

ISSUE BRIEF

TAPPING THE POWER OF WETLANDS TO SECURE A THRIVING PLANET

Wetlands—lands that are saturated with water, at least part of the time—have a critical role to play in addressing twin global threats: the climate crisis and biodiversity collapse. That’s because wetlands store a vast amount of carbon, curb the growing risk of floods, recharge groundwater, and improve water quality. The ecosystem services provided by wetlands have been valued globally at more than \$47 trillion annually.¹ Wetlands also provide disproportionate support to the world’s plants and animals, with up to 40 percent of all species—including amphibians, birds, mammals, and reptiles—living or breeding in wetlands.²

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Wetlands at Cosumnes River Preserve, California.

Even though wetlands cover only about 5 percent of the land in the coterminous United States, they support nearly half of all species federally listed as threatened or endangered, harbor more than 30 percent of plant species, and provide essential habitat for up to half of all North American bird species.

The United States is no exception, with the amount of its wetland cover closely correlating with species richness.³ Even though wetlands cover only about 5 percent of the land in the coterminous United States, they support nearly half of all species federally listed as threatened or endangered, harbor more than 30 percent of plant species, and provide essential habitat for up to half of all North American bird species.⁴ But wetlands in the United States remain highly vulnerable to loss, with today's wetlands covering less than half the acreage that they covered in the 1700s.⁵

NRDC and Point Blue Conservation Science teamed up to survey the scientific literature and synthesize the benefits of our wetlands. Our goal was to identify ways to leverage existing policies and pursue new opportunities to ensure their health and well-being. We have the tools to preserve these workhorses of the natural world. We must prioritize implementation and funding of policies designed to protect those that remain and restore degraded and lost wetlands if we are to realize their numerous benefits.

WETLANDS—AND THEIR MANY BENEFITS—MUST BE PROTECTED AND RESTORED

With NRDC support, Point Blue Conservation Science reviewed 160 studies on various wetland benefits in North America and found significant evidence for many overlapping benefits. Conserving and restoring these valuable habitats

thus offers important opportunities to address multiple crises at once. In general, wetlands of all types excel at removing carbon dioxide from the atmosphere; they also improve water quality and soil health and support a vast array of species including pollinators, amphibians, birds, and mammals of all sizes. Investments to maintain and restore wetlands yield substantial economic benefits and increase our resiliency to climate change by decreasing downstream flooding during heavy rains, reducing sea surges, and increasing water residence and available aquatic habitat in times of drought.

There are several different types of wetlands, each providing myriad benefits:

- **Saltwater wetlands** confer high-value flood risk mitigation benefits in the form of storm surge protection, as well as water quality and biodiversity benefits. Studies have found that these coastal, brackish, and other saline wetlands, including mangroves, salt marshes, coral reefs, and seagrass/kelp beds, can reduce wave heights by more than 70 percent, heading off significant damage to nearby property and infrastructure.⁶ In fact, the height of damaging storm surges can be reduced by an estimated 1 meter for each 9.4- to 12.6-kilometer width of additional coastal wetland.⁷ The protection provided by maintaining existing coastal wetlands along the U.S. Atlantic coast alone has been valued at \$23.2 billion per year.⁸

A majority of the fish and shellfish harvested commercially and recreationally in the United States are supported by saltwater wetland ecosystems.⁹ One study found that salt marshes may account for 66 percent of the shrimp and 25 percent of the blue crab production in the Gulf of Mexico.¹⁰ A 2012 study valued the benefits of mangroves at an estimated \$23,613 per hectare annually for fisheries (in addition to \$37,927 per hectare annually for recreation and tourism and \$38,115 per hectare per year for timber and forestry products).¹¹

Also, saltwater wetlands are typically net carbon sinks with relatively low methane emissions and relatively high soil carbon storage; mangroves also store substantial amounts of carbon in aboveground biomass. A 2015 study estimated the value of carbon sequestration in Tampa Bay coastal wetlands as close to a quarter of a million dollars annually.¹²



A great blue heron at Seedskaadee National Wildlife Refuge, Wyoming.

SONOMA BAYLANDS

The Sonoma Baylands Project is an effort to restore approximately 350 acres of tidal marsh in the midst of highly populated areas of the San Francisco Bay-Delta estuary. This estuary is one of the largest on the Pacific coast of the Americas and constitutes 77 percent of California's remaining perennial estuarine wetlands.

Before the project got underway, the Sonoma Baylands were subsided as much as 2.1 meters below their natural elevations, and up to 1.2 meters below mean sea level. Flooding regularly impaired local roads, including State Route 37, which was closed for 28 days in 2017 due to flooding.

The restoration began with raising the elevation of the site with roughly two million cubic meters of clean dredge from a Port of Oakland channel-deepening project. The design of the restored wetlands incorporated the habitat needs of several endangered and threatened species and reduced flood risk for transportation infrastructure and neighboring landowners.¹³

Benefits

- **Wildlife**, including the federally listed California Ridgway's rail, has responded by returning to the restored site.
 - Point Blue estimates that the project sequestered 175 metric tons of carbon aboveground in the approximately 280 vegetated acres of the site, and 3,751 metric tons of carbon recovered in the soil.
 - The project protected local jobs at the Port of Oakland by allowing use of material dredged from Oakland's shipping channel to support its shipping industry. Disposal of the dredged material had been a barrier to port improvement prior to this use.
 - Some 300 to 500 community members participated in the restoration through Point Blue's STRAW program (Students and Teachers Restoring a Watershed), allowing them to engage with nature and learn about the value of these wetlands.
- **Freshwater depressional wetlands** provide important habitat for diverse and unique plants and animals that rely on seasonal water availability. Prairie potholes and playa wetlands are examples of critical bird breeding habitat that also support numerous insect, pollinator, mammal, and amphibian populations.¹⁴
- Freshwater wetlands also improve soil health, water quality, and water supply. Wetland playas enrolled in the Wetland Reserve Program run by the Natural Resources Conservation Service stored more than five times the water volume of actively farmed playas.¹⁵ Along with other types of wetlands, they also remove nitrogen pollution, an important function given the increasing occurrence of harmful algal blooms across the United States. A recent study estimates that a 10 percent increase in wetland area in strategic locations would result in a 90 percent increase in nitrogen removal.¹⁶

Estimates of carbon storage and flux—or the amount of carbon held in wetlands rather than exchanged with the atmosphere in the long and short term—are highly variable and difficult to generalize for freshwater wetlands, whose net carbon benefit is highly dependent on the rate of methane emissions. Still, many wetlands are likely old enough to be providing net carbon benefits.

- **Riverine wetlands**, including active floodplains and riparian buffers, are biodiversity hot spots. Provided their hydrological connectivity to adjacent rivers and streams is maintained, they can provide significant water supply regulation, flood protection, and water quality benefits.¹⁷ Restoring the natural hydrology and connectivity between rivers and their floodplains can remove harmful nutrients from waterways while also improving vegetation recruitment and productivity, sediment and nutrient deposition, groundwater recharge, and the abundance and growth of fish.¹⁸ Vegetated riparian buffers, the strips of vegetation along river channels, can also contribute substantially to water quality and biodiversity benefits, with the largest benefits associated with the widest buffers. A meta-analysis of 46 studies found that the installation of vegetated riparian buffer strips reduced nitrogen in surface runoff by 57 percent, nitrates in surface runoff by 33 percent, and nitrates in groundwater by 70 percent, compared with no-buffer controls.¹⁹ Riparian forests are particularly recognized for supporting a rich diversity of organisms, including birds, reptiles, amphibians, mammals, and insects, and providing cooling shade for fish and other aquatic species.²⁰

The economic value associated with the flood protection benefits of riverine wetlands is substantial. In St. Louis County, Missouri, researchers estimated the value of flood risk mitigation from the Meramec Greenway, a collection of protected parcels in the Meramec River floodplain, at \$7.7 million per year in avoided damage.²¹

Riverine wetlands also can store the same amount of aboveground carbon as mangroves and should be prioritized for protection and recovery.²²



An aerial view of Sheep Creek in Pike-San Isabel National Forest, Colorado.

© Mark Beardley, EcoMetrics

- **Montane meadows** are also hot spots of biodiversity that can provide an array of benefits, including improving the resilience of water supplies downstream by storing and slowly releasing surface water. Montane meadows serve as important habitat for an array of fish and wildlife species, including the sage grouse and many endangered and threatened species, such as the Yosemite toad and several native trout species. When disturbed, low-tech restoration practices have been effective (and cost-effective) in restoring meadow hydrologic connectivity. In fact, productivity increased by 24 percent in one area of Colorado with the use of simple rock and wood structures designed to slow and disperse the flow of water.²³

Carbon storage and fluxes are less well documented for montane meadows than for other wetland classes, and fluxes are likely to be highly seasonal due to the short growing season and extended periods of snow cover at the mountain elevations where these wetlands are found.

- **Peatlands** are a subtype of each of the above wetlands, defined by and notable for their very high levels of soil carbon storage—which also makes them highly vulnerable to becoming large sources of carbon emissions if their soils are disturbed. Because of relatively slow carbon sequestration rates, any carbon emitted as a result of disturbance in peatlands will take a very long time to recover.²⁴ Conservation of existing peatlands is imperative to prevent the loss and emissions of these carbon stocks.²⁵

Given these many benefits, the importance of protecting remaining wetlands cannot be overstated. When wetlands are disturbed, the soil immediately begins to release its rich carbon stores, exacerbating climate impacts and reducing or eliminating other wetland benefits.²⁶ Wetlands that have already been disturbed or degraded are remarkably quick to recover many of their attributes when restored. Some benefits, such as flood protection, water quality improvements, and colonization by diverse fish and wildlife, may begin to accrue immediately. Net greenhouse gas sequestration benefits may take longer to accrue and will differ across wetland types.²⁷ We must prioritize policy solutions that incentivize and fund the preservation of all remaining wetlands and look to climate-smart wetland restoration to maximize benefits.

WE MUST SUPPORT AND EXPAND EXISTING FEDERAL TOOLS FOR WETLAND PROTECTION AND RESTORATION

The United States already has major federal programs and policies in place that can be leveraged to expand wetland protection and restoration. In this section, we recommend approaches to achieve this. For example, large-scale initiatives like 30x30, the global effort to protect 30 percent of lands, inland waters, and oceans by 2030, can and should be harnessed to advance wetland protection through federal initiatives such as America the Beautiful. Multiple federal agencies already have the authority to safeguard wetland ecosystems; these include the U.S. Department of Interior, Federal Emergency Management Agency, Department of Agriculture, Environmental Protection Agency, and Army Corps of Engineers. Through targeted investments and capacity building, these agencies can secure the carbon benefits of existing wetlands and invest in the long-term emissions reductions and biodiversity benefits of restoring damaged wetlands.

Prioritize Wetland Protection in 30x30

To protect biodiversity and strengthen climate resilience, scientists believe we must conserve at least 30 percent of land, inland waters, and oceans by 2030, a global goal known as 30x30.²⁸ In 2021, President Biden signed an executive order that committed the United States to this global effort, recognizing that it will help stabilize the climate, protect biodiversity, and help communities adapt to the consequences of climate change.²⁹ This federal effort, dubbed the America the Beautiful initiative, takes an all-of-government approach to increase conservation and stewardship of the nation's lands and waters, including wetlands. While implementation is still taking shape, the Bipartisan Infrastructure Law of 2021 will propel the initiative with the largest investment in the resilience of natural systems in American history, providing funds for watershed rehabilitation, drinking water protection, flood prevention, and coastal resilience, among other projects.³⁰ The 2022 Inflation Reduction Act provides additional funding to agencies to invest in nature-based solutions. These funds can and should be directed to wetland protection and restoration on a large scale.

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Establish a National Healthy Riverscapes Initiative

Federal land managers, including the Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service, and U.S. Forest Service manage more than 640 million acres of land—including working forests, wildlife refuges, and national parks—and are responsible for maintaining and restoring the wetlands and rivers under their jurisdiction.³¹ To this end, federal agencies should develop a national healthy riverscapes initiative to improve and expand aquatic habitat across public lands. Riverscapes are stream or river habitats and their associated floodplains, wetlands, and riparian vegetation. Unfortunately, most riverscapes are a tiny remnant of their former footprints on the landscape and are no longer providing meaningful habitat or serving as critical natural infrastructure. A national initiative should require agencies to set explicit restoration goals, integrate riverscape health into their compliance and planning, expand

financial and implementation capacity, collaborate with partners at all levels of government, and establish sound decision support and evaluation tools.

Such efforts should also emphasize low-tech, process-based restoration—the practice of using wood, beaver dam analogs, and other natural inputs to slow flows, reduce channel incision, and reconnect channels to their floodplains so water can move back onto the floodplain and recharge groundwater. Once natural processes are kick-started, in some watersheds beavers can return naturally, or they can be translocated to streams to inexpensively sustain and expand riverscape restoration. By concentrating on simple and cost-efficient processes that mimic natural ones, the federal government can dramatically improve the acreage, complexity, and structure of its riparian systems and lay the groundwork for enduring, healthy riverscapes across the country.

CASE STUDY: BRIDGE CREEK

Overview

The Bridge Creek Watershed Project aimed to restore 32 kilometers of Bridge Creek in Oregon as habitat for the threatened Middle Columbia River steelhead. The project emulated the watershed enhancement skills of beavers by building beaver dam analogs to restore river and floodplain function. Within four years of its implementation, beavers moved in, stream temperature cooled, groundwater levels rose, and the survival and abundance of juvenile steelhead significantly increased, relative to an untreated watershed nearby.

The success of beaver dam analogs at Bridge Creek demonstrates the effectiveness of a low-tech, process-based restoration tool to restore rivers and floodplain functions across degraded riverscapes. Once reestablished, these naturalized systems can support resilient beaver colonies, reconnect incised channels with floodplain wetlands, nurture riparian vegetation, and benefit aquatic species, including salmonids.³²



An aerial view of a healthy riverscape on Blackrock Creek in Bridger-Teton National Forest, Wyoming.

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Once natural processes are kick-started, in some watersheds beavers can return naturally, or they can be translocated to streams to inexpensively sustain and expand riverscape restoration.

Additionally, a healthy riverscapes initiative would complement existing management priorities across the federal government. For example, low-tech, process-based restoration aligns with the Biden administration's broader efforts to advance nature-based solutions to combat climate change and increase resilience, as articulated in the president's April 22, 2022, "Executive Order on Strengthening the Nation's Forests, Communities, and Local Economies."³³ In addition, the National Climate Task Force recommends embedding nature-based solutions in management of federal lands and waters.³⁴ Such investments are also consistent with Bureau of Land Management's goal to increase the resilience of natural and working lands to drought and fire and its Aquatic Resources Program's five-year strategy (2022), which includes objectives to restore and connect riparian, fisheries, and water resources.³⁵



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A beaver in Denali National Park and Preserve, Alaska.

Invest in FEMA's Natural Infrastructure Programs to Increase Community Resilience to Climate Change and Flooding

The Federal Emergency Management Agency (FEMA) is also equipped to enhance climate change resilience, reduce flood risk, and promote wetland protection and restoration. FEMA should prioritize projects that benefit wetland and riparian ecosystems through the Building Resilient Infrastructure and Communities (BRIC) program and the Hazard Mitigation Grant Program (HMGP). The government should establish a mandatory 20 percent set-aside within BRIC for nature-based hazard mitigation projects—including restoring, protecting, and enhancing wetlands, floodplains, and riparian corridors. To ensure that the program has sufficient support to increase climate change resilience, President Biden can expand BRIC's funding to include the full 6 percent of Disaster Relief Fund appropriations, as authorized under section 1234 of the Disaster Recovery Reform Act of 2018.³⁶ FEMA can protect communities from flood hazards by investing in floodplain and stream restoration projects under both BRIC and HMGP, even though these two grant programs have different goals and eligibility requirements.

In addition to ensuring adequate funding for nature-based projects like wetland restoration, floodplain buyouts, and natural infrastructure investments, FEMA must improve its technical assistance. The agency should work with communities to:

- design these projects in compliance with funding requirements,

- simplify and standardize grant applications,
- and promote a suite of best practices, which can create standardized tools to restore floodplains, riparian corridors, and wetlands more consistently and at a larger scale.

Looking ahead, FEMA must reevaluate how climate resilience and flood risk reduction are captured in its planning and evaluation methodology. Instead of relying on a traditional benefit-cost analysis model based on property values, the agency needs to evaluate additional environmental and social factors. By expanding which variables it analyzes, weighting these new metrics to properly reflect their advantages, and requiring much more realistic discount rates for nature-based solutions, FEMA can better capture the carbon, environmental, and structural benefits of protecting and restoring wetland ecosystems. Among other benefits, nature-based solutions improve in performance over time, while traditional hardscape infrastructure like concrete seawalls or constructed levees decline in performance over time. Eventually the agency should investigate alternative evaluation methodologies that could replace benefit-cost analysis. This will allow FEMA to prioritize projects with multiple co-benefits (e.g., nature-based approaches) instead of investing in projects that disproportionately favor communities with high property values.

CASE STUDY: HAMILTON CITY

Since the 1970s, Hamilton City in northern California suffered repeated flooding that threatened homes and the community. Using the Army Corps of Engineers guidelines for multipurpose projects, the community designed a plan to set back almost seven miles of levees to give the river more room to spread out across its floodplain during high flows. The setback levee not only improved flood protection for the community but restored about 1,400 acres of riverine habitat, including riparian forest, scrub, oak savannah, and grassland, with multiple benefits for fish and wildlife.

Hamilton City is a small, agricultural community, and at first analysis, the anticipated cost of breaching the existing ineffective levee and constructing a new setback levee exceeded the estimated value of the protected assets. However, adding in the value of restoring the floodplain and associated riparian habitats increased the benefit–cost ratio of the project more than enough to obtain federal funding. Including the environmental benefit, therefore, was critical to implementing the project.³⁷

Expand the USDA's Agroforestry and Riparian Forest Buffer Initiatives

The U.S. Department of Agriculture (USDA) is well positioned to enhance riparian ecosystems by promoting agroforestry as part of its Climate-Smart Agriculture and Forestry (CSAF) strategy. Agroforestry is the intentional integration of trees and shrubs into crop and animal farming systems to create environmental, economic, and social benefits, including carbon sequestration. Planting riparian forest buffers—trees, shrubs, or perennial plants between agricultural lands and streams, lakes, or wetlands—is one example of an agroforestry practice. Riparian forest buffers stabilize the surrounding soil, filter nutrient runoff from farms, act as a first line of defense against pests and diseases, and reduce the risk of flooding and eutrophication. In addition, forest buffers benefit biodiversity by providing habitat, reducing water temperatures, and serving as wildlife movement corridors. CSAF's current strategy emphasizes voluntary initiatives and provides financial and technical assistance to producers integrating climate-smart practices. By centering agroforestry as a CSAF approach, the USDA can encourage the widespread adoption of riparian forest buffers on cropland, ranches, and private forests.

In addition to prioritizing agroforestry and the restoration of riparian forest buffers as called for in the agricultural

conservation provisions of the Inflation Reduction Act of 2022, **Congress has a significant opportunity to expand and prioritize riparian forest buffers and wetland restoration within the provisions of the 2023 Farm Bill**, which will direct the USDA's agricultural conservation priorities for the following five years. As part of the 2023 Farm Bill, Congress should:

1. Increase funding for a suite of USDA-administered conservation programs, including the Environmental Quality Incentives Program, the Conservation Reserve Program, and the Agricultural Conservation Easement Program;
2. Increase technical resources available for agroforestry work, including by authorizing an expanded scope for the USDA's National Agroforestry Center;
3. Establish regional agroforestry centers and fund agroforestry training for technical service providers;
4. Increase funding for the National Agricultural Statistics Service so it can collect and analyze more robust agroforestry data through the National Agroforestry Survey; and
5. Direct the USDA to play a leading role in coordinating agroforestry research agendas, projects, and grant programs across its mission areas.



Yolo Causeway crossing Yolo Bypass and Vic Fazio Yolo Wildlife Area along Interstate 80, California.



Maggie Creek, Nevada, after cattle grazing agreements and the reintroduction of beavers.

The EPA and U.S. Army Corps of Engineers Must Enforce Clean Water Act Protections for Wetlands

As the federal agencies responsible for implementing the Clean Water Act, the Environmental Protection Agency (EPA) and U.S. Army Corps of Engineers (USACE) must fulfill their regulatory responsibility to strengthen protections for the nation’s waters and wetlands. Both recently took an important step in that direction by officially repealing the Trump administration’s Navigable Waters Protection Rule (dubbed by opponents the “Dirty Water Rule”) and putting in place a permanent policy more grounded in science and therefore better suited to sustaining the nation’s waters. The Dirty Water Rule stripped more than half of all U.S. wetlands, along with countless rain-dependent streams and tributaries, of their protections from pollution under the Clean Water Act. Although two federal courts had already invalidated the Dirty Water Rule nationwide, such that it had not been enforced since the end of August 2021, the formal repeal signaled the EPA’s and USACE’s appropriate rejection of the Dirty Water Rule’s anti-science approach as inconsistent with the law’s purpose.

The EPA must also repeal the Trump administration’s changes to regulations implementing section 401 of the Clean Water Act. The Trump-era rule unlawfully restricted state and tribal authority to regulate federally permitted projects. These changes limit the amount of time states and tribal nations have to review potentially damaging projects, narrow the scope of the impacts they can evaluate—for example, curtailing when states and tribes can consider a project’s biological or water health effect—and ultimately give the federal government the authority to override state and tribal

decisions. Although a court in California vacated the Trump administration’s changes in 2021, a Supreme Court decision in April 2022 effectively restored the Trump rule as the Biden administration considers its changes. The EPA should fulfill its commitment to tribal nations and finalize its repeal of the Trump rule to restore the right of tribes and states to review and reject projects that harm water quality and freshwater habitat on their land.

The EPA and USACE have significant additional opportunities to strengthen Clean Water Act provisions that benefit wetlands. Primarily, USACE should overhaul its fast-track permitting system, which, as currently implemented—enables numerous projects that collectively harm tens of thousands of acres of wetlands a year. The USACE must reevaluate its nationwide permits and follow the Clean Water Act’s directive to limit such permits to activities that cause no more than minimal harm to the environment. By restoring robust federal protections for waters and wetlands, the EPA and USACE can uphold the true purpose of the Clean Water Act.

CONCLUSION

Protecting and restoring wetlands is imperative to securing a sustainable future. Fortunately, there are discrete steps that the U.S. government can take to safeguard wetland ecosystems. As we continue to combat the climate and biodiversity crises, we must coordinate action across federal agencies, prioritizing policies that amplify wetlands’ carbon sequestration and infrastructural, ecological, and water quality benefits.

ENDNOTES

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