
Executive Summary

5 The climate is changing, and the effects are being seen in the nation’s valuable natural resources and in the economies and communities that depend on plants, animals, and ecosystems. Measurements unequivocally show that average temperatures in the United States have risen two degrees Fahrenheit (°F) over the last 50 years. The science strongly supports the finding that the underlying cause of these changes is the accumulation of heat-trapping carbon dioxide (CO₂) and other greenhouse gases (GHG) in the atmosphere. If GHG emissions continue, the planet’s temperature is predicted to rise by an additional 10 2.0 to 11.5 °F by the end of the century, with accompanying increases in extreme weather events and sea levels.

15 Faced with a future climate that will be unlike that of the recent past, the nation has no choice but to adapt to the changes. In 2009, Congress recognized the need for a national government-wide climate adaptation strategy for fish, wildlife, plants, and ecosystems, asking the Council on Environmental Quality (CEQ) and the Department of the Interior (DOI) to develop such a strategy. CEQ and DOI responded by assembling an 20 unprecedented partnership of federal, state, and tribal fish and wildlife conservation agencies to draft the *Strategy*. More than 100 diverse technical and scientific experts from across the country participated in drafting the Strategy for the partnership.

“...develop a national, government-wide strategy to address climate impacts on fish, wildlife, plants, and associated ecological processes.”

- Department of the Interior, Environment, and Related Agencies Appropriations Act, 2010

25 The result is The National Fish, Wildlife and Plants Climate Adaptation Strategy (hereafter *Strategy*). The *Strategy* is the first joint effort of three levels of government (federal, state, and tribal) that have primary authority and responsibility for the living resources of the United States to identify what must be done to help these resources become more resilient, adapt to, and survive a warming climate. It is designed to inspire and enable natural resource managers, legislators, and other decision makers to take effective steps towards climate change adaptation over the next five to ten years.

30 The *Strategy* is guided by nine principles. Those principles include collaborating across all levels of government, working with non-government entities such as private landowners and other sectors like agriculture and energy, and engaging the public. It’s also important to use the best-available science—and to identify where science and management capabilities must be improved or enhanced. When adaptation steps are taken, it’s crucial to carefully monitor actual outcomes in order to adjust future actions to make them more effective, an iterative process called adaptive management. And given the size and urgency of 35 the challenge, we must begin acting now.

40 The *Strategy* details how climate change is expected to affect the eight major ecosystem types in the United States (Chapter 2). Warmer temperatures and changing precipitation patterns are expected to cause more fires and more pest outbreaks like the mountain pine beetle epidemic in forests, for instance, while boreal forest will move north into what is now tundra. Grasslands and shrublands are likely to be invaded by non-native species and suffer wetland losses from drier conditions, which would decrease nesting habitat for waterfowl. Deserts are expected to get hotter and drier, accelerating existing declines in species like the Saguaro cactus.

45 Climate change is expected to be especially dramatic in the Arctic, with temperatures in northern Alaska projected to climb 13 to 26 °F. That would change tundra into shrublands, and bring more fires. In addition, the thawing of frozen organic material in soils would release huge amounts of greenhouse gases, contributing to climate change. Rivers, streams, and lakes face higher temperatures that harm coldwater

species like salmon and trout populations, while sea level rise threatens coastal marshes and beaches, which are crucial habitats for many species. Among those at risk: the diamondback terrapin and the piping plover.

Since water absorbs CO₂ from the air, the rising levels of the gas in the atmosphere have caused the oceans to become 30 percent more acidic since 1750. That's already affecting the reproduction of species like oysters. As the pH of seawater continues to drop, major impacts on aquatic ecosystems and species are expected.

The *Strategy* describes steps that can be taken to combat these impacts and conserve ecosystems and make them more resilient (Chapter 3).

Proposed strategies and actions along with checklists to monitor progress are organized under seven major goals in the *Strategy*: (1) conserving and connecting habitat; (2) managing species and habitats; (3) enhancing management capacity; (4) supporting adaptive management; (5) increasing knowledge; (6) Increasing awareness and motivating action; and (7) reducing stresses not caused by climate change.

Many proposed actions describe types of conservation activities that management agencies have traditionally undertaken, but that will continue to be useful in a period of climate change but that will continue to be useful in a period of climate change. Others are designed to respond to the new challenges posed by climate change.

The most robust approach for helping fish, wildlife, and plants adapt to climate change is conserving enough suitable habitat to sustain diverse and healthy populations. Many wildlife refuges and habitats could lose some of their original values, as the plants and animals they safeguard are forced to more hospitable climes. As a result, there's a growing need to identify the best candidates for new conservation areas, and to provide corridors of habitat that allow species to migrate.

This *Strategy* envisions innovative opportunities for creating additional habitat. Paying farmers in the Great Plains to take some of their land out of production and then restoring prairie grass and sagebrush on the land could offset the projected population declines from climate change of the threatened lesser prairie chicken, according to one analysis. Similarly, adjusting rice farming practices in Louisiana could provide valuable new resources for a variety of waterfowl and shorebirds whose habitat is now disappearing because of wetland loss and sea level rise.

It's also possible to use applied management to make habitats and species more resistant to climate change so they continue to provide sustainable cultural, subsistence, recreational, and commercial use. Stream and habitat restorations that narrow and deepen streams or that ensure a steady supply of cold groundwater can keep water temperatures low enough to maintain healthy trout populations even when air temperatures rise.

Climate change adaptation requires new ways of assessing information, new management tools and professional skills, increased collaboration across jurisdictions, and review of laws, regulations, and policies. Climate change impacts are occurring at scales much larger than the operational scope of individual organizations and agencies, and successful adaptation to climate change demands a strong collaboration among all jurisdictions. Landscape Conservation Cooperatives, Migratory Bird Joint Ventures, National Fish Habitat Partnerships, and other existing and emerging partnerships are useful vehicles to promote collaboration.



Photo: AFWA

Predicting how individual species and ecosystems will react to climate change will frequently be difficult. Adapting to uncertain impacts requires coordinated observation and monitoring, information
95 management and decision support systems, and a commitment to adaptive management approaches. The National Ecological Observatory Network is one example of a coordinated observation system. Coordinated information management systems that link and make available data currently developed by separate agencies or groups will increase access to and use of this information by resource managers, planners, and decision makers. Vulnerability assessments can help managers develop and prioritize
100 adaptation efforts and inform management approaches.

New research is needed to increase knowledge about the specific impacts of climate change on fish, wildlife, plants, and habitats and their adaptive capacity to respond. The use of models has already produced useful information for planning for climate change impacts. More refined models at temporal and spatial scales appropriate to adaptation are required. Methods to objectively quantify the value of
105 ecosystem services provided by well-functioning ecosystems are needed.

Adaptation efforts will be most successful if they have broad public and political support and if key groups and people are motivated to take action themselves. Efforts to increase awareness and motivate action should be targeted toward elected officials, public and private policy makers, groups that are interested in learning more about climate change, private landowners, and natural resource user groups.
110 Engaging these stakeholders early and repeatedly to increase awareness of climate change, to develop integrated adaptation responses, and to motivate their participation and action is key to making this *Strategy* work.

Reducing existing stresses on fish, wildlife, and plants can be some of the most effective, and doable, ways to increase resilience to climate change. Reducing and mitigating the ongoing habitat degradation
115 associated with human development such as pollution and loss of open space is critical and requires collaboration with land use planners. Taking steps to reduce stresses not related to climate, such as fighting invasive species like water hyacinth, can help natural systems cope with the additional pressures imposed by a changing climate.

In addition, the *Strategy* emphasizes that actions to help plants, wildlife, fish, and natural systems adapt to climate change can be coordinated with measures taken in other sectors, such as agriculture and industry, to increase the benefits for all sectors. Reducing stormwater runoff not only reduces risks of flooding in cities, for example, it also reduces the threat that toxic algal blooms will affect aquatic ecosystems.
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The *Strategy* is also designed to build upon and complement many existing adaptation and conservation efforts (Chapter 4). Notable among those are the U.S. Global Change Research Program and the National Climate Assessment it produces every four years; the Interagency Climate Change Adaptation Task Force that coordinates U.S. federal agency adaptation efforts; State Wildlife Action Plans; and Landscape Conservation Cooperatives. Implementing the *Strategy* will require coordination and collaboration among these and many other entities. The *Strategy* proposes creation of a coordination body to oversee its implementation and engage with conservation partners.
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Admittedly, the task ahead is a daunting one. However, we can begin to take effective action to reduce risks and increase resiliency of valuable natural resources. This *Strategy* is a call to action. Unless the nation begins a serious effort to undertake this task now, we risk losing priceless living systems—and the benefits and services they provide—as the climate changes.
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