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A scientist measures water depth in a coastal wetland before installing devices to record water level data. *Getty Images/Tenedos*

How States Can Develop Blue Carbon Programs

Scientific frameworks and legislative and regulatory tools can conserve coastal habitats that mitigate climate change

Overview

As climate change poses more and greater risks to people and the planet, states are turning to "natural climate solutions" that harness the ability of ecosystems to capture and store the greenhouse gases (GHGs), such as carbon dioxide and methane, that fuel sea-level rise, more frequent storms, coastal flooding, and other effects. Coastal habitats, including tidally influenced wetlands and seagrasses, are incredibly efficient at sequestering carbon from the air and surrounding waters. These carbon stores, known as "blue carbon" because they are located in places where the land meets the sea, can remain locked in undisturbed soils and organic material for hundreds or even thousands of years. When coastal habitats are destroyed or degraded, however, their carbon stores are released back into the atmosphere.

Experts in natural climate solutions suggest that, because of limited resources and the urgent need to meaningfully address the changing climate, governments and their partners interested in leveraging blue carbon to help meet climate goals should embrace a hierarchy of action that prioritizes first protecting, then managing, and finally restoring coastal habitats.[1]

This issue brief provides a framework—organized around these three steps with examples and related policy mechanisms—to help states, regions, and supporting organizations develop and refine approaches to conserving and expanding blue carbon habitats and advance their goals of reducing GHG emissions. The strategies outlined here are deliberately broad to support a range of options that coastal managers can apply at the project, state, or regional scale.

Protecting blue carbon ecosystems

To limit or even prohibit activities that cause the release of GHGs and to support continued carbon capture and storage, diverse entities, such as land trusts, state and federal agencies, local governments, Tribes, and lawmakers, can pursue a variety of measures. These include:

- Protective designations and long-term stewardship for intact ecosystems.
- Conservation agreements with private landowners and other public/private partnerships.
- Land acquisition and other strategies to prevent development of parcels adjacent to blue carbon ecosystems to reduce pollution and other threats and to allow coastal habitats to migrate inland as sea levels rise.
- For habitats such as seagrass on state-owned aquatic lands, formal withdrawal from commercial leasing programs.

Aquatic Lease Withdrawals in Washington

Wetland environments in Washington are managed by 11 state agencies, including the Washington Department of Natural Resources (DNR).[2] The department's Aquatic Resources Program oversees 2.6 million acres of state-owned aquatic lands, including estuaries and other blue carbon environments, and manages resources including seaweed, shellfish, sand, minerals, and oil, as well as human-made structures in the waters of and air space above these lands. Additionally, DNR must authorize any use of these lands through its lease and easement process and must ensure that approved uses consider benefits to citizens, including environmental protection.[3]

Eelgrass meadows, such as this one at False Bay Biological Preserve in Washington's San Juan Islands, provide important ecological benefits, including carbon sequestration. *Olivia Graham*

As understanding of blue carbon and its benefits has grown in the state, the department has begun incorporating blue carbon considerations into the lease review process. DNR can withhold leases in certain areas that have "significant natural value," which include eelgrasses and other blue carbon habitats.[4]

Managing blue carbon habitats

Incorporating carbon sequestration benefits into state management plans and leveraging existing regulatory processes can promote conservation and expansion of blue carbon habitats. State and federal agencies; local governments; regional, county, and city commissions and councils; quasi-governmental entities that manage and maintain dikes; and lawmakers all have a role to play in the management of blue carbon ecosystems. And although the specific mechanisms can vary widely based on a state's regulatory framework and decision-making processes, they can include:

- Providing landowner incentives.
- Revising environmental permitting procedures, including ensuring that state and local permitting processes account for losses or gains of stored carbon that would result from proposed projects.[5]
- Updating municipal land-use planning practices.
- Developing management plans for publicly owned lands.

Estuary Management Planning in Oregon

Oregon's land-use planning system is grounded in 19 statewide goals, which are pursued through state regulations, local land-use plans, zoning ordinances, and state management plans. "Goal 16: Estuarine Resources" establishes statewide priorities focused on protecting and maintaining and, where appropriate, developing and restoring "the long term environmental, economic and social values, diversity and benefits of Oregon's estuaries."[6]

Forested tidal wetlands in the South Slough National Estuarine Research Reserve in Charleston, Oregon. One of the state's 19 land-use planning goals calls for protecting and maintaining and, where appropriate, developing and restoring "the long term environmental, economic and social values, diversity and benefits of Oregon's estuaries."
Oregon ShoreZone

Coastal counties and cities achieve these priorities through the development and adoption of estuary management plans. These plans designate appropriate uses for distinct areas within each estuary (known as "estuary management units"), based on biological and physical factors, and review proposed dredging and filling projects in estuaries to ensure that they are consistent with overall management objectives and minimize adverse impacts.

Oregon governs 17 of its 22 major estuaries through management plans informed by Goal 16 and related regulations. Although Goal 16 does not explicitly establish blue carbon as a management objective, the language is flexible enough to allow estuary management plans to consider known blue carbon benefits when determining estuary management units and to authorize or prohibit land uses based on whether they would benefit or harm the habitats. This locally driven process highlights how thoughtful land-use planning and management can support blue carbon habitats and align complementary state-level climate goals with local land-use decisions.

Restoring blue carbon habitats

Restoring degraded coastal wetlands or drained areas can reduce emissions and boost carbon capture and storage. These efforts can be undertaken by a diverse array of entities, including land trusts, watershed councils, state and federal agencies, mitigation bankers (companies that help communities meet Clean Water Act requirements), Tribes, landowners, and private companies and academic institutions that specialize in pursuing independent restoration projects.

Restoration can be passive or active. Passive restoration involves stopping activities that harm or prevent an ecosystem's recovery, such as ending livestock grazing or allowing an environmentally damaging dike to fall. However, after such actions, habitats may require extended recovery time. For faster results, active restoration is usually necessary and can include reintroducing species; removing invasive plants; planting significant amounts of native species; removing levees, tide gates, and dams; and replacing culverts to restore and reconnect tidal, sediment, and freshwater flows. Active and passive restoration can be implemented through an array of policy mechanisms such as:

- Public funding.
- State wildlife conservation plans.
- Natural and working lands strategy targets.
- Public lands management plans.
- Regional wetland restoration programs.
- Landowner incentive programs and agreements.

Wetlands Restoration in Massachusetts

In 1909, the towns of Wellfleet and Truro, Massachusetts, installed a dike at the mouth of the Herring River to help control mosquitoes and create arable land. The structure blocked the tidal inflow of saltwater, diminishing the marsh's salinity, drying it up, and dramatically reducing its carbon sequestration.

"Once you drain the system, you could be releasing hundreds, even millions of years of stored carbon in a matter of decades," Stephanie Simpson, former blue carbon program director for Restore America's Estuaries, told the American Association for the Advancement of Science.[7]

Petra Zuñiga and Tim Smith of the National Park Service measure the height of saltmarsh in Massachusetts' Herring River. A state project is restoring the natural tidal flow to the river's estuary to improve water quality and restore habitats, including those that capture and store blue carbon.
John Tlumacki/The Boston Globe via Getty Images

To restore the flood plain, Wellfleet and the National Park Service in 2005 partnered with Bringing Wetlands to Market, a multiyear research project led by the Waquoit Bay National Estuarine Research Reserve and funded by the National Oceanic and Atmospheric Administration. The team evaluated the feasibility and potential financial benefits of developing a blue carbon project in the area.[8]

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> **Stephanie Simpson,** *former blue carbon program director for Restore America’s Estuaries*

The results of that assessment indicated that restoring tidal flow to the Herring River marshes would reduce GHG emissions from the marsh by as much as 311,608 metric tons of carbon dioxide equivalent over the next 40 years—or roughly the equivalent of the average annual energy usage of 69,342 gasoline-powered passenger vehicles.[9]

In light of those findings, the team is working to replace the dike with a state-of-the-art bridge that includes adjustable tidal gates, which can slowly increase the tidal flow into the wetlands to help them revert back to marshland. This restoration will also boost tourism and the shellfish industry, absorb floodwaters, lessen future stormwater surges, and help manage sea level rise.

Conclusion

Global reduction of GHG emissions is vital to averting the most dangerous consequences of climate change. However, protecting and restoring blue carbon ecosystems—alongside emissions reductions—can help states and the country advance their goals to limit global warming. Policymakers, land managers, and conservationists can leverage coastal habitats’ blue carbon benefits by employing the “protect-manage-restore” framework and drawing on model initiatives, policies, management plans, and partnerships that states throughout the country have already successfully adopted.

Resources

- Blue Carbon Network, https://www.pewtrusts.org/en/research-and-analysis/articles/2022/04/29/pew-launches-blue-carbon-network-to-help-states-address-climate-change
- U.S. Climate Alliance and World Resources Institute’s Natural and Working Lands Inventory Improvements: A Guide for States, https://static1.squarespace.com/static/5a4cfbfe18b27d4da21c9361/t/604652f0d82ffb5074df3b3d/1615221491785/Guide+to+NWL+Inventory+Improvements.pdf
- Restore America’s Estuaries Coastal Blue Carbon Program, https://estuaries.org/coastal-blue-carbon/
- Blue Carbon Initiative, Blue Carbon Manual, https://www.thebluecarboninitiative.org/manual
- NOAA, Blue Carbon, https://coast.noaa.gov/states/fast-facts/blue-carbon.html
- National Estuarine Research Reserve System (NERRS), https://coast.noaa.gov/nerrs/about/
- The Pew Charitable Trusts’ U.S. blue carbon content, https://www.pewtrusts.org/en/research-and-analysis/articles/2021/09/24/us-states-play-major-role-boosting-expanding-blue-carbon
- The Pew Charitable Trusts’ NERRS content, https://www.pewtrusts.org/en/research-and-analysis/articles/2020/07/16/national-system-protects-vital-estuaries

Endnotes

1 S.C. Cook-Patton et al., "Protect, Manage and Then Restore Lands for Climate Mitigation," *Nature Climate Change* 11 (2021): 1027-34, https://doi.org/10.1038/s41558-021-01198-0.

2 Washington State Department of Ecology, "Washington State Wetland Program Plan" (2015), https://www.epa.gov/sites/default/files/2019-03/documents/wa_wppfinal31mar2015.pdf.

3 Washington Department of Natural Resources, "Aquatic Leasing and Land Transactions," accessed Oct. 6, 2023, https://www.dnr.wa.gov/programs-and-services/aquatics/leasing-and-land-transactions.

4 Revised Code of Washington 79.105.210: Aquatic Lands—Preservation and Enhancement of Water-Dependent Uses—Leasing Authority (2023), https://app.leg.wa.gov/rcw/default.aspx?cite=79.105.210.

5 U.S. Environmental Protection Agency, "Wetlands Compensatory Mitigation" (2020), https://www.epa.gov/sites/default/files/2015-08/documents/compensatory_mitigation_factsheet.pdf.

6 Oregon Department of Land Conservation and Development, "Oregon's Statewide Planning Goals & Guidelines Goal 16: Estuarine Resources" (1976), https://www.oregon.gov/lcd/OP/Pages/Goal-16.aspx.

7 M. Hampson, "Herring River Illustrates the Value of Wetlands in Reducing Greenhouse Gas Emissions," American Association for the Advancement of Science, accessed Oct. 6, 2023, https://howwerespond.aaas.org/community-spotlight/herring-river-illustrates-the-value-of-wetlands-in-reducing-greenhouse-gas-emissions/.

8 S. Settelmyer, E. Swails, and J. Eaton, "Herring River Carbon Project Feasibility Study Final Report" (Restore America's Estuaries, 2019), https://nerrssciencecollaborative.org/media/resources/TerraCarbon_HRR_Feasibility_v1.7_Clean.pdf.

9 U.S. Environmental Protection Agency, "Greenhouse Gas Equivalencies Calculator," accessed April 2023, https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator.

This brief was updated in January 2024 to clarify details of Washington state's aquatic lease withdrawal program and to change a related photograph.

For more information, please visit: pewtrusts.org/USBlueCarbon

The Pew Charitable Trusts

Contact: Alex Clayton Moya, officer, U.S. conservation project
Email: aclayton2@pewtrusts.org
Project website: pewtrusts.org/us-conservation

Contact: Elizabeth Ruther, officer, U.S. conservation project
Email: eruther@pewtrusts.org