

NATURE-BASED SOLUTIONS RESOURCE GUIDE 2.0

COMPENDIUM OF FEDERAL EXAMPLES,
GUIDANCE, RESOURCE DOCUMENTS,
TOOLS, TECHNICAL ASSISTANCE, AND
FUNDING PROGRAMS

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Summary

The impacts of climate change and the continual loss of nature endanger American communities, ecosystems, and infrastructure. To help achieve national climate, conservation and equity goals, the Biden-Harris Administration is investing in nature-based solutions. These solutions are actions to protect, sustainably manage, or restore natural or modified ecosystems to address societal challenges, simultaneously providing benefits for people and the environment.¹

Nature-based solutions are being successfully funded, permitted, and implemented by many federal agencies and partners. Yet, these solutions are far from reaching their full potential. One challenge to further adoption is limited awareness and skills for using nature-based solutions. This guide provides a compendium of federal and partner cases and resources that can help overcome this challenge.

The guide contains 30 examples of ways that federal agencies are using nature-based solutions to achieve their goals. The diverse set of examples demonstrates that nature-based solutions can provide many different benefits. For example, nature-based solutions have been used to make federal buildings and assets more resilient to natural hazards and climate impacts. Some agencies have invested in nature to reduce operation and management costs, like those for heating, cooling and stormwater management.

Federal agencies are also supporting communities in their use of nature-based solutions. For example, communities have used federal funding to restore and create wetlands, greenspace, pollinator habitat, and bioswales that enhance resilience of low-income housing and make roads safer. Wetlands and native plants have been used to capture stormwater, reducing flooding and stormwater management costs. Communities have grown rain gardens and shade trees, and native habitats along walking and biking paths as part of their journey towards improved public health. Good jobs have been supported for foresters, ranchers, landscape architects, stormwater engineers and others across sectors responsible for designing, building, and managing nature-based solutions. Shaded fire breaks have reduced the risk of catastrophic wildfires. Tribal Nations and Indigenous Peoples have revived plants and wildlife they value, reconnecting people to important cultural practices and increasing landscape resilience. Communities that have been denied access to nature in the past have been connected to greenspaces in and around cities. Science and evidence have informed these actions, and through all of these efforts, nature has been saved or strengthened.

Despite the breadth of Federal experience, more can be done to accelerate adoption of nature-based solutions by the federal government, partners and communities. In 2022, the Biden-Harris Administration released version 1.0 of this guide and a companion report on “Opportunities to Accelerate Nature-Based Solutions: A Roadmap for Climate Progress, Thriving Nature, Equity

¹ United Nations Environment Assembly. 2020. Resolution adopted by the United Nations Environment Assembly on 2 March 2022—Nature-based solutions for supporting sustainable development, UNEP/EA.5/Res.5. <https://wedocs.unep.org/bitstream/handle/20.500.11822/39752/K2200677%20-%20UNEP-EA.5-Res.5%20-%20Advance.pdf?sequence=1&isAllowed=y>.



and Prosperity.”² The Roadmap identified strategic actions for unlocking the full potential of nature-based solutions. One year after the Roadmap’s release, version 2.0 of this Resource Guide provides additional resources for deploying nature-based solutions. Version 2.0 contains a summary and links to 279 federal knowledge resources, tools, guidance, and technical assistance on nature-based solutions, including 77 new federal resources released in 2023. Many of these resources focus on solutions to reduce risks, especially coastal flood risks. In the last year, agencies added resources to fill gaps for designing nature-based solutions that deliver benefits such as fire and heat risk reduction, jobs, and equity.

This guide also provides a new compendium of 140 federal funding programs that have supported or currently support nature-based solutions. These programs are offered by a diverse set of agencies, illustrating how these solutions can advance a wide range of missions. A few programs solely support these nature-based solutions; the majority allow nature-based solutions as one of many viable approaches. Much of the potential to deliver the benefits anticipated by these funding programs is still untapped. Reported federal funding programs provide more support for planning, design, implementation and construction phases of nature-based solutions, often leaving operations, maintenance and monitoring unsupported. Increased awareness of the types of funding programs that can support nature-based solutions coupled with the resources to guide their development will help to accelerate their implementation.

Together, the resources in this guide provide a firm foundation for accelerating implementation of nature-based solutions, and will help agencies and communities identify opportunities to continue developing funding and resources to unlock their full potential.

² White House Council on Environmental Quality, White House Office of Science and Technology Policy, White House Domestic Climate Policy Office, 2022. Opportunities for Accelerating Nature-Based Solutions: A Roadmap for Climate Progress, Thriving Nature, Equity, and Prosperity. Report to the National Climate Task Force. Washington, D.C.



Abbreviations and Acronyms

AFB	Air Force Base
BIA	U.S. Bureau of Indian Affairs
BOEM	U.S. Bureau of Ocean Energy Management
CEQ	White House Council on Environmental Quality
DHS	U.S. Department of Homeland Security
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOT	U.S. Department of Transportation
EDA	U.S. Economic Development Administration
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FWS	Fish and Wildlife Service
GSA	General Services Administration
HUD	U.S. Department of Housing and Urban Development
NFWF	National Fish and Wildlife Foundation
NIDS	Natural Infrastructure in Dryland Streams
NOAA	National Oceanic and Atmospheric Administration
NPS	U.S. National Park Service
NRCS	Natural Resources Conservation Service
OIA	U.S. Department of the Interior Office of Insular Affairs
OSTP	White House Office of Science and Technology Policy
ROI	Return on Investment
USACE	U.S. Army Corps of Engineers
USAID	U.S. Agency for International Development
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USGBC	U.S. Green Building Council
USGS	U.S. Geological Survey



Federal Stories: Nature-Based Solutions in Action

Federal agencies have pioneered nature-based solutions on federal lands and waters, in federal facilities, and in partnership with communities, companies, and Tribal, state, local, territorial and other national governments. Examples are available from across the federal family, demonstrating the broad relevance of nature-based solutions to a wide range of American challenges and opportunities.

For example, nature-based solutions have been used to make federal buildings and assets more resilient to natural hazards and climate impacts. These solutions have also been used to reduce operation and management costs, like those for heating and cooling, and stormwater management. Federal agencies have supported communities in their use of nature-based solutions to provide many benefits, including to:

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| <ul style="list-style-type: none">• build resilient low-income housing• improve transportation safety• manage stormwater• reduce cooling costs• reduce heat stress• increase the lifetime of infrastructure• support good jobs• increase community engagement• improve worker satisfaction• slow climate change• adapt to climate impacts• reduce wildfire risk• provide recreational opportunities• reduce flooding, sea level rise, and erosion risk to homes, roads, and other infrastructure• slow land subsidence• improve mental and physical health• provide opportunities for nature education• support community values• improve water quality, clean water supplies• reduce future disaster risks• improve knowledge and evidence• protect culturally important sites, experiences• reduce construction and maintenance costs• support food production• protect and rebuild natural habitats• support wildlife• overcome environmental injustices | <ul style="list-style-type: none">• conserve water supplies, reduce effects of drought• provide a beneficial use of dredge material• reduce dredge and disposal costs• benefit local economies, support incomes• reduce business closures from flooding• respect Indigenous Knowledge• maintain Tribal and Native American practices• support practices by private landowners• strengthen private landowner social networks• create corridors for wildlife and connect landscapes• support military operations and readiness• improve living conditions for military service members• improve water clarity• engage volunteers• control invasive species• recharge groundwater• protect threatened and endangered species• reduce need for fertilizers, machinery use• reduce dust storms• improve college campus sustainability• conserve water• beautify landscapes• create school gardens and outdoor classrooms• reduce heat island effects in cities |
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Nature-based solutions adopted or supported by federal agencies include wetland restoration, transportation and facility construction, coral reef protection, farm and forest management, community development, school design, military base management, and beyond. The deployment of nature-based solutions for so many uses by so many agencies with Tribal, state, Territorial and local partners, reflects decades of research and experimentation. The examples below demonstrate that well-designed nature-based solutions can be cost-effective, outlast conventional options, be more resilient to the effects of climate change, and provide multiple benefits often beyond what conventional options provide. These examples are not exhaustive, but rather demonstrate the range of scales and contexts where agencies have adopted nature-based solutions.

AmeriCorps

AmeriCorps strengthens the nature-based solutions workforce

AmeriCorps serves as a modern-day Civilian Conservation Corps focused on tackling 21st century challenges, including environmental challenges, through a more diverse and equitable lens. AmeriCorps works closely with other federal agencies, Governor-appointed State Service Commissions, and non-profit partners. More than 16,000 AmeriCorps members and AmeriCorps Seniors volunteers are engaged each year in conservation, renewable energy, and community resilience projects. AmeriCorps is currently researching members' climate knowledge and literacy before and after participating in AmeriCorps' National Civilian Community Corps "Summer of Service." AmeriCorps-funded service is categorized into six focus areas; many members serve in the area of Environmental Stewardship, implementing a variety of nature-based solutions. Across all of AmeriCorps' focus areas, a large majority of members reported higher likelihoods of discussing the effects of political, social, local, or national issues on the community with their peers. Members also reported participating in their communities more after having served in AmeriCorps. Higher confidence in their ability to adequately address community concerns was also seen. These positive trends provide insight on workforce benefits like education, skills-building, and community participation that come with investing in jobs, including those focused on nature-based solutions and environmental stewardship.

Return on Investment Study: Nevada Conservation Corps

Since 1999, AmeriCorps has supported the work of the Nevada Conservation Corps, an environmental service program supporting Nevada's communities and public lands by deploying forestry teams that use "natural infrastructure solutions" to reduce the severity of wildfires, remove invasive species to increase benefits to society from ecosystems, and build and maintain trails that provide health and recreational benefits. The program contributes to capacity building and workforce development related to nature-based solutions. To better understand the impact of the program, AmeriCorps commissioned a Return on Investment (ROI) analysis. Among the benefits to various stakeholders measured in this study are reduced wildfire damage, environmental benefits, and improved trail access. The ROI study also pioneered strategies for monetizing outcomes associated with reduced greenhouse gas emissions and for discounting ecosystem benefits over regrowth periods.



U.S. Agency for International Development (USAID)

Natural Infrastructure for Water Security in Peru

Building on a series of smaller investments, the USAID/Peru Mission launched the Natural Infrastructure for Water Security project in 2017. Multiple emergencies—including drought, forest fires, floods and landslides—demonstrated Peru’s vulnerability to hydrological and climatic extremes. By working with private companies, local authorities and water users, USAID helped to develop a pipeline of natural infrastructure investment projects to ensure reliable, climate resilient water supplies for urban water utilities that are sustainable, cost-effective, and scalable. Through this program, USAID is: supporting nine Integrated Plans for Flood and Landslide Management that will incorporate \$15 million in natural infrastructure investments; facilitating approval of the Lima Region water utility’s five-year Optimized Master Plan including a one percent Payment for Ecosystem Services tariff; and catalyzing \$8 million in regional government investments. It also includes improving capacity and market access for natural infrastructure linked value chains, including honey and dairy production, that improve livelihoods for local communities and also increases the sustainability of nature-based solution investments.

Climate-Resilient Ecosystems and Livelihoods in Bangladesh

The USAID/Bangladesh Mission is working with Bangladesh to address their high vulnerability to climate stressors such as sea level rise, floods, droughts and other extreme weather events. The Mission’s Climate-Resilient Ecosystems and Livelihoods project focused on conserving biodiversity and strengthening ecosystems in four rural, biologically significant regions to help communities adapt to climate change. From 2012-2018, the project helped local communities across 30 protected area sites reduce climate risks to livelihoods and food security through improved management and conservation of forest and wetland ecosystems. Additional nature-based approaches to increase climate resilience of productivity and household livelihoods included agroforestry, the conservation of natural buffers adjacent to farming plots, and improvements in the management of wild fisheries that serve as safety nets during times of crop failure. The activities helped 965 villages develop climate change adaptation and mitigation plans that included nature-based approaches, and led to 17,000 households benefiting from increases in fish catches.

U.S. Department of Agriculture (USDA)

Central Sierra Recovery and Restoration Project

The southern Sierra Nevada in California is famous for iconic places like Yosemite Valley and the giant sequoia groves. In the past several years, this area of the Sierra Nevada has lost tens of millions of trees to wildfire. The USDA Joint Chiefs’ Landscape Restoration Partnership invested in several nature-based solutions including prescribed fire treatments and removing hazard trees in the wildland urban interface, a practice that is critical to reducing the threat of catastrophic wildfire to local communities and sensitive habitats. Fuels reduction and prescribed



fire treatments were applied to more than 3,100 acres and helped create a defensible space for firefighters to protect four communities during wildfires. The project supported rural economies by reducing fire hazards to help sustain the tourism industry of the Sierra Nevada foothills. These actions also improved habitat for at-risk species like the Pacific fisher, great grey owl, western pond turtle, and foothill yellow-legged frog. In addition, local communities, roads, and active restoration sites were aided by removing hazardous trees. The Landscape Restoration Partnership enables the Natural Resources Conservation Service (NRCS) and U.S. Forest Service (USFS) to collaborate with agricultural producers and forest landowners to invest in conservation and restoration at a big enough scale to make a difference.

Life from Soil: The Ranching Sustainability and Viability Planning Network

The goal of the Life from Soil project is to improve the ecological function of over 500,000 acres of grasslands in Montana, Nebraska, and South Dakota by 2027. Participating ranchers agree to nature-based solutions including zero conversion of their grasslands for ten years. They also develop and implement a written grazing management plan, complete trainings on grazing management, monitoring, and other topics, and participate in on-ranch ecological monitoring. Ranchers are also enrolled in the World Wildlife Fund's Ranch Systems and Viability Planning Network, which creates a support system for ranchers interested in making ecological improvements and enhancing the financial sustainability of their operations. These changes will produce a variety of benefits for ranches including improved soil health and water filtration, increased habitat for wildlife, the potential for reduced emissions through carbon storage and sequestration, improved financial sustainability, and stronger social networks among ranchers. The project leverages almost \$3 million in partner contributions, including eight partner-funded staff conservationists who provide technical assistance to ranchers.

U.S. Department of Commerce (DOC)

National Oceanic and Atmospheric Administration (NOAA)

Pointe au Chien Oyster Restoration Project

NOAA's Regional Coastal Resilience Grants program aided the Pointe au Chien Tribe in creating an oyster shell living shoreline, a type of nature-based solution. The living shoreline restores a section of coast and protects a culturally important site along Louisiana's Gulf Coast from erosion due to wave action, tidal currents, and sea level rise. Several culturally important Tribal earth mounds are located in the vicinity of the project site, which was actively eroding. Many Tribal members make a living from fishing; therefore, a nature-based solutions approach that improves local water quality and provides habitat for fish species is appealing. The area historically supported oyster reefs as well, which have demonstrated effectiveness in stopping or significantly reducing coastal erosion while improving water quality. Additionally, an oyster reef living shoreline is less costly than conventional "hard" shoreline armoring techniques. Additional benefits include improved habitat for fish, shellfish, and birds. The oyster restoration project, installed in 2019, has reduced erosion and has withstood the impacts of multiple hurricanes. The



Tribe is pleased with the performance of the living shoreline and is looking to expand on this method to protect other areas of their homeland.

Wetland Restoration for Ecosystem and Community Resilience in He'eia O'ahu

On O'ahu's Eastern Coast, 405 acres of wetlands and traditional Hawaiian agricultural practices have been restored. These nature-based solutions were supported by NOAA funding, administered by the National Fish and Wildlife Foundation (NFWF) National Coastal Resilience Fund. The project will reestablish ecological function in an area where eight streams once converged and connected to the largest bay in the main Hawaiian Islands. The project aims to minimize flood impacts, reduce sediment and nutrient runoff, create healthy habitat and fish passage for marine and estuarine species, and serve as a source of cultural practice, food, and clean water for the local community. Through the He'eia National Estuarine Research Reserve, The Nature Conservancy, and relationships with partners with local and conventional knowledge, the project is part of a decades-long effort. These partnership efforts ensure the work is locally and culturally grounded and able to engage thousands of volunteers. The project team developed a Before-After-Control-Impact monitoring approach to quantify the impacts of the restoration activities on water and sediment flow, vegetation, and wildlife populations, allowing for adaptive project management now and in the future.

U.S. Economic Development Administration (EDA)

EDA's Economic Integrator Catalyzes Interagency Investments in San Diego

Nestled between Balboa Park and the San Diego International Airport, Maple Canyon is a unique green space that buffers business with nature inside San Diego's sprawling urban core. When flooding hit the canyon in 2017, a vast ecosystem of interdependent commercial enterprises, transportation networks, and natural habitats was impacted. A \$6 million EDA grant to the city of San Diego was matched with \$6 million in local investment to support the final design, permitting, easement acquisition, and construction of vital infrastructure needed to protect San Diego businesses. The project includes innovative nature-based solutions including upstream improvements to reduce runoff and debris deposited into the city's stormwater infrastructure. These investments also mitigate the impact of flooding on local industry while enhancing outdoor recreation and economic development opportunities for the region. Thanks to the cooperation of federal, state, and local agencies—working with private sector partners—nearly 2,000 jobs dependent on the commercial-environmental ecosystem have been retained and an important landscape in urban Southern California has been preserved.

U.S. Department of Defense (DOD)

Permeable Pavement and Rain Gardens for Stormwater Management

Permeable pavement was installed at Joint Base Lewis-McChord near Tacoma, Washington and adjacent to Puget Sound. The use of roadside rain gardens and Eco-Priora permeable pavement



cleans and filters nearly 100% of stormwater runoff from one million square feet of surrounding hardscape and reduces pollutants discharged into Puget Sound. Limiting runoff from the installation allows Joint Base Lewis-McChord the flexibility to build and manage critical impervious infrastructure as needed to support military operations, like the airfield. The project also expanded a high traffic boulevard to make it more accessible and appealing to residents of the installation. The use of permeable pavement for sidewalks reduces the amount of heat absorbed by 35% and enabled the project to be constructed in winter when it is not feasible to use asphalt. Wider, tree-lined sidewalks are also more appealing to the installation community and visitors. Prioritizing stormwater filtration allowed for the installation to meet their goals of accessibility improvement, livability improvement, and stormwater runoff management more efficiently and sustainably.

MacDill Air Force Base (AFB) Shoreline Stabilization Project

MacDill AFB's shoreline in Tampa, Florida suffered significant erosion that resulted in the loss of shoreline and several native plant species, including century-old live oaks. It was estimated the base was losing as much as one horizontal foot of shoreline annually. A multi-phase nature-based solutions project is creating over 7,500 linear feet of oyster reefs, consisting of oyster shell and concrete oyster domes, installed along the shoreline since 2003. The project has successfully prevented erosion, attracted wildlife, and increased plant life. One oyster can filter up to five gallons of water per hour, acting as a natural cleanser for the Tampa Bay and making the water clearer and creating better habitat. The project is also cost-effective and is able to leverage volunteer support, resulting in lower costs and enhanced community interest in shoreline protection. Oyster reefs were chosen as the nature-based solution because they went beyond erosion control to create habitats as a living shoreline. The reduced wave energy and accumulated sediment encourages growth of native marsh grasses and mangroves, which further stabilizes the shoreline, creates habitat, and improves the ecosystem.

Use of Farm Animals to Control Invasive Species at Air Force Bases

Two California-based AFBs (Beale and Travis) are using farm animals to rid base lands of non-native invasive plants not easily managed by annual mowing. The effort is improving wildlife habitat, saving money, and protecting military resources. Grazing leads to shorter grass than mowing, improving habitat for federally-listed threatened species such as the California tiger salamander. The shorter grass also substantially reduces fire risk. There are financial benefits as well—the bases earn money from grazing leases while eliminating mowing costs and the need for herbicides or machinery. This innovative nature-based solution was chosen because it was cost-effective and beneficial to both the installations and the community, including community ranchers. Bases are saving money, reducing fire risk, and enhancing habitat for threatened and endangered species, all while the community benefits from reduced fire risk, improved habitat, and, for ranchers, access to additional pasture for the animals they lease to the bases.



U.S. Army Corps of Engineers (USACE)

Restoration of Deer Island For Habitat and a Resilient Mississippi Sound

The Deer Island Restoration project aims to restore the 3.5-mile-long island off the coast of Biloxi, Mississippi and to create long-term disposal capacity for material dredged from the nearby Biloxi Harbor Navigation Project. Dredged material from a navigation channel in the Biloxi Harbor was used at Deer Island to restore marsh, create habitat for terrestrial and aquatic species, and increase resilience in the shoreline for future storm events. The project was implemented using USACE's *Engineering with Nature* principles and actively considered the diverse needs of the community, including habitat health, water quality, safety, recreation, and the economy. Additionally, the project reduces costs by limiting acquisition of new material and the need for future dredging.

Santa Clara Pueblo Indigenous Knowledge in Action

USACE partnered with the Santa Clara Pueblo Tribal government and multiple federal agencies (e.g., FEMA, USDA, DOI, and EPA) to recover from the 2011 Las Conchas Wildfire in New Mexico, and to reduce future flood and disaster risk for local residents in the Santa Clara watershed. Indigenous Knowledge was used to select culturally-appropriate approaches such as limiting access to sacred spring locations and using locally available materials like tree transplants, logs, and other woody and rock debris to construct control check dams at key locations in the watershed. Low-impact nature-based solutions were prioritized to reduce the costs and impacts of greenhouse gas emissions associated with using non-native techniques and materials. The solutions, informed by Indigenous Knowledge, reduce flood risk, minimize disruption to fragile ecosystems, and protect cultural resources and practices.

Constructing the Oro Loma Horizontal Levee on the South San Francisco Bay Shoreline

In San Francisco Bay, nature-based solutions were constructed to filter wastewater, enhance the resilience of the shoreline, mitigate flood risk from sea level rise, and improve water quality and habitat for local animals and plants. A new wetland was constructed to serve as a horizontal levee and was designed to dampen wave energy, reduce flood risk, and restore lost habitat. A wet weather treatment basin uses vegetation and soils to help filter nutrients from wastewater through biological uptake of nutrients as water flows through the horizontal levee. The use of nature-based solutions provided a cost-effective means of maintaining the integrity of local waters by refining partially treated wastewater. It also reduced flood risk by promoting a wetland as a horizontal levee, leading to improved shoreline habitats that increase the resilience of coastal communities.



U.S. Department of Energy (DOE)

The Southern Appalachian Man and the Biosphere Cooperative

The Oak Ridge Reservation participates in the Southern Appalachian Man and the Biosphere Cooperative, a collective of land management agencies, scientists, and Tribal leaders that supports sustainability-focused decision-making in the Southern Appalachian region. The Oak Ridge National Environmental Research Park engages in conservation efforts with the Eastern Band of Cherokee Indians through the Cooperative. As part of the partnership, the Culturally Significant Plant Species Initiative helps conserve plants within the Reservation that are culturally significant for the Eastern Band of Cherokee Indians. The Laboratory also provides expertise in regional natural resources, geographic information systems, data science, and networking to plan the Extended Cultural Corridor, where natural area protection, set-asides, and low-impact use are important components.

Revitalization of the Fernald Preserve in Hamilton, Ohio

DOE's Office of Legacy Management manages the 1,050-acre Fernald Preserve, the habitat to more than 245 species of birds and 100 nesting spots. Within the Preserve, the Office maintains 385 acres of grassland and a 7-mile network of trails, making the Preserve one of the largest constructed wetland communities in Ohio. The main objectives in the Preserve are to maintain and improve wetland, prairie, and forest habitats; increase wildlife diversity; improve opportunities for birding; and to educate the public on successful ecological restoration. The Preserve is the site of a former World War II facility that once produced high-purity uranium for nuclear weapons. The Visitors Center, once a warehouse, is Ohio's first Leadership in Energy and Environmental Design (LEED) Platinum facility and includes a ground source heating/cooling system. The restoration of the site improves the natural quality and environmental health of the community and provides educational and recreational opportunities to the general public.

U.S. Department of Housing and Urban Development (HUD)

Rebuilding Oysters for “The Town the Oyster Built”

The Staten Island community of Tottenville, historically known as “The Town the Oyster Built,” was once protected by a series of oyster reefs, which in turn supported a robust oyster farming industry. Siltation, overharvesting, channel dredging, and human pathogens in the water resulted in the reefs' collapse. To build coastal resilience and revive the oyster reefs, the community received \$60 million in Community Development Block Grant—Disaster Recovery funding to construct 2,400 feet of nature-based solutions including near-shore breakwaters, partially submerged stone, and ecologically enhanced concrete structures. These features will dampen waves, reduce and reverse erosion, and provide habitats for oysters, tin fish, and other marine species. These structures form a barrier that protects the existing oyster reefs from storm surge, allowing them to grow and expand. Expanding the oyster reefs increases biodiversity and improves water quality as oysters filter water. In contrast to hard infrastructure like flood walls



and dikes, which displace rising water to nearby vulnerable areas, the project's necklace of breakwaters with oyster reefs and other marine habitats slows water movement (rather than redirect) and mitigates storm surges. The structures and reef area also provide educational and recreational opportunities. Partners have developed a Living Breakwaters curriculum for students in 6-8th grade science classes, and the project is seen as a model for community engagement and climate-adaptive green infrastructure. It won both the HUD Rebuild by Design competition in June 2014 and National Planning Achievement Award for Environmental Planning and is featured often in the media.

Recreation and Flood Management Through Liberty Green Park

In Pittsburgh, Pennsylvania, the Housing Authority of the City of Pittsburgh used a \$30 million Choice Neighborhoods grant to transform 14,500 square feet of underutilized land into Liberty Green Park. This greenspace was built to reduce flooding and provide recreation and gathering space for the community. Local community members had long advocated for a safe, high-quality recreational area after suffering from flash floods. The park is located on a plateau, which slopes down to busy nearby thoroughfares where community members have drowned during past flood events. To mitigate flood risk, the park contains a system of green infrastructure with native plants, newly planted trees, and bioswales that absorb 4.5 million gallons of water from the park and surrounding streets. This reduces flooding and slows rainwater such that sewage and roadway toxins do not flow into nearby rivers. The park contains grass-topped play mounds and is called a "super-playground," as it contains the largest play area in Pittsburgh and provides high-quality recreation to local neighborhoods. The park is a great example of how the Choice Neighborhoods program invests in comprehensive neighborhood improvements rather than just brick and mortar housing rehabilitation. It is also an example of how the program effectively integrates community feedback in planning, design, and construction.

U.S. Department of Homeland Security (DHS)

Federal Emergency Management Agency (FEMA)

Stormwater Management and Recreation: Mirabeau Water Garden

In New Orleans, Louisiana, a FEMA Hazard Mitigation grant funded the construction of the Mirabeau Water Garden in the Gentilly neighborhood. This urban stormwater park mitigates flooding while providing additional benefits to the community, which has a high social vulnerability³ and is located entirely below sea level. This stormwater park integrates bioretention with native vegetation to capture, store, and filter stormwater, thereby reducing flooding and preventing land subsidence. The park has a water storage capacity of over 11 million gallons and should result in a 50 – 60% reduction in flood damages from a 2-year storm event and 30 – 40% reduction in damages from a 10-year storm event. The flood reduction benefits have been calculated at nearly double the value of federal investment. The park features

³ Social vulnerability is the "susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood." More information can be found at <https://hazards.fema.gov/nri/social-vulnerability>.



recreation, health, and natural education amenities for the whole community to enjoy; reduces the burden of flood control on local gray infrastructure; protects local homes; reduces heat stress; and provides greenhouse gas mitigation benefits. The use of nature-based solutions also aligns with the values of the community partners who donated the land for the park.

Nature-Based Mitigation in an Era of California Megafires

In Sonoma County, California, a FEMA Building Resilient Infrastructure and Communities grant is supporting three pilot projects across 5,400 acres of the county to increase wildfire resilience. The nature-based solutions in this project expand on a set of conventional approaches like fuel reduction, building material choices, and preparedness and response planning typically applied at a neighborhood or town scale. It combines outreach and engagement with individual property owners to develop and implement a nature-based, landscape-scale approach to vegetation management and fire fuel reduction. This includes trimming undergrowth, fuels reduction for safe ingress and egress of emergency vehicles, and the creation of shaded green belts to serve as fire breaks. The project will apply an innovative systems approach of “Inside-out, Outside-In” that defines an inner core where property owners create and maintain defensible space and an outer vegetated buffer to reduce the risk of catastrophic wildfire losses in the Wildland Urban Interface through prevention and suppression. It is estimated that nearly 6,500 structures could be protected across Sonoma County through this project, which is piloting a comprehensive, holistic, landscape-scale approach that could be scaled into other high wildfire-risk areas.

Protecting Puerto Rico’s Rebuilt Roads with Nature-Based Solutions

In Puerto Rico, FEMA is working with the Puerto Rico Department of Transportation and Public Works to enhance road resilience in the wake of Hurricane Maria. Using Public Assistance mitigation funding, Vetiver grass, a non-invasive species, was planted alongside some of the damaged roads across Puerto Rico to stabilize adjacent slopes and provide protection from future erosion and landslides. FEMA staff created a template for this type of mitigation project to be easily replicated for other damaged roads across the island. This nature-based solution was used as an alternative to retaining walls, gabion baskets, and other conventional “gray infrastructure” and provides environmental benefits, including water quality improvement and erosion control. Cost-effective disaster resilience measures enable future risk reduction without large investments from communities that lack time, money, or capacity for other projects. This nature-based solution offers a relatively easy solution to mitigate road damage from natural disasters and provides a cost-effective alternative to a conventional hard infrastructure solution for erosion control that can be scaled across the Caribbean and in other flood-prone areas of the United States.

U.S. Coast Guard (USCG)

Incorporating nature-based solutions into the USCG Headquarters

The USCG headquarters complex was the first phase of a broader consolidation of the DHS headquarters at St. Elizabeth’s West Campus. A number of nature-based solutions were deployed in the construction of the complex, including green roofs, bioswales, rain gardens, wetland



shelves with a large retention pond, and the replication of local ecosystems through constructed soils and native plant palettes. The USCG notes several environmental and social benefits that informed its use of nature-based solutions in the headquarters' design, including increased biodiversity with woody shrubs and tree planting; reduced heat island effect by upwards of 15-degrees Fahrenheit; conservation of nearly 520,000 gallons of potable water from the District of Columbia reservoir; a 400% increase in carbon sequestration; and increased worker satisfaction for individuals working in the complex.

U.S. Department of the Interior (DOI)

U.S. Fish and Wildlife Service (FWS)

Delaware River Basin Restoration Program

In 2016, Congress authorized the Delaware River Basin Restoration Program, implemented by FWS, to advance collaborative partner conservation to support the Delaware River and its watershed. The Program provides funding for individual projects with a focus on reducing flooding and runoff, restoring fish and wildlife habitats, improving water quality, and enhancing public recreational access. As a pilot for increasing equity, the projects also address racial and economic disparities in access to nature and conservation outcomes by ensuring that 47 percent of these projects will impact a community in which residents have been denied access to natural resources in the past. In just five years, the Program has become a model for voluntary, incentive-driven approaches to landscape conservation that builds upon and strengthens existing partnerships. In recognition of the Program's success, the Bipartisan Infrastructure Law provided another \$26 million to FWS available over five years for implementation of the Delaware River Basin Restoration Program. In 2022, the program expects to fund 12 additional projects totaling \$4.7 million and leverage an approximately equal amount of matching funds. These projects will support innovative uses of nature-based solutions to improve wildlife habitat, sustain ecological functions in the face of climate change, and directly engage communities.

U.S. Geological Survey (USGS)

Restoration Collaborative Rehydrates Arid Landscapes and Conserves Biodiversity in the Madrean Sky Islands

The U.S. Geological Survey (USGS) is working with a bi-national, community-based collaboration of government and non-governmental organizations, private landowners, ranchers, students, volunteers, scientists, and land managers to improve restoration outcomes across the Madrean Sky Islands. This is a 56-million acre mountainous, pine-oak woodland region stretching across the border between Arizona and Mexico. The “*Colonias*” neighborhoods within 150 miles of the US-Mexico border have inadequate housing, lack sewer and water infrastructure, and subsist on below average household incomes. The USGS investigated the restoration benefits of low-cost, low-tech, rock detention structures installed in dryland streams. Rock detention structures, as well as beaver dams, are nature-based solutions that can restore natural watershed dynamics and nutrient cycles in arid ecosystems, creating and restoring



wetland-like environments. Such examples of Natural Infrastructure in Dryland Streams (NIDS) have been shown to provide flood regulation, new and restored habitat, stream flow regulation, water purification, erosion control, groundwater recharge, and carbon sequestration and storage. NIDS also supports adaptation to and protection from climate-related disturbances and stressors such as drought, water shortages, flooding, heatwaves, dust storms, wildfire, and biodiversity losses, while also addressing aspects of food and water insecurity.

Wildfire and Climate Resilience on the San Carlos Apache Reservation

USGS is working with the San Carlos Apache Tribe to identify parts of the Tribe's reservation in Arizona that are most vulnerable to wildfire. The collaboration has worked to identify restoration activities to improve climate resilience. The USGS used satellite imagery and watershed modelling to help the Tribe's natural resource managers prioritize areas for firebreak and water detention installations along large rivers. The results have demonstrated that such nature-based solutions can boost resilience to wildfire by increasing water availability and reducing water stress, while also preventing post-fire flooding and erosion. The Forest Resources Department within the San Carlos Apache Tribe is engaged in preventative thinning of vegetation and resource-benefit burns, which USGS has also shown to reduce wildfire intensity. The USFS is now using this guidance to consider expanding similar nature-based practices to Ancestral Lands in collaboration with the Bureau of Indian Affairs (BIA).

U.S. Department of Transportation (DOT)

Federal Highway Administration (FHWA)

Building Nature-based Resilience for Coastal Highways through Federal and State Partnerships

FHWA sponsored a pilot project with the Delaware Department of Transportation to increase the resilience of coastal highways using nature-based solutions. The project focused on State Route 1, a 17-mile stretch of highway already experiencing flooding and erosion due to sea level rise. The Delaware Center for the Inland Bays worked with private designers and contractors to complete a resilience project that included nature-based solutions: a living shoreline, upgraded storm drain outfalls, and a permeable pavement installation. These nature-based solutions reinforced one of Delaware's major transportation arteries, protecting both critical transportation infrastructure and the drivers who use State Route 1. The FHWA has also scaled up work on nature-based solutions through strategic partnerships with federal and state agencies to sponsor and promote additional research and technical information. A FHWA partnership with NOAA on the Effects of Sea Level Rise Program couples the best coastal science on nature-based solutions with the best science on pavement deterioration from inundation and assesses the effectiveness of coastal nature-based solutions on increasing resilience for highway pavements. This partnership improves the understanding of how nature-based solutions can be deployed to protect critical transportation infrastructure and the drivers who use it.



U.S. Environmental Protection Agency (EPA)

Engaging Students with the Campus RainWorks Challenge

Since 2011, the Campus RainWorks Challenge, a green infrastructure design competition, has sought to engage young environmental professionals at American colleges and universities by promoting and showcasing innovative stormwater management techniques and the benefits of green infrastructure. Green infrastructure practices advanced by the Campus RainWorks Challenge have included green roofs, permeable materials, tree plantings, restored habitat areas, rain gardens, and rain harvesting systems. Beyond water quality benefits, these solutions provide benefits including climate resilience, greenhouse gas sequestration, water conservation, reduction of heat island effects, and the beautification of campus landscapes. The competition has engaged over 800 multi-disciplinary teams from over 270 colleges and universities to foster collaboration and, in some cases, implement real design changes to campuses that improve community access to green space. For example, in 2020, a team from the University of Pennsylvania proposed a design for greenspace which included raised garden beds and an outdoor classroom that was constructed at a West Philadelphia elementary school.

Greening America's Communities

The Greening America's Communities program provides design assistance to communities wanting to use nature-based solutions to develop a vision for neighborhood design that protects the environment, public health, and the economy while inspiring changes to better support sustainable growth. Since 2010, the program has assisted 41 communities in funding nature-based solutions, including nearly \$1 million spent on green street improvements that spurred downtown redevelopment in Lincoln, Nebraska and \$1.3 million invested in transforming blighted areas of Selma, Alabama into the urban Montgomery Trail. Frankfort, Kentucky is coupling a \$1.5 million Greening America's Communities grant with an \$8 million TIGER grant from DOT to invest in green infrastructure. Austin, Texas will invest \$2 billion over the next 15 years in nature-based solutions around the city. The nature-based solutions invested in through the Greening America's Communities program include rain gardens, shade trees, permeable paving, and other green street designs that support all modes of transportation. This program boosts local economies and resilience to climate change while reducing stormwater runoff and heat island effects.

San Francisco National Estuaries Program: Transforming Shorelines

In the San Francisco Bay Area, Transforming Shorelines is a project that is advancing nature-based solutions and building capacity for innovative approaches linked to wastewater treatment as a way to create resilience to sea level rise. Wastewater treatment plants, typically built at the bottom of watersheds to allow gravity to bring in the influent, are at extreme risk of sea level rise and are facing potential nutrient pollution caps on their discharges under the Clean Water Act. In the San Francisco Bay Area, the wastewater treatment sector as a whole has collectively invested in data gathering to maximize investment in nutrient control technologies and invested in innovative approaches to attempt to build horizontal levees on the shorelines in front of their systems to provide flood protection, habitat restoration, and nutrient removal through subsurface



discharges. This effort has created a forum for practitioners and experts on nature-based solutions, including representatives from wastewater treatment, resiliency and nutrient managers, regulators, and experts involved in habitat restoration. Project partners are supporting permit applications for the first full-scale application of a multi-benefit vegetated levee receiving nitrified secondary-treated wastewater in the City of Hayward. Project partners with the City of San Leandro are preparing designs, permit applications, and environmental documentation for the restoration of a 4.3-acre wastewater storage basin to create a multi-benefit treatment wetland. They are also developing a community-based shoreline resilience and tidal marsh restoration vision for the surrounding area.



Federal Knowledge Resources, Tools, Guidance, and Technical Assistance

Agencies identified a wide range of federal resources on nature-based solutions. This guide contains 279 resources, including 77 that were released in 2023. These resources were categorized by type (i.e., knowledge resource, guidance, tool, and/or technical assistance) and by the benefits addressed (Table 1). Inclusion of the resource in the Table below is not an endorsement of the product. Agencies, partners, and communities are encouraged to consider these resources when planning nature-based solutions.

Types of Nature-Based Solution Resources

Knowledge resources provide summaries of the current scientific understanding of nature-based solutions and their benefits.

Guidance resources provide specific information on how to design and execute nature-based solutions projects, including formal guidance, best practices, guidelines, and other related documents.

Tools are any interactive media used for the advancement of nature-based solutions projects.

Technical assistance resources help work through administrative and technical aspects of nature-based solution projects, including permitting and funding applications.

Summary:

Based on the resource review (Figure 1a), existing federal nature-based solution resources are dominated by general knowledge resources, such as case studies and process overviews. Agencies have developed fewer tools, guidance, and technical assistance. Overarchingly, these resources provide information and support for using nature-based solutions for a wide range of benefits. Many of the available federal resources address risk reduction and resilience, which is important for communities facing increasingly intense risks from the combined effects of climate change and nature loss. Based on agency responses, there appears to have been more attention on reducing risks from coastal flooding and creating infrastructure resilience than other aspects of risk reduction (Figure 1b). Opportunities remain for agencies to develop additional resources for applying nature-based solutions to a wide range of other benefits, including jobs, equity, and risks from increasingly frequent extreme events (e.g., fire, drought, extreme heat).



(a) Resources Available in 2023

Benefits	Technical Assistance	Tools	Guidance	Knowledge
Any Risk Reduction	47	63	105	140
Nature	31	58	84	120
Water	25	41	64	71
Climate Mitigation	21	20	39	69
Health	11	24	24	42
Recreation	11	14	37	39
Food	17	28	29	34
Community Development	15	10	28	31
Jobs	4	5	14	17
Equity	7	9	17	19

(b) Resources Available in 2023 for Risk Reduction Specified by Risk

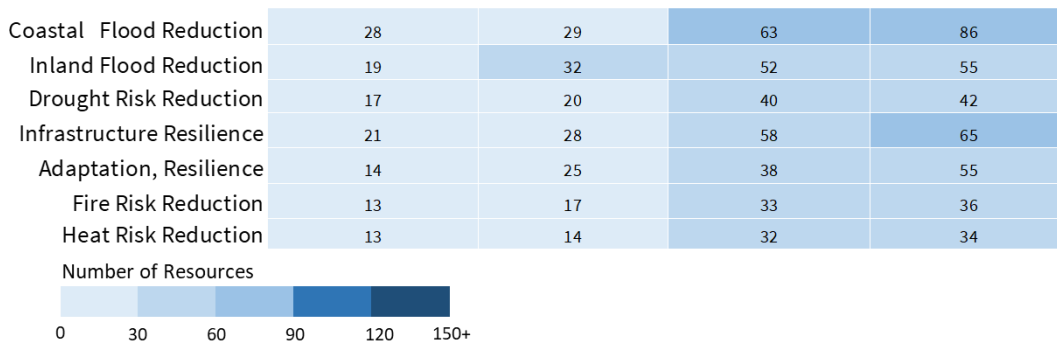


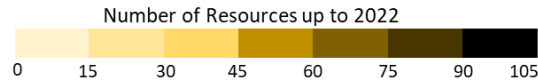
Figure 1. Summary of federal resources available to inform the use of nature-based solutions for a wide range of benefits. Resources with information relating to the reduction of any risk are combined into one category in (a) and separated out by risk in (b) for a more detailed exploration. The figure summarizes resources identified by agencies as of November, 2023.

Since the original publication of Version 1.0 of this guide in 2022, federal agencies have released 77 new resources to support the adoption of effective nature-based solutions. Many of these new resources are focused on benefits that previously had less coverage. For example, resources available in 2022 were dominated by knowledge resources for using nature-based solutions for risk reduction (Figure 2a). In 2023 agencies developed more technical assistance resources and guidance documents focused on the use of nature-based solutions to deliver climate mitigation, community development, equity, jobs and water benefits (Figure 2b). These advances mirror some of the major priorities of the Biden-Harris Administration, such as the Justice40 initiative, confronting the climate crisis, and creating well-paying jobs for all.



(a) Resources Available in 2022

Benefits	Technical Assistance	Tools	Guidance	Knowledge
Any Risk Reduction	32	55	73	92
Nature	20	52	63	83
Water	12	36	42	44
Climate Mitigation	12	14	16	34
Health	7	22	17	31
Recreation	6	12	22	26
Food	14	26	24	24
Community Development	7	6	12	17
Jobs	2	5	10	15
Equity	5	6	7	12



(b) Percent Growth in Resources Available From 2022 to 2023

Benefits	Technical Assistance	Tools	Guidance	Knowledge
Any Risk Reduction	47	15	44	52
Nature	55	12	33	45
Water	108	14	52	61
Climate Mitigation	75	43	144	103
Health	57	9	41	35
Recreation	83	17	68	50
Food	21	8	21	42
Community Development	114	67	133	82
Jobs	100	0	40	13
Equity	40	50	143	58

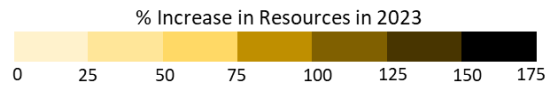


Figure 2. Summary of federal resources available in 2022 and relative increases in resources released in 2023.

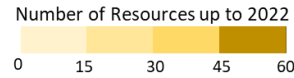
Resources for nature-based solutions focused on a wide range of possible benefits but covered them unevenly in 2022 (a). Newly released resources in 2023 helped fill some of the gaps, with additional resources primarily focused on benefits such as climate mitigation, jobs, equity and community development (b).

Within the broad category of nature-based solutions for risk reduction, new resources in 2023 (Figure 3b) were primarily technical assistance and guidance resources, and focused on risks that were underrepresented in the resource base in 2022 (Figure 3a). Proportionally more resources were released for risks that had major social impacts in 2023, such as heat and fire risk. These patterns show agency attention to filling some resource gaps, while opportunities still remain to fill others.



(a) Resources on Risk Reduction Available in 2022

Benefits	Technical Assistance	Tools	Guidance	Knowledge
Coastal Flood Reduction	16	25	40	53
Inland Flood Reduction	10	28	33	36
Drought Risk Reduction	10	16	23	26
Infrastructure Resilience	9	24	36	36
Adaptation, Resilience	10	18	21	28
Fire Risk Reduction	6	14	18	22
Heat Risk Reduction	6	12	16	22



(b) Percent Growth in Resources Available for Risk Reduction From 2022-2023

Benefits	Technical Assistance	Tools	Guidance	Knowledge
Coastal Flood Reduction	75	16	58	62
Inland Flood Reduction	90	14	58	53
Drought Risk Reduction	70	25	74	62
Infrastructure Resilience	133	17	61	81
Adaptation, Resilience	40	39	81	96
Fire Risk Reduction	117	21	83	64
Heat Risk Reduction	117	17	100	55

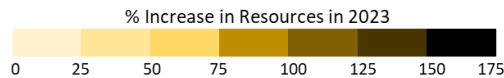


Figure 3. Summary of federal resources available in 2022 for the use of nature-based solutions for risk reduction, and relative increases in resources released in 2023. Within the broad category of any risk reduction, multiple major risks were addressed, though coverage for some risks outpaced others in resources available in 2022

(a). New resources released in 2023 helped close some of these gaps, with emphasis on technical assistance and guidance documents, and large relative growth in resources for nature-based solutions for infrastructure resilience, and fire and heat risk reduction (b).



Table 1. Current federal resources on nature-based solutions, categorized by their type and stated benefit(s)

Resources are listed by authoring agency. The table includes resources reported in the 2022 Resources Guide, as well as new resources released in 2023 (indicated by *).

Author(s)	Resource Title	Resource Type	Benefits Addressed
AmeriCorps	<u>Impact Evaluation on EarthCorps Restoration Methods</u>	Knowledge	Jobs, Water, Nature
AmeriCorps	<u>Impact Evaluation on WA Conservation Corps Restoration Methods</u>	Knowledge	Nature
CEQ/GSA	<u>Supporting the Health of Honey Bees and Other Pollinators</u>	Knowledge, Guidance	Community Development, Food, Nature
Cities of Service/AmeriCorps	<u>What Does Effective Engagement Look Like? Lessons from Resilience AmeriCorps</u>	Knowledge	Jobs, Inland Flood Reduction, Heat Risk Reduction, Adaptation, Resilience, Community Development, Water
DHS (FEMA)	<u>Building Community Resilience with Nature-Based Solutions: A Guide for Local Communities</u>	Guidance	Jobs, Climate Mitigation, Coastal Flood Reduction, Inland Flood Reduction, Heat Risk Reduction, Infrastructure Resilience, Community Development, Water, Recreation, Health, Nature
DHS (FEMA) /DOC(NOAA)/ DOI(USGS)/ DOD(USACE)	<u>Coral Reef Restoration for Risk Reduction (CR4): A Guide to Project Design and Proposal Development</u>	Knowledge, Guidance	Jobs, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Community Development, Water, Food and Products, Recreation, Health, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
DHS (FEMA)	Compiled Resources on Future Conditions and Nature-based Solutions, Including from NOAA and EPA	Knowledge	Jobs, Climate Mitigation, Coastal Flood Reduction, Inland Flood Reduction, Heat Risk Reduction, Drought Risk Reduction, Community Development, Water, Recreation, Health, Nature
DHS (FEMA)	FEMA Economic Benefit Values for Green Infrastructure	Knowledge, Guidance, Tools	Climate Mitigation, Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Nature
DHS (FEMA)	Nature-based Solutions Website	Knowledge, Guidance	Climate Mitigation, Fire Risk Reduction, Coastal Flood Reduction, Inland Flood Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Adaptation, Resilience
DHS (FEMA)*	Building Community Resilience with Nature-Based Solutions: Strategies for Success	Guidance	Jobs, Climate Mitigation, Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Infrastructure Resilience, Recreation
DHS (FEMA)*	Nature-Based Solutions for Mitigating Hazards	Knowledge, Guidance, Technical Assistance	Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Water, Food & Products
DHS (FEMA)*	Application Support Materials	Knowledge, Guidance, Tools	
DHS (FEMA)*	BRIC Program Support Material (PSM) Resources	Guidance	Climate Mitigation, Infrastructure Resilience, Adaptation, Resilience, Equity



Author(s)	Resource Title	Resource Type	Benefits Addressed
DHS (FEMA)*	Engineering with Nature: Alternative Techniques to Riprap Bank Stabilization.	Guidance	Climate Mitigation, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Community Development, Water, Recreation, Nature
DHS (FEMA)*	Guide to Expanding Mitigation: Making the connection to the coast	Guidance, Tools	Climate Mitigation, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Equity, Community Development, Water, Nature
DHS (FEMA)*	FEMA Resources for Climate Resilience	Guidance, Tools	Climate Mitigation, Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Equity, Community Development, Water, Recreation, Health, Nature
DHS (FEMA)*	Hazard Mitigation Assistance Program and Policy Guide	Knowledge, Guidance	Climate Mitigation, Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Equity, Community Development, Water, Recreation, Health, Nature
DHS (FEMA)*	Safeguarding Tomorrow Revolving Loan Fund	Guidance	Jobs, Climate Mitigation, Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Equity, Community Development, Water, Recreation, Health, Nature
DHS (FEMA)*	Timeline for Investing in NBS Strategies (Infographic) (fema.gov)	Guidance	Climate Mitigation, Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Drought Risk Reduction,



Author(s)	Resource Title	Resource Type	Benefits Addressed
			Infrastructure Resilience, Adaptation, Resilience, Community Development, Water, Recreation, Nature
DHS (FEMA)*	Using Nature-Based Solutions Across Landscapes (Infographic)	Guidance	Climate Mitigation, Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Drought Risk Reduction, Adaptation, Resilience, Community Development, Water, Recreation, Health, Nature
DHS (FEMA)*	Hazard Mitigation Assistance Program and Policy Guide	Knowledge, Guidance	Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Equity, Community Development, Water, Recreation, Health, Nature
DOC (NOAA)	Coastal County Snapshots	Tools	Coastal Flood Reduction, Inland Flood Reduction
DOC (NOAA)	Coastal Flood Exposure Mapper	Tools	Coastal Flood Reduction, Infrastructure Resilience, Equity, Water, Nature
DOC (NOAA)	Coral Reef Restoration Monitoring Guide: Methods to evaluate restoration success from local to ecosystem scales	Guidance	Coastal Flood Reduction, Recreation, Nature
DOC (NOAA)	Economic Guidance for Coastal Management Professionals	Tools, Technical Assistance	Climate Mitigation, Fire Risk Reduction, Coastal Flood Reduction, Inland Flood Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Equity, Community Development, Water, Food & Products, Recreation, Health
DOC (NOAA)	Economic Valuation of Shoreline Protection within the Jacques	Knowledge	Coastal Flood Reduction



Author(s)	Resource Title	Resource Type	Benefits Addressed
	<u>Cousteau National Estuarine Research Reserve</u>		
DOC (NOAA)	<u>Economic Valuation Self-Guided Module and Associated guidance documents</u>	Knowledge, Guidance, Technical Assistance	Climate Mitigation, Fire Risk Reduction, Coastal Flood Reduction, Inland Flood Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Equity, Community Development, Water, Food & Products, Recreation, Health
DOC (NOAA)	<u>Fast Facts on Natural Infrastructure</u>	Knowledge	Coastal Flood Reduction, Inland Flood Reduction, Water
DOC (NOAA)	<u>Funding and Financing Coastal Resilience Webinars</u>	Knowledge, Technical Assistance	Coastal Flood Reduction
DOC (NOAA)	<u>Funding and Financing: Options and Considerations for Coastal Resilience Projects</u>	Guidance	Coastal Flood Reduction, Water, Nature
DOC (NOAA)	<u>Green Infrastructure Effectiveness Database</u>	Tools, Knowledge	Climate Mitigation, Coastal Flood Reduction, Inland Flood Reduction, Infrastructure Resilience, Water, Food & Products
DOC (NOAA)	<u>Green Infrastructure Mapping Guide</u>	Guidance, Technical Assistance	Coastal Flood Reduction, Inland Flood Reduction, Infrastructure Resilience, Water
DOC (NOAA)	<u>Green Infrastructure Options to Reduce Flooding</u>	Guidance	Coastal Flood Reduction, Inland Flood Reduction, Drought Risk Reduction, Infrastructure Resilience, Water, Recreation, Nature
DOC (NOAA)	<u>Guidance for Considering the Use of Living Shorelines</u>	Guidance	Coastal Flood Reduction, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
DOC (NOAA)	How to Map Open Space for Community Rating System Credit	Knowledge, Guidance, Technical Assistance	Coastal Flood Reduction, Inland Flood Reduction
DOC (NOAA)	NOAA Restoration Center: Monitoring and Evaluation for Restoration Projects Providing Technical Support for Habitat Restoration Efforts	Guidance, Technical Assistance	Coastal Flood Reduction, Inland Flood Reduction, Water
DOC (NOAA)	Nature-Based Solutions for Coastal Hazards	Guidance, Technical Assistance	Coastal Flood Reduction
DOC (NOAA)	Nature-Based Solutions for Coastal Hazards: The Basics	Knowledge, Tools	Coastal Flood Reduction, Water, Recreation, Nature
DOC (NOAA)	Nature-Based Solutions: Benefits, Costs, and Economic Assessments	Knowledge, Guidance	Climate Mitigation, Coastal Flood Reduction, Inland Flood Reduction, Heat Risk Reduction, Water, Recreation, Health, Nature
DOC (NOAA)	NOAA Living Shorelines Project Map	Knowledge	Coastal Flood Reduction, Nature
DOC (NOAA)	Oyster Reef Habitat Conservation	Guidance, Tools	Coastal Flood Reduction, Water, Food & Products, Nature
DOC (NOAA)	Planning for Sea Level Rise in the Northeast: Considerations for the Implementation of Tidal Wetlands Habitat Restoration Projects; workshop report	Guidance	Coastal Flood Reduction, Recreation, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
DOC (NOAA)	Science-Based Restoration Monitoring of Coastal Habitat Volume 1 (2003): Framework for Monitoring Plans Under the Estuaries and Clean Water Act of 2000	Guidance, Technical Assistance	Coastal Flood Reduction, Water, Food & Products, Recreation, Nature
DOC (NOAA)	Science-Based Restoration Monitoring of Coastal Habitat Volume 2 (2005): Tools for Monitoring Coastal Habitats	Guidance, Technical Assistance	Coastal Flood Reduction
DOC (NOAA)	Sea Level Rise Viewer Marsh Migration Data	Tools	Coastal Flood Reduction
DOC (NOAA)	Florida Sea Grant Living Shorelines Training for Marine Contractors	Knowledge, Guidance	Jobs, Coastal Flood Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Nature
DOC (NOAA)	Working with Nature: A Guide to Native Plants for New York's Great Lakes Shorelines	Guidance	Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Water, Nature
DOC (NOAA)	Restoration Atlas	Tools	Nature
DOC (NOAA)/EPA	Coastal & Waterfront Smart Growth	Knowledge, Tools	Jobs, Climate Mitigation, Coastal Flood Reduction, Inland Flood Reduction, Infrastructure Resilience, Community Development, Water, Food & Products, Recreation, Health, Nature
DOC (NOAA)/DOI (USGS, FWS)	Federal Interagency Nature-like Fishway Passage Design Guidelines for Atlantic Coast Diadromous Fishes	Guidance	Jobs, Food & Products, Recreation, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
DOC (NOAA)*	Funding and Financing Coastal Resilience	Guidance, Tool, Technical Assistance	Climate Mitigation, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Recreation
DOC (NOAA)*	Integrating Blue Carbon Ecosystems into MPA Management	Knowledge, Guidance	Climate Mitigation, Adaptation, Resilience, Nature
DOC (NOAA)*	Funding and Financing Coastal Resilience Webinar Series	Knowledge, Technical Assistance	Jobs, Coastal Flood Risk Reduction, Infrastructure Resilience, Community Development, Water, Nature
DOC (NOAA)*	Case Study: Community-Led Resilience Program Leads to Shovel-Ready Projects	Guidance, Technical Assistance	Coastal Risk Reduction, Infrastructure Resilience, Community Development, Water, Nature
DOC (NOAA)*	Dune Restoration Increases Flood Protection and Access for Community	Knowledge	Coastal Flood Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Community Development, Recreation, Nature
DOC (NOAA)*	Dynamic Revetments Provide a Nature-Based Approach to Control Erosion in High Wave Energy Environments	Knowledge	Coastal Flood Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Community Development
DOC (NOAA)*	Resiliency Officer Helps Design an Environmental Impact Bond to Finance Community Resilience Projects	Knowledge	Coastal Flood Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Community Development, Health
DOC (NOAA)*	Innovative Green Infrastructure Project Has Diverse Funding and Financing Portfolio	Knowledge	Coastal Flood Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Community Development, Water, Recreation, Health, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
DOC (NOAA)*	Using Novel Approaches to Create Resilient Dune Systems Following Hurricane Maria	Knowledge	Coastal Flood Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Community Development, Recreation, Nature
DOC (NOAA)*	Mississippi-Alabama Sea Grant Living Shorelines Program	Knowledge, Guidance, Technical Assistance	Jobs, Coastal Flood Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Nature
DOD	Department of Defense Climate Adaptation Plan	Knowledge	Fire Risk Reduction, Coastal Flood Reduction, Inland Flood Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience
DOD	Readiness and Environmental Protection Integration Program (REPI) Climate Resilience Resource Library	Knowledge, Guidance, Tools, Technical Assistance	Fire Risk Reduction, Coastal Flood Reduction, Inland Flood Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Nature
DOD	Building Resilience to Climate Change Through Off-Base Natural Infrastructure Solutions: A REPI guide for installations and partners	Guidance, Tools	Fire Risk Reduction, Coastal Flood Reduction, Inland Flood Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Nature
DOD (USACE)	Engineering with Nature: Supporting Mission Resilience and Infrastructure Value at Department of Defense Installations	Knowledge	Infrastructure Resilience, Nature
DOD (USACE)	Engineering with Nature: An Atlas Series (Volumes 1 and 2)	Knowledge, Guidance, Tools	Jobs, Climate Mitigation, Fire Risk Reduction, Coastal Flood Reduction, Inland Flood Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Community Development, Water, Food & Products, Recreation, Health, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
DOD (USACE)	Flood Plain Management Services	Technical Assistance	Coastal Flood Reduction, Inland Flood Reduction
DOD (USACE)	Natural Infrastructure Opportunities Tool	Tools	Coastal Flood Reduction, Inland Flood Reduction, Infrastructure Resilience, Adaptation, Resilience, Water, Nature
DOD (USACE)	Planning Assistance to States, U.S. Army Corps of Engineers, New England District	Technical Assistance	Drought Risk Reduction, Water
DOD (USACE)	Use of Natural and Nature-based Features (NNBF) for Coastal Resilience	Knowledge, Guidance	Jobs, Climate Mitigation, Fire Risk Reduction, Coastal Flood Reduction, Inland Flood Reduction, Infrastructure Resilience, Community Development, Water, Food & Products, Recreation, Nature
DOD (USACE)	USACE Sand Availability and Needs Determination (SAND)	Knowledge	Jobs, Coastal Flood Reduction, Infrastructure Resilience, Recreation, Nature
DOD (USACE)/ DOI(USGS) (with the State of Alabama)	Alabama Barrier Island Restoration Assessment	Knowledge, Guidance	Coastal Flood Reduction, Health, Nature
DOD (USACE)*	Journal Article: A Multi-Decadal Assessment of Dredged Sediment Beneficial Use Projects, Part 1 and Part 2	Knowledge	Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Infrastructure Resilience, Water
DOE	Energy Communities IWG	Technical Assistance	Jobs, Equity, Community Development



Author(s)	Resource Title	Resource Type	Benefits Addressed
DOI	Office of Insular Affairs Technical Assistance Program	Technical Assistance	Infrastructure Resilience, Adaptation, Resilience, Community Development, Nature
DOI (BIA)	Tribal Climate Resilience	Technical Assistance	Adaptation, Resilience
DOI (BOEM)	BOEM Marine Minerals Information Systems (MMIS)	Knowledge, Tools	Coastal Flood Reduction, Water, Nature
DOI (BOEM)	Fact Sheet: Marine Minerals Information System (MMIS)	Knowledge	Coastal Flood Reduction, Water, Nature
DOI (BOEM)	BOEM Marine Minerals Overview	Knowledge	Coastal Flood Reduction, Water, Nature
DOI (BOEM)	BOEM Marine Minerals Program	Knowledge	Coastal Flood Reduction, Nature
DOI (BOEM)	Marine Mineral Studies	Knowledge	Health, Nature
DOI (BOEM)	Economic and Geomorphic Comparison of OCS and Nearshore Sand for Coastal Restoration Projects	Knowledge	Coastal Flood Reduction, Nature
DOI (FWS)	The Beaver Restoration Guidebook	Knowledge, Guidance, Technical Assistance	Climate Mitigation, Inland Flood Reduction, Fire Risk Reduction, Nature
DOI (FWS)	Biological Carbon Sequestration Accomplishments Report	Knowledge	Climate Mitigation, Fire Risk Reduction, Resilience, Nature
DOI (FWS)	Coastal Program	Technical Assistance	Climate Mitigation, Coastal Flood Reduction, Resilience, Nature
DOI (FWS)	Culvert Design Guidelines for Ecological Function	Knowledge, Guidance,	Climate Mitigation, Inland Flood Reduction, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
		Technical Assistance	
DOI (FWS)	Farm Bill Conservation Programs Brochure	Knowledge, Guidance, Technical Assistance	Climate Mitigation, Drought Risk Reduction, Resilience, Food & Products, Nature
DOI (FWS)	National Fish Passage Program	Technical Assistance	Food & Products, Nature
DOI (FWS)	Partners for Fish and Wildlife Program	Technical Assistance	Climate Mitigation, Coastal Flood Reduction, Resilience, Nature
DOI (FWS)	Pollinator Initiative	Guidance Knowledge	Climate Mitigation, Fire Risk Reduction, Drought Risk Reduction, Resilience, Food & Products, Nature
DOI (FWS)	Urban Wildlife Conservation Program	Knowledge, Technical Assistance	Climate Mitigation, Coastal Flood Reduction, Inland Flood Reduction, Heat Risk Reduction, Drought Risk Reduction, Equity, Food & Products, Recreation, Health, Nature
DOI (FWS)	Salt Marsh Sediment Augmentation	Technical Assistance	Coastal Flood Reduction, Nature
DOI (FWS, USGS)	Report: Impacts of Sediment Removal from and Placement in Coastal Barrier Island Systems	Knowledge	Coastal Flood Reduction, Nature
DOI (NPS)	Coastal Adaptation Strategies Handbook	Knowledge, Guidance	Coastal Flood Reduction, Infrastructure Resilience, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
DOI (NPS)	Fire Island National Seashore Breach Management Plan/EIS	Knowledge	Equity, Water, Nature
DOI (NPS)	National Park Service Beach Nourishment Guidance	Guidance	Coastal Flood Reduction, Inland Flood Reduction, Recreation, Nature
DOI (NPS)	Northeast Coastal and Barrier Network Geomorphological Monitoring Protocol	Guidance	Nature
DOI (NPS)	Planning Tools for Green Infrastructure	Guidance, Tools	Climate Mitigation, Coastal Flood Reduction, Inland Flood Reduction, Infrastructure Resilience, Water, Nature
DOI (NPS)	Planning for a Changing Climate	Guidance	Coastal Flood Reduction, Infrastructure Resilience, Nature
DOI (USGS)	A geological perspective on the degradation and conservation of western Atlantic coral reefs	Knowledge	Coastal Flood Reduction, Nature
DOI (USGS)	Ancient Methods of Preventing Desertification and Recovering from Drought	Knowledge, Guidance, Tools	Drought Risk Reduction, Infrastructure Resilience, Water, Nature
DOI (USGS)	Biological Carbon Sequestration (Western U.S.) Biological Carbon Sequestration (Eastern U.S.)	Knowledge	Climate Mitigation



Author(s)	Resource Title	Resource Type	Benefits Addressed
DOI (USGS)	Future Coastal Flooding: - Prediction of Flooding Now and Into the Future	Tools	Jobs, Coastal Flood Reduction, Infrastructure Resilience
DOI (USGS)	Coastal Wetlands Synthesis	Knowledge	Climate Mitigation, Coastal Flood Reduction, Nature
DOI (USGS)	Estuary Restoration and Wildlife/Carbon Storage Co-Benefits	Knowledge	Climate Mitigation, Nature
DOI (USGS)	Evaluating tidal saline wetland migration along the U.S. Gulf of Mexico coast under alternative sea-level rise and urbanization scenarios	Knowledge	Coastal Flood Reduction, Infrastructure Resilience, Nature
DOI (USGS)	USGS Coastal Change Hazards Portal	Tools	Coastal Flood Reduction, Nature
DOI (USGS)	U.S. Geological Survey monitor barrier islands	Tools	Coastal Flood Reduction, Nature
DOI (USGS)	Green infrastructure in the Great Lakes	Knowledge, Guidance	Infrastructure Resilience, Water, Nature
DOI (USGS)	Green Infrastructure Projects	Knowledge, Guidance, Tools	Inland Flood Reduction, Drought Risk Reduction, Adaptation, Resilience, Water, Health, Nature
DOI (USGS)	Green Stormwater Infrastructure to Reduce Suburban Runoff	Knowledge	Inland Flood Reduction, Adaptation, Resilience, Water, Health, Nature
DOI (USGS)	Hazards Exposure and Reporting Analytics	Guidance, Tools	Inland Flood Reduction, Infrastructure Resilience, Equity, Community Development, Water, Recreation, Health, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
DOI (USGS)	Restoration of Wetland Invertebrates to Improve Wildlife Habitat in Minnesota.	Knowledge	Nature
DOI (USGS)	Assessing pollinator habitat services to optimize conservation programs	Knowledge	Food & Products, Nature
DOI (USGS)	Marshes and Mangroves as Nature-Based Coastal Storm Buffers	Knowledge	Coastal Flood Reduction
DOI (USGS)	National Assessment of Geologic Carbon Dioxide Storage Resources—Results	Knowledge, Guidance	Climate Mitigation
DOI (USGS)	National Climate Change Viewer	Knowledge, Tools	Fire Risk Reduction, Inland Flood Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Water, Food & Products, Recreation, Health, Nature
DOI (USGS)	National Shoreline Change - Exploring Shoreline Positions of the United States From the 1800s To the Present	Tools	Coastal Flood Reduction
DOI (USGS)	Natural Infrastructure to Enhance Fire and Climate Resilience in Tribal Lands and Watersheds	Knowledge	Fire Risk Reduction, Adaptation, Resilience, Water, Nature
DOI (USGS)	Natural Infrastructure in Dryland Streams to Reverse Desertification	Knowledge	Drought Risk Reduction, Equity, Water, Health
DOI (USGS)	Natural Solutions to Ecological and Economic Problems Caused by Extreme Precipitation Events	Knowledge	Inland Flood Reduction, Adaptation, Resilience, Water



Author(s)	Resource Title	Resource Type	Benefits Addressed
DOI (USGS)	Protected Areas Database of the United States (PAD-US)	Knowledge, Tools	Jobs, Recreation, Health, Nature
DOI (USGS)	Real-time Forecasts of Coastal Change	Tools	Coastal Flood Reduction
DOI (USGS)	Rigorously Valuing the Potential Coastal Hazard Risk Reduction Provided by Coral Reef Restoration in Florida and Puerto Rico	Knowledge	Coastal Flood Reduction, Nature
DOI (USGS)	Sea-Level Change: An Interactive Guide to Global and Regional Sea Level Rise Scenarios for the United States	Tools	Coastal Flood Reduction, Nature
DOI (USGS)	The Role of U.S. Coral Reefs in Coastal Protection	Knowledge	Coastal Flood Reduction, Nature
DOI (USGS)	Reducing Urban Heat with Tree Canopy	Knowledge	Climate Mitigation, Adaptation, Resilience, Equity, Health
DOI (USGS)	Restoration of Freshwater Mussels to Improve Water Quality	Knowledge	Water, Health, Nature
DOI (USGS)	Restoring America's Sagebrush Biome	Knowledge, Guidance	Adaptation, Resilience, Recreation, Nature
DOI (USGS)	Hydrologic Restoration in Coastal Wetlands Enhances Climate Change Mitigation Benefits	Knowledge	Climate Mitigation, Coastal Flood Reduction
DOI (USGS)	Science Supporting the Elwha River Restoration Project	Knowledge, Guidance, Tools	Jobs, Coastal Flood Reduction, Inland Flood Reduction, Water, Health, Food & Products, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
DOI (USGS)	Land Management Explains Major Trends in Forest Structure and Composition over the Last Millennium in CA Klamath Mountains	Knowledge	Climate Mitigation, Fire Risk Reduction, Nature
DOI (USGS)	U.S Geological Survey Wildland Fire Science Strategic Plan	Knowledge	Climate Mitigation, Fire Risk Reduction
DOI (USGS)	A framework for identifying and characterizing coral reef “oases” against a backdrop of degradation	Knowledge	Adaptation, Resilience, Nature
DOI (USGS)	Restoring tides to reduce methane emissions in impounded wetlands: A new and potent Blue Carbon climate change intervention	Knowledge	Climate Mitigation, Nature
DOI (USGS)	USGS Integrated Drought Science	Knowledge, Tools	Drought Risk Reduction, Infrastructure Resilience, Water
DOI (USGS, FWS)	Monitoring Habitat Restoration Projects: U.S. Fish and Wildlife Pacific Region Partners for Fish and Wildlife Program and Coastal Program Protocol	Guidance	Nature
DOI*	Workbook: Action Plan for Restoration of Coral Reef Coastal Protection Services: Case Study Example and Workbook	Knowledge, Tool	Climate Mitigation, Coastal Flood Risk Reduction, Recreation
DOI (USGS)*	Research: Impacts of marsh site characteristics in Buzzards Bay marshes and their watersheds	Knowledge	Climate Mitigation, Coastal Flood Risk Reduction, Water, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
DOI (USGS)*	Coral Reef Project	Knowledge	Climate Mitigation, Coastal Flood Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Water, Nature
DOI (USGS)*	Coastal Resource Evaluation for Management Application (CREMA)	Knowledge, Tools	Coastal Flood Risk Reduction, Adaptation, Resilience, Nature
DOI (USGS)*	Coral Reef Restoration for Risk Reduction (CR4): A Guide to Project Design and Proposal Development	Guidance, Tool, Technical Assistance	Climate Mitigation, Coastal Flood Risk Reduction, Infrastructure Resilience, Community Development, Water
DOI (USGS)*	Resource: Pollinator Conservation and Climate Science at the U.S. Geological Survey	Knowledge	Climate Mitigation, Infrastructure Resilience, Equity, Adaptation, Resilience, Food & Products, Health, Nature
DOI (USGS)*	Resource: The Bee Lab Fact Sheet	Knowledge	Climate Mitigation, Infrastructure Resilience, Adaptation, Resilience, Equity, Health, Food & Products, Nature
DOI (USGS)*	Future Marsh Evolution Due to Tidal Changes Induced by Human Adaptation to Sea Level Rise	Knowledge, Guidance	Climate Mitigation, Coastal Flood Risk Reduction, Adaptation, Resilience, Water, Nature
DOI (USGS)*	Compound flood model for the lower Nooksack River and delta, western Washington--Assessment of vulnerability and nature-based adaptation opportunities to mitigate higher sea level and stream flooding	Tools	Climate Mitigation, Coastal Flood Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Water, Nature
DOI (USGS)*	USGS short film about Check Dams featured in "Water is Life" festival, Tucson, Arizona	Knowledge	Climate Mitigation, Inland Flood Risk Reduction, Drought Risk, Adaptation, Resilience, Water, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
DOI (USGS)*	Active Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) projects geospatial vector data	Knowledge	Climate Mitigation, Coastal Flood Risk Reduction, Nature
DOI (USGS)*	Wildfire immediately reduces nest and adult survival of greater sage-grouse	Knowledge	Fire Risk Reduction, Nature
DOI (USGS)*	Literature Summary of Indicators of Water Vulnerability in the Western US 2000-2022	Knowledge	Climate Mitigation, Drought Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Equity, Community Development, Water, Health, Nature
DOI (USGS)*	Spatially explicit models of seed availability improve predictions of conifer regeneration following the 2018 Carr Fire in northern California	Knowledge	Climate Mitigation, Adaptation, Resilience, Nature
DOI (USGS)*	Mapping methane reduction potential of tidal wetland restoration in the United States	Knowledge	Climate Mitigation, Coastal Flood Risk Reduction, Adaptation, Resilience, Nature
DOI (USGS)*	Societal benefits of floodplains in the Chesapeake Bay and Delaware River watersheds: Sediment, nutrient, and flood regulation ecosystem services	Knowledge	Climate Mitigation, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Adaptation, Resilience, Water, Nature
DOI (USGS)*	Hydrologic Investigations of Green Infrastructure by the Central Midwest Water Science Center	Knowledge	Climate Mitigation, Inland Flood Risk Reduction, Heat Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Water, Recreation, Health, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
DOI (USGS)*	Coral Reef Restoration for Risk Reduction (CR4): A Guide to Project Design and Proposal Development	Knowledge, Guidance, Technical Assistance	Coastal Flood Risk Reduction, Infrastructure Resilience, Community Development, Water, Nature
DOI (USGS)*	Framework for facilitating mangrove recovery after hurricanes on Caribbean islands	Knowledge, Guidance	Coastal Flood Risk Reduction, Infrastructure Resilience, Water, Nature
DOI (USGS)*	Climate change mitigation potential of Louisiana's coastal area: Current estimates and future projections	Knowledge	Climate Mitigation
DOI (USGS)*	Mangrove reforestation provides greater blue carbon benefit than afforestation for mitigating global climate change	Knowledge	Climate Mitigation, Nature
DOI (USGS)*	Coral restoration for coastal resilience: Integrating ecology, hydrodynamics, and engineering at multiple scales	Knowledge, Guidance	Climate Mitigation, Coastal Flood Risk Reduction, Infrastructure Resilience, Adaptation, Resilience
DOI (USGS)*	Sharing land via keystone structure: Retaining naturally regenerated trees may efficiently benefit birds in plantations	Knowledge	Food & Products
DOI (USGS)*	Could biological soil crusts act as natural fire fuel breaks in the sagebrush steppe?	Knowledge	Fire Risk Reduction
DOI (USGS)*	Above- and Belowground Biomass Carbon Stock and Net Primary Productivity Maps for Tidal Herbaceous Marshes of the United States	Knowledge, Tool	Climate Mitigation



Author(s)	Resource Title	Resource Type	Benefits Addressed
DOI (USGS)*	Natural infrastructure in dryland streams (NIDS) can establish regenerative wetland sinks that reverse desertification and strengthen climate resilience	Knowledge	Climate Mitigation, Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Water, Food & Products
DOI (USGS)*	The Potential for coral reef restoration to mitigate coastal flooding as sea levels rise	Knowledge	Climate Mitigation, Coastal Flood Risk Reduction, Infrastructure Resilience, Adaptation, Resilience
DOI (USGS)*	USGS Science in the American Territories	Knowledge, Tool	Climate Mitigation, Coastal Flood Risk Reduction, Adaptation, Resilience, Water, Food & Products, Nature
DOI (USGS)*	Monitoring of Wave, Current, and Sediment Dynamics Along the Chincoteague Living Shoreline, Virginia	Knowledge	Coastal Flood Risk Reduction, Infrastructure Resilience
DOI (USGS)*	Marshes and Mangroves as Nature-Based Coastal Storm Buffers	Knowledge	Climate Mitigation, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Infrastructure Resilience
DOI (USGS)*	Restoration and Conservation Opportunity Maps for the conterminous U.S. (CONUS)	Tool	Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Community Development, Food& Products, Nature
DOT	Nature-Based Solutions Pilot Reports	Knowledge	Coastal Flood Risk Reduction, Nature
DOT (FHWA)	White Paper: Nature-Based Solutions for Coastal Highway Resilience	Knowledge	Coastal Flood Reduction, Infrastructure Resilience, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
DOT (FHWA)	Nature-Based Solutions for Coastal Highway Resilience: An Implementation Guide	Knowledge, Guidance	Coastal Flood Reduction, Infrastructure Resilience, Nature
DOT (FHWA)	Case Studies in Realizing Co-Benefits of Multimodal Roadway Design and Gray and Green Infrastructure	Knowledge	Inland Flood Reduction, Infrastructure Resilience, Water, Recreation, Health
DOT (FHWA)	Peer Exchange Summary Report - Nature-Based Solutions for Coastal Highway Resilience	Knowledge	Coastal Flood Reduction, Infrastructure Resilience, Nature
DOT*	Checklist for a Strong Climate Change Mitigation, Adaptation and Resilience Grant Application	Technical Assistance	Climate Mitigation, , Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Community Development, Water, Health
EPA	Brownfields Technical Assistance, Training, and Research	Technical Assistance	Equity, Community Development, Recreation, Health, Nature
EPA	Build Green Infrastructure	Guidance, Tools	Climate Mitigation, Inland Flood Reduction, Infrastructure Resilience, Water, Nature
EPA	Clearinghouse for Environmental Finance	Tools	Adaptation, Resilience, Water, Food & Products, Nature
EPA	Community-Based Public-Private Partnerships and Alternative Market-Based Tools for Integrated Green Stormwater Infrastructure: Guide for Local Governments	Guidance	Infrastructure Resilience, Water
EPA	Drinking Water State Revolving Fund Eligibility Handbook	Guidance	Infrastructure Resilience, Water



Author(s)	Resource Title	Resource Type	Benefits Addressed
EPA	Financing Alternatives Comparison Tool	Tools	Water
EPA	Financing Options for Nontraditional Eligibilities in the Clean Water State Revolving Fund Program	Guidance	Infrastructure Resilience, Water
EPA	Getting to Green: Paying for Green Infrastructure, Finance Options and Resources for Local Decision-Makers	Guidance	Inland Flood Reduction, Infrastructure Resilience, Water
EPA	EPA Green Infrastructure Resources	Knowledge, Guidance, Tools, Technical Assistance	Climate Mitigation, Coastal Flood Reduction, Heat Risk Reduction, Infrastructure Resilience, Community Development, Water, Recreation, Health, Nature
EPA	Green Infrastructure Funding Opportunities	Guidance	Infrastructure Resilience, Water
EPA	Green Infrastructure Modeling Toolkit: Storm Water Management Model; National Stormwater Calculator; Green Infrastructure Wizard; Watershed Management Optimization Support Tool; Visualizing Ecosystems for Land Management Assessment Model; Green Infrastructure Flexible Model; Community-enabled Lifecycle	Tools	Inland Flood Reduction, Adaptation, Resilience, Water, Health, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
	<u>Analysis of Stormwater Infrastructure Cost Tool; and Integrated Decision Support Tool</u>		
EPA	<u>Financing Green Infrastructure: A Best Practices Guide for the Clean Water State Revolving Fund</u>	Guidance	Infrastructure Resilience, Water
EPA	<u>Including Watershed Planning and Green Infrastructure into State Hazard Mitigation Plans</u>	Guidance, Technical Assistance	Coastal Flood Reduction, Inland Flood Reduction, Heat Risk Reduction, Drought Risk Reduction, Water, Recreation
EPA	<u>Overview of Clean Water State Revolving Fund Eligibilities</u>	Guidance	Infrastructure Resilience, Water, Food & Products, Nature
EPA	<u>Tools, Strategies and Lessons Learned from EPA Green Infrastructure Technical Assistance Projects</u>	Knowledge, Technical Assistance	Climate Mitigation, Adaptation, Resilience, Infrastructure Resilience, Community Development, Water, Health
EPA	<u>Water Infrastructure and Resiliency Finance Center</u>	Tools, Technical Assistance	Infrastructure Resilience, Water
EPA	<u>The Importance of Operation and Maintenance for the Long-Term Success of Green Infrastructure: A Review of Green Infrastructure O&M Practices in ARRA Clean Water State Revolving Fund Projects</u>	Knowledge, Guidance, Technical Assistance	Inland Flood Risk Reduction, Heat Risk Reduction, Community Development, Water, Nature
EPA	<u>Environmental Benefits of Clean Water State Revolving Fund Green Infrastructure Projects</u>	Knowledge, Guidance	Inland Flood Risk Reduction, Community Development, Water, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
EPA	<u>CWSRF Best Practices Guide for Financing Nonpoint Source Solutions</u>	Knowledge, Guidance	Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Drought Risk Reduction, Adaptation, Resilience, Community Development, Water, Recreation, Health, Nature
EPA	<u>Funding Resilient Infrastructure and Communities with the Clean Water State Revolving Fund</u>	Knowledge	Climate Mitigation, Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Equity, Community Development, Water, Recreation, Health, Nature
EPA/ DOC (NOAA)	<u>Green Infrastructure for Coral Conservation</u>	Knowledge	Water, Recreation, Nature
EPA/Environmental Law Institute	<u>Nature-Based Mitigation Goals and Actions in Local Mitigation Plans</u>	Knowledge	Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Drought Risk Reduction, Adaptation, Resilience, Water, Recreation, Nature
EPA*	<u>Creating Co-Benefits Through Hazard Mitigation Planning and Water Resource Management Module</u>	Knowledge, Technical Assistance	Climate Mitigation, Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Equity, Community Development, Water, Recreation, Health, Nature
EPA*	<u>Navigating Federal Funding for Green Infrastructure and Nature-Based Solutions</u>	Guidance	Jobs, Climate Mitigation, Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Equity, Community Development, Water, Recreation
EPA*	<u>Disaster Resilient Design Concepts</u>	Guidance	Climate Mitigation, Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Drought Risk Reduction, Infrastructure Resilience,



Author(s)	Resource Title	Resource Type	Benefits Addressed
			Adaptation, Resilience, Equity, Community Development, Recreation
EPA*	Creating Co-Benefits Through Hazard Mitigation Planning and Water Resource Management	Knowledge, Guidance, Technical Assistance	Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Equity, Community Development, Water, Recreation, Health, Nature
EPA*	Webinar: Planting Trees for the Future	Knowledge, Guidance	Climate Mitigation, Water, Food & Products, Nature
GSA	Facilities Standards for the Public Buildings Service (P100)	Knowledge, Technical Assistance	Infrastructure Resilience, Water, Nature
GSA	Planted Roofs	Knowledge	Heat Risk Reduction, Infrastructure Resilience, Equity, Health, Water, Nature
HUD	HUD Climate Resilience Implementation Guide – Nature-based Solutions	Guidance	Climate Mitigation, Fire Risk Reduction, Coastal Flood Reduction, Inland Flood Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Equity, Community Development, Recreation, Health
HUD	HUD Community Resilience Toolkit	Tools	Fire Risk Reduction, Coastal Flood Reduction, Inland Flood Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Community Development
HUD	Green Infrastructure and the Sustainable Communities Initiative	Knowledge	Jobs, Climate Mitigation, Inland Flood Reduction, Heat Risk Reduction, Infrastructure Resilience,



Author(s)	Resource Title	Resource Type	Benefits Addressed
			Community Development, Water, Recreation, Health, Nature
HUD*	Climate Resilience Implementation Guide: Nature-Based Solutions	Knowledge, Guidance	Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Drought Risk Reduction, Recreation
NFWF/ DOC (NOAA)	Coastal Resilience Evaluation and Siting Tool (CREST)	Tools	Coastal Flood Reduction, Nature
NFWF/ DOC (NOAA)	Regional Coastal Resilience Assessments	Knowledge	Coastal Flood Reduction, Nature
NFWF/ DOC (NOAA)	Targeted Watershed Assessments	Knowledge	Inland Flood Reduction, Coastal Flood Reduction, Nature
OSTP (U.S. Global Change Research Program)	Climate Resilience Toolkit	Knowledge, Guidance, Tools	Fire Risk Reduction, Coastal Flood Reduction, Inland Flood Reduction, Heat Risk Reduction, Drought Risk Reduction, Equity, Water, Food & Products, Recreation, Health, Nature
OSTP (U.S. Global Change Research Program)	Second State of the Carbon Cycle Report, Chapter 15 Tidal Wetlands and Estuaries	Knowledge	Climate Mitigation, Nature
OSTP (National Science and Technology Council)	Research Needs for Coastal Green Infrastructure	Knowledge	Jobs, Climate Mitigation, Coastal Flood Reduction, Inland Flood Reduction, Infrastructure Resilience, Water, Recreation, Health, Nature
USAID	The Blue Guide to Coastal Resilience: Protecting Coastal	Knowledge, Guidance	Coastal Flood Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
	Communities through Nature-based Solutions		
USAID	Ecosystem-Based Adaptation: A Nature-Based Approach to help People Adapt to Extreme Weather and Climate Change	Knowledge, Guidance	Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Equity, Community Development, Water, Food & Products, Nature
USAID	Green Infrastructure Resource Guide	Knowledge, Guidance	Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Water, Food & Products, Health, Nature
USAID	Integrating Biodiversity and Climate Change Adaptation in Activity Design	Knowledge, Guidance	Jobs, Adaptation, Resilience, Community Development, Nature
USAID	USAID Climate Strategy 2022-2030	Knowledge, Guidance	Jobs, Climate Mitigation, Adaptation, Resilience, Water, Food & Products, Health, Nature
USAID/WWF	Natural and Nature-based Flood Management: A Green Guide	Knowledge, Guidance	Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Infrastructure Resilience, Adaptation, Resilience, Water, Nature
Plant Conservation Alliance Federal Committee (12 Federal Agencies)	National Seed Strategy	Knowledge, Guidance, Tools	Climate, Mitigation, Drought Risk Reduction, Fire Risk Reduction, Nature
USDA	Adaptation Resources for Agriculture	Guidance, Tools, Technical Assistance	Adaptation, Resilience, Food & Products



Author(s)	Resource Title	Resource Type	Benefits Addressed
USDA	Adaptation Resources for Agriculture: Case Studies using the Adaptation Workbook	Knowledge, Guidance, Tools, Technical Assistance	Adaptation, Resilience, Food & Products
USDA	After Fire: Toolkit for the Southwest	Guidance, Tools, Technical Assistance	Fire Risk Reduction, Water, Food & Products, Nature
USDA	Air-Water Database (AWDB)	Tools	Water, Food & Products, Nature
USDA	Climate Adaptation Actions for Urban Forests and Human Health	Knowledge, Guidance	Fire Risk Reduction, Inland Flood Reduction, Heat Risk Reduction, Drought Risk Reduction, Equity, Health, Nature
USDA	Climate Adaptation Tools for Wetland Conservation and Management	Guidance, Technical Assistance	Drought Risk Reduction, Infrastructure Resilience, Water, Nature
USDA	Dust Mitigation Handbook	Knowledge, Guidance	Food & Products, Nature
USDA	Climate Quick Reference Guides	Knowledge, Tools	Food & Products, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
USDA	Conservation Technical Assistance Program	Technical Assistance	Climate Mitigation, Food & Products, Nature
USDA	Conservation Concerns Tool	Tools	Equity, Food & Products, Nature
USDA	NRCS Field Office Technical Guide	Guidance	Food & Products, Nature
USDA	A Guide to USDA Resources for Historically Underserved Farmers and Ranchers	Guidance	Equity, Food & Products, Nature
USDA	Hurricane Preparation and Recovery Commodity Guides	Guidance	Coastal Flood Reduction, Inland Flood Reduction, Water, Food & Products
USDA	Saltwater Intrusion and Salinization on Coastal Forests and Farms	Knowledge, Technical Assistance	Coastal Flood Reduction, Food & Products
USDA	National Water and Climate Center: Water and Climate Information System	Tools	Adaptation, Resilience, Water, Food & Products, Nature
USDA	Recommended Florida Native Beach and Dune Plants for Beachfront Properties and Dune Restoration	Knowledge, Guidance	Coastal Flood Reduction, Nature
USDA	Plant Materials Technical Note: Coastal Shoreline and Dune Restoration	Knowledge, Guidance	Coastal Flood Reduction, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
USDA	Plant List of Attributes, Names, Taxonomy, and Symbols (PLANTS Database)	Tools	Food & Products, Nature
USDA	2022 Strategic Pollinator Priorities Report	Knowledge	Equity, Food & Products, Nature
USDA	Win-PST (Windows-based Pesticide Screening Tool)	Tools	Water, Food & Products, Health, Nature
USDA	Water Quality Index (WQI)	Tools	Water, Food & Products, Nature
USDA	Incised Stream Restoration in the Western U.S.	Knowledge, Guidance	Drought Risk Reduction, Adaptation, Resilience, Water, Recreation, Nature
USDA and partners	Adaptation Resources for Agriculture: Responding to Changes in Climate in Alaska	Knowledge, Guidance, Tools, Technical Assistance	Climate Mitigation, Drought Risk Reduction, Adaptation, Resilience, Food and Products, Health
USDA (and non-federal partners)	Conservation Webinar Portal	Technical Assistance	Jobs, Climate Mitigation, Fire Risk Reduction, Drought Risk Reduction, Water, Food & Products, Health, Nature
USDA (and Colorado State University)	COMET-Farm COMET-Planner	Tools	Climate Mitigation, Food & Products, Nature
USDA (and New Mexico State University)	Ecosystem Dynamics Interpretive Tool	Tools	Food & Products, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
USDA (USFS)	Climate Change Resource Center: Tools CCRC: Compendium of Adaptation Approaches	Guidance, Tools	Fire Risk Reduction, Inland Flood Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Water, Food & Products, Recreation, Health, Nature
USDA (USFS)	Forest Adaptation Resources	Knowledge, Guidance, Tools	Fire Risk Reduction, Infrastructure Resilience, Nature
USDA (USFS)	Forest Management Handbook for Small-Parcel Landowners in The Sierra Nevada and Southern Cascade Range	Knowledge, Guidance, Tools, Technical Assistance	Adaptation, Resilience, Food & Products, Nature
USDA (USFS) (and non-Federal partners)	i-Tree	Tools	Climate Mitigation, Heat Risk Reduction, Infrastructure Resilience
USDA (USFS) (and non-Federal partners)	Vibrant Cities Lab	Knowledge, Guidance, Tools	Adaptation, Resilience, Equity, Community Development, Water, Recreation, Health, Nature
USDA (USFS) (and non-federal partners)	The Adaptation Workbook	Tools	Climate Mitigation, Adaptation, Resilience, Nature
USDA*	Fact Sheet: NRCS Conservation Programs and the Inflation Reduction Act (IRA)	Knowledge, Technical Assistance	Climate Mitigation, Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Water, Nature



Author(s)	Resource Title	Resource Type	Benefits Addressed
USDA*	Seedlot Selection Tool	Knowledge, Guidance, Tool, Technical Assistance	Climate Mitigation, Fire Risk Reduction, Inland Flood Risk Reduction, Drought Risk Reduction, Water, Food & Products, Health, Nature
USDA*	Fact Sheet: Harnessing the IRA to Support Western Agricultural Landscapes	Knowledge, Technical Assistance	Climate Mitigation, Fire Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Drought Risk Reduction, Water, Food & Products, Nature
USDA*	Rapid Carbon Assessment	Guidance, Tool	Climate Mitigation, Drought Risk Reduction, Water, Nature
USDA*	Cover Crop Selection and Calculator Tool for the Mid-South	Tool	Climate Mitigation, Drought Risk Reduction, Water, Food & Products, Nature
USDA*	Prescribed Grazing Tool for the Pacific Islands Area	Tool	Climate Mitigation, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Drought Risk Reduction, Water, Food & Products, Nature
USDA*	Western Water and Working Lands Framework for Conservation Action	Knowledge, Guidance	Inland Flood Risk Reduction, Heat Risk Reduction, Drought Risk Reduction
USDA*	Report: Estimates of forest ecosystem carbon for common reforestation scenarios in the United States	Knowledge	Climate Mitigation, Nature
USDA*	Caribbean Climate Hub OneUSDA Workshops	Knowledge, Guidance	Climate Mitigation, Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Heat Risk Reduction, Drought Risk Reduction, Infrastructure Resilience, Water, Food & Products, Nature
USDA*	Climate Risk Viewer	Tool	Climate Mitigation, Fire Risk Reduction, Coastal Flood Risk Reduction, Inland Flood Risk Reduction,



Author(s)	Resource Title	Resource Type	Benefits Addressed
			Heat Risk Reduction, Drought Risk Reduction, Water, Food & Products, Recreation, Health, Nature
USDA*	A Climate Resilience Guide for Small Forest Landowners	Knowledge, Guidance	Climate Mitigation, Adaptation, Resilience, Water, Recreation, Nature
USDA*	Forest Owner Carbon and Climate Education (FOCCE) program	Knowledge, Guidance	Climate Mitigation
USDA*	People's Garden Initiative	Guidance, Tools	Adaptation, Resilience, Equity, Community Development, Food & Products
USDA* & partners	California Reforestation Resources	Knowledge, Guidance, Tools, Technical Assistance	Climate Mitigation, Adaptation, Resilience, Water, Recreation, Nature
USDA* & partners	CaRPE Tool	Tool	Climate Mitigation, Drought Risk Reduction, Adaptation, Resilience, Food & Products, Nature
USGBC	USGBC Online NBS trainings	Knowledge, Technical Assistance	Climate Mitigation, Coastal Flood Risk Reduction, Inland Flood Risk Reduction, Infrastructure Resilience, Community Development, Water, Recreation, Nature



Federal Funding Relevant to Nature-Based Solutions

Agencies identified 140 federal funding programs that are supporting or could support nature-based solutions. These programs are offered by a diverse set of agencies, illustrating how nature-based solutions can advance a wide range of missions. Some of these federal funding programs solely support nature-based solutions, such as NOAAs Coastal and Marine Habitat Restoration Grants that support community-based restoration efforts, and the DOI National Park Service's Land and Water Conservation Fund. Many other programs recognize nature-based solutions as one of many types of solutions that may be supported. For example, FEMA's Building Resilient Infrastructure and Communities grants support communities to build climate resilience, and DOT's PROTECT grants program aims to increase the resilience of surface transportation infrastructure – both of these encourage the use of nature-based solutions. The information below is a snapshot in time and is meant to help build awareness of the types of funding opportunities that have been available in the past and may be available in the future.

The table below provides the name of each funding program, relevant links to program information, and a description of the project lifecycle stage(s) that the federal funding could support, including:

- Planning & Design
- Implementation or Construction
- Operations & Maintenance
- Monitoring

To date, federal funding programs have provided more robust support for planning, design, implementation and construction phases of nature-based solutions, while operations, maintenance and monitoring are less supported. More balanced funding across all phases of nature-based solution adoption may be needed to support agencies and communities in realizing the full potential of these solutions.

Agency websites will maintain the most up to date information about active funding programs and potential applicants should confirm the information below for accuracy. In addition to the information below, compilations maintained by [EPA](#) and [National Wildlife Federation](#) (NWF) provide information on open or recurring funding opportunities.⁴

⁴ The EPA-led Green Infrastructure Federal Collaborative has reviewed the information in the NWF database, but cannot guarantee the accuracy of any current information or updates.



Table 2. Federal funding programs that support nature-based solutions

Funding programs identified by agencies as of November, 2023. Programs are listed by supporting agency. Project phases that each program can support are noted. This list provides examples of the broad range of agencies and programs that have or are currently supporting nature-based solutions, or that may support nature-based solutions in the future. Programs may not have active funding opportunities at all times. Please check agency websites and information sources for the most up to date information.

Agency	Funding Program	Planning & Design	Implementation or Construction	Operations & Maintenance	Monitoring
DHS (FEMA)	BRIC Sub-Program: Direct Technical Assistance (DTA)	YES	YES	NO	NO
DHS (FEMA)	Building Resilient Infrastructure and Communities (BRIC)	YES	YES	NO	NO
DHS (FEMA)	Community Assistance Program: State Support Services Element (CAP-SSSE) (97.023)	YES	YES	YES	NO
DHS (FEMA)	Emergency Management Performance Grant	YES	YES	NO	NO
DHS (FEMA)	Hazard Mitigation Grant Program (HMGP)	YES	YES	NO	NO
DHS (FEMA)	Fire Management Assistant Grants	YES	YES	NO	NO
DHS (FEMA)	Flood Mitigation Assistance (FMA) Grant Program	YES	YES	NO	NO
DHS (FEMA)	Flood Mitigation Assistance Sub-Program: Swift Current Initiative	YES	YES	NO	NO
DHS (FEMA)	Mitigate Disaster Damage with FEMA Public Assistance	YES	YES	NO	NO
DHS (FEMA)	Pre-Disaster Mitigation (PDM) Grant	YES	YES	NO	NO
DHS (FEMA)	Regional Catastrophic Preparedness Grant Program (RCPGP)	YES	YES	NO	NO
DHS (FEMA)	Safeguarding Tomorrow Revolving Loan Fund	YES	YES	NO	YES



Agency	Funding Program	Planning & Design	Implementation or Construction	Operations & Maintenance	Monitoring
DHS (FEMA)	Tribal Funding, Mitigation, & Planning	YES	NO	NO	NO
DOC (EDA)	American Rescue Plan Program: Economic Adjustment Assistance Funds	YES	YES	NO	NO
DOC (EDA)	Public Works and Economic Adjustment Assistance Funds	YES	YES	NO	NO
DOC (NOAA)	Bay Watershed Education and Training (B-WET)	YES	NO	NO	NO
DOC (NOAA)	Climate Resilience Regional Challenge	NO	YES	NO	YES
DOC (NOAA)	Coastal and Marine Habitat Restoration Grants	YES	YES	YES	YES
DOC (NOAA)	Inflation Reduction Act: Climate Ready Coasts	YES	YES	YES	NO
DOC (NOAA)	NOAA Fisheries: Coastal Habitat Restoration and Resilience Grants for Tribes and Underserved Communities	YES	YES	NO	YES
DOC (NOAA)	Coastal Zone Management (CZM) Habitat Protection and Restoration Bipartisan Infrastructure Law Competition	YES	YES	NO	NO
DOC (NOAA)	Effects of Sea Level Rise (ESLR) Program	YES	NO	NO	YES
DOC (NOAA)	Great Lakes Fish Habitat Restoration Regional Partnership Grants	YES	YES	NO	YES
DOC (NOAA)	National Coastal Resilience Fund (NCRF)	YES	YES	NO	NO



Agency	Funding Program	Planning & Design	Implementation or Construction	Operations & Maintenance	Monitoring
DOC (NOAA)	NERRS Habitat Protection and Restoration Bipartisan Infrastructure Law Competition	YES	YES	NO	NO
DOC (NOAA)	Restoring Fish Passage Through Barrier Removal Grants	YES	YES	NO	YES
DOC (NOAA)	Restoring Tribal Priority Fish Passage Through Barrier Removal Grants	YES	YES	NO	YES
DOC (NOAA)	Sea Grant Funding Opportunities	YES	YES	NO	YES
DOC (NOAA)	Transformational Habitat Restoration and Coastal Resilience Grants	YES	YES	NO	YES
DOD	Readiness and Environmental Protection Integration (REPI) Program	NO	YES	YES	NO
DOD	Installation Resilience Program – Office of Local Defense Community Cooperation	YES	YES	NO	NO
DOD	Defense Community Infrastructure Pilot Program – Office of Local Defense Community Cooperation	YES	YES	NO	NO
DOD	Public Schools on Military Installations - - Office of Local Defense Community Cooperation	YES	YES	NO	NO
DOD (USACE)	Continuing Authorities Program (CAP) Section 103 - Beach Restoration and Shoreline Protection – Technical Assistance	YES	YES	YES	YES



Agency	Funding Program	Planning & Design	Implementation or Construction	Operations & Maintenance	Monitoring
DOD (USACE)	CAP Section 204 - Beneficial Use of Dredged Material – Technical Assistance	NO	YES	YES	NO
DOD (USACE)	CAP Section 205 - Small Flood Risk Management Projects – Technical Assistance	YES	YES	NO	NO
DOD (USACE)	CAP Section 206 - Aquatic Ecosystem Restoration – Technical Assistance	YES	YES	NO	NO
DOD (USACE)	CAP Section 1135 - Project Modifications for Improvements of the Environment – Technical Assistance	YES	YES	NO	NO
DOD (USACE)	Environmental Infrastructure Program (EI)	YES	YES	NO	NO
DOD (USACE)	Floodplain Management Services Program – Technical Assistance	YES	NO	NO	NO
DOD (USACE)	Permanent Measures to Reduce Emergency Flood Fighting Needs for Communities Subject to Repetitive Flooding (Section 119)	YES	YES	NO	NO
DOD (USACE)	Individually Authorized Feasibility Studies and Projects – Technical Assistance	YES	YES	YES	YES
DOD (USACE)	Planning Assistance to States and Tribes Programs (PAS)	YES	NO	NO	NO
DOD (USACE)	Silver Jackets Program – Technical Assistance	YES	NO	NO	NO
DOD (USACE)	Tribal Partnership Program (TPP) – Technical Assistance	YES	YES	NO	YES



Agency	Funding Program	Planning & Design	Implementation or Construction	Operations & Maintenance	Monitoring
DOI	Climate Change Technical Assistance for Territories	YES	YES	NO	NO
DOI	Office of Surface Mining and Reclamation and Enforcement: Abandoned Mine Reclamation Fund	NO	YES	NO	NO
DOI (BIA)	Tribal Climate Resilience Grants – Annual Awards Program	YES	YES	YES	NO
DOI (BLM)	IRA Bureau of Land Management Headquarters (HQ) Threatened and Endangered Species Program	YES	YES	NO	YES
DOI (BLM)	IRA Bureau of Land Management Headquarters (HQ) Plant Conservation and Restoration Management Program	YES	YES	NO	YES
DOI (BLM)	IRA Bureau of Land Management Headquarter (HQ) Rangeland Resource Management	YES	YES	NO	YES
DOI (BLM)	IRA Bureau of Land Management Headquarter (HQ) Wildlife Program	YES	YES	NO	YES
DOI (BOR)	WaterSMART Aquatic Ecosystem Restoration Projects	YES	YES	YES	NO
DOI (BOR)	WaterSMART Environmental Water Resources Projects	YES	YES	YES	NO
DOI (BOR)	WaterSMART Cooperative Watershed Management Program	NO	YES	YES	NO
DOI (FWS)	National Coastal Wetlands Conservation Grants	YES	YES	YES	NO
DOI (FWS)	FWS National Wildlife Refuge System Resiliency	YES	YES	YES	YES



Agency	Funding Program	Planning & Design	Implementation or Construction	Operations & Maintenance	Monitoring
DOI (FWS)	North American Wetlands Conservation Act (NAWCA) Grants	NO	YES	NO	NO
DOI (FWS)	State Wildlife Grants	YES	YES	YES	YES
DOI (FWS)	National Fish Passage Program	YES	YES	YES	NO
DOI (NPS)	Land and Water Conservation Fund – State and Local Assistance Program		YES	YES	NO
DOT	Multimodal Project Discretionary Grant (MPDG) program	YES	YES	NO	NO
DOT	Reconnecting Communities and Neighborhoods Grant Program	YES	YES	NO	YES
DOT	Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Grant Program	YES	YES	NO	NO
DOT (FHWA)	Surface Transportation Block Grants	YES	YES	NO	NO
DOT (FHWA)	Wildlife Crossing Program	YES	YES	NO	NO
DOT (FHWA)	National Culvert Removal, Replacement, and Restoration Grant Program (Culvert Aquatic Organism Passage (AOP) Program)	YES	YES	NO	YES
DOT (FHWA)	Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Discretionary Grants Program	YES	YES	NO	NO
DOT (FHWA)	Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Formula Program	YES	YES	NO	NO



Agency	Funding Program	Planning & Design	Implementation or Construction	Operations & Maintenance	Monitoring
DOT (FHWA)	Surface Transportation Block Grant (STBG) Program – Transportation Alternatives	YES	YES	YES	NO
EPA	Brownfields Grants	YES	NO	NO	NO
EPA	Brownfields Assessment Grants	YES	NO	NO	NO
EPA	Brownfields Cleanup Grants	YES	YES	YES	YES
EPA	Brownfields Multipurpose Grants	YES	YES	YES	YES
EPA	Brownfields Revolving Loan Funds (RLF) Grants	YES	YES	YES	YES
EPA	Climate and Environmental Justice Block Grants	YES	YES	NO	YES
EPA	Drinking Water State Revolving Fund	YES	YES	NO	NO
EPA	Environmental Justice Small Grants	YES	YES	NO	YES
EPA	Gulf Hypoxia Program	YES	YES	YES	YES
EPA	Gulf of Mexico Underserved Farmer to Farmer Grants Program RFA	YES	NO	NO	NO
EPA	San Francisco Bay Water Quality Improvement Fund Grants (Base and BIL)	YES	YES	NO	YES
EPA	Columbia River Basin Restoration Funding Assistance Program Grants	YES	YES	NO	YES
EPA	Puget Sound Partnership Grants	YES	YES	NO	YES
EPA	Long Island Sound Community Impact Fund	YES	YES	NO	NO
EPA	Long Island Sound Futures Fund	YES	YES	NO	NO
EPA	Lake Champlain Basin Program Grants	YES	YES	NO	YES



Agency	Funding Program	Planning & Design	Implementation or Construction	Operations & Maintenance	Monitoring
EPA	Southeast New England Program Stormwater and Natural Infrastructure Grant	YES	YES	YES	YES
EPA	Superfund Redevelopment Program	Yes	NO	NO	NO
EPA	EPA Water Technical Assistance (WaterTA)	YES	NO	NO	NO
EPA	Wetland Program Development Grants and EPA Wetlands Grant Coordinators	YES	NO	NO	YES
EPA	Clean Water State Revolving Fund (CWSRF)	YES	YES	NO	NO
EPA	Environmental Justice Collaborative Problem-Solving Cooperative Agreement Program	YES	YES	NO	YES
EPA	Environmental Justice Government-to-Government (EJG2G) Program	YES	YES	NO	YES
EPA	Green Streets, Green Jobs, Green Towns (G3) Grant Program	YES	YES	NO	NO
EPA	National Estuary Program Coastal Watersheds Grant	YES	YES	NO	YES
EPA	National Estuary Program Watersheds Grant	YES	YES	NO	YES
EPA	Section 319 Nonpoint Source Grants (Clean Water Act)	YES	YES	YES	YES
EPA	Sewer Overflow and Stormwater Reuse Municipal Grants (OSG)	YES	YES	NO	NO
EPA	Water Infrastructure Finance and Innovation Act (WIFIA)	YES	YES	NO	NO
EPA/ DOC (NOAA)	Great Lakes Restoration Initiative (GLRI) Funds	YES	YES	NO	NO



Agency	Funding Program	Planning & Design	Implementation or Construction	Operations & Maintenance	Monitoring
HUD	Choice Neighborhoods Implementation Grant	NO	YES	NO	NO
HUD	Community Development Block Grant Disaster Recovery Grant Funds	YES	YES	NO	NO
HUD	Community Development Block Grant Mitigation Program	YES	YES	NO	NO
HUD	CDBG Section 108 Loan Guarantee Program	YES	YES	NO	NO
NFWF	Emergency Coastal Resilience Fund (ECRF)	YES	YES	NO	NO
NFWF	Lower Mississippi Alluvial Valley Restoration Fund	YES	YES	NO	NO
NFWF	NFWF America the Beautiful Challenge	YES	YES	NO	NO
USDA	Conservation Reserve Enhancement Program	YES	YES	YES	YES
USDA	Continuous Conservation Reserve Program (CCRP)	YES	YES	YES	YES
USDA	Farmable Wetland Program	YES	YES	YES	YES
USDA	General Conservation Reserve Program (CRP)	YES	YES	YES	YES
USDA	Continuous Conservation Reserve Program (CCRP)	YES	YES	YES	YES
USDA	Emergency Conservation Program	YES	YES	NO	NO
USDA	Emergency Forest Restoration Program (EFRP)	YES	YES	NO	NO
USDA	State Acres for Wildlife Enhancement (SAFE)	YES	YES	YES	YES



Agency	Funding Program	Planning & Design	Implementation or Construction	Operations & Maintenance	Monitoring
USDA	Collaborative Aquatic Landscape (CALR) Restoration Program	NO	YES	NO	NO
USDA	Community Wildfire Defense Grant Program	YES	YES	NO	NO
USDA	Collaborative Forest Landscape Restoration Program (CFLRP)	YES	YES	NO	YES
USDA	Community Forest and Open Space Conservation Program	YES	NO	NO	NO
USDA	Forest Legacy Program	YES	NO	NO	NO
USDA	Forest Stewardship Program	YES	NO	NO	NO
USDA	Secure Rural Schools Program	NO	YES	NO	NO
USDA	State Fire Assistance Program	YES	YES	YES	YES
USDA	Urban and Community Forestry Program – Grant Cost Share	YES	YES	YES	NO
USDA	Joint Chief's Landscape Restoration Partnership Program	YES	YES	YES	YES
USDA	Agricultural Conservation Easement Program - Agricultural Land Easements (ACEP-ALE)	YES	YES	NO	YES
USDA	Conservation Innovation Grants (CIG)	YES	YES	YES	YES
USDA	Conservation Stewardship Program (CSP)	YES	YES	YES	NO
USDA	Emergency Watershed Protection	YES	YES	NO	NO
USDA	Environmental Quality Incentives Program	YES	YES	YES	YES
USDA	Landscape Conservation Initiatives	YES	YES	YES	YES
USDA	National Water Quality Initiative	YES	YES	YES	YES
USDA	Regional Conservation Partnership Program (RCPP)	YES	YES	NO	NO



Agency	Funding Program	Planning & Design	Implementation or Construction	Operations & Maintenance	Monitoring
USDA	<u>Watershed and Flood Prevention Operations (WFPO) Program</u>	YES	YES	NO	NO
USDA	<u>Watershed Rehabilitation Program (REHAB)</u>	YES	YES	NO	NO
USDA	<u>WaterSMART Initiative (WSI)</u>	YES	YES	YES	YES
USDA	<u>Western Lake Erie Basin Initiative (WLEB)</u>	YES	YES	YES	YES
USDA	<u>Wetland Mitigation Banking Program</u>	YES	YES	NO	YES
USDA	<u>Agricultural Conservation Easement Program - Wetland Reserve Easements (ACEP-WRE)</u>	YES	YES	NO	YES
USDA	<u>Wetland Reserve Enhancement Partnership</u>	YES	YES	NO	YES