Natural Climate Solutions

A Federal Policy Platform of the National Wildlife Federation







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Cover images: Front cover (left to right): *Restored wetlands on a farm in Queen Anne's County, Maryland. Credit: Will Parson, Chesapeake Bay Program; A Chinese mantis devours a monarch butterfly along a riparian buffer next to the Anacostia River in Washington, D.C. Credit: Will Parson, Chesapeake Bay Program; Tree seedlings from a reforestation project in Oregon. Credit: BLM Oregon & Washington; Plants at an Organic Cover Crop Workshop in Corvallis, Oregon. Credit: NRCS Oregon; A marsh crab on Deal Island in Maryland. Credit: Matt Rath, Chesapeake Bay Program; Chesapeake Bay wetlands. Credit: Timothy Pohlhaus, via Flickr; A green tree frog in a North Carolina wetland. Credit: Amanda Mueller, NC Wetlands.* ***Back cover (left to right):*** *Marsh restoration projects in the Mississippi River delta. Credit: Lauren Sullivan, via Flickr; Planted seagrass along Jensen Beach, Florida. Credit: Rick Schwartz, via Flickr; A spring fawn. Credit: Ray Fetherman, USFWS Volunteer; Sharp-tailed grouse in a North Dakota prairie. Credit: Rick Bohn, USFS Mountain-Prairie; A karner blue butterfly. Credit: Jill Utrup, USFWS; Abandoned mine drainage ponds in Colorado. Credit: USGS Unmanned Aircraft Systems; Restored wetlands on a farm in Queen Anne's County, Maryland. Credit: Will Parson, Chesapeake Bay Program.*

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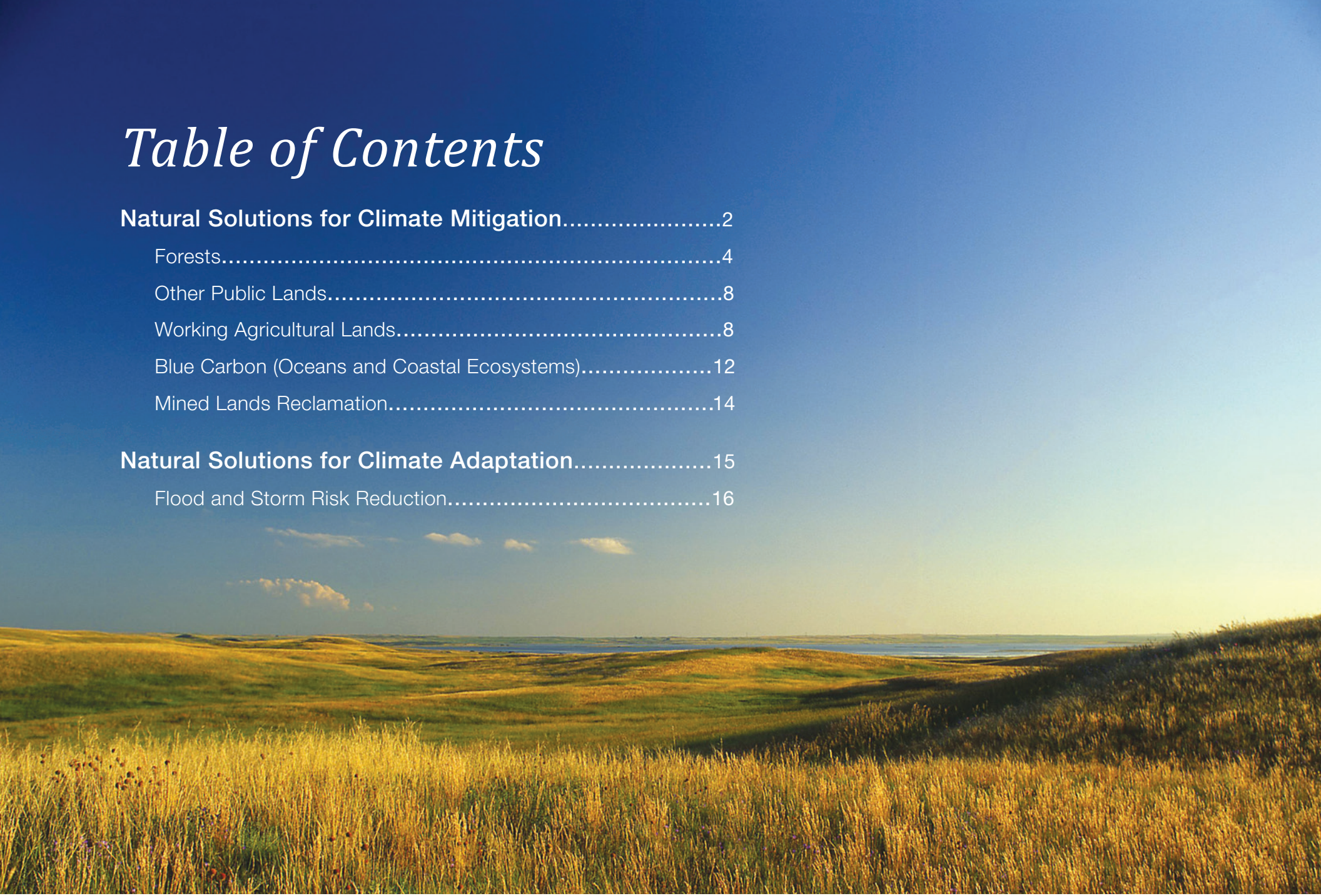


Native prairie at North Dakota's Chase Lake National Wildlife Refuge. Credit: Rick Bohn, USFWS Mountain-Prairie.

Fall in Montana's Beaverhead-Deerlodge National Forest. Credit: USFS, Northern Region.

Amidst the global effort to confront the growing risks of climate change, natural climate solutions have risen to the forefront of policy discourse as being critical to success. The National Wildlife Federation defines the concept of natural climate solutions as strategies that support or enhance the ability of natural systems to both mitigate climate change (enhancing the removal or storage of carbon) and strategies that increase the resilience of human communities and wildlife populations to the impacts of climate-related natural hazards. These two focal areas are subsets of our broader efforts to support climate solutions through policies and programs that reduce anthropogenic greenhouse gas (GHG) emissions and enhance climate adaptation for natural and human systems.

This document lays out the National Wildlife Federation's federal policy recommendations to swiftly scale up natural climate solutions, for both climate mitigation and climate resilience. Recommendations are structured around several analytical categories based on land or habitat type. We include key principles for consideration and specific policy recommendations within each.

We look forward to working with partners and policymakers to find and implement solutions that benefit people, wildlife, and the climate.

Natural Solutions for Climate Mitigation

Natural climate solutions harness nature's inherent ability to sequester atmospheric carbon in soils, water, and living organisms. They have the potential to remove and store up to 10 gigatons of carbon dioxide cumulatively by 2050,[1] and should be a central component of any mitigation strategy. Though, with a suggested U.S. carbon removal target of 2 gigatons annually,[2] natural solutions alone will be insufficient. Technological approaches to carbon removal are also necessary, but are beyond the scope of this policy platform.

The Intergovernmental Panel on Climate Change (IPCC) estimates that the lands on Earth currently serve as a net carbon sink, capturing and storing roughly 29 percent of all carbon dioxide emissions.[3] U.S. lands, however, are currently sequestering 11 percent of domestic carbon dioxide emissions.[4] The IPCC also reports that, in order to limit planetary warming to 1.5 degrees Celsius over the pre-industrial era, an array of carbon-capturing practices will need to be implemented worldwide, in addition to measures that reduce emissions. Natural sequestration pathways often offer the most cost-effective means of carbon removal while also providing numerous co-benefits that will help human and biological communities adapt to a changing climate.

A range of nature-based strategies can be deployed in our forests, watersheds, coastal areas, grasslands, farmlands, and other natural systems to enhance the health of our soils and ecosystems. In turn, these approaches can expand the national carbon sink, improve the quality of wildlife habitat, reduce climate risks to communities, and create economic opportunity through reclamation, restoration, and maintenance of these sinks, or the implementation of new management practices.

Alaskan salmon, including the sockeye pictured here, are one of many species in the U.S. at risk from climate change. Natural climate solutions can benefit wildlife populations while mitigating climate change. Credit: USFS Alaska Region.

Carbon Sequestration Principles

• **Climate policies should work towards the goal of slashing global greenhouse gas emissions roughly in half by 2030, and reaching net zero emissions by midcentury at the latest.** These are the benchmarks established by the IPCC as necessary to avoid the most catastrophic effects of climate change, roughly equivalent to limiting warming to 1.5 degrees Celsius over the pre-industrial era.

• **Mitigation strategies should include carbon removal and storage, in addition to emissions reductions.** Meeting a net-zero emissions goal will necessitate strategies to sequester and store carbon dioxide that is already in the atmosphere—i.e., negative emissions strategies—as well as strategies to capture emissions in industrial applications for storage or reuse. However, carbon removal strategies should not be viewed as a substitute for emissions reduction efforts, as they are insufficient to meet climate stabilization targets.[5]

• **Natural solutions should be part of any carbon emissions strategy, particularly in the near term.** While some technological approaches for capturing or reusing carbon emissions require investment and time to mature, natural solutions are readily available and cost-effective, and should be employed immediately.[6]

• **Carbon sequestration efforts must be compatible with other ecological values.** It is important that carbon sequestration and other climate mitigation strategies do not undermine natural ecosystem resilience, and the services and benefits natural systems provide. Significant trade-offs can exist between managing systems for carbon and biodiversity. For example, growing trees in a grassland ecosystem or planting fast-growing invasive species may maximize carbon sequestration, but cause negative impacts to grassland birds, pollinators, and other native wildlife species.

• **Carbon offset policies or programs should adhere to strong environmental integrity principles.** This includes ensuring that carbon pools are quantifiable and sustainable over the long term. Doing so requires robust approaches to measure carbon in live and dead biomass, soils, and harvested wood products. It also requires managing the natural systems that sequester and store carbon (e.g., forests and coastal wetlands) in ways that reduce the risks of damage or loss due to both climate and non-climate stressors.[7] Natural sequestration for carbon offsets should not come at the expense of air and water quality elsewhere, particularly in disadvantaged communities, communities of color, and areas already facing disproportionate pollution burden.

Bottomland hardwoods in North Carolina's Lumber River State Park. Credit: NC Wetlands.

In 2017, the combination of forest land, harvested wood products, and urban trees in the United States accounted for an estimated net uptake of 730.9 million metric tons of carbon dioxide equivalent (MMT CO2 eq.).

Forests

Forests and other wooded areas represent perhaps the best opportunity to remove carbon from the atmosphere quickly, reliably, and relatively cheaply. In 2017, the combination of forest land, harvested wood products, and urban trees in the United States accounted for an estimated net uptake of 730.9 million metric tons of carbon dioxide equivalent (MMT CO2 eq.).[8] Between 1990 and 2017, "forest land remaining forest land" was the nation's largest net sink, and conversions of forest land were the largest source of land-based emissions.[9] However, these benefits depend on careful policy and program design and implementation.

Key Principles

• **Strive for optimization, not maximization, of carbon.** Strategies focused strictly on enhancing carbon sequestration (e.g., converting habitat to plantations of rapid-growing tree species) may run counter to other important ecological and social values, including biodiversity conservation. To account for trade-offs between carbon management and biodiversity conservation, prioritize strategies that achieve both climate mitigation and ecosystem resilience.

• **Avoid conversion of forests to other uses.** Protecting and restoring existing forests, including via strategies that support complex systems and diverse patchworks of old-growth and young trees, are especially useful in optimizing carbon removal and storage. Such strategies also provide a range of additional ecosystem services.[10]

• **Increase reforestation of historically forested areas.** Aggressively scaling up reforestation in historically forested areas is one of the best ways to enhance carbon sequestration and support other important ecosystem services. Reforestation strategies should strive to support habitat complexity (rather than monoculture plantations) and should account for long-term climate trajectories and other ecological concerns (such as the potential for introducing invasive species).[11]

• **Focus afforestation efforts on severely degraded lands.** Afforestation (i.e., planting trees in areas not historically in forest cover) can contribute to meeting carbon goals when implemented carefully. Afforestation efforts should focus on severely degraded lands, such as brownfields and mined lands, that do not border remaining naturally treeless systems such as native grasslands and shrublands, which also sequester carbon and support a range of important social and ecological values. Carbon sequestration efforts on other altered lands (e.g., farmland or pasture) should focus on restoring ecologically appropriate habitat types.

• **Implement climate-smart management of the nation's forests to enhance the capacity of these systems to sequester carbon over the long term.** In particular, managers should implement strategies to restore natural patterns of fire and other processes and manage changing intensity and frequency of fires, disease, and insect infestations due to climate change. While some strategies, such as strategic thinning and the use of prescribed burns, may release some carbon in the near term, they can enhance forest health and resilience and support long-term sequestration and storage of carbon.[12,13]

Aspen trees along the Abineau Trail in Arizona's Coconino National Forest. Credit: USFS, Coconino National Forest.

• **Consider mutually beneficial harvest and carbon sequestration opportunities.** Supporting markets for sustainably sourced, long-lived wood products can help incentivize keeping forest land forested. Forest management practices should also focus on enhancing harvest and processing efficiency.[14]

• **Prevent conversion of natural forests to intensively managed plantations.** Intensively managed plantations do not achieve the carbon storage potential of natural forests (with an estimated 28 percent lower total carbon stock).[15] Additionally, they have greatly reduced wildlife and biodiversity values. Preventing the conversion of remaining natural forest areas to plantations is critical to maintaining forest carbon stocks.

• **Increase investments and application of agroforestry practices in appropriate landscapes.** Agroforestry refers to the incorporation of trees into agricultural landscapes, and can provide an effective way of increasing carbon on farms and pastures located in historically forested regions, while providing other

To account for trade-offs between carbon management and biodiversity conservation, prioritize strategies that achieve both climate mitigation and ecosystem resilience.

Southern live oaks in Audubon Park, a 35-acre city park in New Orleans. Credit: Kristen Bobo, via Flickr.

important ecosystem services (e.g., riparian buffers, windbreaks, and pollinator habitat).[16] This practice is not generally appropriate on naturally treeless landscapes, as it can fragment remaining habitat and reduce populations of declining grassland bird species.

• **Increase investment in urban forestry.** Urban trees in the United States store an estimated 643 million metric tons of carbon, and they currently sequester an estimated 25.6 million tons annually.[17] Urban forests also provide a range of additional ecosystem services, including reducing energy use during heat waves, absorbing stormwater, and providing habitat for wildlife. Strategies to enhance urban forests should prioritize use of climate-resilient, non-invasive tree species.

Policy Recommendations for National Forests

• **Increase the pace and scale of climate-informed, ecologically appropriate forest restoration on national forests** in ways that provide benefits for carbon sequestration, wildlife, water, resilience, and public safety.

• **Increase the U.S. Forest Service (USFS) budget for proactive and climate-informed restoration and management activities,** particularly now that there is a wildfire-funding fix in place, which should reduce the practice of drawing from such proactive funding accounts to pay for wildfire response.

• **Increase mandatory funding levels for the USFS Reforestation Trust Fund** to prioritize reforestation and restoration.

• **Provide additional resources for USFS to accelerate the timetable for revising national forest plans under the 2012 forest planning rule,** which incorporates elements of climate resilience. Direct USFS to finalize and issue guidance for applying key components of the planning rule to encourage full consideration of climate mitigation and adaptation in these plans.

• **Increase opportunities and incentives for the use of prescribed fire in restoring forest health and reducing extreme fire events;** identify policy mechanisms for better coordination on smoke management with respect to Clean Air Act compliance.

• **Protect bedrock environmental authorities (e.g., Endangered Species Act, Clean Water Act, National Environmental Policy Act) and their application for forest management and restoration.**

Forest of hemlocks and white pine trees in Pennsylvania's Reynolds Spring Natural Area. The protected area is part of the Tioga State Forest. Credit: Nicholas A. Tonelli, via Flickr.

• **Create incentives for investing non-federal funding in climate-smart forest management.** Innovative conservation finance offers a potentially significant source of funding to complement more limited congressional dollars. Policies would include establishing a restoration fund for non-federal matching contributions, promoting sourcewater fund models, and supporting capital impact investment.

• **Build on the existing Forest Inventory and Analysis program to fund the design of an advanced forest carbon monitoring system within USFS** to monitor carbon enhancing activities, increase statistical sampling of stored carbon in select projects, and estimate ecosystem carbon storage averages that include regular use of remote sensing data.

Policy Recommendations for Private Forests

• **Incentivize private forest management for ecologically appropriate carbon storage by creating a new, transferable tax credit.**

• **Include climate-informed, ecologically appropriate forest restoration and management programming in allocation of revenues from any carbon pricing legislation.**

• **Include forests in any climate legislation creating a carbon "offsets" market that pairs negative emission strategies with comparable carbon emissions made elsewhere.** Encourage inclusion of forests in any market where emitters can purchase carbon reduction credits from projects in other sectors, but ensure projects are verifiable, additional, transparent, permanent, and ecologically sound. Plus, ensure offsets do not allow increased environmental degradation by emitters.

• **Significantly increase mandatory funding for the USFS Healthy Forests Reserve, Urban and Community Forestry, and State and Private Forestry Programs.**

• **Support developing markets for long-lived wood products through:**

  • Increased research and development into long-lived wood products;

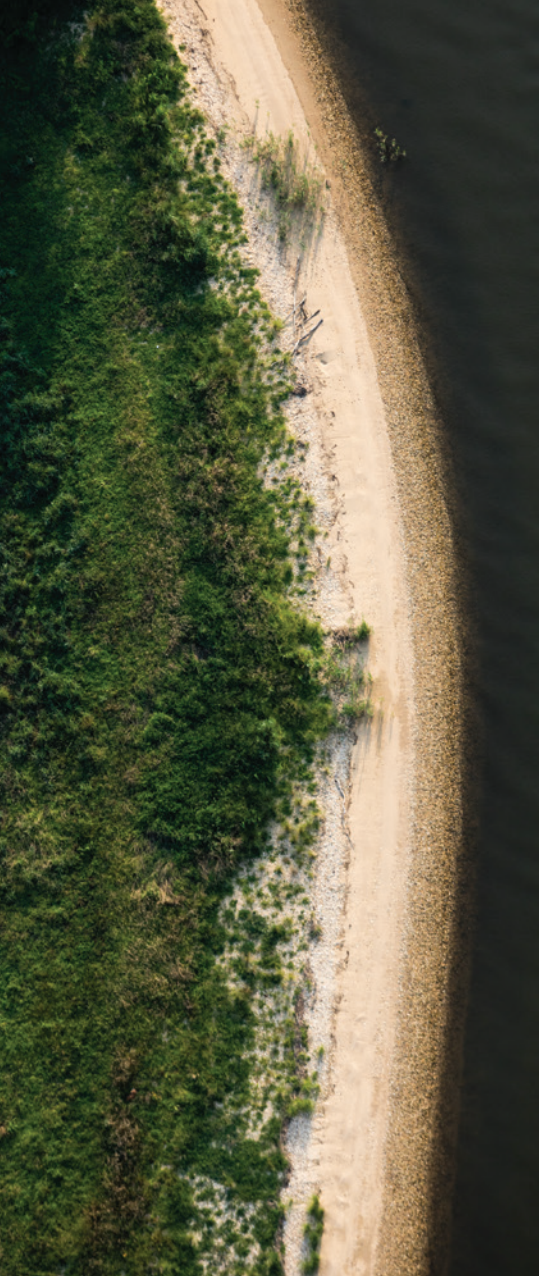
  • Increased funding for USFS's Wood Innovation Grant program to accelerate development of new products, conduct independent lifecycle carbon accounting (LCA) analyses, and develop markets for new, long-lived wood products that have net benefits to the climate. Direct USFS to limit the program to long-lived wood products that reduce GHGs within the timeframe needed to address global warming (less than 20 years);

  • Offer tax credits for use of new, long-lived wood products with LCAs that show a certain level of improvement in GHG emissions over materials being replaced, when considered over a 20-year timeframe (e.g., mass timber over steel in construction of tall buildings); and

  • Use the bio-preferred program and funding for pilot programs to incentivize use of new, long-lived, GHG-beneficial wood products in government buildings, and offer grant preferences to federal funding recipients that utilize these products.

• **Improve forest health by increasing funding for research into forest diseases, pests, and non-target impacts from agricultural chemicals,** such as Dicamba and 2-4D.

• **Develop a bottomland hardwood forest restoration program** that offers a retirement option for frequently flooded croplands that would put the lands in a permanent easement and restore them to hardwoods.



A living shoreline built to withstand sea level rise at Conquest Preserve, on the Corsica River in Maryland. Credit: Will Parson, Chesapeake Bay Program, with aerial support from Southwings.

Other Public Lands

Public lands comprise nearly a third of our country.[18] Resource development on those lands is responsible for nearly 25 percent of our country's GHG emissions annually.[19] In fact, according to government research, emissions from energy extraction on federal lands and oceans have been contributing roughly four times more GHG emissions than the lands have been absorbing naturally, making federal lands a net source of climate pollution.[20]

Investment in carbon removal through natural systems on public lands would benefit the climate, and has the potential to create numerous jobs. Optimizing the potential for public land to store carbon requires a massive investment in jobs to deliver the necessary restoration of forests, grasslands, and wetlands. These jobs tend to be durable and concentrated in rural or semi-rural areas in need of employment opportunity and investment.

Key Principles

• **The Department of the Interior should manage its 500 million acres of land to optimize carbon sequestration and storage in natural ecosystems.** Non-forested areas also offer meaningful potential for climate mitigation. For example, federal rangelands offer potential sequestration of 16.6 million metric tons of carbon dioxide each year.[21]

• **Carbon emissions on U.S. public lands should reach net zero by 2030,** including by putting people to work on restoration of our natural systems and responsibly permitting and building zero-carbon energy projects.

Policy Recommendation

• **Conserve and restore wetlands and grasslands,** thus increasing their capacity to store carbon, including through reauthorizing and increasing funding for successful programs such as the North American Wetlands Conservation Act.

Working Agricultural Lands

America's farmers, ranchers, and private forest owners are both highly threatened by climate change and well equipped to play a role in successful climate mitigation and adaptation. The agriculture sector can help mitigate climate change through management practices that sequester carbon in soil and vegetation, through reducing GHG emissions (including nitrous oxide and methane emissions), and through avoiding conversion of grasslands, wetlands, and forests. Climate-smart agricultural practices such as cover cropping, reduced tillage, rotational grazing, and diversified cropping systems have the potential to sequester carbon while also providing benefits for soil, water, and wildlife—and helping farmers adapt to climate change. Fully implementing these practices could remove as much as 100-200 million metric tons of carbon dioxide annually by 2050.[22]

Key Principles

• **Avoid conversion of natural ecosystems such as grasslands, which sequester carbon and have high biodiversity value.** Plowing natural areas like native prairie and converting the land to intensive crop production

reverses decades, centuries, or even millennia of carbon accumulation and storage in the soil. This massive release of carbon into the atmosphere—which has rivaled that from tropical deforestation hotspots in the last two decades—is particularly problematic, as we have a very limited amount of time available to avoid the most destructive impacts of climate change.[23]

• **Make the most out of limited funding.** Even envisioning a significant increase in funding for conservation practices, federal money would still be limited. To make the most of available dollars, funding should be targeted to:

  • The most effective practices and processes that offer the biggest bang for the buck;

  • Practices with multiple natural resource benefits, to maximize co-benefits to water, wildlife, air quality, farm resilience, soil health, and biodiversity;

  • Practices with high carbon benefits but low return to farmers and ranchers. Practices such as buffer strips provide significant carbon benefits and wildlife and water co-benefits, but don't help improve yield or reduce inputs for farmers—so we can't expect farmers to adopt these practices on their own; and

  • Practices that promote both sequestration and resilience.

• **Provide transition assistance, but not indefinite funding, for adoption of practices that can provide net benefits to farmers and ranchers in the short-to-medium term.** Some GHG-beneficial practices, such as cover cropping, rotational grazing and no-till planting can yield net

Esh Farm in Lancaster County, Pennsylvania. The farm has implemented best management practices to support trout habitat, as well as stream fencing, livestock crossings, and a riparian forest buffer. Credit: Will Parson, Chesapeake Bay Program.

The agriculture sector can help mitigate climate change through management practices that sequester carbon in soil and vegetation, through reducing GHG emissions, and through avoiding conversion of grasslands, wetlands, and forests.

benefits to producers within a few years. In such cases, paying indefinitely for such practices sends the wrong message—that the practice is only worth adopting if it results in a payment—and cessation of the payments may result in high rates of practice reversal. However, when culturally appropriate outreach and technical assistance are targeted at assisting producers in meeting their production needs and realizing the benefits the practices provide, the motivation is built to maintain the practice long term. Short-term transitional payments, and/or risk management protection to increase producer willingness to try something new, may help accelerate adoption.

• **Reward high performers and early adopters, but pay for adoption of new practices and increased levels of conservation.** Only providing benefits to new adopters of GHG-beneficial practices fails to reward early adopters and the GHG benefits they have provided, and can even lead to practice reversal. Yet paying for practices that would have been implemented anyway does not result in net benefits. A middle ground is to allow early adopters of GHG-beneficial practices bonuses or enhanced payments and/or priority access to programs that reward adoption of additional practices.

• **Prioritize socially disadvantaged, veteran, and beginning farmers and ranchers.** These are the producers least likely to have access to the capital and information required to implement many practices. They may also represent some of the farmers most ready and willing to adopt these practices.

• **Focus on more permanent conservation strategies to ensure long-term benefits.** Examples include long-term or permanent easements and putting mechanisms in place to ensure against reversibility.

• **Ensure the predicted GHG benefits of practices are based on best available science, but allow for some degree of uncertainty in instances where measurement is prohibitively expensive or resource intensive.** The difficulty in measuring the exact GHG benefits for some practices, such as cover cropping, can mean that some practices become prohibitively expensive or impractical to monitor if a high degree of accuracy is required. An alternative is to use the best available science to conservatively predict the GHG benefits of a practice in a given region. Periodic sampling of results can be used to fine-tune predicted GHG benefits.

• **Provide significantly more technical assistance, outreach, education, and conservation planning.** Outreach efforts should expand on current technical assistance to address social and cultural components of climate-smart agriculture to ensure lasting adoption of sustainable practices.

• **Invest heavily in research and development, particularly around new and innovative crops and practices.** Research efforts should include both traditional institutions (U.S. Department of Agriculture (USDA) agencies, land grant universities) and innovative arrangements (citizen science, data sharing platforms) to maximize applicability across field, farm, and landscape contexts.

Policy Recommendations

• **Establish a new federal conservation policy for grasslands, a North American Grassland Conservation Act,** modeled after the North American Wetland Conservation Act, that will maintain or increase carbon storage capacity, bolster community resilience from flooding and hurricanes, support ranchers, and have the additional benefit of improving habitat for birds, pollinators, and wildlife.

• **Improve climate benefits of existing conservation programs.** In addition to increased funding to existing Farm Bill programs, there are numerous ways in which these programs can better utilize limited dollars to achieve climate gains. These include cataloging climate benefits or drawbacks of all existing conservation practice standards; adjusting programmatic rankings of projects to reward those that better benefit the climate and denying projects likely to harm it; adding climate as a priority initiative within the Environmental Quality Incentives Program (EQIP);

creating bundles of climate-smart agriculture practices within the Conservation Stewardship Program (CSP) and adding these practices into nutrient management bundles; better emphasizing and utilizing easements (including permanent easement options) and targeting them to areas at greatest risk of conversion; expanding the Conservation Reserve Program (CRP) and creating long-term and permanent contract options to avoid losing the land's carbon storage in the future; and making climate a sub-category of project initiatives within the Regional Conservation Partnership Program (RCPP).

• Reform initiatives across various USDA agencies to spark climate action and encourage climate mitigation.

• Call on the Secretary of Agriculture to study the risk implications of climate change for USDA programs (including the consequences to crop insurance of inhibiting or failing to encourage producers to adapt by implementing less risky practices) and establish a plan for USDA to address those risks.

• Create a department-wide crop diversification initiative, with an emphasis on establishing diverse cropping systems through research, credit, conservation, and rural development programs.

• Create a climate-smart agriculture certification program, modeled after the National Organic Program.

A farm in Linn County, Iowa. America's farmers and ranchers are well equipped to play a role in successful climate mitigation and adaptation. Credit: Rich Herrmann, via Flickr.

• Direct USDA to study how each Farm Bill program—including but not limited to conservation programs—can do more to address climate change. This can include ways to sequester more carbon and avoid GHG emissions.

• Reform the federal crop insurance program to actively promote climate-smart agriculture practices, remove barriers to their adoption, and incorporate the resulting reduction in risk. Right now there are many ways in which existing crop insurance structure and rules stand in the way of farmers who want to implement new practices. There are missed opportunities for rewarding farmers who do the right thing, and for using the immense taxpayer subsidies of the crop insurance program to force better climate performance. The program has not recognized that better conservation and climate stewardship reduce taxpayer risk by conferring to the farm increased performance and resilience.

• Prevent conversion of native grasslands to croplands through a nationwide Sodsaver provision, which protects native prairies by reducing federal premium subsidies for crop insurance on land where native sod has been plowed for row crop planting.

• Reduce on-farm emissions and support on-farm renewable energy.

• Expand the Rural Energy for America Program through significant new funding, with a strong investment in anaerobic digesters.

• Incentivize or mandate methane reduction from manure lagoons.

• Dedicate significant resources to research, data collection, and dissemination of knowledge.

• Increase funding for research into crop varieties with increased carbon sequestration potential, such as perennial varieties of crops and enhanced root crops.

Native vegetation planted on restored sand dunes in Florida. Natural infrastructure such as dunes can enhance the resilience of human communities to climate change. Credit: Kim Shiflett, NASA.

• Create and maintain data sharing networks to allow farmers, agencies, researchers, and industry to share and utilize data on practices, soil health, yield, carbon sequestration, and climate impacts.

• Increase funding for the Sustainable Agriculture Research and Education (SARE) program and the National Institute of Food and Agriculture (NIFA) and direct a portion of the funding to climate-smart agriculture and resilience.

• Direct USDA to increase research on manure storage, biogas, and digestive emissions from livestock.

• Provide mandatory funding for Climate Hubs for each state and the Long Term Agricultural Research (LTAR) network. Direct LTAR to address long-term climate mitigation strategies.

• Significantly increase funding for technical assistance within the Natural Resources Conservation Service (NRCS) and other USDA agencies, with a focus on guidance on practices benefiting long-term climate adaption and mitigation.

• Increase capacity and climate literacy for outreach from USDA, land grant universities, and Cooperative Extension services. Establish a state-level climate outreach coordinator position within each state NRCS office.

• Increase USDA social science capacity to better guide outreach efforts to address social and cultural barriers to long-term adoption of climate-smart agricultural practices, and share this learning with other outreach agents.

Blue Carbon (Oceans and Coastal Ecosystems)

Oceans and coastal ecosystems play a valuable role in mitigating climate change, particularly through the ability of wetlands, mangroves, and seagrasses to capture and store carbon, as well as buffer the effects of sea-level rise and increasingly severe storms. These repositories of "blue carbon" sequester more carbon per unit area than forests with longer average duration.[24] Therefore, maintenance and enhancement of these ecosystems are a critical part of a successful climate strategy—for mitigation, climate adaptation, and community resilience objectives.

Key Principles

• **Coastal and marine systems are a major part of the climate solution.** Protection of existing coastal and marine ecosystems—specifically mangroves, seagrass, and salt marshes—offers the best opportunities for carbon mitigation and broader adaptation co-benefits. In particular, resource managers should implement strategies to enhance the resilience of these habitats to sea-level rise and coastal storms, which can result in habitat loss and subsequent carbon losses.

• **Habitat protection is more effective as a carbon sink, but habitat restoration and creation are also important.** Existing healthy habitat has greater carbon sequestration and storage capacity than degraded or lost habitat that has been restored. In addition, as habitat is lost or degraded, it can release stored carbon and methane back into the atmosphere.

Riprap lining a living shoreline in Gloucester County, Virginia. Credit: Steve Droter, Chesapeake Bay Program.

Oceans and coastal ecosystems play a valuable role in mitigating climate change, particularly through the ability of wetlands, mangroves, and seagrasses to capture and store carbon. In fact, these repositories of "blue carbon" sequester more carbon per unit area than forests with longer average duration.

• Prioritize blue carbon solutions that offer sustained atmospheric carbon dioxide removal benefits. Investing in coastal ecosystem restoration to ensure blue carbon habitats persist and remain resilient in the face of future threats will likely result in long-term carbon removal benefits.

Policy Recommendations

• Invest in planning and construction of ecosystem restoration and protection projects, including blue carbon ecosystems, to mitigate the impacts of climate change, promote community resilience, and allow wildlife to thrive. Many iconic ecosystems around the nation, including but not limited to the Everglades, Mississippi River Delta, the Great Lakes, the Chesapeake Bay, and the Delaware River Watershed have associated restoration plans or opportunities that should be better resourced to expedite recovery. Many of these iconic ecosystems absorb and store carbon and serve as the first line of defense against climate-fueled storms and flooding for surrounding communities. These special places are also nationally significant hubs of tourism, and many support and protect other critical industries including fisheries, shipping, and energy production. Restoration implementation also supports $25 billion in economic activity that directly employs 126,000 people and supports 95,000 other jobs, mostly in small businesses.[25]

• Support creative finance opportunities. To increase investments in conservation and restoration of blue carbon ecosystems, innovative finance opportunities and public-private partnerships should be explored, such as insurance, debt swaps, taxes, and credits. Ecosystem restoration and natural infrastructure investments should be focused in the most vulnerable areas that are sensitive to natural and human threats, including where salt marshes, mangroves, and seagrass beds are currently healthy and functioning but are facing future disturbance threats such as development.

• Fund research into the carbon removal benefits of blue carbon ecosystems. Additional research is needed to develop a more comprehensive understanding of carbon fluxes, assess existing blue carbon sinks, and fill research gaps—particularly in blue carbon hotspots identified by scientists, such as the Gulf of Mexico. Similarly, improved methods of accounting for carbon storage and sequestration fluxes would enable the integration of all blue carbon sources (not just wetlands) in Environmental Protection Agency and local GHG inventories.

The Ehrenfeld Abandoned Mine Reclamation Project in Pennsylvania. Credit: U.S. Department of the Interior.

With proper management, abandoned mine lands have the potential to sequester millions of tons of carbon dioxide annually in new and restored forests, grasslands, and soils.

Mined Lands Reclamation

Degraded lands lose significant amounts of carbon from the soil through erosion, leaching, and decomposition.[26] The U.S. Department of the Interior's Office of Surface Mining estimates there are approximately 1 million acres of abandoned mine land in Appalachia alone. With proper management, these lands have the potential to sequester millions of tons of carbon dioxide annually in new and restored forests, grasslands, and soils. There is no national clean-up program or fund to reclaim the more than 500,000 abandoned hardrock mine sites across the United States (clean-up that would cost an estimated $50 billion). There is, however, an existing federal clean-up fund for abandoned coal mine sites, the Abandoned Mine Lands Reclamation Fund, set to expire in 2021 even though there remains more than $10 billion in outstanding abandoned coal site reclamation work. This could be an important resource for conducting vital reclamation and ecosystem restoration projects that optimize carbon removal and storage.

Key Principles

• **Invest in and address the compelling national need to aggressively reclaim and restore abandoned coal and hardrock mine sites to produce multiple benefits.** Reclamation should fix serious existing environmental damage while contributing to future carbon sequestration. Cleaning up these sites will abate serious land erosion and severe long-term water pollution problems. With intentional revegetation methods, reclaiming these lands can bolster carbon sequestration from previously severely degraded landscapes. Reclamation of abandoned underground coal mines also helps reduce leaking methane. In certain cases, underground mine openings and cracks emit fugitive methane emissions from coal shafts. Reclamation work to close or seal them would protect public safety and curb emissions.

• **Invest in abandoned mine reclamation to create well-paying jobs, stimulate local economies, and spur new economic development.** Reclamation work produces direct and indirect employment and economic benefits. When reclamation priorities and plans are created with local community involvement, they can be built to deliver longer-term economic development in some of the most climate/energy/economically distressed regions.

Policy Recommendations

• **Enact bipartisan legislation (RECLAIM Act) to invest $1 billion over 5 years in eligible coal states** to accelerate abandoned mine cleanups while helping distressed coal communities transition to a more stable and equitable future.[27]

• **Reauthorize Title IV of the Surface Mining Control and Reclamation Act of 1977** to extend the Abandoned Mine Land Fund for coal through 2036, to ensure the fund does not expire in 2021 and has the financial resources to address the unmet coal reclamation need.[28]

• **Through 1872 Mining Law reform legislation, establish a national hardrock abandoned clean-up program funded by industry fees.** Supporting agency regulations and policies for such legislation must require reclamation and revegetation standards or directives to optimize carbon sequestration and climate resiliency outcomes.[29]

Arrow arum, a freshwater marsh plant, in the Alligator River National Wildlife Refuge. Credit: NC Wetlands.

Natural Solutions for Climate Adaptation

Recognizing that climate change is already having significant impacts on people and wildlife, and that further changes are inevitable, climate adaptation is a necessary complement to mitigation efforts. Broadly, climate adaptation refers to strategies and actions that enhance the ability of natural and human communities to withstand or adjust to climate change and its associated impacts. Resilience, in turn, may be a desired outcome of those adaptation strategies.

For human communities, resilience refers to their ability to maintain valued socio-economic systems in the face of near-term disturbances and long-term climatic changes. For natural communities, resilience generally reflects the ability of ecological systems (e.g., forests, coastal wetlands, coral reefs) to resist, recover from, or adapt to those changes and maintain desired functions.

While efforts are wide-ranging to enhance the resilience of both natural and human communities to the impacts of climate change, this platform is focused on natural and nature-based strategies to reduce risks to human communities from climate-related natural hazards.

Principles for Natural and Nature-Based Resilience Measures

• **Protecting and restoring natural infrastructure, such as wetlands, dunes, and riparian corridors, can enhance resilience of human communities to climate-fueled disasters and provide critical co-benefits to society.** Natural and nature-based approaches (e.g., living shorelines and constructed oyster reefs) should be prioritized for hazard mitigation because of their benefits for water and habitat quality. They should be used in combination with or as an alternative to gray infrastructure wherever feasible.

• **Investing in risk reduction now can produce large savings in the long term.** Investing in risk reduction measures well in advance of floods, hurricanes, wildfires, and other hazards provides better outcomes for communities than rebuilding post-disaster. It is estimated that for every $1 spent on risk reduction activities, the United States saves $6 in disaster costs, producing large savings for taxpayers and insurance policy holders over the long term.[30]

• **Social equity considerations are a necessary component of any community resilience strategy.** Climate impacts are unevenly distributed across society, and frontline communities directly impacted by climate change should be engaged in resilience planning to help ensure shared benefits. Social justice and equity are important considerations in the development and implementation of durable and fair national climate policy and any related adaptation or disaster policy.

A great blue heron. Credit: Miki Jourdan, via Flickr.

Flood and Storm Risk Reduction

Key Principles

• **Along our coastline and in floodplains, we must prevent new development and protect natural open space in hazard-prone areas.** One of the best opportunities to reduce risks to communities from flooding and hurricanes is to keep people out of harm's way in the first place. We must also work to protect natural open spaces adjacent to vulnerable marsh habitat, to enable marsh migration with rising sea levels, and avoid conversion of marsh to open water.

• **It is time to adapt to increased risk through new forms of protection, accommodation, and retreat.** With rising coastal risks, we'll need to shift our traditional approaches to flood control and community protection and effectively buffer communities from natural hazards. We must also plan for inevitable changes and making community lifelines (i.e., essential community and government services) more resilient to extremes in climate and weather.

• **We should restore for the future, not recreate the past.** With the realities of sea level rise, our coastlines in particular will fundamentally change despite our best interventions. Smart, strategic restoration should be future-facing, and designed to sustainably provide ecosystem services.

• **Planning is critical to successful adaptation, particularly along our dynamic coastlines and in floodplains.** Resilience and hazard mitigation planning is an iterative process that requires a long-term commitment by states and supportive federal agencies. To the extent possible, different state planning efforts (hazard mitigation plans, coastal zone management plans, etc.) should be coordinated or integrated in furtherance of a multi-sectoral, science-based, and cohesive vision for adaptation. Strong plans should also: define goals and set clear expectations; be anchored in science; account for uncertainty and residual risk; focus on impacts to people; and identify funding needs and challenges.

Policy Priorities

• **Establish a Resilient Communities Revolving Loan Fund (RLF) and Grant Program** to provide low- to zero-interest loans for communities to invest in projects and programs that improve disaster preparedness and long-term resiliency, with an emphasis on the use of natural defenses to achieve those goals. To support efforts in lower-income communities, the RLF should be administered alongside a grant program with aligned goals, or should include a mechanism to ensure access to the program for communities that otherwise would not have the resources available to participate. The National Wildlife Federation recommends an initial federal investment of $60 billion over 5 years, where loan repayments replenish the fund for additional projects over time.[31]

• **Increase investments in pre-disaster mitigation programs.** Historically, the vast majority of mitigation dollars have flowed to communities after disaster strikes, often through Federal Emergency Management Agency (FEMA) and Department of Housing and Urban Development (HUD) grant programs. While this support is critical to help communities get back on their feet, an increased investment in proactive mitigation is an efficient and cost-effective way to decrease future damages. Per provisions in the 2018 Disaster Recovery Reform Act, FEMA now has the authority to set aside an amount equivalent to 6 percent of the estimated aggregate total of other FEMA disaster grants for pre-disaster mitigation assistance. This set-aside authority as drafted is optional and at the discretion of the President. It should be made mandatory and the percentage increased, to ensure adequate investment in resilience pre-disaster. Congress must also prioritize direct mitigation investments in historically disadvantaged and economically vulnerable communities.

The Dosewallips River floodplain in Washington, site of a project to create and maintain wetland habitats. Credit: C. Swenson, USFWS Pacific Region.

It is time to adapt to increased risk through new forms of protection, accommodation, and retreat.

Oyster reef breakwaters and native marsh grasses line a living shoreline in Destin, Florida. Credit: Jennifer McPeak.

Protecting and restoring natural infrastructure, such as wetlands, dunes, and riparian corridors, can enhance resilience of human communities to climate-fueled disasters and provide critical co-benefits to society.

• **Reauthorize and reform the National Flood Insurance Program (NFIP).** After 13 short-term extensions, Congress must fully reauthorize and modernize the NFIP. Needed reforms include resources to increase accuracy of flood risk maps and additional mitigation investments to reduce overall risk, including through community-wide nature-based mitigation approaches. Such improvements would both decrease at-risk infrastructure and help inform future, smarter infrastructure investments.

• **Strengthen NFIP eligibility rules to address natural infrastructure.** FEMA is responsible for establishing eligibility rules for community participation in the NFIP. FEMA should update eligibility criteria to require communities to include within their Flood Hazard Mitigation Plans an analysis of the flood risk mitigation potential of the natural infrastructure within their boundaries. Communities already participating in the program should be given a 5-year deadline to update their plans and complete this analysis.

• **Reestablish Federal Flood Protection Standards that apply to all federal infrastructure spending.** Ensure that all federal dollars expended to support the construction of public buildings, facilities, and other infrastructure account for the future impacts of climate change and associated risks in their design and construction, and avoid investments in floodplains and coastal areas vulnerable to sea level rise.

• **Strengthen and expand the Coastal Barrier Resources Act.** As more storms and sea level rise alter high-risk areas along our coast, it is imperative to update and modernize the Coastal Barrier Resources System (CBRS) maps to continue to maximize the benefits of this program, and to protect coastal communities and natural resources. Anticipating the migration of shoreline features inland, we must look for ways to support open spaces that can accommodate this change in a fiscally and environmentally responsible way. Strategically expanding the CBRS shoreward, in consideration of anticipated sea level rise scenarios, would make good fiscal, environmental, and public safety sense.

• **Significantly increase funding for competitive grant programs that fund natural infrastructure or climate-smart solutions.** Such programs can encourage innovation and create a low-risk opportunity for communities to increase their comfort level with new risk reduction techniques or types of projects. Examples of grant programs that merit new or increased funding include:

  • The National Coastal Resilience Fund, a competitive grant program administered by the National Fish and Wildlife Foundation in partnership with the National Oceanic and Atmospheric Administration (NOAA), to restore, increase, and strengthen natural infrastructure to protect coastal communities from storm and flood hazards.[32]

• The Living Shorelines Act of 2019 (H.R. 3115), which establishes a NOAA grant program and associated monitoring requirements for implementation of living shorelines projects around the nation.

• Reform Army Corps and FEMA Benefit Cost Analyses. These benefit-cost analyses (BCAs) are often wildly inaccurate and do not provide a reliable assessment of whether a project is in the federal interest. Congress should modernize the BCA requirements to ensure that ecosystem services lost are counted as a project cost, and ecosystem services gained are counted as a benefit. Congress should also prevent the Army Corps from counting as benefits actions that are contrary to federal law and policy, such as agricultural development benefits created by draining wetlands, development benefits resulting from new or intensified use of floodplains or wetlands, or flood reduction benefits from new or intensified use of lands subject to flood easements or permanent conservation easements.

• Direct the development of national guidance on how to value natural solutions. Despite the many benefits that natural systems provide, the majority of these often go unaccounted for in project or impact evaluations. There have been some federal steps in a helpful direction (such as the 2013 Principles and Requirements for Federal Investments in Water Resources by the Council on Environmental Quality).[33] However, there is still a need for a consistent approach for valuing the benefits of natural infrastructure and to develop tools, data, and best practices to advance the integration of such approaches into hazard mitigation and water resource planning.

• Significantly increase federal investments in America's water infrastructure, prioritizing natural solutions and climate-resilient infrastructure. Our water and wastewater facilities have exceeded their intended lifespans and are breaking down, with the most severe impacts often disproportionately borne by low-income communities and communities of color. The threat of climate change is further stressing these water systems as they increasingly struggle to keep up with flooding, sea level rise, droughts, and other impacts. To help address our infrastructure backlog and adapt our water and wastewater utilities to a changing climate, Congress should increase federal investments in water infrastructure, including roughly tripling appropriations to the Clean Water State Revolving Fund (from $1.7 billion in FY18 to $6 billion annually) and the Drinking Water State Revolving Fund (from $1.95 billion in 2020 to $6 billion). This funding should require and incentivize the use of natural and green infrastructure and invest in making our water systems more climate resilient.[34]

Mangroves in Everglades National Park. Protection of existing coastal ecosystems, including mangroves, offers opportunities for carbon mitigation and climate adaptation. Credit: dconvertini, via Flickr.

Endnotes

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An American alligator in Everglades National Park. Credit: Judy Gallagher, via Flickr.

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