL.pdf.

[99] RAE, "Blue Carbon National Working Group."

[100] Coleman, "Trump Moves to Hobble."

[101] CRS searched legislation introduced in the 118th and 119th Congresses on Congress.gov using the following search terms and phrases: *blue carbon*, *marine carbon dioxide removal*, *marine CDR*, *mCDR*, and *ocean carbon dioxide removal*; reviewed the results; and identified potential bills of interest to include in this report.

[102] For example, see Macreadie et al., "Blue Carbon as a Natural Climate Solution," p. 830; and NASEM, *Coastal Blue Carbon Approaches*, p. 5.

seagrass meadows and tidal marshes.[103] In March 2023, the Biden Administration's *Ocean Climate Action Plan* explicitly identified the need to expand the mapping of coastal blue carbon ecosystems to determine their carbon removal capacity.[104]

In its early January 2025 draft report, DOE noted that the development of maps and remote sensing products to indicate wetland management and hydrologic condition was a key federal goal.[105] Other stakeholders have expressed interest in mapping coastal blue carbon ecosystems, as described in the sections below.[106] The geographic coverage of coastal blue carbon ecosystems has been used to estimate of GHG emissions and sinks. For example, EPA has considered the geographic coverage of coastal wetlands, including some coastal blue carbon ecosystems, in its annual national inventory of GHG emissions and sinks.[107] Federal and nonfederal decisionmakers may use this knowledge to prioritize areas for restoration and conservation projects, if they decide to support such efforts. In contrast, other stakeholders might argue that these mapping initiatives could be used to limit future infrastructure development or increase regulation of certain coastal areas.

Some Members of previous Congresses have expressed interest in enhancing the mapping of coastal blue carbon ecosystems for several purposes. In the 118th Congress, some Members introduced bills that would have provided direction to NSTC to establish a new IWG for producing and maintaining a national-level mapping of coastal blue carbon ecosystems.[108] As an alternative to establishing a new IWG, Congress may consider codifying existing working groups or committees that are developing a national map and inventory of coastal blue carbon ecosystems (refer to "Federal Agency Research Coordination and Collaboration on Coastal Blue Carbon Ecosystems," above). For example, the SERC Coastal Carbon Research Coordination Network developed and maintains the Coastal Carbon Atlas, a web-based global tidal wetland database, and the Blue Carbon Data Inventory, a database of U.S. coastal blue carbon soil information.[109] Congress also may consider conducting oversight and investigations to inform any potential actions it might take to reverse, amend, or codify in statute actions taken by the Trump Administration to eliminate the USGCRP, which coordinates some IWGs, as discussed above.

Some Members have proposed that NOAA identify or inventory U.S. coastal areas with CDR-related purposes.[110] For example, in the 118th Congress, several bills would have directed NOAA to "carry out mapping and evaluation of coastal marine ecosystems for carbon dioxide removal potential," in collaboration with NASA.[111] Others would have directed NOAA to conduct an

[103] In general, *natural capital* refers to stocks of natural resources that include geology, soil, air, water, and all living things (Convention on Biological Diversity, "Natural Capital," https://www.cbd.int/business/projects/natcap.shtml). Office of Science and Technology Policy, Office of Management and Budget (OMB), and DOC, *National Strategy to Develop Statistics for Environmental-Economic Decisions: A U.S. System of Natural Capital Accounting and Associated Environmental-Economic Statistics*, January 2023, pp. 55 and 62.

[104] White House Ocean Policy Committee, *Ocean Climate Action Plan*, p. 48.

[105] DOE, *Draft CDR Purpose, Approaches, and Recommendations*, pp. 31-32.

[106] For example, Watanabe et al., *Blue Carbon Roadmap*, p. 65.

[107] For example, see EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2022*, EPA 430-R-24-004, 2024.

[108] H.R. 9912 and §513 of Subtitle B of S. 3785 in the 118th Congress.

[109] The Blue Carbon Data Inventory provides state-level report cards ranking all coastal states and the District of Columbia on the quantity, quality, and coverage of coastal blue carbon data. SERC, "Coastal Carbon Network."

[110] Congress's distinction between mapping, identifying, and inventorying of coastal blue carbon ecosystems is unclear in the bills, as introduced.

[111] §301 of H.R. 5457 and S. 2812 in the 118th Congress.

inventory of coastal and other areas suitable for mCDR research.[112] An additional proposal would have directed NOAA to identify coastal and marine areas of "particularly high potential for carbon sequestration and high rates of carbon storage" as well as "blue carbon areas of significance," as defined by the bill.[113]

Satellite Observations for Coastal Blue Carbon Ecosystem Mapping and Congressional Interest

Incomplete mapping, low-quality mapping data, or outdated maps, among other factors, limit scientists' ability to accurately estimate the areal coverage of coastal blue carbon ecosystems (i.e., mangrove forests, tidal marshes, and seagrass meadows). The U.S. Geological Survey demonstrated that satellite imagery can be used to accurately and reliably map coastal ecosystems. Some stakeholders contend that analysis of satellite imagery provides a cost-effective and efficient alternative to traditional field mapping. However, new technology used for Earth observations, such as high-resolution imagery for coastal blue carbon mapping, can be costly and may take years to launch into space. In addition, the instruments required to map coastal blue carbon ecosystems at the necessary spatial resolution to differentiate between vegetation types (e.g., 0.5 to 5 meter resolution) may be done by only a few satellites that have competing research uses. Some stakeholders may question the relative priority of using satellite resources to map coastal blue carbon ecosystems over other federal activities. Other stakeholders may contend that the analysis of sequential (e.g., annual) satellite imagery for coastal blue carbon ecosystem mapping can be used to analyze land use change trends. For example, a 2020 study led by National Aeronautics and Space Administration (NASA) scientists found mangrove loss in some parts of the world, such as in the United States, Brazil, and Australia, is driven primarily by natural causes, whereas other parts of the world, such as Mexico and some countries in southeast Asia, are experiencing human-driven losses.

In the 118th Congress, some Members introduced legislation that would have directed certain federal agencies to use satellite observations for coastal blue carbon ecosystem mapping activities. For example, H.R. 5457 and S. 2812 would have established a whole-of-government approach to support carbon dioxide removal (CDR) research and development. The bills included two provisions about the application of satellite observations.

- §301 of Title III would have directed the National Oceanic and Atmospheric Administration, in collaboration with NASA, to "carry out mapping and evaluation of coastal marine ecosystems for carbon dioxide removal potential."
- §801 of Title VIII would have directed NASA, using satellite imagery, to "carry out mapping and evaluation of coastal marine ecosystems for carbon dioxide removal potential—including (i) wetlands; (ii) peatlands; and (iii) seagrass beds."

As an alternative to federal satellite systems, Earth observations may be acquired through commercial data purchase programs. Previous Administrations and Congresses (e.g., §301, Title III, of H.R. 6093 in the 118th Congress) have shown interest in commercial data purchase programs and partnerships between federal agencies and the U.S. commercial space industry. Several federal agencies have purchased Earth observation remote sensing data for various purposes, from science to national intelligence, but the terms of those purchases, unless renegotiated, may not allow use of the data for purposes beyond their original scope (e.g., mapping of coastal ecosystems). Congress may consider whether these purchases and partnerships, in some cases if amended, could be used for mapping coastal blue carbon ecosystems. When negotiating new or renegotiating existing end-user license agreements, federal agencies and commercial providers may face consideration of both scientific factors (e.g., data use and sharing) and commercial interests (i.e., higher prices for greater data usage).

Members of Congress have not introduced legislation related to the application of satellite observations or commercial data purchase programs for coastal blue carbon mapping efforts in the 119th Congress.

Sources: European Space Agency, "Coastal Blue Carbon," https://eo4society.esa.int/projects/coastal-blue-carbon/; Liza Goldberg et al., "Global Declines in Human-Driven Mangrove Loss," *Global Change Biology*, vol. 26, no. 10 (2020), pp. 5844-5855; NASA, "Mapping the Roots of Mangrove Loss," https://earthobservatory.nasa.gov/images/147142/mapping-the-roots-of-mangrove-loss; National Science and Technology Council, Subcommittee on U.S. Group on Earth Observations Committee on the Environment, *United States Government Earth Observations Data Purchases: Perspectives from the Earth Observations Enterprise*, July 2022, pp. 1-29; U.S. Geological Survey, "Case Study: Monitoring Coastal Change via Satellite Imagery at Regional Scale in the Pacific Northwest," March 21, 2024, https://www.usgs.gov/programs/cmhrp/news/case-study-monitoring-coastal-change-satellite-imagery-regional-scale-pacific; White House, *National Space Policy of*

[112] §103 of Title I of H.R. 10471 and S. 5629 in the 118th Congress.

[113] §2 of H.R. 10491 in the 118th Congress.

the United States of America, June 28, 2010, pp. 10-11; White House, *National Space Policy of the United States of America*, December 9, 2020, pp. 20-23; and White House, *United States Space Priorities Framework*, December 2021.

Conservation, Restoration, and Creation of Coastal Blue Carbon Ecosystems

Congress might consider whether to support or change existing efforts or to authorize new efforts to conserve, restore, and create coastal blue carbon ecosystems.

Some stakeholders have supported actions that aim to maintain or increase CO_2 sequestration in coastal blue carbon ecosystems.[114] These actions aim to maintain or grow carbon sink capacity and include

- conserving existing blue carbon ecosystems;
- restoring degraded coastal blue carbon ecosystems; and
- creating new or expanding existing coastal blue carbon ecosystems into areas within their environmental thresholds that currently do not have these ecosystems.

In some cases, the primary goal of these activities is carbon sequestration; in other cases, carbon sequestration is a co-benefit of an intended goal. For example, the Biden Administration's *Ocean Climate Action Plan* identified advancing conservation and restoration of coastal blue carbon ecosystems as a key element of U.S. climate mitigation goals through nature-based solutions.[115] It also identified conservation and restoration of coastal blue carbon ecosystems as a priority in coastal resource planning and management decisions and coastal climate resilience, which may have the co-benefit of maintaining or increasing coastal blue carbon sequestration.[116] In addition, DOE cited "protecting and restoring blue carbon habitats" as a key goal in its early 2025 draft report.[117]

If Congress is interested in increasing the conservation and restoration of existing or creating new coastal blue carbon ecosystems, it could consider several policy approaches. Congress could indirectly support carbon sequestration in coastal blue carbon ecosystems by reauthorizing and funding existing programs that conserve, restore, and create coastal blue carbon ecosystems, such as NOAA's Community-Based Habitat Restoration Program.[118] Additionally, Congress could amend statutes or direct agencies to consider or prioritize carbon sequestration in existing coastal

[114] For example, NASEM, "Chapter 2: Coastal Blue Carbon," p. 54.

[115] White House Ocean Policy Committee, *Ocean Climate Action Plan*, p. 21.

[116] White House Ocean Policy Committee, *Ocean Climate Action Plan*, pp. 21 and 23. An existing grant program with similar goals is the National Fish and Wildlife Foundation's (NFWF's) National Coastal Resilience Fund, which "invests in conservation projects that restore or expand natural features such as coastal marshes and wetlands … that minimize the impacts of storms and other naturally occurring events on nearby communities." NFWF receives funding for the program from EPA, NOAA, and the Department of Defense, as well as nonfederal entities (NFWF, "National Coastal Resilience Fund," https://www.nfwf.org/programs/national-coastal-resilience-fund).

[117] DOE, *Draft CDR Purpose, Approaches, and Recommendations*, p. 32.

[118] NOAA, "Community-Based Habitat Restoration," https://perma.cc/7UUG-HHG4. For other examples of existing ecosystem restoration programs, see CRS Report R47263, *Ecosystem Restoration in the Infrastructure Investment and Jobs Act: Overview and Issues for Congress*, coordinated by Anna E. Normand and Pervaze A. Sheikh. For examples of federal land and water conservation designations, see CRS Report R43429, *Federal Lands and Related Resources: Overview and Selected Issues for the 118th Congress*.

blue carbon ecosystem-related programs or appropriations laws.[119] Alternatively, Congress could support coastal blue carbon sequestration by directing agencies to create new restoration programs to support the conservation, restoration, and creation of coastal blue carbon ecosystems.[120]

Congress also might consider some of the complexities of conserving, restoring, and creating coastal blue carbon ecosystems when deciding whether or how to address this issue. Efforts to address coastal blue carbon ecosystems are complex due to multiple factors, such as land ownership (e.g., private or public) and competing priorities for coastal lands.[121] For example, existing federal grant programs that support conservation, restoration, or expansion of coastal blue ecosystems often require public access to such ecosystems, a potential issue for private landowners. Alternatives that Congress might consider include supporting restoration on non-private lands or soliciting easements for access from private landowners. These options may pose fiscal considerations for Congress that may or may not align with the Trump Administration's aims to reduce federal spending. In addition, the priorities under these federal programs may compete with the priorities of other coastal stakeholders, raising questions regarding how to weigh competing priorities for development, species and habitat protection, recreation, carbon sequestration, and other ecosystem services.

Further, some in Congress may question whether investments in coastal areas are prudent due to the uncertainty of how these ecosystems may change in the long term and uncertainty regarding their CDR potential.[122] Efforts to conserve, restore, and create new coastal blue carbon ecosystems may face consideration of current and projected environmental stressors and changes to coastal areas due to the frequency and intensity of extreme weather events, sea level rise, and ocean acidification, among other issues.[123]

Estimating Coastal Blue Carbon Stocks and Sequestration Rates

Some stakeholders and research findings assert that location-specific measurements of coastal blue carbon stocks and sequestration rates are needed.[124] Location-specific field measurements of carbon stocks and sequestration rates might be more accurate than generalized estimates that span a region or several ecosystems. Further, location-specific measurements might reveal specific factors affecting ecosystems relevant for implementing policies, such as constructing accurate national carbon inventories or identifying priority coastal blue carbon ecosystems for conservation and restoration efforts. An early January 2025 DOE draft report noted a need to develop measurement and monitoring frameworks through research, technology development, and computer modeling, at the project and jurisdictional levels, as well as improved and novel monitoring approaches for some ecosystems, such as seagrasses.[125] A stakeholder group recommended the development of inexpensive sensors and machine learning techniques to monitor the outcomes of coastal blue carbon ecosystem restoration and creation.[126] The National Academies of Sciences, Engineering, and Medicine (NASEM) also identified that basic research

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[119] For example, H.R. 7106 in the 118th Congress.

[120] For example, as in H.R. 1196, H.R. 9912, and H.R. 10491 in the 118th Congress.

[121] NASEM, "Chapter 2: Coastal Blue Carbon," pp. 83-85.

[122] For example, Kristensen et al., "Predicting Climate Mitigation Through Carbon Burial in Blue Carbon Ecosystems," p. 9. Previously introduced legislation regarding some of these concerns include H.R. 9912 in the 118th Congress.

[123] NASEM, "Chapter 2: Coastal Blue Carbon," p. 51.

[124] For example, see Buma et al., "Expert Review of the Science."

[125] DOE, *Draft CDR Purpose, Approaches, and Recommendations*, pp. 30, 32, and 37.

[126] Watanabe et al., *Blue Carbon Roadmap*, p. 66.

on the fate of carbon sequestered and stored in coastal blue carbon ecosystems "will address some of the key uncertainties in understanding and using coastal ecosystems as a [negative emissions technology]."[127] For example, a 2024 research study of Bahamian seagrass meadows (the largest seagrass meadow ecosystem in the world) revealed lower-than-predicted carbon stock capacity.[128] The researchers attributed this finding to multiple environmental and human factors.[129] These findings could be interpreted as evidence of need for more location-specific measurements of coastal blue carbon.

Some Members of Congress have expressed interest in directing federal agencies to improve estimates of coastal blue carbon through basic research.[130] Other Members have considered directing NOAA to award grants for mCDR-related research projects.[131] In considering the potential value of extramural research, Congress could require that coastal blue carbon data collected via federally funded extramural research be shared with an IWG or a data management entity (e.g., SERC) that addresses coastal blue carbon; such a requirement might increase the knowledge base of coastal blue carbon ecosystems and provide a greater return on invested federal resources.

Some analyses have found that improved carbon stock estimates and sequestration rates, including the development and standardization of how data are collected, managed, and reported, have helped U.S. coastal states better understand the CDR potential of their coastal blue carbon ecosystems.[132] This knowledge may help managers set measurable conservation and restoration goals for these habitats. Congress has considered initiatives and programs that aim to monitor coastal ecosystems, which may influence CDR in such ecosystems.[133] Congress may consider devising authorizing language to explicitly require mapping as part of monitoring protocols. However, some stakeholders have found that most carbon sequestration rates are overestimated for coastal blue carbon ecosystems; they argue that the overestimation could cause some decisionmakers and managers to overlook the implementation of other mitigation actions.[134]

Coordinating Federal Coastal Blue Carbon Science

Federal agencies have taken on various roles in conducting coastal blue carbon science. Some stakeholders note that establishing and maintaining research projects, partnerships, and cross-federal collaborations remains challenging because of different agency missions and mandates, among other things.[135] Some may argue that federal agencies need more well-defined directives related to coastal blue carbon science and a clear mandate to coordinate across the government to reach certain goals. Others may argue that federal agencies should devote fewer resources to coastal blue carbon ecosystem science, including interagency coordination efforts—leaving such efforts to coastal states and localities that often have jurisdiction over, and therefore a greater

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[127] NASEM, "Chapter 2: Coastal Blue Carbon," p. 75.

[128] Fu et al., "Substantial Blue Carbon Sequestration."

[129] Fu et al., "Substantial Blue Carbon Sequestration."

[130] For example, §§301-302 of Title III of H.R. 5457; §2 of H.R. 10491; §4 of H.R. 9912; S. 3785; S. 1576; S. 2812; and S. 5369 in the 118th Congress.

[131] For example, §101 of Title I of H.R. 10471; §3 of H.R. 10491; and S. 5629 in the 118th Congress.

[132] Alex Clayton Moya, "States Improve How They Assess Coastal Wetlands' Impact to Reduce Climate Pollution," Pew Charitable Trusts, August 20, 2024, https://www.pewtrusts.org/en/research-and-analysis/articles/2024/08/20/states-improve-how-they-assess-coastal-wetlands-impacts-to-reduce-climate-pollution.

[133] For example, H.R. 5457/S. 2812, H.R. 9912, and S. 5369 in the 118th Congress.

[134] Kristensen et al., "Predicting Climate Mitigation Through Carbon Burial in Blue Carbon Ecosystems," p. 9.

[135] Williams et al., *2022 North American Carbon Program Science Implementation Plan*, p. 143.

vested interest in, these ecosystems. For example, as noted above, the Trump Administration made changes to the contract supporting the USGCRP. Reportedly, the changes are being made to "support the congressionally-mandated program while also increasing efficiencies across the 14 agencies and advisory committee."[136] It is unclear which activities coordinated by the USGCRP may continue, and whether its subgroups focused directly or indirectly on coastal blue carbon activities will continue to exist under reduced USGCRP staffing.

Congress might consider options to more fully define federal agency roles in studying coastal blue carbon.[137] At the same time, Congress also may deliberate whether to create a new or designate an existing federal program or agency to lead coastal blue carbon science and foster collaboration among agencies conducting related science. This program or agency could track and coordinate agency activities, administer funding for coastal blue carbon science activities, and convene an interagency working group and/or advisory board, among other actions.[138] An advisory group associated with the program also could provide recommendations that might lead to changes in long-standing federal agency programs and activities.

Some federal agencies have attempted to coordinate on coastal blue carbon activities by creating or participating in ad hoc working groups focused on the carbon cycle broadly or on coastal blue carbon specifically, as described above. Various stakeholders and some Members of Congress have advocated for the formal establishment of federal interagency working groups focused on CDR or coastal blue carbon activities.[139] In both cases, the groups would be tasked with developing and implementing national strategic plans.

Federal and Nonfederal Collaboration on Coastal Blue Carbon Science

Federal agencies and nonfederal entities have collaborated on coastal blue carbon science activities in multiple ways, as described above. NASEM has argued that public engagement results in increased opportunity for dialogue, potential improvement in research quality, and greater legitimacy and trust by the public.[140] While some federal agencies have stated they intend to continue to solicit nonfederal participation and engagement in coastal blue carbon ecosystem science,[141] others have argued that such collaboration should be required. For instance, DOE stated in its early January 2025 report that a robust national CDR program "can and must be done while strengthening engagement with communities and stakeholders that could participate in or

[136] Coleman, "Trump Moves to Hobble."

[137] Previously introduced legislation includes H.R. 5457 and S. 2812; H.R. 10471; and S. 5629 in the 118th Congress.

[138] For example, Congress provided EPA the authority to lead federal agencies in the creation of an interagency action plan as part of its Great Lakes Restoration Initiative and to pass through funding to said federal agencies to support the plan's implementation (11 U.S.C. §1268(c)(7)(D)(ii)).

[139] Energy Futures Initiative (EFI) Foundation, *Clearing the Air: A Federal RD&D Initiative and Management Plan for Carbon Dioxide Removal Technologies*, 2019, p. 155, https://efifoundation.org/wp-content/uploads/sites/3/2022/03/ClearingTheAir_Report_compressed.pdf (hereinafter EFI, *Clearing the Air*); and RAE, *A National Blue Carbon Action Plan: Opportunities and Recommendations*, 2022, p. 7, https://estuaries.org/wp-content/uploads/2022/02/Blue-Carbon-National-Action-Plan-Final.pdf. For example, H.R. 10471, S. 2002, S. 5629 in the 118th Congress focused on CDR and mCDR. H.R. 9912 and S. 3785 in the 118th Congress focused on coastal blue carbon ecosystems.

[140] For example, NASEM, "Chapter 9: Synthesis and Research Strategy," *A Research Strategy for Ocean-Based Carbon Dioxide Removal and Sequestration* (Washington, DC: National Academies Press, 2022), p. 62 (hereinafter NASEM, "Chapter 9: Synthesis and Research Strategy").

[141] For example, see Cross et al., *Strategy for NOAA Carbon Dioxide Removal Research*, pp. 76-77.

be affected by CDR, including environmental organizations, Tribal nations, labor unions and workforce development entities, industry, and academia."[142]

Congress may consider whether to require federal agencies to work with nonfederal entities on coastal blue carbon science through various mechanisms. Policies to consider could include the establishment of working groups with federal and nonfederal participants, the creation of nonfederal advisory councils that could provide policy recommendations to federal agencies, and continued funding of nonfederal research. Other stakeholders may question the additional emphasis on federal and nonfederal collaboration and whether such collaboration is necessary to advance the science. These stakeholders may argue that the existing efforts are adequate, that there are competing priorities of higher importance, that additional collaboration may slow down efforts, and that a cost-share requirement among parties may create a barrier to participation, among other reasons. For example, as noted above, the Trump Administration has made changes to funding and staffing for the USGCRP, which included a nonfederal advisory committee,[143] and directed federal agencies to identify "unnecessary" federal advisory committees across the government to terminate.[144]

In addition to domestic nonfederal collaboration, some stakeholders have argued for greater collaboration between the United States and international research communities, either through existing or new agreements. For example, NASEM states that CDR research should be international so that it can cultivate "social legitimacy," is applicable to multiple cultural and geographic contexts, and addresses the priorities of communities where mCDR may be used.[145] DOE in its early January 2025 report added that "international collaboration can rapidly accelerate technology advancement by distributing workloads for research, development, and demonstration."[146] As noted above, some federal agencies have worked with international partners in working groups or on individual projects.[147] For example, the Blue Carbon Scientific Working Group aspires to create international standards, ultimately allowing data collected in various countries to be comparable and useful in a regional or global context. [148] Some stakeholders may contend that existing efforts are adequate, that there are competing priorities of higher importance, and that additional collaboration may slow down efforts. For example, the Trump Administration has cut funding to some projects in other fields with international collaborators and has asked collaborators to describe how projects align with the Administration's

[142] DOE, *Draft CDR Purpose, Approaches, and Recommendations*, p. xii. Introduced bills include H.R. 10471, S. 5629, and H.R. 10491 in the 118th Congress.

[143] Coleman, "Trump Moves to Hobble."

[144] E.O. 14217, "Commencing the Reduction of the Federal Bureaucracy," 90 *Federal Register* 10577, February 19, 2025 (hereinafter E.O. 14217, "Commencing the Reduction of the Federal Bureaucracy"). For federal advisory committees terminated since the release of the executive order, see Government Services Administration, "FACADATABASE.gov," https://www.facadatabase.gov/FACA/s/account/Account/00Bt0000001I5GFEA0.

[145] NASEM, "Chapter 9: Synthesis and Research Strategy," p. 245.

[146] DOE, *Draft CDR Purpose, Approaches, and Recommendations*, pp. xviii and 37.

[147] See section entitled "Federal Agency Research Coordination and Collaboration on Coastal Blue Carbon Ecosystems."

[148] The Blue Carbon Initiative, "Blue Carbon Scientific Working Group," https://www.thebluecarboninitiative.org/scientific-working-group.

priorities.[149] In light of these views, Congress could consider whether to legislate requirements that federal agencies work with international partners and provide funding to do so.[150]

Funding for Coastal Blue Carbon Science

Congress may consider whether existing funding is sufficient to address its priorities for coastal blue carbon science or if funding should be increased or decreased. U.S. federal coastal blue carbon science activities occur under various authorities and budget line items, making it difficult to estimate how much Congress has appropriated for blue carbon activities and how much federal agencies have spent on such activities. Some agencies, such as DOE, have developed a CDR-focused cross-agency crosscut.[151] Some groups have advocated for a crosscut budget to be created that covers all U.S. agencies.[152] Congress may consider directing federal agencies to estimate their coastal blue carbon science-related proposed or actual spending through crosscut budgets, or other mechanisms, at the agency level or across agencies.[153]

Some stakeholders contend that increased funding to certain federal agencies or specific federal programs would improve understanding of coastal blue carbon ecosystems. One group has advocated for additional funding for NSF, and other agencies, to support fundamental research focused on understanding carbon sequestration in coastal ecosystems, such as those that support blue carbon.[154] In another example, NOAA identified increased funding for the agency's Coastal Change Analysis Program as a way to improve seagrass meadow mapping.[155] Congress could provide funding specifically for these and other agency activities.[156] Alternatively, it could provide appropriations to agencies for coastal blue carbon science more broadly and allow the agencies discretion in their use. Some stakeholders may argue that funding should instead support higher-priority topics.

Some stakeholders have argued for a greater federal investment in CDR research, development, and demonstration (RD&D) more broadly, rather than specific topics as recently supported in statements accompanying appropriations law.[157] Some experts have estimated the cost of conducting past and future coastal blue carbon research activities. For example, one group estimated the total value of CDR research grants globally for 1991-2022 to be about $2.6

[149] Juliette Portala and David Matthews, "Europe Scrambles to Help Researchers Escape Trump," March 20, 2025, *Science Business,* https://sciencebusiness.net/international-news/europe-scrambles-help-researchers-escape-trump.

[150] Previously introduced bills include H.R. 5457 and S. 2812; H.R. 9912; and H.R. 10471 and S. 5629 in the 118th Congress.

[151] DOE, *FY2025 Congressional Justification, Volume 2,* pp. 237-244, https://www.energy.gov/sites/default/files/2024-03/doe-fy-2025-budget-vol-2-v4.pdf. A crosscut budget is typically a document that organizes and reports the activities and funding of several entities working within the same broad initiative in a way that *cuts across* organizational boundaries.

[152] EFI, *Clearing the Air,* p. 157.

[153] For an example of a crosscut budget report focused on actual spending, see OMB, *Chesapeake Bay Restoration Spending Crosscut: Report to Congress*, October 2024, https://bidenwhitehouse.archives.gov/wp-content/uploads/2025/01/2024-Chesapeake-Bay-Crosscut-Report.pdf. Previously introduced bills that would track proposed or actual spending include H.R. 9912 and S. 2002 in the 118th Congress.

[154] EFI, *Clearing the Air,* p. 81.

[155] Cross et al., *Strategy for NOAA Carbon Dioxide Removal Research*, p. 47.

[156] For example, as proposed in U.S. Congress, House Appropriations Committee, *Commerce, Justice, Science, and Related Agencies Appropriations Bill, 2025*, Report Together with Minority Views to Accompany H.R. 9026, 118th Cong., 2nd sess., July 11, 2024, H.Rept. 118-582, p. 29; and H.R. 7106 in the 118th Congress.

[157] DOE, *Draft CDR Purpose, Approaches, and Recommendations*, pp. 49-50.

billion.[158] The group also identified that, between 2000 and 2022, 40% of all active research grants and 59% of the research funding on CDR took place in Canada or the United States.[159] Research grants on *coastal wetland restoration*, defined by the group to include coastal ecosystems such as tidal marshes, mangroves, and seagrass meadows, made up less than 5% of the total for the United States and Canada.[160] Looking toward the future, NASEM estimated that basic costs of a coastal blue carbon research agenda would require at least $65 million per year for up to 20 years (approximately $1.3 billion in total) across multiple agencies.[161] Another group estimated that $769 million would be needed over 10 years (approximately $76.9 million per year) to fund coastal blue carbon-related RD&D.[162]

Some stakeholders have proposed that Congress provide new multiyear authorizations and/or appropriations to support coastal blue carbon science broadly.[163] Congress could use estimates from outside groups (as discussed above), information from an interagency or intra-agency crosscut budget focused on coastal blue carbon activities, or another mechanism to determine an appropriate amount for authorizations and appropriations. In addition, Congress may deliberate establishing or encouraging other funding mechanisms to support coastal blue carbon science, such as fees collected for certain private activities, bonds, payments for ecosystem services, ecosystem service insurance, private equity, venture capital, or others.[164] Some stakeholders or Members may argue that existing authorized levels of appropriations and appropriation amounts across the government are adequate or too high and that the federal government should shift support to other priorities. For example, as discussed above, the Trump Administration has made changes to existing federal funding for certain projects and topics and has signaled its interest in lowering government expenditures overall.[165]

Stakeholders have identified other ongoing challenges related to funding, including administrative constraints on research funding duration and mechanisms (e.g., limitations on type of institution or cross-agency transfer of funds).[166] Congress may consider whether to permit federal agencies the ability to combine available federal funding to support prioritized research needs or set up other mechanisms for agencies to use federal funding for coastal blue carbon science. For example, Congress might consider authorizing an agency to transfer funding to other agencies to conduct blue carbon science. The transfers could be based on coastal blue carbon needs articulated by an interagency task force or working group.[167]

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[158] Stephen M. Smith et al., *The State of Carbon Dioxide Removal 2024-2nd Edition*, 2024, pp. 31-32. Hereinafter Smith et al., *State of CDR*.

[159] Smith et al., *State of CDR*, p. 32.

[160] Smith et al., *State of CDR*, pp. 34 and 219.

[161] NASEM, "Chapter 2: Coastal Blue Carbon," pp. 76-77. Funding would be spread across DOE, EPA, FS, FWS, NASA, NOAA, NSF, and USACE.

[162] EFI, *Clearing the Air*, p. 192. Funding would be spread across NASA, NOAA, NSF, and USACE.

[163] EFI, *Clearing the Air*, p. 156. Previously introduced legislation to do so includes H.R. 5457 and S. 2812; H.R. 9912; H.R. 10471; S. 5629; and H.R. 10491 in the 118th Congress.

[164] For example, Daniel A. Friess et al., "Capitalizing on the Global Financial Interest in Blue Carbon," *PLOS Climate*, vol. 1, no. 8 (2022); and DOE, *Draft CDR Purpose, Approaches, and Recommendations*, p. 53; and Smith et al., *State of CDR*, p. 57.

[165] E.O. 14154, "Unleashing American Energy;" and E.O. 14217, "Commencing the Reduction of the Federal Bureaucracy."

[166] Williams et al., *2022 North American Carbon Program Science Implementation Plan*, p. 143.

[167] For example, Congress provided EPA the authority to pass through funding from its Great Lakes Restoration Initiative to other federal agencies involved in the effort, in line with an interagency action plan (33 U.S.C. §1268(c)(7)(D)(ii)).

Appendix. Coastal Blue Carbon-Related Legislation Introduced in the 118th Congress

During the 118th Congress, some Members introduced legislation that would have addressed aspects of coastal blue carbon ecosystems (i.e., mangrove forests, tidal marshes, and seagrass meadows), including these ecosystems' potential for carbon dioxide removal (**Table A-1**). Of these bills, Congress passed H.R. 2950, the Coastal Habitat Conservation Act of 2023 (P.L. 118-138). As of April 24, 2025, no legislation addressing coastal blue carbon has been introduced in the 119th Congress.

Table A-1. Coastal Blue Carbon-Related Legislation Introduced in the 118th Congress

Bill Number	Bill Name	Committee of Referral	Focus (blue carbon, mCDR)	Related to
H.R. 1196	Don Young Restoration Grants for Coastlines and Fisheries Act of 2023	Natural Resources; Transportation and Infrastructure	Blue carbon	—
H.R. 2950[a]	Coastal Habitat Conservation Act of 2023	Natural Resources	Blue carbon	S. 1381
H.R. 5457	Carbon Dioxide Removal Research and Development Act of 2023	SST; Agriculture; Natural Resources; Transportation and Infrastructure; Energy and Commerce	Blue carbon, mCDR	S. 2812
H.R. 7106	National Oceans and Coastal Security Improvements Act of 2024	Natural Resources; SST	Blue carbon	—
H.R. 9912	Coastal Restoration Act of 2024	Natural Resources; SST; Administration; Energy and Commerce	Blue carbon	—
H.R. 10471	ReSCUE Oceans Act	SST; Natural Resources	Blue carbon, mCDR	S. 5629
H.R. 10491	Blue Carbon Protection Act	Natural Resources; SST	Blue carbon	—
S. 1381	Coastal Habitat Conservation Act of 2023	Environment and Public Works	Blue carbon	H.R. 2950[a]
S. 1576	CREST Act of 2023	Energy and Natural Resources	Blue carbon	—
S. 2002	CREATE Act of 2023	Commerce, Science, and Transportation	Blue carbon, mCDR	—
S. 2812	Carbon Dioxide Removal Research and Development Act of 2023	Health, Education, Labor, and Pensions	Blue carbon, mCDR	H.R. 5457
S. 3785	Working Waterfronts Act of 2024	Finance	Blue carbon	—
S. 5369	Carbon Dioxide Removal Investment Act	Finance	mCDR	—
S. 5629	ReSCUE Oceans Act	Commerce, Science, and Transportation	Blue carbon, mCDR	H.R. 10471

Source: Compiled by the Congressional Research Service (CRS) from Congress.gov, using the following search terms and phrases: blue carbon, marine carbon dioxide removal, marine CDR, mCDR, and ocean carbon dioxide removal.

Notes: mCDR = marine carbon dioxide removal; SST = Science, Space, and Technology. CRS reviewed bill text to determine whether identified bills have a focus on blue carbon, mCDR, or both. For the bills included in the table that only list mCDR as a focus, the ocean or marine-based approach was described or defined in such a way that blue carbon could be considered a type of mCDR under an agency's interpretation. The committees of referral are ordered as presented in Congress.gov.

a. H.R. 2950 was enacted as P.L. 118-138.

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