

Ecosystems Science - Genes to Landscapes

Bountiful fisheries, healthy and resilient wildlife, flourishing forests and vibrant grasslands are coveted resources that benefit all Americans. U.S. Geological Survey (USGS) science supports the conservation and management of the Nation's fish and wildlife, and the landscapes they inhabit. Our biological resources—ecosystems and the wild things that live in them—are the foundation of our conservation heritage and an economic asset to current and future generations of Americans.

The USGS Ecosystems Mission Area, the biological research arm of the Department of the Interior (DOI), provides science to help America achieve sustainable management and conservation of its biological resources. This work is done within the broader mission of the USGS—to serve the Nation with science that advances understanding of our natural resources, informs land and water stewardship, and helps safeguard communities from natural and environmental hazards. The Ecosystems Mission Area provides research, technical assistance, and education conducted by Cooperative Research Units and Science Centers located in nearly every State.

The quality of life and economic strength in America hinges on healthy ecosystems that support living things and natural processes. Ecosystem science better enables society to understand how and why ecosystems change and to guide actions that can prevent damage to, and restore and sustain ecosystems. It is through this knowledge that informed decisions are made about natural resources that can enhance our Nation's economic and environmental well-being.

Ecosystems Core Priorities and Examples of USGS Science

The Ecosystems Mission Area concentrates its research on five core priorities that address modern natural resource and societal issues, and the interests of our partners and the public.

Natural Resource Stewardship

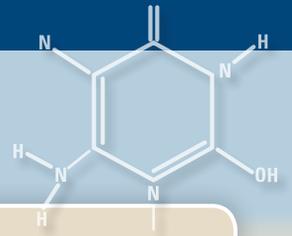
USGS science guides fish, wildlife, and land management to support outdoor recreation, prevent or reverse the need for Federal species protections, and provide habitat for a diversity of fish and wildlife.



Each year, about 440 million people visit lands managed by DOI, largely located in rural America, and spend \$145 million in these communities on outdoor recreation such as hunting, fishing, and wildlife viewing. Land and resource-management agencies rely on the best science available to manage and sustain the natural resources that people value.

Mule deer are an integral presence in the fabric of the Western landscape and are highly valued by recreational hunters. In Wyoming, where outdoor enthusiasts contribute millions of dollars to the State's economy, USGS science led to the discovery of the longest-known migration of mule deer in the country—approximately 150 miles. With the importance of the corridor made clear from USGS research, wildlife managers and the public came together to create a new, State-owned management area that conserves a portion of this critical migration habitat.

Long-term USGS research and monitoring has informed collaborative species conservation for several animals across the Nation including decisions to remove Federal protections for the Yellowstone grizzly bear, downlist the Florida manatee from endangered to threatened, and prevent the need of Federal protections for the Pacific walrus.



Advances in National Energy and Security

USGS science provides tools to assist government and energy producers in optimizing energy production while minimizing impacts to wildlife.

Energy resources on public lands offer extraordinary benefits to the Nation by providing the energy needed to drive our economy and support our energy infrastructure needs. The U.S. energy industry employs more than 1.9 million workers on production from oil, gas, coal, hydropower, wind, solar, and geothermal sources. USGS science guides efforts in smart and balanced development—enhancing sustainable energy production while minimizing impacts to lands and waters that sustain America’s fish and wildlife heritage.

Dams supply hydropower for people, help to control floods, provide irrigation water, and create recreational opportunities. However, many dams fail to provide upstream fish passage, eliminating access to important spawning areas for numerous fish species. USGS science is helping restore self-sustaining populations of migratory fish while maintaining a balance between energy production, water management, and ecosystem restoration.

The State of Hawai‘i requires 100 percent of its energy be generated from domestic, renewable sources, but not at the expense of the native Hawai‘ian hoary bat, which is susceptible to injury from wind turbines. USGS science is helping Hawai‘i reach their energy goals and protect the bats by developing innovative tools to reduce injuries and fatalities from wind turbines using ultrasonic and ultraviolet light deterrents. The goal is to expand the use of these deterrents across the United States, optimizing domestic wind energy production while conserving and protecting wildlife.



Invasive Species and Wildlife Disease

The USGS is at the forefront of providing the tools necessary for early detection and effective response to damaging invasive species and wildlife diseases.

The negative consequences of invasive species and wildlife disease cost the U.S. billions of dollars in damages every year on surveillance, education, prevention, and management. These costs are borne by agriculture, businesses, and governments battling to control the threats these issues pose. The USGS develops tools and approaches to combat invasive species and disease, mitigating their impacts on ecosystems and the economy.

Invasive zebra mussels have been found in over one-half of U.S. lakes including all five Great Lakes. These invaders can have negative repercussions for agriculture, drinking-water supplies, recreation, and native species. The USGS supports Federal and State managers as they work to prevent spread of these invaders with scientific detection and monitoring tools and by developing control measures.

Since its discovery in 2007, white-nose syndrome (WNS) has killed more than 6 million bats, which has huge implications to the U.S. economy. Recent USGS research shows that pest-control services provided by insect-eating bats likely saves the U.S. agricultural industry at least \$50 billion a year. USGS scientists develop advanced tools for disease diagnosis, surveillance, risk assessment, and control to support management of this devastating wildlife disease.



Emerging and Existing Threats

USGS develops strategies and tools to safeguard communities, natural resources and infrastructure from emerging and existing threats such as wildfire, diseases, and harmful algal blooms

Unexpected events across the globe and in the Nation can rapidly affect public safety, and the health of our economy and environment. Keeping people, lands, and wildlife safe from emerging threats, and quickly responding to existing threats, is a priority for the country. USGS develops strategies and tools to safeguard our communities, infrastructure, and natural resources in the face of emerging and existing threats.

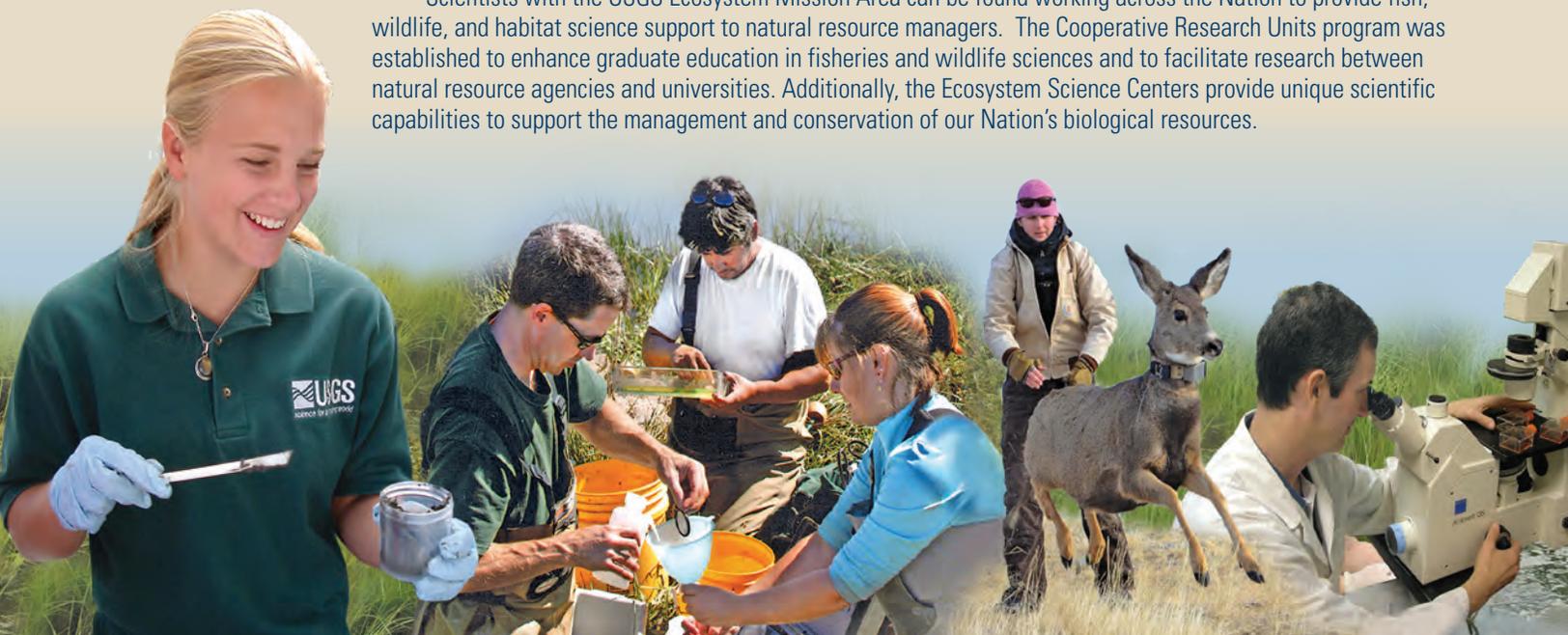
Though wildfire is a benefit to nature, wildfire seasons have lengthened and fires have increased in size, increasing the threats to public safety, the economy, and the environment. In 2017, 10 million acres burned in the U.S. costing the Federal government \$2.9 billion in firefighting costs. USGS science is essential to decision making before, during, and after wildfires and is widely used by stakeholders across the U.S. to help prevent and manage larger, catastrophic events. In Western sagebrush landscapes, invasive plants, such as cheatgrass, colonize burned areas and increase fuel for fires. Land managers are using USGS tools to decide what areas to prioritize for fire protection and post fire habitat restoration for species like sage grouse and mule deer, as well as for ranchers that rely on sagebrush systems.

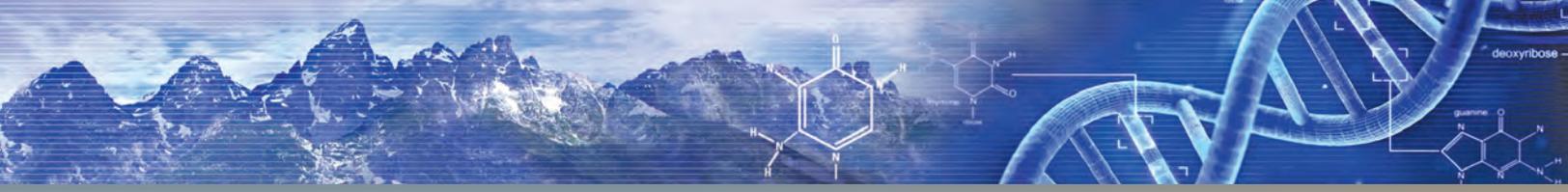
Harmful Algal Blooms (HABs) are a concern in all 50 States and impact human health, fisheries, and the economy. Fishing license sales near Lake Erie fell by 10 to 13 percent when an algal bloom was present, and recent studies show that home values near lakes affected by algae can decrease dramatically. USGS science answers questions about controlling HABs and provides early warning tools to avoid and minimize human exposure. For example, in Native American and Alaskan Native communities that depend on subsistence fishing, USGS tools are being used to help identify HABs to keep fisheries thriving and communities safe.



USGS Science at Work

Scientists with the USGS Ecosystem Mission Area can be found working across the Nation to provide fish, wildlife, and habitat science support to natural resource managers. The Cooperative Research Units program was established to enhance graduate education in fisheries and wildlife sciences and to facilitate research between natural resource agencies and universities. Additionally, the Ecosystem Science Centers provide unique scientific capabilities to support the management and conservation of our Nation's biological resources.





Infrastructure Development



USGS science guides optimal infrastructure development by identifying barriers to wildlife movement, returning landscapes to conditions that promote balanced use, and enhancing the integrity of our coasts.

The U.S. coast will see population growth to nearly 134 million people by 2020. These growing communities are at increased risk from extreme coastal storms like Hurricanes Harvey and Irma, which severely damaged infrastructure and property. As the Nation rebuilds and updates infrastructure, USGS science assists in developing cost-effective projects that promote infrastructure needs that benefit national security, the economy, and cultural and natural resources.



In Washington State, the Elwha and Glines Canyon Dams were removed due to low productivity, high maintenance costs, and the dams' blockage of native fish migration. During dam removal, USGS science was used in the successful reconnection of river flow and fish habitat to coastal areas of the Olympic Peninsula. Fish populations are higher than they have been in more than 30 years and shorelines and coastal beaches are growing. The removal of these dams resulted in economic growth from increased tourism activity, and cultural and public safety benefits to the Lower Elwha Klallam Tribe.



In South Florida, the Everglades is the cornerstone of the tourist, outdoor recreation, and agriculture economies. A priority for the State is to restore the quality and distribution of water to the Everglades while maintaining flood control and water supply for more than 7 million people. Small differences in water depth can significantly influence regional water-management and the Everglades ecosystem. The Everglades Depth Estimation Network is a USGS-created and managed network of tools that provide real-time water-depth information to monitor the Everglades' responses to water level change and guide restoration strategies.



USGS Cooperative Research Units and Science Centers are located throughout the United States. Congress provides funding to the Ecosystems Mission Area through six programs: Cooperative Research Units, Environments, Fisheries, Invasive Species, Status and Trends, and Wildlife.

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