Ecosystem Services at Superfund Sites

Reuse and the Benefit to Community

EPA

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Introduction

Superfund site cleanup and reuse can result in restored value to site properties and surrounding communities. Sites in reuse and continued use can revitalize a local economy with economic benefits such as jobs, new businesses, tax revenues and local spending. New or restored ecosystems on sites can also generate important economic benefits by producing a range of services – timber, purification of surface water and recreation opportunities, among others, commonly known as ecosystem services.

While the exact value of these ecosystem services can be challenging to measure, they provide substantial benefits to communities. Ecosystem services support all facets of human systems, providing trillions of dollars in amenities and important natural capital. This case study explores different types of ecosystem services, how ecosystems generate economic benefits and non-financially driven benefits and efforts by economists and ecologists to value and quantify these benefits. Throughout the case study, examples of ecosystem services in action at Superfund sites highlight the positive impacts of these services at remediated sites across the country. The number of sites supporting ecological and recreational uses and the number of instances of specific beneficial uses at Superfund sites nationwide are listed to the right.

15,000
Acres Conserved

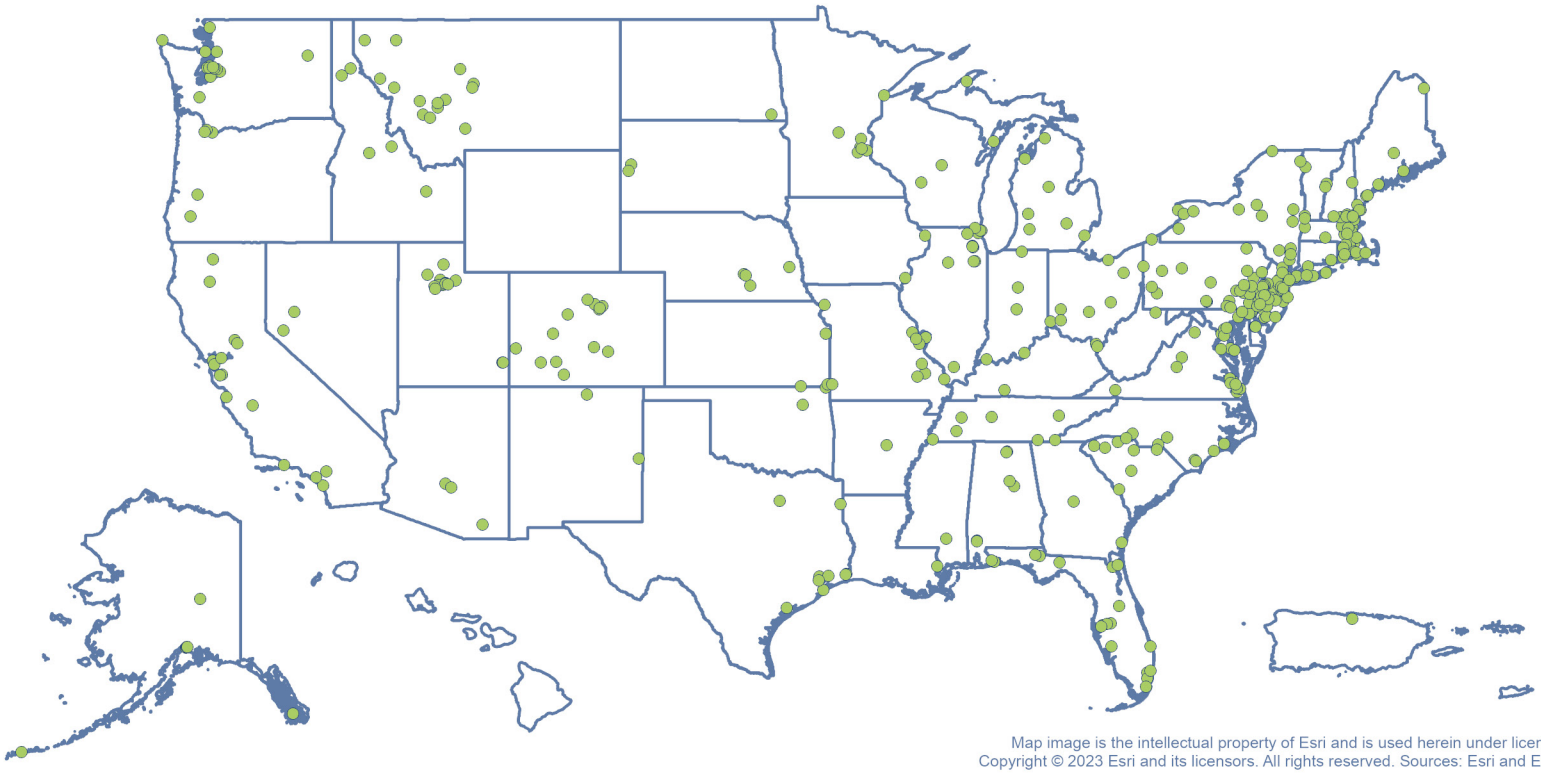
250+
Sites in Ecological Use

300+
Sites in Recreational Use

700+
Parks and Picnic Areas

300+
Trails on Superfund Sites

13,000
Acres of Public Access



There are currently nearly 2,000 ecological and recreational reuse activities, which are often closely tied to ecosystem services, at about 460 Superfund sites, noted in green above, across the United States.

Economic Value of Ecosystem Services

Ecologists use the term "ecosystem" to describe the dynamic interactions of plant, animal and microorganism communities with one another as well as their environments. The components of their environments – such as the amount of rainfall and availability of sunlight – have a major impact on how they live, interact and adapt over time.

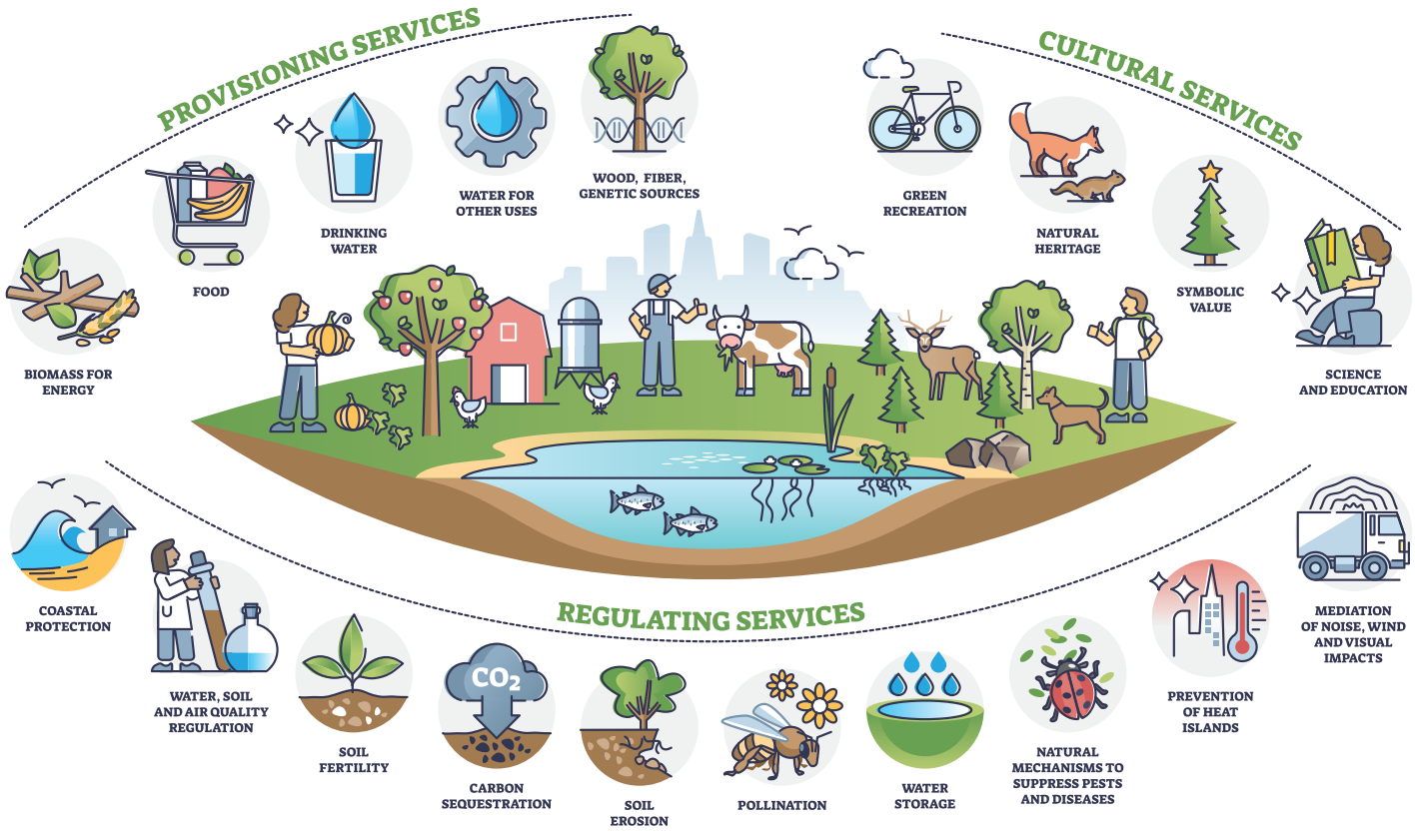
Ecosystem services are the many benefits that these ecosystems provide to humans. These services provide people with tangible benefits – timber for making furniture, crops that provide food and fuel – as well as intangible or non-material benefits such as inspiration to create art. Ecosystem services make human life possible by providing life-sustaining benefits such as food, clean air and water, and fertile soil, as well as support for cultural growth and environmental education. Ecosystem services affect a wide range of communities and organizations, including businesses. In turn, these communities, organizations and businesses affect local well-being and quality of life, employment rates, property values and tax revenue generation.

DID YOU KNOW?

$1.6 trillion
estimated annual value of ecosystem services in the United States

$32 billion
total ecosystem service value of national wildlife refuges protected under the Endangered Species Act

ECOSYSTEM SERVICES



Economic Approaches to Ecosystem Services Valuation

Measuring the economic value of ecosystem services can be complex. Some services – such as fish, agricultural produce and timber – have market values, because they can be bought and sold. However, other services, such as putting a dollar value on how much someone is willing to pay for the opportunity to enjoy a view, are more challenging to measure. Economic valuation methods seek to understand the tradeoffs people are willing to make for ecological improvements based on the benefit received from ecological goods and services. Some methods show tradeoffs in the form of money while others look at individuals' choices and behaviors. Together, these tools help economists provide more complete information about the economic impacts of policies and help inform decision-making at Superfund sites.

There are five primary methods of ecosystem services valuation.

Market-Based Methods

Focus on market prices of goods and services to infer values related to ecosystem services and changes.

Travel Cost Methods

Focus on how much people pay directly or indirectly to visit locations with specific environmental features and ecosystem services to understand how much they value them.

Hedonic Pricing

Focus on how much people pay for directly purchased items, such as a house, with specific environmental features to understand how much they value changes in those features.

Averting-Behavior Methods

Focus on identifying how much people spend to avoid negative effects, including environmental effects, to understand how much they are willing to pay for improvements.

Survey Questions

Focus on helping researchers understand the tradeoffs people are willing to make for ecological improvements and to inform economic analyses.

To identify the ways that ecosystems contribute to human well-being, EPA uses the Final Ecosystem Goods and Services (FEGS) measure to define outputs from nature that humans use and appreciate in diverse ways. For example, water flowing in a stream that is used for kayaking is a final ecosystem service; it reflects multiple supporting ecosystem services such as groundwater recharge and precipitation. Other processes produce final ecosystem services but are not classified as FEGS because they are not directly consumed, used or enjoyed. For example, that same water flowing in a stream is not a final ecosystem service to a hiker who appreciates a deer that drinks that water; the direct use by a beneficiary is crucial in what makes a particular ecosystem good or service a FEGS.

Standardized ecosystem services definitions and classifications inform research and decision-making. EPA researchers develop resources and tools to help communities incorporate the benefits of ecosystems into local planning efforts. For example, EPA's FEGS classification system provides a framework that identifies ecosystem services and associates them with a beneficiary. A beneficiary is a person, organization, household or business that uses or appreciates an ecosystem service, resulting in an impact on their welfare.

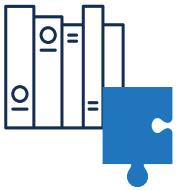
This diagram highlights connections and exchanges between ecosystem services and human systems.

NON-USE VALUE OF ECOSYSTEM SERVICES

At the broadest level, people benefit from the existence value of a landscape and its flora and fauna. Economists measure the value of this service through surveys that measure people's willingness to pay. For example, many people care about the survival and health of monarch butterfly populations. In 2013, the willingness to pay for the existence of monarchs among U.S. households was calculated at a total one-time payment of $4.8 billion to $6.6 billion.

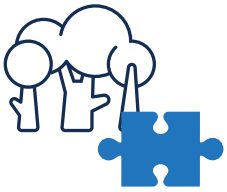
EPA TOOLS FOR ASSESSING VALUE

EPA has a toolkit of resources that guides the assessment of values for ecosystem services. These tools help EPA and others gain a more robust understanding of the impacts of ecosystem services, to inform cleanup and reuse decisions at Superfund sites.

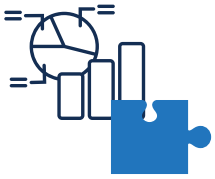


Final Ecosystem Goods and Services (FEGS) Scoping Tool
This tool identifies and prioritizes FEGS beneficiaries, the benefits they receive, and environmental characteristics required to realize those benefits. The tool informs decision-making by ranking alternatives using weighted criteria.

National Ecosystem Services Classification System (NESCS)
The NESCS classifies FEGS, direct uses and direct users to identify ecosystem services used and appreciated by humans, how humans use and appreciate FEGS, and who directly uses each FEGS.



FEGS Metric Report
This report presents FEGS metrics in a set of tables organized by ecosystem and the ways people interact with or perceive nature. The report describes how these metrics were identified for beneficiaries.



EcoService Models Library (ESML)
This online database identifies ecological models that may be useful for quantifying ecosystem goods and services. It helps guide ecosystem-based management in different environments.

EnviroAtlas
An online suite of interactive tools for users to discover, analyze and download data and maps related to ecosystem services.

Ecosystem-Based Management (EBM) Textbook
This resource describes concepts, tools and case studies from EPA's Ecosystem Services Program. EBM-based approaches help people address complex social-environmental challenges.

ECOSYSTEM MARKETPLACE

Offering conservation incentives or credits paid to landowners and managers to protect, restore or mitigate impacts to ecosystems is one approach to safeguarding ecosystem services. Nationally, demand for forest carbon offsets, watershed services and biodiversity conservation is valued at an estimated $16.7 to $18 billion annually. The U.S. Department of Agriculture Office of Environmental Markets, EPA and the Forest Trends' Ecosystem Marketplace partnered to bring environmental market data into EnviroAtlas. The market data layers show where organizations have used markets for wetlands and streams, watersheds, forest carbon and compromised species and habitats. The data allow users to understand trends, gaps, and opportunities, and to ask questions about demand and impact on environmental markets.

Superfund Considerations of Ecosystem Services

EPA's Superfund site teams evaluate the effects of contamination and options to mitigate associated risks to protect human health as well as the environment. Ecological risk assessments (ERAs) are a part of the remedial investigation process and determine whether the ecological risks warrant remedial action or cleanup. EPA's Guidelines for Ecological Risk Assessment defines an assessment endpoint as the environmental value to be protected (an ecological entity and its characteristics). For example, an ecological entity might be an important species of fish. One of its attributes could be procreation. ERAs that include ecosystem service endpoints provide more useful information than conventional endpoints alone for economists doing cost-benefit analyses.

Assessing risks to ecosystem services can highlight potential assessment endpoints not considered by conventional risk assessments, such as nutrient cycling, carbon sequestration and soil formation. ERAs can predict the probability of future impacts. They can also evaluate the probability that currently observed effects are the result of past or ongoing exposure to hazardous substances and other stressors such as land use and invasive species. Management of ecological risk protects a landscape's natural resources as well as its supporting ecosystem services, such as flood control, nutrient cycling and photosynthesis.

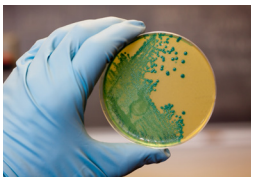
The U.S. Department of the Interior, along with state, tribal and other federal partners acting as trustees for injured natural resources, manage the Natural Resource Damage Assessment and Restoration (NRDAR) Program. While ERAs inform Superfund site remediation decisions, ecosystem restoration decisions, compensation and evaluation of proposed redevelopment are informed by the natural resource damage assessment (NDRA) process. The NRDAR program identifies injured resources and determines the extent of injuries, recovers damages from responsible parties, and plans and implements natural resource restoration activities. This NRDA process identifies, measures and quantifies the baseline value and reduction in services resulting from the damaged resources, in order to determine appropriate compensation.

OPPORTUNITIES TO CONSIDER ECOSYSTEM SERVICES THROUGHOUT SITE CLEANUP

Decision-making and actions taken during different stages of the Superfund process can affect ecosystems and ecosystem services in different ways.

Ecosystem services are considered throughout the entire process

ASSESSMENT



Discovery of Contamination

Preliminary Assessment

Site Inspection

National Priorities List (NPL) Site Listing

Early engagement with community members during the preliminary assessment for the Chemical Commodities, Inc. Superfund site in Kansas identified local reuse priorities, including pollinator habitat and environmental education.

CHARACTERIZATION

Remedial Investigations/ Feasibility Study & Proposed Plan

Characterization of mine tailings in the West Page Swamp area of the Bunker Hill Mining & Metallurgical Complex Superfund site in Idaho identified a non-engineered approach to capping soil with compost and wood ash to reduce accessibility and bioavailability of contamination and to restore wetland function.

SELECTION OF REMEDY

Record of Decision

Multi-agency coordination at the Atlas Tack Superfund site in Massachusetts resulted in the selection of site-specific sediment remedial goals that facilitate wetland restoration, including the design of fresh and saltwater marshes to outcompete an invasive species.

CLEANUP

Remedial Design

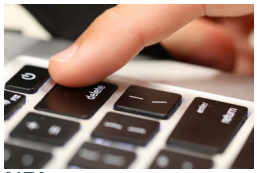
Remedial Action

Cleanup at the Naval Amphibious Base Little Creek Superfund site in Virginia converted a landfill into a tidal wetland including native tidal vegetation consistent with surrounding marsh areas.

Five Year Reviews

POST-CONSTRUCTION

Operation and Maintenance



NPL Deletion

Monitoring at the Loring Air Force Base Superfund site in Maine employed indicator species such as dragonfly nymphs, midge flies, dace minnow and brook trout to track the recovery of the stream system.

Green Remediation Cleanups Optimize Ecosystem Services

EPA also supports "greener" cleanups of Superfund sites through a variety of green remediation strategies, many of which make use of ecosystem services to minimize their environmental footprint. Examples of green remediation approaches include using renewable energy sources, reducing air pollutants and greenhouse gas emissions, preserving water quality, conserving material resources, reducing waste, using select plants and bacteria that can accelerate the breakdown of contaminants, and protecting land and ecosystem services.

Cleanups at 33 Superfund sites include green remediation elements. For example, anaerobic bioreactor systems at the Re-Solve, Inc., Superfund site in Massachusetts produce less waste than conventional groundwater treatment methods. At the Ryeland Road Arsenic Superfund site in Pennsylvania, plantings of Chinese brake ferns in the site's forested wetland reduce arsenic concentrations in groundwater. A 100% solar-powered groundwater treatment system at the Frontier Fertilizer Superfund site in California offsets more than 54 metric tons of carbon dioxide emissions each year. Coupled with an electrical resistance heating system, the solar cleanup approach is anticipated to shorten the cleanup timeline by 120 years.

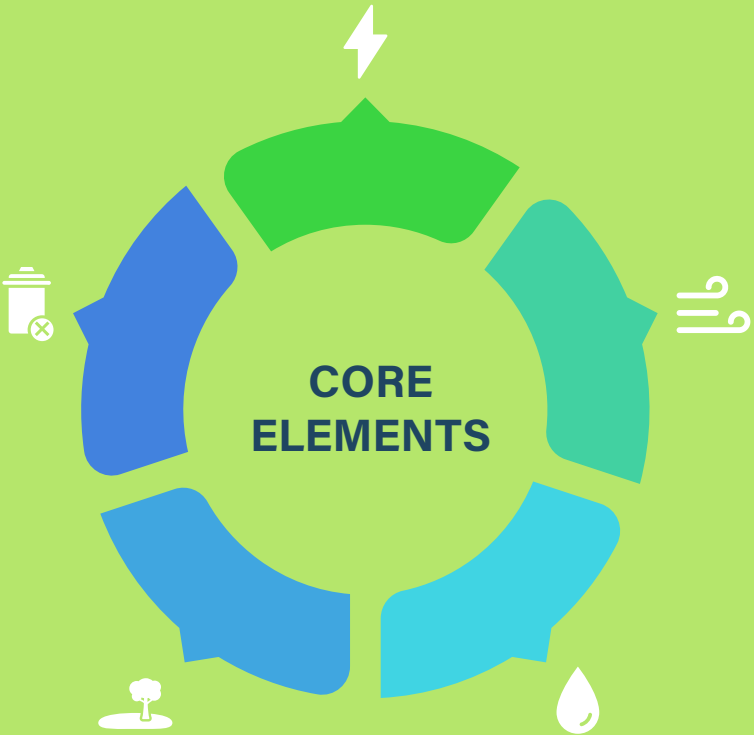
EPA planted and harvested Chinese brake ferns as part of a project using plants to break down contaminants at the Ryeland Road Arsenic Superfund site in Pennsylvania.

Solar energy provides 100% of the power needed for operation and maintenance activities at the Frontier Fertilizer Superfund site in California.

GREENER CLEANUPS

Superfund cleanups require economic and natural resources. The energy, water and materials needed create an environmental footprint. Best management practices consider five core elements to make cleanups greener:

- Total energy use and renewable energy use.
- Air and atmospheric pollutants and greenhouse gas emissions.
- Water use and impacts on water resources.
- Land management and ecosystem services.
- Materials management and waste reduction.



Beneficial Effects of Ecosystem Services and Ecological Reuse at Superfund Sites

Superfund cleanups often include efforts to restore ecosystems damaged or destroyed by contamination. Ecological revitalization – the process of returning land from a contaminated state to one that supports functioning and sustainable habitat – may occur at sites with anticipated future ecological use. Ecological reuse of Superfund sites allows communities to reclaim lost land, provides important habitat, creates green space, protects water resources, sequesters carbon and helps remove the stigma associated with formerly contaminated lands. Over 1,930 ecological uses, ranging from grassland habitats to wetlands and forests, and nearly 1,000 recreational uses, including protected parklands and athletic fields, are supported at 460 Superfund sites. The following sections highlight different types of ecosystem services, some of the associated benefits they provide and examples of ecosystem services in action at Superfund sites.

460
Superfund sites

1,000
Recreational uses, including protected parklands and athletic fields

1,930+
Ecological uses, ranging from grassland habitats to wetlands and forests

EPA tracks various ecological site uses, including beaches, forests, gardens, grasslands, lakes, oceans, pollinator habitat and wetlands. Additional examples include the following number of uses:

58
Endangered, Threatened and Protected Species Habitats

41
Constructed Habitats

915
Rivers, Creeks and Streams

EPA tracks various recreational site uses, including boating, camping, disc golf, fishing, hunting, rock climbing and athletic fields. Additional examples include the following number of uses:

309
Trails

132
Boat Launches

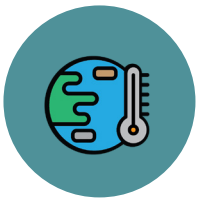
334
Municipal, State and National Parks

Ecosystem Service Highlights

Wetlands

Recreation

Pollination



Climate, Sustainability and Resilience

Culture

Green Infrastructure

Environmental Education

Subsistence and Commercial Extraction

Energy Generation

WETLANDS

Wetlands are among the most productive ecosystems in the world, with an immense variety of biodiversity in microbes, plants, insects, birds and fish. These rivers, streams, marshes, floodplains, swamps and other ecosystems flooded by water periodically or perpetually, are significant landscape features that provide beneficial services for people and wildlife.

Wetlands support open space and water bodies for outdoor recreation, protect and improve water quality, provide wildlife habitat and support commercial fishing, store floodwaters, and maintain surface water flow during dry periods. Wetlands include mangrove forests and estuaries along coastlines, marshes, and inland lakes and rivers. The interconnection of wetland areas brings together precipitation, runoff, groundwater and stormwater, facilitating a dynamic flow and delivery of nutrients.

Wetlands also make vital contributions to local, national and global economies. In the contiguous United States, Hawaii and Puerto Rico, wetlands cover about 8.2% of the total land mass in the country, excluding Alaska. A 2019 study estimated that the global monetary value of wetland ecosystems is Int$47.2 trillion (international dollars), 43.5% of the value of all natural biomes. A report on New Jersey's natural capital estimated values of $8,700 and $6,500 per acre for freshwater and saltwater wetlands, respectively, for a total value of $10.6 billion per year in the state. The economic value of specific wetland sites varies widely depending on location, habitat quality and other factors.

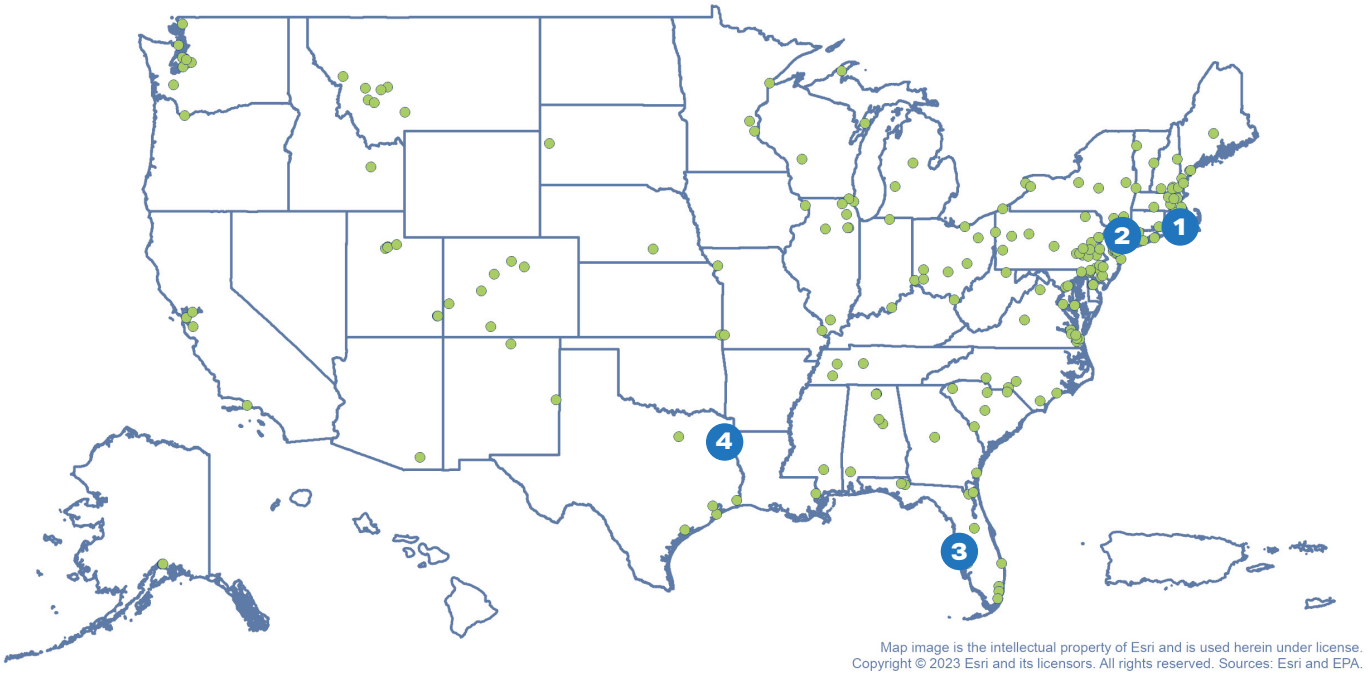
With increased understanding of the benefits from wetlands and the services they provide, some studies have attempted to estimate the economic value of specific wetland ecosystem services. For example, wetlands store and slowly release large volumes of water, providing natural flood control services. In Minnesota, the annual cost of replacing the flood control function of 5,000 acres of drained wetlands is estimated at $1.5 million. Wetland water quality control is another example. Wetlands improve water quality as it moves through an ecosystem and contaminants are filtered out. Quantifying the value of this service can be done by estimating the cost to purify the same water using a manmade system. For example, a

2022 study found that southern Ontario, Canada, wetlands provide over US$4 billion worth of water and sediment filtration services.

Impacted wetlands at many Superfund sites have been restored. Sites have also been turned into protected wetland areas to preserve habitats and ensure the protection of beneficial wetland processes. Considering the ecosystem goods and services received from wetlands is an important part of the cleanup process and remedial design for sites with wetland areas. Wetlands often play an active role in cleanups, breaking down contaminants through naturally occurring bacteria and microorganisms and filtering water. Wetlands can also be a core part of a site's long-term remedy and reuse infrastructure, providing stormwater management to protect remedy components and support the site's potential future recreational, cultural and commercial uses. A table showing ecosystem services provided by wetlands and examples of wetland ecosystem services at Superfund sites across the country are highlighted on the following pages.

An Overview of the Ecosystem Services Provided by Wetlands

Category	Beneficiary	Importance
Agricultural	Irrigators	Water for growing and maintaining crops.
	Livestock grazers	Water and vegetation (e.g., salt, hay) for livestock consumption.
	Aquaculturists	Conditions (e.g., water quality) for cultivating aquatic organisms.
	Farmers	Suitable soil and conditions for the cultivation of crops; wild pollinators, depredators and (pest) predators that enable crop growth.
Commercial and Industrial	Food, fiber, timber and ornamental extractors	Edible organisms, timber, fiber or ornamental products (e.g., duck, cypress, sphagnum, cattails, grasses, shells, dried flowers) for commercial use or sale.
	Resources-dependent business	Opportunity for placement of infrastructure; reduced risk of flooding, erosion and pest infestation.
	Pharmaceutical suppliers	Organisms used in medicines or sold for medicinal purposes.
	Fur/hide trappers and hunters	Organisms (e.g., beavers, alligators, snakes) that provide fur or hides for commercial use or sale.
Subsistence	Food subsisters	Edible organisms (e.g., fish, crawfish, ducks) or associated products that are gathered or hunted for personal use.
	Timber, fiber and fur/hide subsisters	Timber, fiber or organisms (e.g., cypress, reeds, grasses, alligators) used for clothing/warmth, infrastructure, housing, roofing or fuel for personal use.
Recreational	Experiencers and viewers	Opportunity to view the environment and organisms; landscape, organisms, sounds and scents that provide a sensory experience.
	Food pickers and gatherers	Edible organisms (e.g., crawfish, mussels) or associated products that are picked or gathered for personal use.
	Hunters	Organisms (e.g., beavers, ducks, geese, alligators) that can be hunted.
	Anglers	Fish in the water.
	Waders, swimmers	Opportunity and conditions for wading, swimming and diving.
	Boaters	Opportunity, medium and conditions for recreational boating.
Inspirational	Spiritual/ceremonial participants	Opportunity and conditions for spiritual and ceremonial practices and celebrations.
	Artists	Inspiration for art; materials and sensory experiences used in art.
Educational	Educators/students	Opportunities to understand, communicate and educate.
	Researchers	Research opportunities.
Non-Use	People who care	Knowing that the environment exists.



There are more than 240 functioning wetlands, indicated by green dots above, located at Superfund sites across the country. Wetland restoration is often part of Superfund remedies. It is a key part of broader efforts to restore functioning ecosystems at these sites.

Atlas Tack Corp. | Fairhaven, Massachusetts

EPA's cleanup included the restoration of wetland areas and enhancements to preserve the natural and scenic habitat. Boys Creek and associated wetlands and saltwater marshes provide habitats for plants, fish and wildlife. The Massachusetts National Heritage Program designated the area as a rare species habitat.

Universal Oil Products (Chemical Division) | East Rutherford, New Jersey

The Meadowlands area includes a large ecosystem of marshes and streams that serves as an important habitat for birds, fish, crabs and mollusks. EPA expedited cleanup of site lagoons to facilitate construction of an elevated rail line across the site.

Raleigh Street Dump | Tampa, Florida

Cleanup included restoration and expansion of wetland habitat, establishment of wildflower and native grass meadows, installation of nesting boxes for small birds, and creation of habitat brush piles. Potentially responsible parties also installed a bat box to provide habitat for native Florida bats and planted two milkweed gardens to provide habitat for Monarch butterflies.

Longhorn Army Ammunition Plant | Karnack, Texas

The establishment of Caddo Lake National Wildlife Refuge on site helps ensure that migratory and resident waterfowl and neo-tropical migratory birds associated with these wetlands are conserved and protected. Studies have identified 224 species of birds, 22 species of amphibians, 46 species of reptiles, 93 species of fish and 500 species of plants in the area.

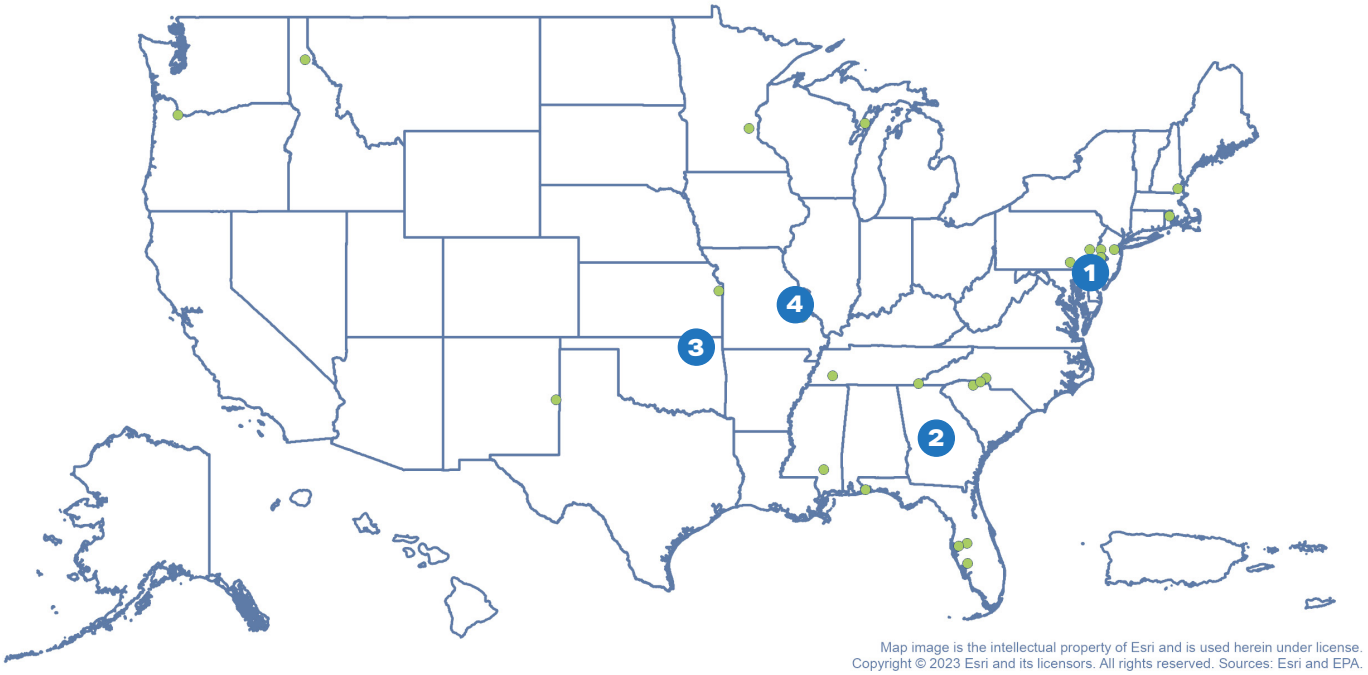
Ecosystem Service

POLLINATION

Pollinators such as birds, bees, bats, butterflies, moths and beetles carry pollen from flower to flower, fertilizing wildflowers, food crops, and half of the world's oils, fibers and raw materials. It is difficult to overstate the importance of pollinators in our everyday lives and the health of ecosystems. Pollination is essential to life-sustaining food systems, vibrant natural spaces and robust local economies. Recognizing this, EPA pursues ways to protect and foster pollinator habitats, including through the Pollinator Protection Initiative and opportunities throughout the Superfund process.

Leading food crops worldwide depend on animal pollinators, accounting for more than one third of global food production. One out of every three bites of food taken is a result of pollinators. One study suggests pollinators contribute an estimated $34 billion to the U.S. economy. Unfortunately, pollinator species are experiencing a global decline due to habitat loss, toxic pesticide use, increases in nonnative plant species displacing native species, parasites, disease and climate change. The International Union for the Conservation of Nature declared one of the world's most iconic pollinators, the monarch butterfly, endangered in 2022.

EPA's Superfund Redevelopment Program supports work being done to protect and increase pollinator habitat at contaminated and formerly contaminated sites. Examples of this work are highlighted on the next page.



Pollinator habitat has been created, protected or re-established as part of the cleanup and redevelopment of more than 30 Superfund sites, indicated by green dots above, across the country.

E.I. Du Pont De Nemours & Co., Inc. (Newport Pigment Plant Landfill) | Newport, Delaware

Cleanup enabled various reuses, including a half-acre of pollinator meadows and 20 acres of wildlife habitat, that provide ecological benefits. DuPont collaborated with the Wildlife Habitat Council to create the habitat. Activities included building structures and planting wildflowers to attract pollinators and birds.

Armstrong World Industries | Macon, Georgia

Armstrong, EPA and the nonprofit Pollinator Partnership collaborated on the 4.5-acre Armstrong Macon Meadow. Fifty native plants, selected to represent the natural history of central Georgia, attract a diverse array of pollinators.

Tulsa Fuel and Manufacturing | Collinsville, Oklahoma

Cleanup of this former zinc smelter included waste consolidation under a cap planted with a mixture of grasses and clover. The clover turned the area into an ideal habitat for honeybees. Local beekeepers now manage about 30 hives on the cap, providing homes for rescued bee swarms. Proceeds from honey sales support swarm rescues and preservation of the local honeybee population.

Weldon Spring Quarry/Plant/Pits (USDOE/Army) | St. Charles County, Missouri

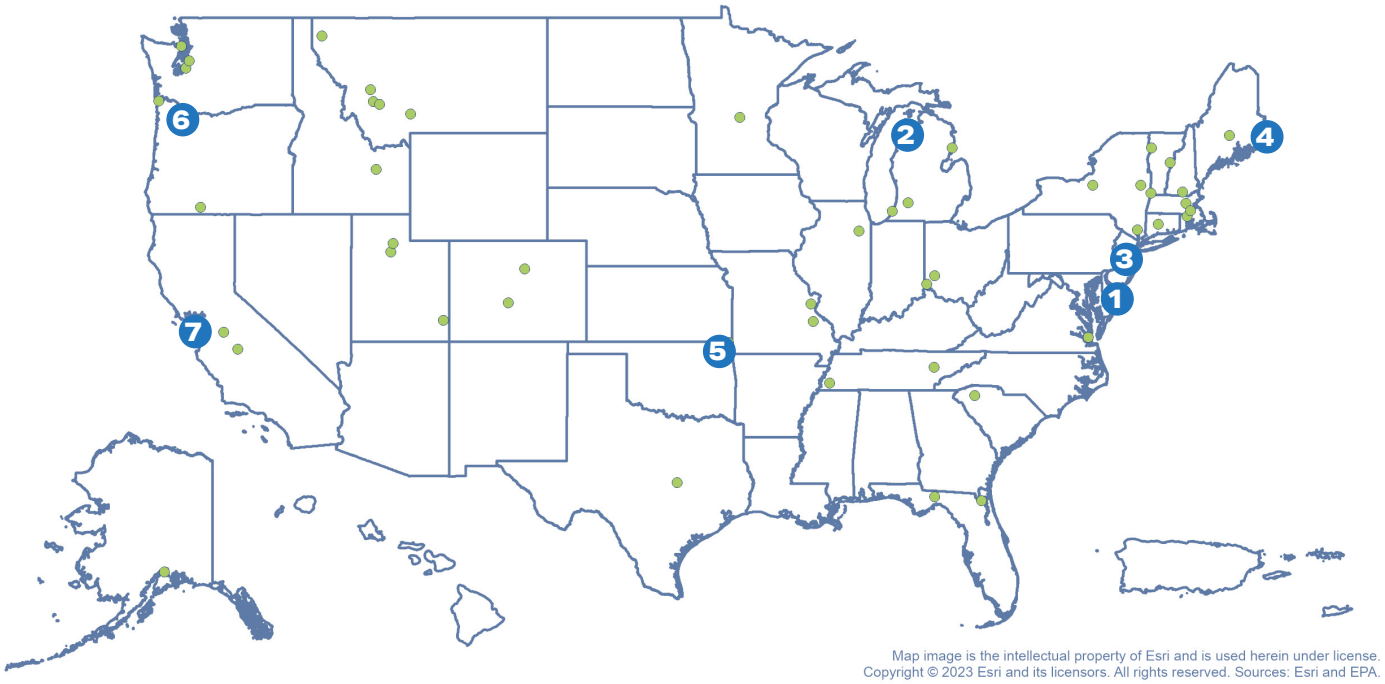
This site now hosts the 150-acre Howell Prairie, one of the largest of its kind in the St. Louis area. It is home to over 80 species of grasses and wildflowers and provides habitat for pollinator species. Combined with an 8-acre native plant education garden, the site's pollinator and wildlife habitat provide rich ecological benefits, in addition to serving as an environmental education and outdoor recreation space for students and other visitors.

CULTURE

Cultural services are the intangible, non-material benefits that ecosystems provide to people and communities. They include spiritual enrichment, knowledge and education, inspiration, aesthetic experiences, sense of place, and cultural heritage.

Valuing intangible ecosystem service benefits such as cultural services relies on a range of economic approaches. Some service values – such as material goods – can be quantified through market pricing. Other services are valued by surveying the public about their preferences and their willingness to pay for different things.

Many Superfund sites are home to significant cultural features that recognize community achievements and history. Examples of these features are highlighted on the next page.



Reuse supports cultural ecosystem services at more than 50 Superfund sites, indicated by green dots above, across the United States.

Roebling Steel Co. Site | Florence, New Jersey

The Roebling Steel mill played a critical role in the achievements of the industrial age, producing and manufacturing steel for the George Washington Bridge, as well as ships, airplanes, communications infrastructure and even household items. Today, the restored historic Main Gate House invites visitors into the Roebling Museum, which documents the community's vibrant social and industrial history.

Grand Traverse Overall Supply Co. | Greilickville, Michigan

In 2014, a local non-profit purchased the site, including a former elementary school and redeveloped the property into the Grand Traverse Regional Arts Campus, also known as Leelanau Studios. Former classrooms now host studio spaces for painters, photographers, and other local businesses that focus on art, music, culture and classes.

Marathon Battery Corp. | Cold Spring, New York

Cleanup identified and documented over 145,000 Native American and Civil War-era artifacts in Foundry Cove and adjacent areas, which are part of the West Point Foundry National Historic District. The village of Cold Spring and the Putnam County Historical Society successfully preserved the recovered artifacts and documented the area's rich history. The village also renovated Cold Spring Pier, which was stabilized during cleanup. The historic pier serves as a community gathering place, fishing spot and tourism destination.

Indigenous Culture and Environmental Inspiration

Indigenous peoples and their respective communities have a historical continuity with a given land area, its environmental features, biodiversity and ecosystems, that predates modern institutions and the colonial systems that founded them. Indigenous communities have distinct social and economic systems as well as culture and beliefs that are deeply connected with the natural resources of their ancestral homelands and the ecosystem services that support these resources. In the United States, many tribes rely on local and regional ecosystems as sources of food, medicine and clothing as well as cultural sustenance. Tribes' approaches to natural resource management, rooted in deep respect for the environment and the natural world's capacity to sustain communities over generations, provide best practices that guide environmental restoration and stewardship efforts. Tribal leadership has made a vital difference at Superfund sites across the country, providing significant ecosystem service benefits as part of projects that also restore and celebrate tribal histories and cultures. Several examples of these efforts are highlighted below.

Eastern Surplus Site | Meddybemps, Maine

When cleanup found Native American artifacts on site, the Passamaquoddy Tribe led an archeological dig for an ancient tribal fishing village. The tribe is now working with the state to restore the historic spawning run area for alewives, a culturally significant tribal resource. The tribe has named the area N'tolonapemk, meaning "Our Relatives' Place" in the Passamaquoddy language.

Tar Creek Site | Ottawa County, Oklahoma

The Quapaw Tribe Environmental Office led the first tribally managed Superfund cleanup in the nation at the site, cleaning up decades of mining waste. Throughout the cleanup, the Quapaw Nation has sought to preserve historical structures, artifacts and landscape features of cultural significance that are now accessible for archaeological research and education opportunities.

Portland Harbor | Portland, Oregon

The Willamette River is important to many tribes, with fish among the resources most frequently used by the tribes in the Portland Basin and the Willamette Valley. Native plants are also gathered for food and medicines. Subsistence hunting, fishing and gathering feed tribal communities and protected gathering rights share cultural heritage and skills.

Indian Island | Humboldt Bay, Eureka, California

Listed on the National Register of Historic Places as a threatened National Historic Landmark, the Tuluwat Village on Indian Island was home to the Wiyot Tribe. Colonial efforts to displace the Wiyot culminated in the massacre of hundreds of Wiyot and forced relocation of survivors. Decades of shipyard operations and contamination affected the island and surrounding area. In 2000, the tribe purchased the contaminated site property. For more than a decade, it worked to leverage more than $2.8 million in state and federal resources to clean up the site. In 2013, the Wiyot Tribe held its World Renewal ceremony, an annual traditional honoring of tribal ancestors, on site for the first time in more than 150 years.

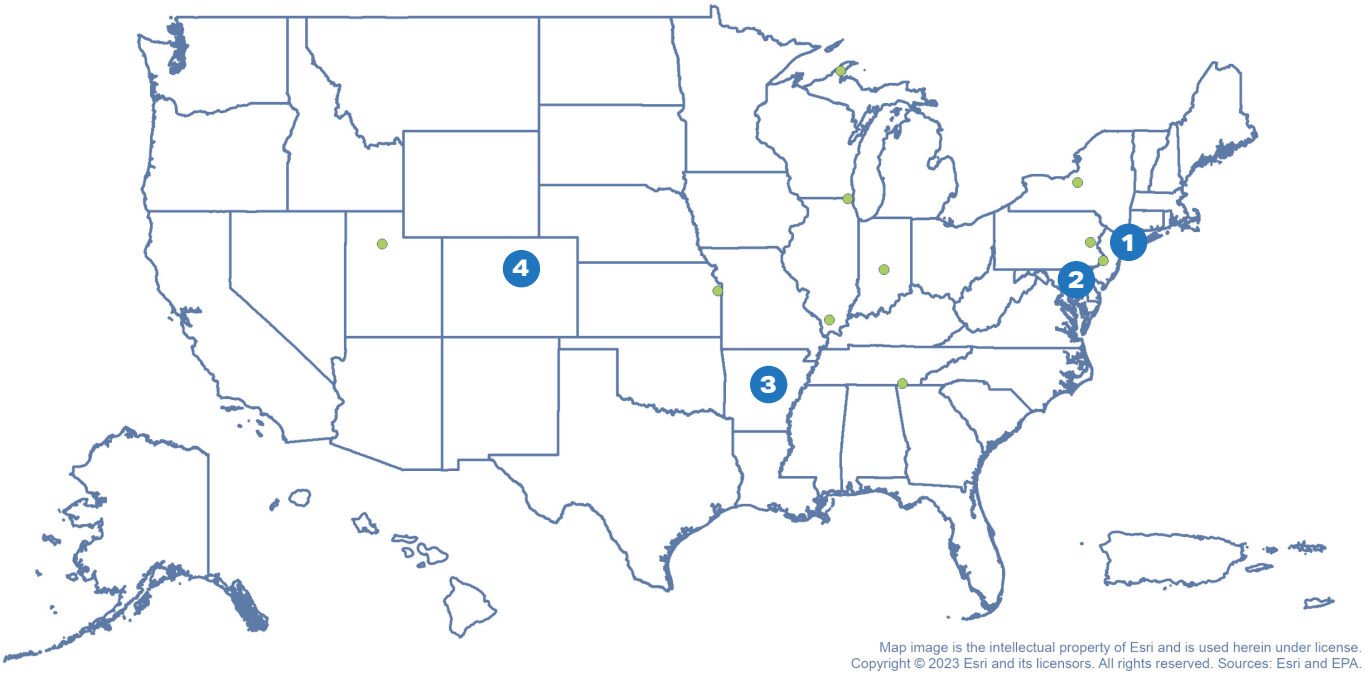
ENVIRONMENTAL EDUCATION

Environmental education offers opportunities to explore key issues, seek solutions, and develop skills to make more informed decisions. Environmental education increases public awareness of environmental issues, the ways that different groups experience these issues, and the range of approaches taken to working on solutions. Increasing public awareness and knowledge of environmental issues is an important part of helping communities navigate the impact of these issues on a local level.

Environmental education benefits all ages. As of 2020, there were over 580 nature-based preschools, forest kindergartens and outdoor preschools in the United States. For researchers and scientists, the natural environment provides the key materials – soil and water, natural phenomena – needed to study natural processes and systems. Ecosystems provide opportunities for all of these efforts. Ecosystems serve as living, open-air classrooms and laboratories wherever there is green space.

The National Environmental Education Act of 1990 requires that EPA provide national leadership to increase environmental literacy. The Agency's Office of Environmental Education leads these efforts. Through its Environmental Education Grants Program, EPA provides financial support for projects focused on environmental education practices, methods and techniques. Since 1992, EPA has provided $2 million to $3.5 million in grant funding each year, giving more than 3,800 grants to local, state and environmental agencies, institutions of higher education, nonprofits and tribal education agencies.

At Superfund sites, environmental education helps people learn about the impacts of contamination on ecosystems and wildlife as well as on communities. It also helps people learn about the value of local ecosystems and the benefits provided by their restoration and long-term stewardship. Environmental education efforts at several of these sites are highlighted on the next page.



Formal environmental education programs exist at about 15 Superfund sites, indicated by green dots above, across the United States.

Newtown Creek | Brooklyn, Queens, New York

Historical industrial activities that include oil, chemical and metal handling, and dumping of sewage contributed to the contamination of Newtown Creek. Investigations and cleanup are ongoing. The Newtown Creek Alliance is active in identifying opportunities to re-introduce native plants to shorelines along the creek. The North Brooklyn Boat Club provides environmental education tours to promote and discuss ecological issues facing the creek.

Woodlawn County Landfill | Cecil County, Maryland

The Wildlife Habitat Council manages the Woodlawn Wildlife Area – New Beginnings at the site. Local schools, the Boy Scouts and Girl Scouts of America, and community members visit an educational pavilion with a living "green" roof that serves as a nature and science study area. The area hosts more than 160 species of birds.

Vertac, Inc. | Jacksonville, Arkansas

Ron Newport Recycling Education Park is now located at this former industrial area. This environmental education center is a field trip destination for area schools. A park tour includes a visit to the recycling plant, a stop at the compost demonstration area, and a walk through education stations that highlight recycling methods and recyclable materials.

Rocky Mountain Arsenal (US Army) | Adams County, Colorado

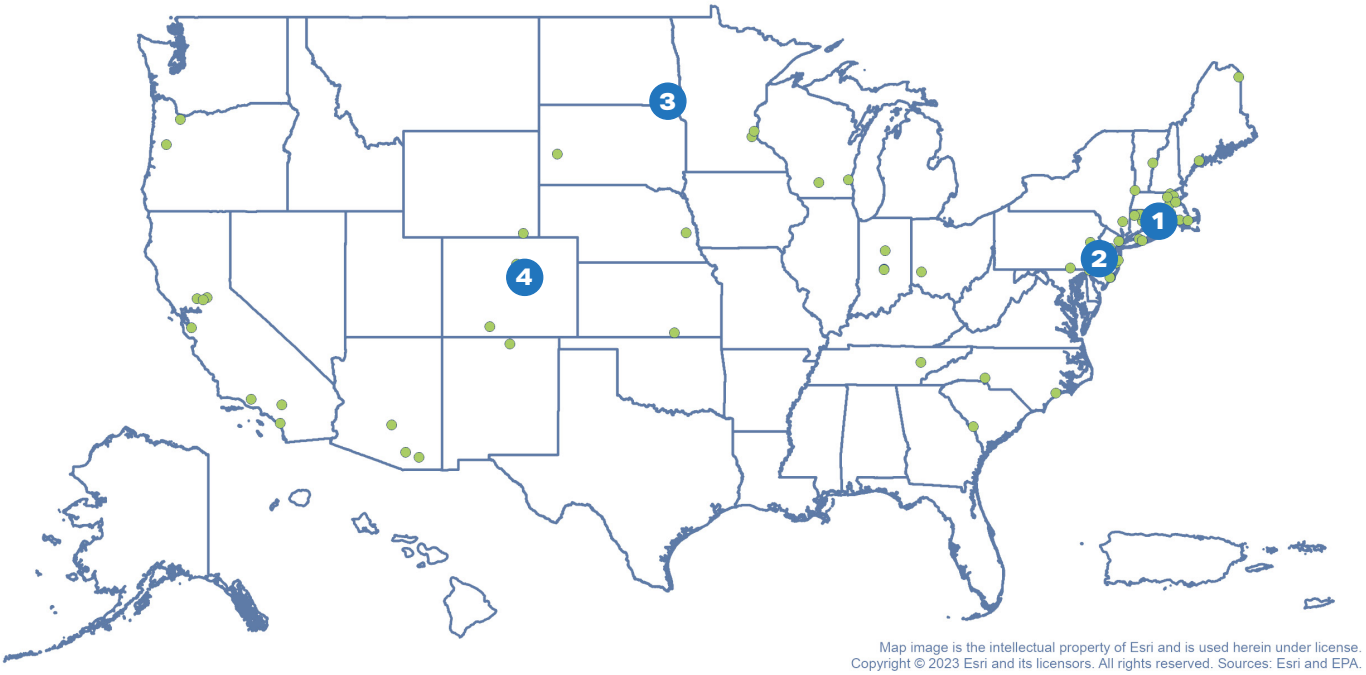
Cleaned-up areas at this former military base and pesticide manufacturing area are now a wildlife refuge. The Rocky Mountain Arsenal Wildlife Refuge Visitor Center shares exhibits about the refuge and the site's history and restoration. About 300,000 people visit the refuge each year.

ENERGY GENERATION

Renewable energy projects harness natural systems to provide cleaner sources of power. These remarkable and diverse resources include solar energy from the sun, geothermal energy from heat in the earth, wind energy, biomass from plants, marine energy from waves, and hydropower from flowing water. Supporting ecosystem services provide the water, geothermal heat, wind, biomass and other resources that turn into energy resources for communities. Supporting ecosystem services also provide the land and space needed for equipment such as solar arrays.

According to the U.S. Department of Energy, renewable energy generated about 20% of all U.S. electricity in 2021; this percentage continues to grow as companies, governments and people invest millions of dollars in renewable energy efforts that offset environmental impacts. Valuing the impact of ecosystem services that generate energy can be challenging due to the different ways ecosystem services affect energy markets. For example, ecosystem services can mitigate erosion and other environmental impacts from energy generation facilities and related industries. Renewable energy projects have positive economic impacts beyond powering homes and manufacturing facilities, such as providing new jobs, income and sales.

Renewable energy projects are located at Superfund sites across the country. At many of these sites, renewable energy facilities help power cleanup infrastructure such as groundwater treatment systems. Solar arrays on rooftops and solar canopies above parking spaces help offset emissions from commercial and industrial operations. Sites with open spaces and good solar exposure now host solar arrays that provide power for thousands of homes and businesses. Several of these facilities are highlighted on the next page.



About 75 renewable energy projects, indicated by green dots above, are located at Superfund sites across the United States.

Gallup's Quarry | Plainfield, Connecticut

Today, Greenleaf Power's Plainfield Renewable Energy biomass cogeneration plant is located at this former quarry. The 37.5-megawatt facility uses waste wood to generate enough electricity to power the equivalent of about 40,000 homes in Plainfield. The facility provides a market for waste biomass materials that would otherwise be taken to a landfill or left to decay, leading to off-gassing of methane and other greenhouse gases.

Welsbach & General Gas Mantle (Camden Radiation) | Camden and Gloucester City, New Jersey

One of more than 125 businesses within the footprint of the site, the 88-acre Gloucester Marine Terminal supports the Riverside Renewable Energy solar project. It covers over one million square feet; 27,000 photovoltaic solar panels are on the rooftop of the terminal's refrigerated warehouses. The solar array generates an estimated 11 million kilowatts-hours of renewable energy each year.

Arsenic Trioxide | Ransom, Richland and Sargent County, North Dakota

To ensure continued groundwater treatment and distribution, even during power outages, the Southeast Water Users District installed a geothermal heating and cooling system to power its headquarters building where the district manages remote sensing of the system. This approach reduces the facility's use of fossil fuels and lowers operation and maintenance costs.

Lowry Landfill | Aurora, Colorado

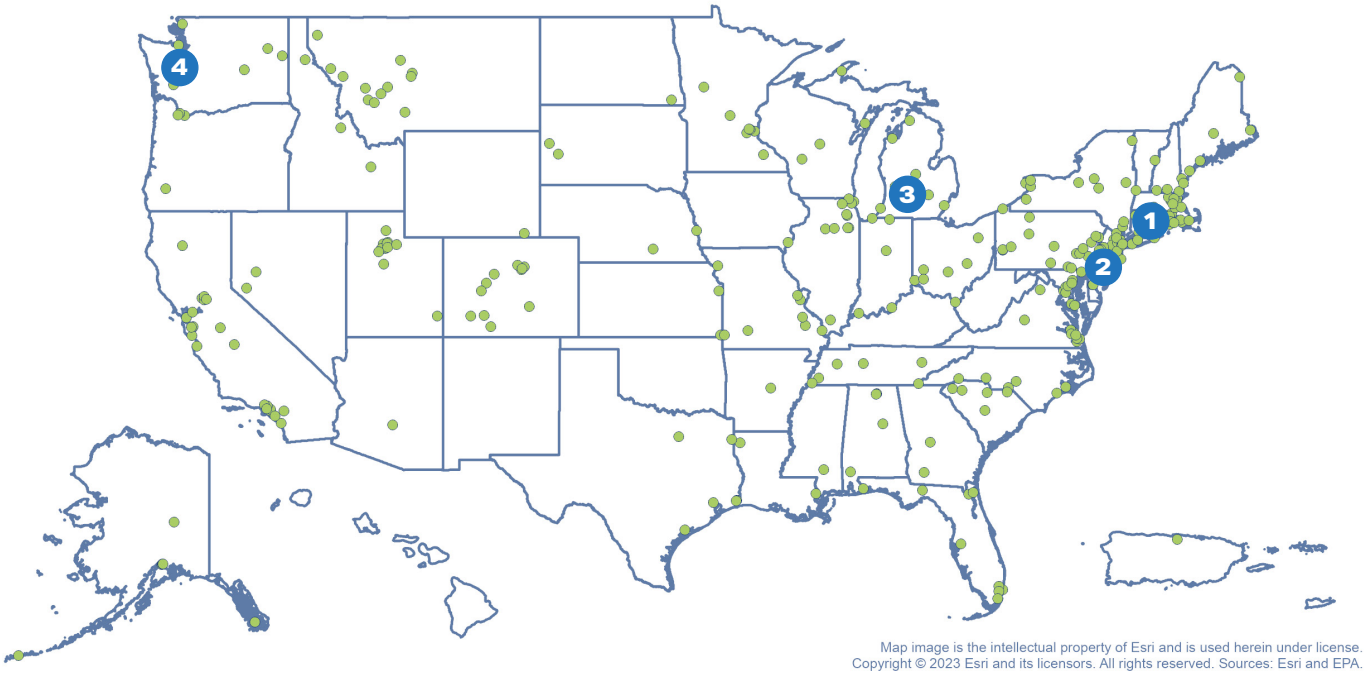
A landfill-gas-to-energy plant on site captures and uses gas emissions, rather than burning them off. The plant converts gas from the former Lowry Landfill and an adjacent working landfill into 3.2 megawatts of power.

RECREATION

People of all ages enjoy outdoor activities for recreation and leisure. Whether walking on trails or kayaking down streams, people spend time in diverse outdoor environments, including natural areas, parks and waterways. Many ecosystem services enable these activities. Bodies of water such as streams and lakes provide water for rafting, biodiversity provides opportunities for birdwatching, and natural areas provide green spaces for walking, running, hiking and climbing. In turn, recreation activities in nature provide many benefits. Outdoor recreation supports active and healthy lifestyles, lowers stress, increases quality of life and brings people together. These benefits are quantifiable. For example, The Trust for Public Land estimates that every able-bodied adult who exercises regularly generates an annual savings of $1,100 in medical expenses.

Recreation and tourism associated with outdoor environments can also play a major role in local economies, especially in areas with protected lands, such as national parks, forests, monuments and wildlife refuges. In 2021, for example, the U.S. national park system had over 287 million recreation visits. Recreation bolsters local economies, bringing locals and visitors to visit recreation spaces, spending money on meals, snacks, registration fees, fuel and hotels, and supporting secondary purchases such as fishing tackle, athletic equipment, walking shoes and binoculars for outdoor activities. U.S. Bureau of Economic Analysis data show that the outdoor recreation economy accounted for 1.8%, or $374.3 billion, of the nation's gross domestic product (GDP) in 2020. At the state level, outdoor recreation value added as a share of state GDP in 2020 ranged from 1.2% in New York and Connecticut to 4.3% in Montana.

As of 2020, about 200 million people (about 61% of the U.S. population) live within 3 miles of a Superfund site, a Resource Conservation and Recovery Act Corrective Action facility, or a brownfield. Recreational uses are located at about 345 Superfund sites across the country, providing parks, playgrounds, athletic facilities, wildlife habitat and open space for hiking and picnicking, and other opportunities for indoor and outdoor leisure activities. More than 700 parks and picnic areas are located at Superfund sites. The recreation amenities at these sites are vital community and neighborhood assets. Green spaces are also integral components of sustainable communities, providing opportunities for people to gather, exercise and connect with nature as well as creating corridors for migrating species and stormwater management. Recreation and green space planning can inform cleanup plans and timelines, supporting the restoration of contaminated properties as valuable community assets. Examples of recreation-based ecosystem services at Superfund sites are highlighted on the next page.



Nearly 1,000 recreational uses, indicated by green dots above, are active on Superfund sites across the United States.

Peterson/Puritan, Inc. Site | Lincoln and Cumberland, Rhode Island

This site is now home to Blackstone River Valley National Historic Park, Blackstone River State Park and the Blackstone River Bikeway. The Blackstone River and associated park areas are significant natural, recreational and cultural resources for communities in Rhode Island and Massachusetts for kayaking, fishing, hunting and hiking.

Lipari Landfill Site | Pitman, New Jersey

Cleanup restored community access to three municipal parks – Alcyon Park, Betty Park and Hollywood Dell Park – and Alcyon Lake. Alcyon Park features picnic areas, trails, and baseball, softball and football fields. People use the lake for boating and fishing. The ecological restoration of site wetlands and streams as well as establishment of a native habitat meadow attracts wildlife and reduces erosion.

Allied Paper Inc./Portage Creek/Kalamazoo River Site | Allegan and Kalamazoo County, Michigan

The site's cleanup is stabilizing riverside areas that will no longer contribute contamination to the Kalamazoo River. This will allow fish passage and enable community access to 41 miles of the river, significantly increasing recreation amenities in several communities.

Lower Duwamish Waterway Site | Seattle, Washington

The waterway supports shipping, water-dependent industries and a commercial salmon fishery. People also use it for rowing, boating, kayaking, fishing, beach play and marina living. The estuarine waterway provides riparian, nearshore and aquatic habitat, with increasing use by otters and osprey.

Community Access and Health-Related Impacts

Recreation strengthens communities by providing space for social gatherings, promoting local volunteerism and stewardship, and offering opportunities for physical activity as well as mindfulness and well-being. Researchers identified mental health benefits that correlate with participation in sports and even living near a park. Several studies have shown that sports participation has a positive effect on the subjective well-being of the population. A 2014 study found that "mental health is significantly related to residential distance from parks, with the highest Mental Health Inventory (MHI-5) scores among residents within a short walking distance from the park (400 meters) and decreasing significantly over the next distances." The study authors calculated that "a nearby urban park is associated with the same mental health benefits as decreasing local unemployment rates by 2 percentage points."

However, accessibility to recreation opportunities is not universal. Many communities of color, people with disabilities and urban communities in areas with limited green space have fewer opportunities for outdoor activities. Access is extremely important to ensure the benefits of these recreational resources are experienced by people of all backgrounds, regardless of where they live.

A health impact assessment is an EPA decision-support tool used to investigate how proposed projects, programs and policies may affect the health and well-being of communities and the distribution of those impacts within each population. While health impact assessments do not always consider ecosystem services, they can rely on ecosystem services datasets and tools alongside other community data and considerations. Health impact assessments help decision-makers consider environmental justice and sociological and demographic data as part of their work.

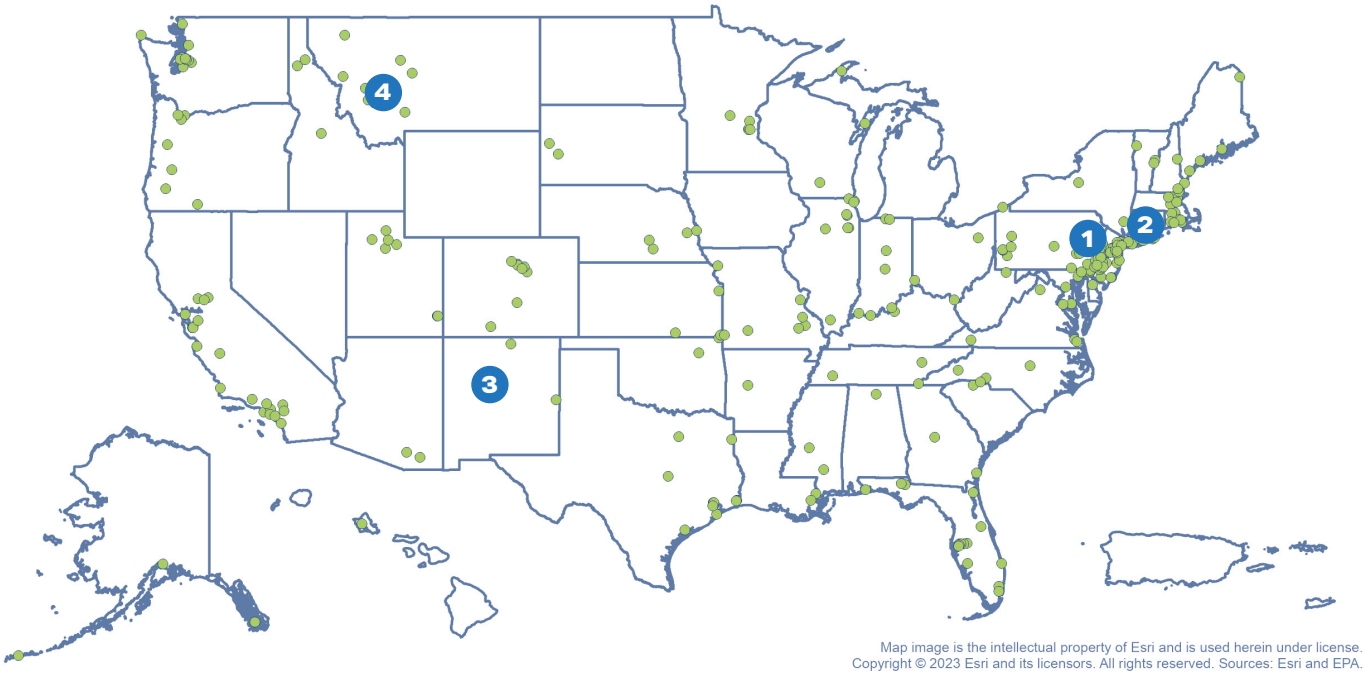
CLIMATE, SUSTAINABILITY AND RESILIENCE

Earth's climate evolves over time, influenced by its own internal dynamics as well as major natural events such as volcanic eruptions and changes in the sun's energy. Since the Industrial Revolution, human activities have also released large amounts of carbon dioxide and other greenhouse gases into the atmosphere, further changing the earth's climate. Greenhouse gases trap heat in the atmosphere, warming the planet and rapidly changing environmental conditions for ecosystems and organisms.

Properly functioning ecosystems, and natural resources such as soil, oceans and vegetation, provide regulating services, helping to reduce or stabilize this rate of change through the long-term capture and storage of carbon using biological processes such as photosynthesis. This process is known as carbon sequestration and storage. A 2013 study by the U.S. Forest Service estimated that forests in the United States store 708 million tons of carbon, with the service valued at an estimated $50 billion. Ensuring the safety of ecosystems, preserving functional green spaces and incorporating green development techniques helps to build climate resiliency as well as the sustainability and resiliency of communities.

Ecological goods and services provide commercial and recreational use benefits while also working to stabilize the rate of climate change. For example, forests provide space for hiking and other recreation activities as well as timber, food and fiber for communities and businesses. Trees, grasses and other vegetation stabilize soil and prevent erosion that can damage roads, fill reservoirs, reduce water quality and harm fish. Trees trap airborne matter and dust, improving air quality. Soil stabilization, erosion control and air quality regulation are other benefits provided by ecosystem services. Studies to assess the economic value of these benefits look at the amount of money that local, state and national governments and agencies spend to repair or maintain infrastructure damaged by erosion and lost food and nutrients from poor water and air quality, as well as the cost in health deficits to the general public. One study by the U.S. Department of Agriculture estimated that, in the U.S., the cost of soil erosion is over $44 billion, with an estimated resulting loss in farm income of $100 million per year.

Ecosystem services that support climate stabilization and resiliency are part of cleanup and reuse efforts at many Superfund sites. Consideration of site needs for stormwater management, erosion control and carbon emissions can yield stronger, environmentally conscious infrastructure designs that support healthier ecosystems. Nationwide, there are green cleanup projects at 41 Superfund sites. These projects manage stormwater, mitigate flooding and protect the natural functions of areas such as floodplains. Examples of these projects in action at Superfund sites across the country are provided on the next page.



There are 277 Superfund sites, indicated by green dots above, with climate stabilization and resiliency projects active on site.

Palmerton Zinc Pile | Palmerton, Pennsylvania

The Lehigh Gap Wildlife Refuge is the result of the large-scale revegetation and reforestation of this former zinc smelter area with native warm season grasses and 13,000 trees, including the nearly extinct American Chestnut tree. The revegetated mountain provides habitat to local and migratory species while also stabilizing area soil, minimizing erosion and improving water quality.

Solvents Recovery Service of New England | Southington, CT

This site's soil and sediment cap includes the reestablishment of native plant communities near the Quinnipiac River. Restored vegetation along the riverbanks and in upland areas helps replenish local and regional ecosystems. This extensive vegetation also removes greenhouse gases from the atmosphere and alleviates flooding and soil erosion. Plant-lined channels successfully managed stormwater and runoff on site during Hurricane Ida in 2021. A solar array atop the cap powers the site's groundwater extraction pumps, further reducing greenhouse gas emissions.

Fruit Avenue Plume | Albuquerque, New Mexico

A housing development on site includes 72 micro-efficiency units. These affordable housing units include a rooftop array of solar panels for domestic hot water and supplemental space heating, cisterns for roof water collection, a greywater reuse system, low-emitting materials and low-water plants. The building has an outdoor courtyard with a community garden.

Anaconda Co. Smelter | Anaconda, Montana

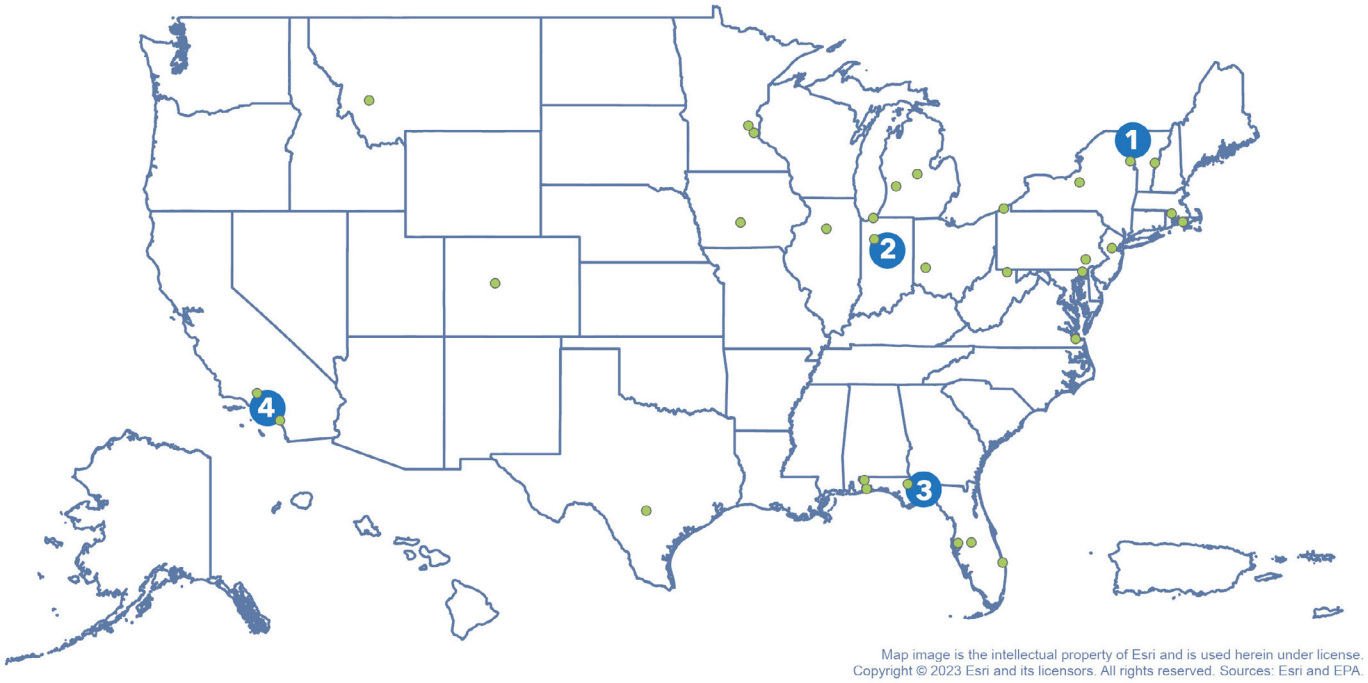
Thousands of acres of former waste disposal sites have been capped and now provide wildlife habitat, including nearly 1,000 acres of new wetlands. Nearly 1,000 acres of new wetlands have been constructed, another 5,000 acres have been protected, and over 12,000 acres of adjacent contaminated soils have been reclaimed. They now support wildlife habitat and grazing lands.

GREEN INFRASTRUCTURE

Superfund cleanups and reuse projects offer opportunities to incorporate ecosystem services such as stormwater and flood mitigation and groundwater recharge and filtration, as part of green infrastructure efforts. Green infrastructure practices help communities move away from a reliance on traditional "gray" systems for stormwater management, and focus instead on cleaner water and air as well as ecological benefits. As stormwater runs over paved surfaces, it picks up pollutants, which it carries into local waterways. Green infrastructure practices use plants, soil, landscape design and engineered techniques to retain, absorb, filter and reduce that polluted stormwater runoff. These features cut down on the need to send stormwater into overburdened, aging sewer systems, while enhancing water quality and conservation, flood-risk mitigation, habitat diversity and access to green space. These outcomes increase the resilience of communities and provide significant environmental, social and economic benefits.

Rainwater harvesting systems help slow runoff and capture rainwater for future use. Bioretention features such as rain gardens can collect runoff from roofs, driveways, sidewalks and parking lots, while providing habitat for wildlife. Filtration and plant uptake in bioswales and rain gardens naturally remove pollutants as the water soaks into the ground, benefiting vegetation and groundwater supplies. Permeable pavements enable rain to infiltrate into soil, and planter boxes filled with gravel, soil and vegetation capture stormwater that would otherwise run down the sidewalk and into the gutter.

At Superfund sites, green infrastructure is part of cleanup remedies as well as redevelopment projects. Examples of these innovative approaches are highlighted on the next page.



Green infrastructure components are located at 31 Superfund sites in reuse across the country, indicated by green dots above.

Plattsburgh Air Force Base | Plattsburgh, New York

As part of the cleanup, the city of Plattsburgh installed a bioswale and bioretention basin at the site's U.S. Oval area. The 2.5-acre bioswale captures stormwater runoff, channeling it to the bioretention basin, where it soaks into the ground. These features reduce the volume of stormwater entering the city's sewer system and eventually Lake Champlain. The city also planted native plants in the basin, improving resilience to extreme weather conditions.

Continental Steel Corp | Kokomo, Indiana

Stakeholders built a stormwater retention pond at this site's former Markland Avenue Quarry area. Repurposed fill from another project enabled its construction, saving EPA $5 million and accelerating the cleanup. The pond mitigates flooding by capturing stormwater runoff in an area that has experienced major flood events in recent years.

Cascade Park Gasification Plant | Tallahassee, Florida

Cleanup enabled the creation of Cascades Park, a thriving recreation resource in downtown Tallahassee that also serves as an innovative stormwater management feature. The park is designed to flood, capturing and filtering stormwater in a pond and restored stream corridor, and reducing the effects of flooding in the heart of the city. For more information, visit: www.talgov.com/parks/parks-cascades-feature.

Pemaco Maywood | Maywood, California

Maywood Riverfront Park has extensive green infrastructure features that divert and filter stormwater including retention basins, vegetated berms and bioswales. These features provide effective and less expensive alternatives to traditional stormwater infrastructure, while facilitating groundwater infiltration and recharge and reducing erosion. An on-site solar array powers soil vapor and groundwater treatment and eliminates about 3.3 tons of carbon dioxide emissions annually.

SUBSISTENCE AND COMMERCIAL EXTRACTION

Provisioning ecosystem services include any type of benefit to people that can be extracted from nature. Many ecosystems provide primary production or raw materials that support manufacturing operations and sales for commercial and industrial markets. Whether it be fish, crustaceans and mollusks provided to commercial fisheries or timber and fiber provided to lumber and paper companies, ecosystem services play a crucial part in production and consumption processes.

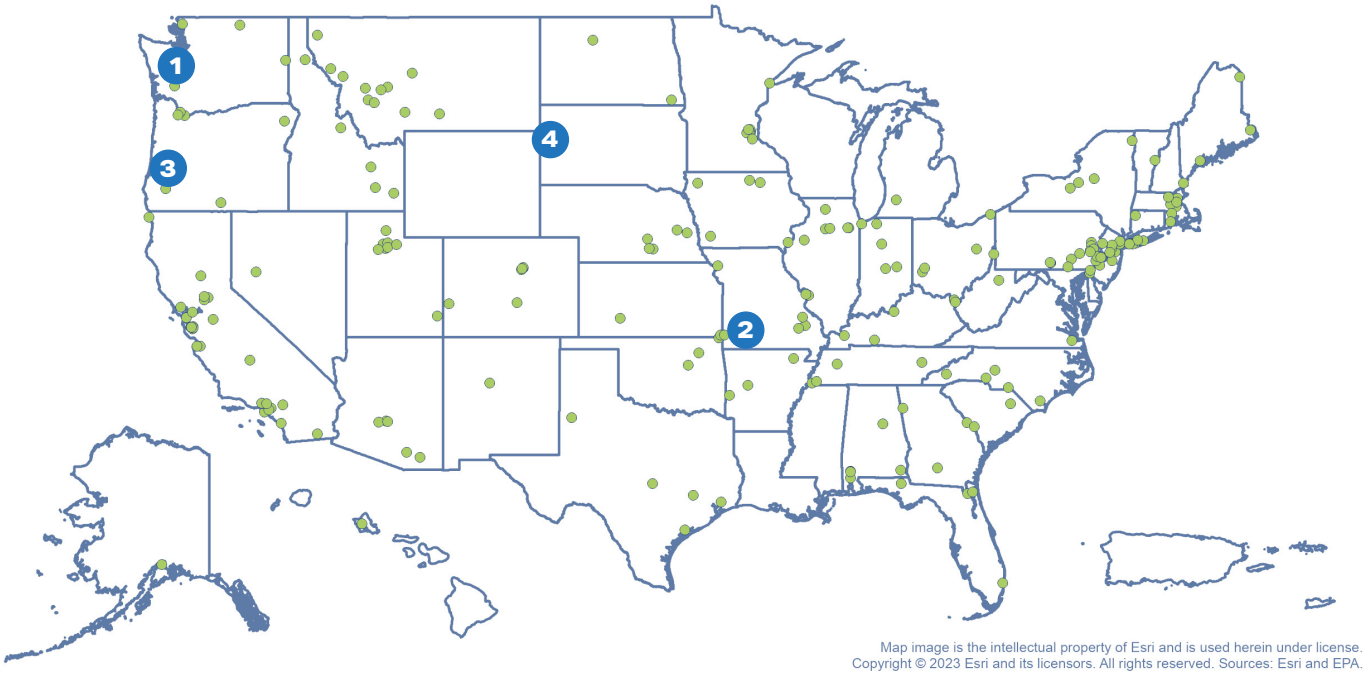
A 2019 NOAA report found that commercial fisheries support 1.2 million jobs and generate an estimated $165 billion in sales in the United States, contributing $68 billion to the national GDP. Timber and fiber can also be extracted from ecosystems to supply lumber markets and industries requiring wood for manufacturing products such as furniture making and paper. A 2019 study found that the national GDP associated with paper, wood and furniture manufacturing totals over $107 billion.

Different regions rely on these provisioning ecosystem services goods to support their local economies and job markets. Many industries rely on ecosystems for the basic raw materials needed for research and production. Alongside plants used in traditional medicine, pharmaceutical industries need natural materials such as leaves, fruits, flowers, fungi and seeds to make medicines.

Many ecosystem goods are extracted directly from natural environments by people for their own subsistence, through activities such as fishing and growing crops for food. For millennia, people relied on local ecosystems and lands to harvest animals, crops and fiber needed for themselves and their communities. Subsistence extraction remains an important ecological baseline for many communities, sourcing basic needs in their local environments and providing food security. Many forms of subsistence extraction, such as subsistence agriculture, also include long-standing cultural traditions.

Ecosystem-based management is an approach to balancing sustainable development with biodiversity by considering ecosystem services and their complex connections with social systems and economies. This approach helps address issues such as overfishing and deforestation. Ecosystem-based management optimizes productivity by supporting and enhancing extractive ecosystem services while also protecting the economic security of fisheries and the communities that rely on them for income and food.

Consideration of extractive ecosystem goods and services at Superfund sites helps inform cleanup and reuse planning activities. EPA works closely with communities and local governments to make sure that extractive ecosystem services, such as fishing, are safe for human consumption and that site remedies remain protective of human health and the environment. Examples of subsistence and commercial extraction of ecosystem services at Superfund sites are highlighted on the next page.



Over 200 Superfund sites across the United States, indicated by green dots above, host agricultural, commercial and industrial reuses that rely on fishing, timber, land and other provisioning services.

Commencement Bay, Near Shore/Tide Flats | Tacoma, Washington

The Puyallup Tribe of Indians and Muckleshoot Indian Tribe are working with EPA and other natural resource trustees to clean up and restore the bay, which supports important recreational and tribal fisheries. Efforts to restore subsistence fishing in this tribal Usual and Accustomed fishing area focus on removing contamination sources and restoring intertidal mudflat and salt marsh habitats that support fish and other wildlife.

Oronogo-Duenweg Mining Belt | Joplin, Missouri

This 250-square-mile site supports many reuse activities, including many agricultural uses. Various ranches raise livestock for consumption, labor or secondary products such as milk, cheese, eggs and fibers. Commercial and family-owned farms also contribute fresh produce to local markets.

Black Butte Mine | Cottage Grove, Oregon

There has been occasional commercial logging at this site since final mine closure in the late 1960s, and the site was purchased by a timber company in 1990. Timber harvesting is the predominant land use in the area. Downstream areas of the site include the Coast Fork Willamette River and Cottage Grove Reservoir, both of which support recreation (camping, boating, fishing) and agriculture.

Whitewood Creek | Lawrence, Meade and Butte Counties, South Dakota

Today, about 83% of the site remains native woodlands and provides habitat for wildlife. Whitewood Creek's banks are now vegetated, and parts of the site are in reuse as ranchland. The creek is a water source for irrigation and recreation, and residents along the creek continue to raise livestock and crops for feed on site.

Conclusion

Healthy, functioning ecosystems are vitally important for human and environmental health. Ecosystem services make life possible, and support our economic vitality, social development, and overall health and well-being across provisioning, regulating, cultural and supporting services. Ecosystem services provide nutritious food, clean water, disease regulation and prevention, fuel, climate resiliency and stability, space for recreation activities, and inspiration for cultural and spiritual practices. These services contribute significantly to human welfare, providing trillions of dollars in natural capital that are integral to our survival.

At Superfund sites, ecosystem services generated by cleanup and ecological revitalization create economically important benefits for communities across the country. These benefits range from marketable goods such as lumber, fish and reclaimed groundwater to less-tangible resources such as cultural experiences and educational opportunities. EPA recognizes the value of ecosystems and opportunities for restoring and strengthening ecosystem services during Superfund cleanups. For this reason, EPA is conducting quantitative evaluations of ecosystem services during the Superfund process, developing best management practices and working closely with communities to realize their goals for future reuse in an environmentally conscious way. Consideration of ecosystem services throughout cleanup and reuse planning efforts will continue to ensure that Superfund remedies will protect the vital benefits provided by our natural environment.

Ecosystem Services at Superfund Sites (FY2022)

For more information about EPA's Superfund Redevelopment Program, visit:

www.epa.gov/superfund-redevelopment

Sources used in development of this report are available at:

https://semspub.epa.gov/src/document/hq/100003255