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U.S. Fish & Wildlife Service

Rising to the Challenge

Strategic Plan for Responding to Accelerating Climate Change

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On the cover:
Polar Bears.
Courtesy of National Geographic

September 21, 2009 (Revised draft). Until finalized, this draft document does not represent the official position of the Service, nor commit the agency to implement any proposed actions.

Executive Overview

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The U.S. Fish and Wildlife Service (Service) is an agency born of ecological crisis and raised on the nation's will to respond. The Service's genesis was the Federal response in 1871 to the collapse in the nation's food fishes from overharvesting, and its mandate was to find ways to reverse that decline. By the early 1900s, a crisis over the decimation of migratory birds for their plumes prompted the development of a national system of lands and waters set aside as refuges for wildlife and the passage of the first Federal wildlife laws. By the mid-1960s, the loss and threat of loss of entire species of fish, wildlife, and plants from human-induced pressures grew the Service's mission to also include the conservation and recovery of threatened and endangered species.

Over its 138-year history, the Service has faced every challenge to the future of the nation's fish and wildlife heritage head-on. As an agency, we have attracted to our ranks those individuals whose personal commitment to conserving, protecting, and enhancing America's fish and wildlife resources is matched by their professional resolve to do whatever it takes to accomplish that mission. The passion and creativity that drove Spencer Baird, Paul Kroegel, Guy Bradley, J.N. 'Ding' Darling, Rachel Carson and countless others who have stood in the breach for wildlife lives on in the hearts and minds of today's Fish and Wildlife Service employees.

At the dawn of the 21st century, we find our commitment and resolve and our passion and creativity being called upon once again as we face what portends to be the greatest challenge to fish, wildlife, and habitat conservation in the history of the Service: The Earth's climate is changing at an accelerating rate that has the potential to cause abrupt changes in ecosystems and mass species extinctions[a]. In turn, these changes will adversely affect local, state, regional, national and international economies and cultures and will diminish the goods, services, and social benefits that we Americans are accustomed to receiving at little cost to ourselves from ecosystems across our nation.

Given the disruption and destabilization that a changing climate implies for our mission, our nation, and our world, the Service and Department of the Interior cannot afford to simply go on about business as usual. We must rise up and respond to a 21st century conservation challenge with 21st century organizational, managerial, and scientific tools and approaches. To address and combat climate change and its impacts, we must position our agency more strategically for this battle, building shared scientific and technical capabilities with others and working more collaboratively than ever before with governments, business and industry, the conservation community, and citizens. As a Department, agency and conservation community we must act decisively, recognizing that climate change threatens to exacerbate other existing pressures on the sustainability of our fish and wildlife resources. We must act boldly, without having all the answers, confident that we will learn and adapt as we go. And most importantly, we must act now, as if the future of fish and wildlife and people hangs in the balance—for indeed, all indications are that it does.

As a Service, we are committed to examining everything we do, every decision we make, and every dollar we spend through the lens of climate change, fully confident in our workforce to rise to this challenge and to lead from in front and from behind. We recognize their efforts that are already underway, and we look to our employees for their on-the-ground knowledge and expertise in focusing our energies and recalibrating our activities.

Our Strategic Plan acknowledges that no single organization or agency can address an environmental challenge of such global proportions without allying itself with others in partnerships across the nation and around the world. This document commits us to a philosophy of interdependent, collaborative conservation, rooted in our **Climate Change Principles**.

Our Climate Change Principles

Priority-Setting. We will continually evaluate our priorities and approaches, make difficult choices, take calculated risks and adapt to climate change.

Partnership. We will commit to a new spirit of coordination, collaboration and interdependence with others.

Best Science. We will reflect scientific excellence, professionalism, and integrity in all our work.

Landscape Conservation. We will emphasize the conservation of habitats within sustainable landscapes, applying our "Strategic Habitat Conservation" framework.

Technical Capacity. We will assemble and use state-of-the-art technical capacity to meet the climate change challenge.

Global Approach. We will be a leader in national and international efforts to address climate change.

[a] Our use of the term "fish, wildlife and their habitats" throughout this plan includes plants.

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Our Strategic Plan's primary purpose is to lay out our vision and to provide direction for our own organization and its employees, defining our role within the context of the larger conservation community. In this plan, we express our commitment to our vision through strategic goals and objectives that we believe must be accomplished to sustain fish, wildlife, and habitats nationally and internationally. In an appendixed **5-Year Action Plan**, we identify specific actions that will lead to the accomplishment of our goals and objectives.

In our Strategic Plan, we have nested our goals, objectives, and actions under three major strategies that correspond with our mission to "work with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people." These strategies are:

Adaptation: Helping fish, wildlife and their habitats adapt to climate change.

Mitigation: Reducing levels of greenhouse gases in the Earth's atmosphere.

Engagement: Reaching out to others, internally and externally, to join forces with them in seeking solutions to the challenges and threats to fish and wildlife conservation posed by climate change.

We recognize that as an organization, the Service has been entrusted by the American people with legal authorities for fish and wildlife conservation that are national and international in scope and that put us in a position of unique responsibility within the conservation community. These authorities and responsibilities include working across jurisdictional boundaries in shared responsibility with all 50 States, and across international boundaries, to manage fish and wildlife populations; conservation of endangered and threatened species, inter-jurisdictional fish, and migratory birds; management of an unequaled conservation land base—the 150-million-acre National Wildlife Refuge System; and collaboration in carrying out conservation activities internationally through conventions, treaties, and agreements with foreign nations. By virtue of this public trust, the Service accepts its obligation to take leadership in helping to catalyze the conservation community's collective response to climate change. We will bring the community together to engage in dialogue; identify common interests and goals; and define innovative, collaborative, and effective strategies for addressing this shared crisis. We recognize that our own future success in conserving fish and wildlife will depend on how well we integrate our efforts with those of our partners, how quickly we can build needed technical and technological capacities and capabilities, and how strategic we are with our limited resources in addressing climate-induced changes.

Our Strategic Plan acknowledges the climate crisis as one of enormous consequence and challenge for fish and wildlife conservation. We put this plan forward as a manifestation of our resolve, as individuals and as an organization, to face this challenge with a sense of duty and integrity, and a spirit of public service and optimism.

Our Vision

Over the 21st century, the Interior Department and the U.S Fish and Wildlife Service envision a North American continent continuing to be altered by accelerating climate change, but managed to sustain diverse, distributed, and abundant populations of fish and wildlife by conserving healthy habitats in a network of interconnected, ecologically-functioning landscapes. While many species will continue to thrive, we also envision that some populations and species may decline or be lost, and some will only survive in the wild through our direct and continuous intervention. We will be especially challenged to conserve species and habitats that are particularly vulnerable to climate-driven changes, but we will dedicate our absolute best efforts and expertise to the task, recognizing that it may not be possible to save everything. Embracing the Department-wide vision for addressing all impacts of climate change on our natural resources we will need to make choices and set priorities and, working with our partners, apply ourselves where we can make the greatest difference.

We see climate change as an issue that will unite the conservation community like no other issue has since the early 1960s, when Rachel Carson sounded an alarm about pesticides. We envision a new era of collaborative conservation in which members of the conservation community work interdependently, building knowledge, sharing expertise, and pooling resources as we craft explicit landscape-scale goals and pursue these goals together. We foresee unparalleled opportunities to engage with, and enlist the involvement of, private citizens, businesses and industry, non-governmental organizations, and national and international governments at all levels to conserve fish, wildlife and habitats in the face of climate change.

"Individual commitment to a group effort—that is what makes a team work, a company work, a society work, a civilization work."

Vince Lombardi, 1913–1970, American football coach and national symbol of single-minded determination to win

Introduction

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Climate change is an immense, serious, and sobering challenge—one that will affect fish and wildlife profoundly. At the same time, climate change is galvanizing the conservation community in ways we have not seen since a half-century ago, when *Silent Spring* alerted the world to the hazards of overuse of pesticides and launched a worldwide environmental movement. As concern for climate change and its impacts grows, so do the opportunities for the Service and members of the conservation community to pool our talents, imagination, creativity, and spirit of public service to reduce and manage those impacts in ways that sustain fish, wildlife and habitats. Working interdependently and collaboratively, the Service will mount a bold response to climate change, on the ground, where our actions have the most impact; and in other settings where policies, priorities, and budgets are shaped and tough choices and decisions are made.

Across the Service, our employees have initiated local actions to address climate change. Some employees are monitoring sea-level rise and exploring ways of safeguarding our coastal National Wildlife Refuges and the trust resources they support. Other employees are finding creative ways of protecting ice-dependent species, such as polar bears, whose survival is threatened by receding ice in Arctic waters. Others are working tirelessly with water managers to ensure fish and wildlife resources are considered meaningfully in water allocation decisions, particularly in the Southwest, where climate change is likely to prolong drought. Some are busy calculating the Service's carbon footprint and devising innovative ways of helping the Service become carbon neutral. Still other employees are reaching out to our workforce and our external partners to help them better understand the direction and magnitude of climate change and its effects on fish and wildlife. It remains for the Service to do two things: First, we must focus the talents, creativity and energy of our employees on a common set of strategies, goals, objectives and actions for addressing climate change impacts. Second, we must provide employees with additional support in terms of knowledge, technology, and resources to enable them to realize their full potential in conserving fish, wildlife and habitats.

This Strategic Plan establishes a basic framework with which the U.S. Fish and Wildlife Service and our employees will work as part of a broader Department-wide strategy and with the larger conservation community to help ensure the sustainability of fish, wildlife, and habitats in the face of climate change. The plan looks broadly at how climate change is affecting these resources; what our role will be as a key member of the conservation community with national responsibilities for fish and what we will contribute to the international community and its campaign to ensure the future of fish and wildlife.

This plan is a starting point for action and discussion. It was drafted by a team of 20 Service employees representing all Service regions and programs and has been revised to reflect the comments of hundreds of Service employees. We look forward to updating it further as we work with and learn from others, as our experiences and knowledge grow, and as the conservation community unites more closely in a new era of collaborative conservation. Likewise, we welcome feedback on the approaches described in this plan and its appendix document, our **5-Year Action Plan**.

Did You Know…

- In the Arctic, record losses of sea ice over the past decade are affecting the distribution, behavior, and abundance of polar bears, animals that are almost completely dependent upon sea ice for survival.
- In the Southeast, rising sea levels are expected to flood as much as 30 percent of the habitat on the Service's coastal Refuges.
- In the Southwest, climate change is already exacerbating deep droughts, heightening water allocation conflicts, and increasing pressure on water uses at the Service's National Fish Hatcheries and National Wildlife Refuges.
- In the Northwest, climate change is warming the landscape and enabling insect pests to expand their ranges and decimate ecologically and commercially valuable forests.

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"Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level." So concludes the Intergovernmental Panel on Climate Change (IPCC) in its *Fourth Assessment Report* published in 2007[1]. There is no longer any doubt that the Earth's climate system is changing at an accelerating rate and that the changes are in large measure the result of human-generated greenhouse gas concentrations in the atmosphere caused by increasing human development and population growth. Climate change has manifested itself in rising sea levels, melting sea ice and glaciers, changing precipitation patterns, growing frequency and severity of storms, and increasing ocean acidification.

A growing body of evidence has linked accelerating climate change[b] with observed effects on fish and wildlife populations and their habitats in the United States[2]. Polar bear population declines have already been noted in the Arctic[3], and population extirpations of Bay checkerspot butterflies in the San Francisco Bay area[4] and pikas in the West's Great Basin[5] are also documented. Across the continental United States, climate change is affecting the migration cycles and body condition of migratory songbirds, causing decoupling of the arrival dates of birds on their breeding grounds and the availability of the food they need for successful reproduction[6].

Climate change has very likely increased the size and number of wildfires, insect outbreaks, pathogens, disease outbreaks, and tree mortality in the interior West, the Southwest, and Alaska and will continue to do so[7]. In the aquatic environment, evidence is growing that higher water temperatures resulting from climate change are negatively impacting cold- and cool-water fish populations across the country[8]. Along our coasts, rising sea levels have begun to affect fish and wildlife habitats, including those used by shorebirds and sea turtles that nest on our coastal National Wildlife Refuges[9]. In the oceans, subtropical and tropical corals in shallow waters have already suffered major bleaching events driven by increases in sea surface temperatures[10].

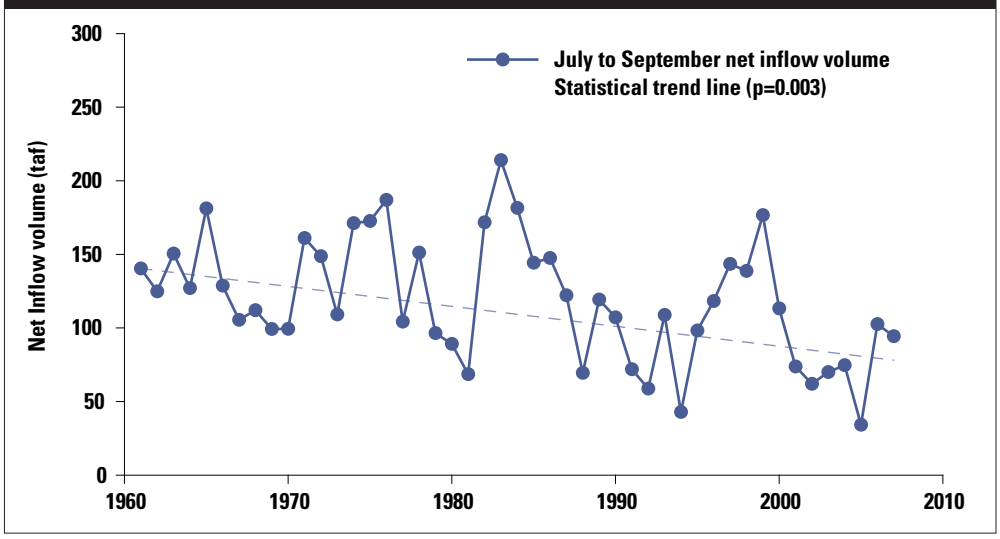
Klamath Basin's Warmer Winters Affecting Spring Snowpack and Summer Stream-flows

In the Klamath Basin of southern Oregon, spring snowpack represents a reservoir of water that will sustain stream-flows throughout the summer. In recent years, warmer winters have resulted in more precipitation falling as rain instead of snow, reducing the spring snowpack. Rivers in the upper Basin have shown rather large declines in stream inflows in recent decades. This includes inflows to Upper Klamath Lake that provide water for irrigation, national wildlife refuges, sucker habitat, and downstream river flows for salmon.

This trend means that in the Klamath Basin, as elsewhere, we can no longer assume that the future will look like the past. As warming trends continue, there will be less water available to meet competing demands. Like many water issues in the West, resolution of water issues in the Klamath Basin will require landscape-scale solutions and the active involvement and cooperation of all stakeholders.

Tim Mayer, Water Resources Branch hydrologist, Engineering Division, Portland, OR

July to September Upper Klamath Lake Net Inflow, 1961 to 2007



This graph shows the actual measurements of net inflows in the Upper Klamath Lake for each year from 1961–2007. The dashed statistical-trend line indicates that despite some variability from year to year, there has been a downward trend in net inflows from July-Sept. since 1961.

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The immensity and urgency of the climate change challenge are indeed sobering. The IPCC's *Fourth Assessment Report*[11] concludes that approximately 20 to 30 percent of the plant and animal species assessed are likely to be at increased risk of extinction if increases in global average temperature exceed 1.5–2.5°C. Global average temperature increases of 0.74°C are already documented, and temperature increases in some areas are projected to exceed 3.0°C over the next decade. The IPCC further concludes that, for increases in global average temperature exceeding 1.5–2.5°C, major changes in ecosystem structure and function, species' ecological interactions, and species' geographical ranges will occur. These changes will have predominantly negative consequences for biodiversity and ecosystem goods and services (e.g., water and food). The IPCC also reports that the resilience of many ecosystems around the world is likely to be exceeded this century by an unprecedented combination of climate change; disturbances associated with climate change, such as flooding, drought, wildfire, and insects; and other global change-drivers, including land-use changes, pollution, habitat fragmentation, urbanization, and growing human populations and economies. These projected changes have enormous implications for management of fish and wildlife, and their habitats around the world.

If unabated, climate change will cause abrupt ecosystem changes and widespread species extinctions. These changes will reduce the ability of natural systems to provide many societal goods and services—including the availability of clean water, our planet's lifeblood—which in turn will impact local, regional, and national economies and cultures. Clearly, we cannot delay in addressing climate change. It demands urgent attention and aggressive action.

If unabated, climate change will cause abrupt ecosystem changes and widespread species extinctions.

Conserving and Managing Pacific Walrus in a Warming Arctic

Climate change and record losses of Arctic sea ice are presenting us with some enormous conservation challenges for Pacific walrus. The rate of habitat loss has caught us by surprise and is forcing us to rethink and reprioritize our management efforts. We are trying to provide opportunities for walruses to adapt to changing habitats. To accomplish this, we must identify, monitor and protect important habitat, such as the remaining offshore foraging and resting areas and land-based coastal "haul-out" areas where the animals can rest between feeding bouts, all the while recognizing that these areas may change as the climate changes.

As oil and gas activities increase with warming temperatures, we will need to work closely with industry to develop effective monitoring programs and protective measures to minimize interactions with, and impacts to, walruses in the offshore environment. As walruses become more dependent on coastal regions, local management programs and conservation initiatives are going to become increasingly important for the co-existence of walruses and humans along the Arctic coast.

Joel Garlich-Miller, biologist, Marine Mammals Management Program, FWS, Anchorage, AK

A group of walruses rest on seasonal pack ice in the Bering Sea.

PHOTO BY JOEL GARLICH-MILLER, USFWS

[b] Hereafter, when we refer to "climate change," we mean accelerating climate change. While climate change has occurred throughout the history of our planet, current changes are occurring at a greatly accelerated rate, largely as a result of human activities.

The Challenge

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Mission success in fish and wildlife conservation over the coming decades will require unprecedented cooperation and partnership among governments, private sector and non-government organizations, and individual citizens. Consequently, the greatest challenge we and other members of the conservation community face is the need to form new and interdependent relationships, sharing integrated capacities, building on common strengths, identifying and addressing weaknesses, and focusing our responses on shared goals and objectives. For the Service, this is especially true of our relationships with Interior Department agencies, State fish and wildlife agencies, which have managment authority on much of our nation's lands and waters, and with Tribal fish and wildlife managment authorities.

The Challenge of Thinking Differently about Partnerships

In the Southeast, we have built new relationships with traditional and non-traditional partners — The Conservation Fund, American Electric Power Company, and Entergy Inc. — to help achieve their objectives and ours. Nine years ago, we launched an innovative program in the Lower Mississippi Valley aimed at restoring native habitats to bolster populations of wildlife and migratory birds through a carbon sequestration initiative. Together we have added more than 40,000 acres of habitat to the National Wildlife Refuge System and reforested more than 80,000 acres with more than 22 million trees, sequestering 30 million metric tons of carbon over the project's 70-year lifetime.

Pete Jerome, Refuges and Wildlife Area Supervisor, Southeast Region, Atlanta, GA

To succeed in sustaining fish, wildlife and their habitats, our plans and actions must recognize all management roles and authorities and realistically reflect the limitations and uncertainties in our understanding of climate change. They must target stewardship activities at all geographic scales, beginning with the design of conservation strategies at landscape scales. Our plans and actions must also encourage collaborative approaches that give common purpose to our employees and our conservation activities at all levels.

Our experiences with climate change in Alaska and its effects on sea ice, polar bears, walruses and Native cultures have taught us that we will be increasingly challenged to recalibrate our conservation goals by integrating climate change. We need to plan for conservation on landscape scales and be prepared to act quickly, sometimes without the scientific certainty we would prefer.

Climate change is the trans-formational conservation challenge of our time, not only because of its direct effects, but also because of its influence on the other stressors that have been and will continue to be, major conservation priorities.

Many other issues, such as the spread and control of invasive species; the mounting pressures on limited water supplies; the need for robust fire management to help conserve natural systems; the harm to species from exposure to environmental contaminants; continued changes in land use, specifically habitat loss; and the impacts of all of these factors on biodiversity, have been and will continue to pose tremendous challenges to sustaining healthy, vibrant ecosystems.

Rising Sea Levels on North Carolina Coast

North Carolina's east coast is identified as particularly vulnerable to climate change because it is so long, low and flat. As rising sea levels have pushed saltwater into the area, peat soils are degrading and plants and trees have died. Researchers estimate that 1 million acres along the coast could be lost within 100 years.

We know that the estuarine waters surrounding Alligator River National Wildlife Refuge are getting saltier. We've seen with our own eyes shoreline losses and plant community changes on thousands of acres of this 153,000-acre Refuge. Modeling data suggests that if nothing is done, we'll lose up to 67 percent of swamp land and 90 of dry land by 2100 — that's most of the Refuge.

We're finding opportunities in the crisis. We're working with The Nature Conservancy, Duke Energy, and other partners to create a management response that includes building resilience into the land and connecting Refuge lands to other lands. Duke Energy recently donated $1 million that will fund climate change research and activities to help wildlife adapt to the effects of rising sea levels on the Refuge.

Mike Bryant, Project Leader, North Carolina Coastal Plain Refuges Complex

Saltwater intrusion is affecting plant life at Alligator River NWR.

PHOTO BY DEBBIE CRANE, THE NATURE CONSERVANCY

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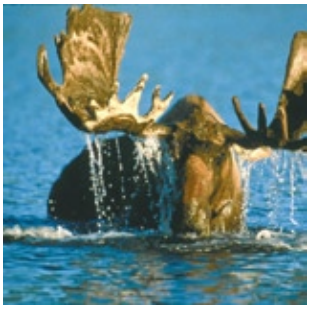
Climate change does not replace these other challenges or render them less important; they must remain priorities in the years ahead. It is, however, essential that we understand how climate change will exacerbate these challenges and pose new ones. For example, climate change will allow the range of some invasive species to expand, perhaps markedly. Climate change will also make some regions drier, further complicating what are already very challenging efforts to capture water and deliver it to the natural system. Such changes in precipitation patterns will also affect fire regimes, requiring careful consideration by our employees and partners to protect the natural world as well as the places where people live.

In addition, climate change will have many unforeseen impacts on land use and development. For example, rising seas will result in immense pressure to build sea walls and other structures to protect coastal development. These actions will impact the fish, wildlife, and plants that rely upon nearby beaches, salt marshes and other natural habitats. Furthermore, climate change may divert development pressure from coastal areas to relatively higher ground as people seek to escape places threatened by rising seas. Together, all of these stressors will have impacts on species that are imperiled today, and they could cause others to become imperiled for the first time.

One of the major challenges of addressing climate change effects on fish and wildlife will be identifying and accounting for the uncertainty that remains in our understanding of future climate change and how that change will affect ecological systems. Our understanding of future climate change is based largely on projections from global climate models (also known as General Circulation Models) that are run using different greenhouse gas emissions scenarios. These projections are not perfect; they contain a degree of uncertainty due to our inability to perfectly model the climate system, to variations between individual models, and to the large geographic and temporal scales associated with model results. These shortcomings can be addressed to a degree by using the results from multiple models rather than a single model, and by using various "downscaling" techniques to achieve finer spatial and temporal resolution. However, uncertainty cannot be eliminated. Another source of uncertainty relates to the greenhouse gas emissions scenarios that are used to obtain projections. The IPCC has developed a number of these scenarios, but we do not know exactly which of them will occur in the future, because, as the IPCC has stated, the scenarios are "based on assumptions concerning…future socio-economic and technological developments, that may or may not be realized, and are therefore subject to substantial uncertainty." This uncertainty can be addressed to some degree by using projections from a range of scenarios rather than a single scenario; this does not eliminate the uncertainty but allows us to account for it in planning for climate change. There also remains much uncertainty over how climate change will interact with other ecosystem stressors, such as land development and wildfire, to cause ecological change at different scales. Because we cannot predict with certainty the magnitude, geographic extent and timing of climate change or its interactions with non-climate stressors, we are likely to be best served by considering a range of possible futures rather than a single future.

Climate Change Implicated in the Mystery of the Dying Moose



No visit to northern Minnesota is complete without seeing a moose. So you can imagine our concern here at Agassiz National Wildlife Refuge when the moose population dropped dramatically in a few years' time. The Refuge was once home to 250 to 400 moose. Today, it is estimated that less than 40 remain on Agassiz. The decline in population on the Refuge was part of a regional decline in Northwest Minnesota.

This population fell from a peak of 4,000 animals in 1984 to a low of about 85 in 2007.

A research study initiated in 1995 with the Minnesota Department of Natural Resources and support from citizens, landowners, and volunteers concluded that climatic changes, combined with increased deer numbers and parasite transmission rates, may have rendered Northwest Minnesota inhospitable to moose. Winter and summer temperatures in the past 41 years have increased by about 12°F and 4°F, respectively. The study showed that moose declines often occurred the year after summers with higher mean temperatures.

Moose have temperature thresholds that, when exceeded, require them to expend energy to keep cool. The data indicates that warmer temperatures may have contributed to heat stress, which in turn accentuated the animals' already poor body condition from parasite-induced chronic malnutrition. The bottom line: Until the climatic factors that are making the moose range shrink are reversed, we will probably see fewer moose in Northwest Minnesota.

Maggie Anderson, Manager, Agassiz National Wildlife Refuge, Middle River, MN

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We must account for this uncertainty as we design, implement and evaluate our plans in response to climate change and as we carry out our management, regulatory and monitoring programs. We must learn as we go, using new knowledge and results of focused research to reduce uncertainty. As we learn more about climate change, we will be better able to refine our planning, decisions, and management actions to reflect that greater understanding.

Another major challenge of accelerated climate change is its unprecedented scope and magnitude. In the history of wildlife conservation, the Service and the larger conservation community have never experienced a challenge that is so ubiquitous across the landscape. Our existing conservation infrastructure will be pressed to the limit — quite likely beyond its limits — to respond successfully. New and different capacities and capabilities will be required, and our dedicated employees will be challenged to acquire new skills quickly. We may find that elements of our current legal, regulatory, and policy frameworks within which we and our partners operate are no longer adequate to encourage and support the new approaches and innovative thinking needed to address climate change effectively. In our land management, the original purposes for which some of our National Wildlife Refuges have been established may change or become obsolete. We will need financial and technological resources commensurate with this great challenge; and we will need the political leadership and will to pursue necessary statutory and regulatory changes, apply predictive models, make risk-based decisions, and manage and operate adaptively in changing environments.

Making people more aware of how accelerating climate change is harming fish, wildlife, and their habitats and of how it reduces the flow of societal goods and services ecosystems provide is a challenge for the Service, our State and Tribal counterparts, and the conservation community at large. The same ecosystem functions that provide for sustainable fish and wildlife populations also provide communities with significant benefits, such as good water quality, flood and fire protection, and recreation. Meeting the challenge will require that the Service and its partners use every available communication tool to engage the public about the ecological, economic, social, and cultural costs exacted by climate change.

BRIAN JONKERS / USFWS

Our Committed Response

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Our Strategic Plan calls for a committed response, expressed in progressive approaches and bold actions. We will employ three state-of-the-art strategies to address climate change: Adaptation, Mitigation, and Engagement. We will also commit ourselves to seven bold undertakings, outlined as Seven Commitments, that we believe will help reshape the face of conservation and are key to enabling us to take our appropriate role in the conservation community as we address the challenges of a changing climate system.

Three Progressive Strategies: Adaptation, Mitigation, Engagement

The plan's goals, objectives, and actions are positioned under three major strategies that correspond with the Service's mission. These strategies are:

Adaptation: Helping fish, wildlife and their habitats adapt to climate change.

Mitigation: Reducing levels of greenhouse gases in the Earth's atmosphere.

Engagement: Reaching out to others, internally and externally, to join forces in seeking solutions to the challenges and threats to fish and wildlife conservation posed by climate change.

Adaptation is defined by the IPCC as *an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities*. In our Strategic Plan, adaptation refers to planned management actions we will take to help reduce the impacts of climate change on fish, wildlife, and their habitats. Adaptation forms the core of the Service's response to climate change and is the centerpiece of our Strategic Plan. Our adaptive response to climate change will involve strategic conservation of terrestrial, freshwater, and marine habitats within sustainable landscapes. This approach to achieving our landscape conservation objectives is called "Strategic Habitat Conservation."

We take as a given that effective conservation always necessitates that we answer a few basic questions: First, what are our goals? What healthy populations of species do we seek to conserve, and what specifically are our targets? Second, how can we develop a conservation design to meet these goals? Third, how will we deliver this conservation approach? Fourth, what sorts of monitoring will be needed to determine whether we've been successful or whether we need to adapt our strategies? Fifth, what new scientific research do we need to meet our conservation objectives? These ideas are not new; they are key components of any adaptive management or landscape scale conservation strategy. Distilled, they become the five elements of Strategic Habitat Conservation (SHC):

Element 1. *Biological Planning*: setting targets/goals

Element 2. *Conservation Design*: developing a plan to meet the targets/goals

Element 3. *Conservation Delivery*: implementing the plan

Element 4. *Outcome-based Monitoring and Adaptive Management*: measuring success and improving results

Element 5. *Assumption-Based Research*: increasing knowledge and understanding through iteration (repetitive looping) of all five elements in constellation with one another

In adopting the SHC framework to address climate change impacts, the Service acknowledges that it needs a structured, objective-driven process for biological planning and conservation design; predictive models for managed systems, especially models that acknowledge uncertainties and challenge our decisions; monitoring to improve our understanding and management; and effective ways of delivering conservation action on the ground that will typically require extensive partnerships and collaboration.

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Climate Change and SHC's Five Elements

Climate change is integrally tied to each of SHC's five elements. For example, setting realistic and achievable biological targets requires careful consideration of the effects of climate change; otherwise, we could unwittingly set species goals that rely on locations that won't be available as habitat in the future. The impacts from sea level rise provide a clear example: We anticipate that some of today's valuable coastal habitat will be inundated in the years ahead and, thus, unable to support certain wildlife species. The task before us is to anticipate these changes and incorporate them into our goal-setting, as well as our conservation planning and delivery. We must ask ourselves whether we are conserving the right places based on the changes we anticipate from climate change.

Climate change also makes monitoring and adaptive management more important than ever. The predicted impacts from climate change are wide-ranging and their timing is highly uncertain. We need monitoring to understand the rate and magnitude of climate change; but more importantly, we need monitoring to understand the effectiveness of our strategies in the face of climate change and other threats. Only then will we be able to effectively modify our strategies over time.

Climate change also must be squarely factored into our research efforts. We must challenge ourselves to envision a future environmental baseline that takes into account the changes in the landscape caused by climate change and other ecosystem change-drivers, such as land use practices. Integrating climate change into our research priorities will help us to create conservation strategies that stand the test of time.

Paul Souza, Field Supervisor, South Florida Ecological Services Field Office, Vero Beach, FL

We recognize two types of adaptive response to climate change: **reactive** and **anticipatory**. Traditional and current approaches to conservation have been directed mainly toward maintaining current or historic conditions. In many cases, maintaining those conditions means working against the effects of climate change as they occur on the landscape. Reacting to climate change in this way is reactive adaptation. Combating rising sea levels by pumping sand ashore to replenish beaches and maintain existing habitat for nesting sea turtles and shorebirds is an example of **reactive adaptation**. A second approach to responding to climate change is to manage toward future, and often less certain, landscape conditions by predicting and working with the effects of climate change. This is anticipatory adaptation because it anticipates and manages for future conditions. An example of **anticipatory adaptation** is planning for sea level rise by modeling future shoreline conditions; developing shoreline "retreat" plans (including relocation of infrastructure) that allow rising sea levels to erode existing beaches and establish new shorelines landward for nesting sea turtles and shorebirds; and monitoring the results.

We must be explicit and strategic about which adaptation approach we will take in a given situation because an inappropriate response or a series of inconsistent responses can result in large expenditures of time, energy, and resources with questionable or insufficient outcomes. In some situations, our response to climate change will be to implement reactive adaptation measures only, as these measures will be sufficient to achieve and maintain desired conditions in the face of ongoing climate change. In other situations, we will first implement reactive adaptation measures to maintain current or historical conditions for as long as possible, and then transition to anticipatory adaptation as our capacity to predict and manage future conditions grows. In still other situations, our certainty regarding future landscape conditions will be adequate to allow us to proceed immediately with anticipatory adaptation. Our decisions about which adaptation approaches to use will be based on where we stand as a conservation community in terms of climate change knowledge and understanding, management technologies and techniques, and policy constraints and opportunities. We will practice adaptive management where possible, and will apply other techniques when circumstances dictate. Over time, we will increase the certainty of our collective understanding and actions in regard to climate change impacts.

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Determining Effects of Climate Change on Rio Grande Cutthroat Trout

Air temperature in the Southwest has increased markedly over the last 30 years, and greater increases are predicted. Because air temperature strongly influences water temperature, the temperature of streams that harbor our native Rio Grande cutthroat trout may have already increased, or likely will increase. Trout love cold water. Warmer water temperatures could affect their health, their ability to compete with non-native trout, the amount of suitable habitat available to them, and their food supply. The Service's Southwest Region is funding research to examine historical water temperatures in comparison to current water temperatures in streams occupied by Rio Grande cutthroat trout. In conjunction with other studies that look at the temperature tolerance of Rio Grande cutthroat trout, this research will help us determine the level of risk that increased water temperatures pose to this species.

Marilyn Myers, lead biologist for Rio Grande cutthroat trout, Ecological Services Field Office, Albuquerque, NM

Rio Grande cutthroat trout caught during population sampling on the Rio Santa Barbara in New Mexico.

PHOTO BY YVETTE PAROZ, NEW MEXICO DEPARTMENT OF GAME AND FISH

Mitigation is defined by the IPCC as *human intervention to reduce the sources or enhance the sinks*[c] *of greenhouse gases*. Mitigation involves reducing our carbon footprint by using less energy, consuming fewer materials, and appropriately altering our land management practices, such as wildlife food production. Our goal is to achieve carbon neutrality as an organization by the Year 2020.

Mitigation is also achieved through biological carbon sequestration, which is basically the process by which CO_2 from the atmosphere is taken up by plants through photosynthesis and stored as carbon in biomass (e.g., tree trunks and roots). Sequestering carbon in vegetation, such as bottomland hardwood forests, can often restore or improve habitat and directly benefit fish and wildlife.

We will be aggressive in sequestering carbon and using best practices to manage our lands, meet our stewardship responsibilities, and manage our facilities, vehicles and vessels, travel, and purchases and acquisitions so that we become carbon neutral by 2020. Our success in pursuing and achieving carbon neutrality will help us to model appropriate organizational behaviors and to participate with the conservation community in catalyzing action to reduce greenhouse gas emissions worldwide. In addition, we expect our mitigation successes to influence local, regional, national, and international land use and energy policies and actions and to further reduce greenhouse gas emissions, thereby reducing the impacts of climate change on fish, wildlife, and their habitats.

Engagement is reaching out to Service employees; our local, national and international partners in the public and private sectors; our key constituencies and stakeholders; and everyday citizens to join forces with them in seeking solutions to the challenges and threats to fish and wildlife conservation posed by climate change. By building knowledge and sharing information in a comprehensive and integrated way, the Service and our partners and stakeholders will increase our understanding of global climate change impacts and use our combined expertise and creativity to help wildlife resources adapt in a climate-changed world. Through engagement, Service employees will be better equipped to address climate change in their day-to-day responsibilities; America's citizens will be inspired to participate in a new era of collaborative environmental stewardship, working to reduce their carbon footprints and supporting wildlife adaptation efforts; and leaders at the local, regional, national, and international levels will be motivated to craft and support legislation and policy that address climate change and consider its impacts to fish and wildlife.

Adaptation, Mitigation, Engagement: A Balanced Approach. We will use a balanced approach in undertaking adaptation, mitigation and engagement. Goals and objectives in this plan will be stepped down to specific actions that will form our near-term, 5-Year Action Plan for addressing climate change. We will progress in a manner that will reflect increasing certainty about what actions we should take and when we should take them[d].

[c] Sinks are the removal or sequestration of greenhouse gases.

[d] Certainty increases when the collective understanding of climate change trajectories (i.e., the magnitude and direction of change) in a given area, their impacts on fish, wildlife, plants and their habitats, and our ability to successfully manage those impacts increases and becomes more accepted, both within the Service and the general public. Increasing certainty within the Service and among our publics and partners is a strategic goal of our research and monitoring programs and our educational endeavors.

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Rare Cacti: Is Hotter and Drier Better?

As the most readily recognized component of arid ecosystems, we intuitively think that cacti are uniquely adapted to live in the desert and may be able to withstand hotter and drier conditions brought on by climate change. Based on monitoring information we have collected for several Federally listed and candidate cacti species in Arizona and New Mexico, this may be an incorrect assumption. Populations of these cacti have been monitored for at least 20 years, with each species' population showing declines in overall numbers and reduced, or no, reproduction since the 1990s.

What will happen to these cacti species if drought conditions continue? Seed banks may be reduced, and seed germination and seedling survival will likely be reduced. Even for established plants, increases in rabbit and rodent predation of cacti that occur during drought may remove large, reproductive individual plants from populations.

Due to their limited geographic distribution, these cacti species may not be able to disperse into areas where they can persist. The management questions before us are, How do we manage for these and similar species under changing climatic regimes? Are these species candidates for population augmentation in their existing locations or for assisted colonization—moving them or placing seeds in other areas that may be favorable for their continued existence?

Mima Falk, plant ecologist, Phoenix Ecological Services Field Office, Tucson, AZ

Acuna cactus in bloom. PHOTO BY USFWS

We will increase our adaptation efforts significantly in the near term as we respond to increasing climate change impacts. Our initial emphasis will be on reactive adaptation, as we work to build resilience in ecosystems through our management efforts and, in some cases, to buy additional time to increase our certainty regarding future landscape conditions. Over the long term, however, we will work with partners to assemble the technical and institutional capability to increase our anticipatory adaptation, particularly as we become more certain about the impacts of climate change. As our expertise and that of our conservation partners grow, and as we learn more about climate change, we will increasingly emphasize anticipatory adaptation.

With regard to mitigation, we will begin immediately and work aggressively to reduce our carbon footprint to achieve carbon neutrality. Over time, we anticipate that we will build a strong mitigation consciousness and track record in our organization; consequently, our mitigation efforts will plateau and will be maintained at that level for the long term.

With regard to engagement, we will increase our internal efforts immediately so that our employees can acquire the additional knowledge and skills they need to address climate change as a central focus of our programs and activities. At the same time, we will increase our external engagement to learn from others and help build public support nationally and internationally for the Service's adaptation and mitigation activities. In addition, we will encourage members of the public to join us in reducing their carbon footprints.

Seven Bold Commitments

We will fulfill our leadership role as the principal national agency through which the Federal Government carries out its fish, wildlife, and habitat conservation mission for the American public by committing to seven bold undertakings that we believe are essential to our success in effectively responding to the threats posed by climate change. As a Service, we will:

1. Establish new, shared scientific and technical capacity within the conservation community in the form of *Regional Climate Science Partnerships* to acquire and translate climate change information into knowledge that together we can apply to better predict, understand and address the effects of climate change on fish, wildlife and their habitats at all spatial scales.

2. Establish *Landscape Conservation Cooperatives* that enable members of the conservation community to plan, design and deliver conservation in ways that integrate local, State, Tribal, regional, national and international efforts and resources, with our 150 million-acre National Wildlife Refuge System playing a role in ensuring habitat connectivity and conserving key landscapes and populations of fish and wildlife;

3. Develop new organizational and managerial processes and procedures that enable the Service to evaluate its actions, decisions, and expenditures through the lens of climate change and that unite us across our programs in a shared commitment to address the effects of climate change on fish, wildlife, and their habitats;

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4. Use our informational, educational, training, and outreach capabilities to engage our employees, our conservation partners, business and industry, government and non-government organizations, the public, and other internal and external audiences in a dialogue about the consequences of climate change and inspire their innovative actions to combat its effects on fish, wildlife, habitats, and people.

5. Become carbon neutral as an agency by Year 2020 and encourage other organizations to do the same.

6. Apply Strategic Habitat Conservation (SHC) as the Service's framework for landscape conservation.

7. Inspire and lead the conservation community in creating and implementing a shared national vision for addressing climate change by:

a. Facilitating development of a *National Fish and Wildlife Adaptation Strategy*, as called for in draft climate change legislation of the U.S. Congress, that would be our shared blueprint to guide wildlife adaptation partnerships over the next 50-100 years;

b. Creating a *National Biological Inventory and Monitoring Partnership* that facilitates a more strategic and cohesive use of the conservation community's monitoring resources. The Partnership would generate empirical data needed to track climate change effects on the distribution and abundance of fish, wildlife and their habitats; model predicted population and habitat change; and help us determine if we are achieving our goals;

c. Organizing a *National Climate Change Forum* where members of the conservation community can exchange ideas and knowledge, network, and build the relationships that will ensure our success in addressing climate change.

Managing for Predicted Changes in Water Levels at Ottawa National Wildlife Refuge

At Ottawa National Wildlife Refuge, we're taking action now to mitigate potential impacts from predicted drops in water levels in the Great Lakes as a result of climate change. The Refuge, established in 1961 to preserve habitat for migrating birds, is located in the heart of the Southwest Lake Erie marshes, the shallowest portion of the Great Lakes. Most of our water comes indirectly from Lake Erie. As water levels fall, newly exposed shallow water areas and mudflats may be overtaken by invasive plants, such as Phragmites and purple loosestrife. These problem plants are already a threat to native vegetation needed to sustain many of the Refuge's fish and wildlife species.

To address the current problem and prevent it from worsening in the future, we are using chemical, mechanical, and biological controls to eradicate these invasives and minimize their spread to new areas. We are battling the plants on the ground through spraying and crushing, and we've enlisted the assistance of the Ohio Division of Wildlife to help us with aerial spraying. We are also introducing a beetle known to consume only purple loosestrife to help eliminate this species.

The good news is that as we've thinned out these destructive plants and opened habitat, we've seen a resurgence in native species, including the reappearance of the endangered Eastern prairie fringed orchid. The Refuge population of the orchid is now one of the largest in the state of Ohio—a silver lining to the dark cloud posed by climate change.

Ottawa NWR MarshMaster tramples invasive Phragmites stalks and opens up space for native species, getting a jump on impacts from a predicted drop in water levels in Lake Erie as a result of climate change. PHOTO BY USFWS

Leadership and Management

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We anticipate that within the next 2–3 years, the U.S. Congress and the Federal Government will make political decisions and policies relative to climate change that will have enormous significance for 21st century conservation of fish and wildlife and their habitats. To help shape these decisions and policies, the Service must already have in place at the national and regional levels a climate change leadership and management capability that can provide a credible and cohesive approach to the issue. Our National Climate Team and eight Regional Climate teams, operating under the guidance of our Directorate and its Climate Change Working Group, will help us establish that capability and credibility. The National Climate Team will have representation from all Service regions and programs; and the Regional Climate teams will be made up of both Regional Office and field employees. Together, these teams will provide input to the development of national climate change policies and guidance; and provide leadership and direction in the management of the Service's climate change activities, including budget and performance; policy development and implementation; landscape conservation design, delivery, and evaluation; internal and external partnership development; Congressional assistance; engagement and communication; and science direction.

Accomplishing our mission in an era of accelerated climate change will require a fundamental rethinking of how we in the Service do business in the coming decades, including how we define leaders and leadership and how we manage and deliver our conservation activities.

The exercise of leadership will not be limited to the Directorate or the National and Regional Climate teams; it must permeate all levels of the Service. The crisis of a changing climate is unlike any other we have faced in world history. Climate change is not the result of the actions of the few that are impacting the many; it is the direct result of the activities of each one of us as we live and work in the modern world. In a crisis of this magnitude and scope, we must each take leadership in our own sphere of influence to make the changes that will eliminate or reduce the causative factors of climate change. As Service employees, we each have the added responsibility of taking leadership within our professional spheres of influence to address the impacts that climate change is already having or will have on fish, wildlife and habitats.

The **Directorate and the Washington Office must lead the way** by recognizing the crisis nature of climate change and seeking the resources needed to address it; by making difficult choices about Service program priorities and budgets that will guide and define our activities; and by calling upon every employee to get appropriately involved in our adaptation, mitigation, and engagement strategies.

Regional leaders and employees must lead the way by stepping down national guidance and plans to the field, facilitating the feedback loop between national leadership and the field, ensuring that resources to accomplish work on the ground reach those who need them, and removing any barriers to success.

Project leaders and field employees must lead the way by ground-truthing our efforts, identifying the species and habitat priorities that must be addressed; implementing our strategies; monitoring our results; and recommending new approaches as necessary.

All employees must lead the way by participating in the creation of new climate change partnerships, and by working with others to find new and innovative means for incorporating climate change considerations into our day-to-day activities.

Climate change leadership will function in much the same way as our strategic habitat conservation approach—it will be more iterative than hierarchical, with Service leaders at each level making indispensible and ongoing contributions critical to our success as they operate in constellation with one another.

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Conserving and Managing Apache Trout in a Warmer, Drier Southwest

In a region already known for its warm temperatures and relatively low precipitation, aquatic species in the Southwest may be venerable due to climate change. What will this mean for the conservation and recovery of Apache trout? Climate models for the Southwest predict a continuing increase in drought and flood severity, warmer air and water temperatures, less precipitation, and more water loss through plant transpiration and ground evaporation; as well as an increase in events such as wildfire and extreme drought.

Warming trends may alter seasonal river flows, making them higher during winter and lower during summer. Less snowfall and more rain during winter may result in earlier spring runoff (an important cue for the spring-spawning Apache trout). Post-wildfire flooding can eliminate populations and can make streams uninhabitable for years. We are working with our partners to identify strategies to address these new threats through habitat protection, restoration to increase habitat resiliency, and monitoring. Understanding how climate change may influence habitat for Apache trout will be critical for effective management and recovery of this species.

Jeremy Voeltz, lead biologist, Apache Trout Recovery Program, FWS, Pinetop, AZ

Apache trout taken from Arizona creek.

PHOTO BY JEREMY VOELTZ, USFWS

Working closely with the Department of the Interior's Climate Change Response Council, we will play a key role in the Department's coordinated response to impacts of climate change and work with other Interior bureaus to improve the sharing and communication of climate change impact science. This includes participating in Department-wide carbon storage efforts, as well as the development of a unified greenhouse gas emission reduction program. As a Service, we will approach the management and delivery of our conservation activities with a new spirit of entrepreneurship, which we define as "the process of identifying, evaluating, and seizing an opportunity and bringing together the resources necessary for success." As climate change entrepreneurs, we will learn and embrace new conservation approaches that lead to better results for fish, wildlife, and their habitats. We will face hard facts; and we will redirect our priorities and make difficult budget decisions as those facts dictate. We will hold ourselves accountable, formally monitoring and evaluating the effectiveness of our efforts as we implement our Strategic Plan and our 5-Year Action Plan. We will seek outside, independent reviews of our climate change efforts after three years. We will recognize and reward Service employees, programs, or offices that demonstrate entrepreneurship by taking substantive actions on climate change adaptation, mitigation, or engagement.

As a Service, we will show leadership by effectively representing fish, wildlife, and habitat conservation interests in discussions relating to national climate policy and legislation. We will help create climate change legislation that incorporates wildlife adaptation strategies, as outlined in our Strategic Plan, and that reflects our Guiding Principles for addressing this conservation challenge. We will play a key role in galvanizing governments, organizations, businesses and industry to collaborate in developing a National Fish and Wildlife Adaptation Strategy and partnering in its implementation.

As a conservation leader, the Service recognizes that the crisis of climate change also opens up great opportunities for those of us committed to the sustainability of our nation's fish and wildlife resources and their habitats. This crisis is an opportunity to expand and strengthen our partnerships in ways that will inevitably help us to more effectively address not just this threat to the future of fish and wildlife but all other threats, such as unsustainable land-use practices, degradation of water quality and quantity, and invasive species. It is an opportunity to for us to "take it to the next level" scientifically by building an unequalled network of shared scientific capacity, capability and knowledge that we can draw upon in every decision we make. It is an opportunity to engage the public as never before in facing the fact that our actions, individually and collectively, have implications for the future of wildlife, people, and the planet. The crisis of climate change is, in the final analysis, an unparalleled opportunity to bring people together, nationally and internationally, to solve a world problem, not through conflict but through collaboration.

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We acknowledge that this Strategic Plan and its accompanying 5-Year Action Plan call upon Service employees to engage in many new teams, partnerships, and assessments. We take as a given that it is the responsibility of leadership at each level in the Service to pursue and make available to employees the resources, time, training, and tools to accomplish our mission. It is worth noting that climate change is not a new mission; it is the lens through which we must accomplish the mission we already have. As we address climate change in carrying out that mission, we will seek new resources that we need, reprioritize and reallocate the resources we have, and leverage our collective resources by working in partnerships, internally and externally. Our best certainty of receiving additional resources is to demonstrate leadership on climate change by assembling our best talent and aligning our present resources and priorities in response to this challenge. Our nation is at a turning point in regard to climate change, and we have the opportunity and the responsibility to help tip the balance in favor of aggressive action.

Given the magnitude of the threat posed by climate change to life as we know it, we cannot afford to think small or be held back by our fears or concerns. All great achievements in human history have occurred within the context of daunting challenges and have been accomplished by people with vision who were willing to move forward without having all the answers and resources they would have desired. Our National Wildlife Refuge System, a 150-million-acre network of lands and waters spread from "sea to shining sea," is a sterling example of what can happen when even one person with courage and vision is willing to stand in the breach for wildlife and call the nation's attention to the threat at hand. This is our moment, as individuals and as a Service, to rise to the threat posed by climate change. If we succeed, we will have done our duty. If we fail, let it not be said of us that we were afraid to try.

"Vision without action is merely a dream. Action without vision just passes the time. Vision with action can change the world."

—Joel Barker, living American scholar and futurist, the first to popularize the concept of paradigm shifts in the corporate world

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Goals and objectives will turn our strategic vision into action, and position the Service as a responsible leader and creative partner in facilitating wildlife adaptation, greenhouse gas mitigation, and engagement with others to address the effects of accelerating climate change on fish and wildlife and their habitats. Action items needed to achieve these goals and objectives are included in the appendix document, the 5-Year Action Plan.

Adaptation

GOAL 1

We will develop long-term capacity for biological planning and conservation design and apply it to drive conservation at broad, landscape scales.

Objective 1.1: Develop a National Fish and Wildlife Adaptation Strategy

Pending climate legislation in Congress includes provisions for a national strategy for helping fish and wildlife adapt to climate change. We view this as the most consequential and crucial conservation endeavor of the 21st century. We commit ourselves to an intensive, multi-year collaboration with Federal, State, Tribal, private, and international organizations to support the development of a National Fish and Wildlife Adaptation Strategy.

A National Fish and Wildlife Adaptation Strategy is likely to consist of an agreement among major conservation interests (e.g., local governments, States, Tribes, conservation organizations, Federal agencies, and private landowners) that identifies and defines principles and methods to maintain key terrestrial, freshwater and marine ecosystems and functions needed to sustain fish, wildlife and plant resources in the face of accelerating climate change. In short, a National Fish and Wildlife Adaptation Strategy will be our shared blueprint to guide wildlife adaptation partnerships over the next 50-100 years. It will outline appropriate scientific support (including inventory, monitoring, research, and modeling) to inform management decisions; the need for and importance of collaboration and interdependency; and the financial resources (including grants, appropriated funds, and private contributions) to implement the decisions. The strategy will enable the national and international conservation communities to harness collective expertise, authorities, and abilities to define and prioritize a shared set of conservation goals and objectives, as well as prescribe a plan of concerted action.

A National Fish and Wildlife Adaptation Strategy will cover the length and breadth of the United States, from the Pacific Islands to the eastern seaboard and from Alaska to the Caribbean; and will extend beyond our borders to encompass habitats used by cross-border species (e.g., those shared with Canada and Mexico)[e], as well as areas in the Western Hemisphere associated with many migratory species (e.g., Central and South American wintering areas of migratory songbirds)[f]. The Service will work to inspire, organize, and carry out a collaborative process that brings together diverse interests to develop a National Fish and Wildlife Adaptation Strategy and fully integrate resource management agencies and organizations from around the country and internationally into the process.

Objective 1.2: Access Regional Climate Science and Modeling Expertise through Department Regional Climate Change Response Centers.

Successful conservation strategies will require an understanding of climate change; the ability to predict how that change will affect fish and wildlife at multiple scales; and the skill to translate this understanding into useful tools for landscape-level conservation design. We need access to experts in climate science and modeling who have the capability of putting climate data and projections into forms that are useful for biological planning and conservation design. This expertise can be found within organizations such as the U.S. Geological Survey, the National Oceanic and Atmospheric Administration, universities, and some nongovernmental organizations. Because these experts tend to be widely dispersed across the government, conservation, and academic communities, they will most likely collaborate through virtual networks and be coordinated through entities such as the U.S. Geological Survey's National Climate Change and Wildlife Science Center's Regional Hubs. We will work with the Department's network of Regional Climate Change Response Centers to help employees and partners access this expertise to support a broad spectrum of natural resource management activitites.

[e] Transboundary issues will be addressed through the Canada/Mexico/U.S. Trilateral Committee for Wildlife and Ecosystem Conservation and Management (the Trilateral Committee). The Trilateral Committee was established to facilitate and enhance coordination, cooperation, and the development of partnerships among the wildlife agencies of the three countries regarding programs and projects for the conservation and management of species and ecosystems of mutual interest in North America.

[f] Western hemisphere issues will be addressed through the Western Hemisphere Migratory Species Initiative, which seeks to contribute significantly to the conservation of the migratory species of the hemisphere by strengthening communication and cooperation among nations, international conventions, and civil society; and by expanding constituencies and political support.

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Climate science and modeling expertise will (1) make global climate model outputs usable at multiple planning scales through downscaling approaches (either dynamical or statistical); (2) integrate global or downscaled climate models with ecological and land-use change models to project future changes in the distribution and abundance of fish, wildlife, and their habitats resulting from climate and land-use changes; (3) identify and predict climate-change thresholds for key species and habitats; (4) facilitate research to address key uncertainties in applying climate change science to fish and wildlife conservation; and (5) support regional or local climate monitoring programs. Currently, this expertise is not readily available to managers; without it, they cannot develop successful adaptation strategies for fish and wildlife.

Objective 1.3: Develop Landscape Conservation Cooperatives to Acquire Biological Planning and Conservation Design Expertise

To promote wildlife adaptation to accelerating climate change, we need the capability to develop, test, implement, and monitor conservation strategies that will be responsive to the dynamic landscape changes resulting from climate change. These strategies must be model-based and spatially explicit, allowing us to effectively apply our emerging climate knowledge to predict habitat and species changes and to target our conservation actions to address impacts. To accomplish this, we will develop biological planning and conservation design expertise across the Service and among diverse partners, as defined in our Strategic Habitat Conservation framework.

We will work with partners to develop Landscape Conservation Cooperatives (LCCs) as networks for acquiring this expertise. The precise organizational structure for LCCs will vary based on the shared needs of cooperators. In some cases, we will build on expertise in existing partnerships—such as the Lower Mississippi Valley Joint Venture—to establish an LCC. In many cases, we will need to build new partnerships if we are to successfully plan and design conservation measures to support fish and wildlife adaptations to changing climate.

With the expertise available through LCCs, we and our partners will assemble climate, land-cover, land-use, hydrological and other relevant data in spatially-explicit contexts, and use those data to develop explicit, predictive and measurable biological objectives to guide landscape-scale conservation design. We will apply population-habitat and ecological models, statistical analysis and geographic information systems, and we will apply those results to design conservation strategies that drive conservation delivery at landscape scales. We will develop statistically valid, collaborative population and habitat monitoring programs that are linked to and support agency decision-making processes. We will develop and facilitate research projects focused explicitly on the documented assumptions and uncertainties resulting from biological planning and conservation design activities.

Objective 1.4: Conduct Species and Habitat Vulnerability Assessments

To establish priorities for species and landscape conservation, we must first understand which species and habitats are most vulnerable to accelerating climate change. We will work with partners to develop methodologies to assess species and habitat vulnerability, and we will work with regional and field staff to test and apply these methodologies. Climate vulnerability assessments will be used in conjunction with analyses of non-climate stressors—such as water quantity and quality for aquatic species, spread of invasive species, impacts of fire regimes, exposure to contaminants, and changes in land use—to assess the overall vulnerability of species and habitats.

Objective 1.5: Incorporate Climate Change in Service Activities and Decisions

We will consider actual and predicted climate change impacts to fish and wildlife populations and their habitats in Service planning, management, and restoration efforts. Planning efforts will include resource planning (e.g., Recovery Plans, Fish Habitat Plans, Migratory Bird Plans, and Comprehensive Conservation Plans); operations planning (e.g., facility maintenance, construction, and equipment and fleet management); and administrative planning (e.g., workforce planning, information technology management planning).

We will review all Service grant programs and modify grant criteria, as necessary and legally allowable, to direct more funding to projects that specifically address climate change adaptation, mitigation, or engagement. Where modification of grant criteria is not legally allowable, such as Pittman-Robertson and Dingell-Johnson grants made through the Wildlife and Sport Fish Restoration Programs, we will work with partners to encourage grantees to consider climate change initiatives.

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Objective 1.6: Provide Requested Support to State and Tribal Managers to Address Climate Change Issues that Affect Fish and Wildlife Service Trust Resources

Many States are already working to address climate change in their State Wildlife Action Plans and other management plans, and Tribes are likely to consider management changes as well. When requested, we will work collaboratively with States and Tribes to provide information and to support their efforts to incorporate climate change considerations into their State Wildlife Action Plans and other fish and wildlife management plans and programs.

Objective 1.7: Evaluate Fish and Wildlife Service Laws, Regulations, and Policies to Identify Barriers To and Opportunities for Successful Implementation of Climate Change Actions

We will review the Service's laws, regulations, and policies to determine what, if any, changes may be necessary to support effective adaptation and mitigation responses to climate change. We will focus particularly on determining the need to develop new policies (e.g., for managed relocation[g]) and necessary revisions of existing policies (e.g., what constitutes native, invasive, or exotic species). In addition, we will identify laws, regulations, policies, guidance, and other protocols necessary to provide incentives or eliminate barriers to our efforts to mitigate climate change by reducing our carbon footprint.

[g] Managed relocation is the intentional translocation of a species with limited dispersal ability to a site or sites where it currently does not occur or has not been known to occur in recent history and where the probability of persistence in the face of climate change is predicted to be higher.

GOAL 2

We will plan and deliver near-term and long-term landscape conservation actions that support climate change adaptations by fish, plants, wildlife, and habitats of ecological and societal significance.

Objective 2.1: Implement a National Fish and Wildlife Adaptation Strategy as the Service's Long-term Adaptive Response to Climate Change

Long-term Approach: Our long-term approach to climate change will be guided by a National Fish and Wildlife Adaptation Strategy, a coordinated, multi-organization plan for landscape conservation across the United States, portions of Mexico and Canada, and certain, more-distant areas within Central and South America. As it is developed and implemented, we will work to ensure that our National Fish and Wildlife Adaptation Strategy (1) embraces the philosophy that maintaining healthy fish and wildlife populations and ecosystem sustainability are interdependent goals; (2) recognizes appropriate roles for both reactive and anticipatory adaptation approaches; (3) reflects that, over time, we will be better able to make anticipatory adaptations; (4) addresses species and habitat priorities that are based on scientific assessments and risk-based predictions of vulnerability to changing climate; and (5) identifies key ecological processes and methods to conserve priority species and habitats. Finally, we expect that the National Fish and Wildlife Adaptation Strategy will include a national strategy for monitoring of species and habitats that are most vulnerable to climate change and will support and encourage adaptive resource management strategies as a keystone in our response to climate change.

Near-term Approach: We anticipate that a National Fish and Wildlife Adaptation Strategy will take five or more years to develop; therefore, the timeline for implementation of much of the Strategy is beyond the scope of our 5-year Action Plan. In the meantime, there are many on-the-ground efforts we can take in the near term to begin the process of helping fish and wildlife adapt to climate change. These are identified under the objectives 2.2–2.10 that follow. As we implement these near-term efforts, we will evaluate success and failure and use this information to inform development and implementation of a National Fish and Wildlife Adaptation Strategy.

Objective 2.2: Take Conservation Action for Climate-Vulnerable Species

We will rely on results of our vulnerability assessments and on our field expertise in focusing our efforts to protect climate-vulnerable species, such as ice-dependent or sky island species and their habitats. Timely identification of climate-vulnerable species and habitats is critical. For some species, this may allow us to take pre-emptive conservation action, thereby reducing or eliminating the need to list them under the Endangered Species Act (ESA). For other species, climate vulnerability may provide one basis for listing them as endangered or threatened under the ESA as early as possible to provide more flexibility in developing regulatory and recovery efforts, including the designation of critical habitat. For yet other species, vulnerability assessments will provide the information needed to develop conservation and recovery actions to help ensure the species' survival. We will use the results of vulnerability assessments and our field expertise to conserve the highest priority species and habitats.

[h] Sky islands are mountains in ranges isolated by valleys in which other ecosystems are located. As a result, the mountain ecosystems are isolated from each other, and species can develop in parallel, as on island groups such as the Galápagos Islands.

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Objective 2.3: Promote Habitat Connectivity and Integrity

Climate change is interacting with non-climate stressors—such as land-use change, wildfire, and urban and suburban development, and agriculture—to fragment habitats at ever-increasing rates. Protecting and restoring contiguous blocks of unfragmented habitat and enhancing connectivity between habitat blocks, particularly protected areas such as National Wildlife Refuges, using linkages and corridors will facilitate the movement of fish, wildlife, and plant species responding to climate change. Through conservation designs developed by Landscape Conservation Cooperatives, we will work with other Interior Department land management agencies and partners to identify needed habitat protection and landscape-scale habitat linkages and corridors. By joing the habitat protection and management capacities of the Service (e.g., National Wildlife Refuge System, Fish and Wildlife Conservation Offices, Partners for Fish and Wildlife Program, National Fish Passage Program, Neotropical Migratory Bird Conservation Act, and North American Wetlands Conservation Act) with those of our partners, we will help build this connectivity within and between landscapes.

We must also strive to maintain ecosystem integrity by developing new and innovative ways of protecting and restoring key ecological processes to sustain fish, wildlife, and plant populations. Processes such as pollination, seed dispersal, nutrient cycling, natural disturbance cycles, predator-prey relations, and others must be part of the natural landscapes we seek to maintain or restore. These processes are likely to function more optimally in landscapes composed of large habitat blocks connected by well-placed corridors. We will work with partners to identify how key ecological processes are likely to be affected by climate change, and to determine how management actions might help maintain or restore key ecological processes. We will also conduct research (see Objective 3.4) and create demonstration projects, particularly on Land Management Research and Demonstration areas[i] on National Wildlife Refuges, to evaluate management actions for maintaining or restoring key ecological processes.

Objective 2.4: Identify and Fill Priority Freshwater Needs

Water is the key to life, and climate change will alter the distribution, abundance, and quality of water by affecting precipitation, air and water temperatures, and snowmelt. Climate change will drive adaptations of our nation's water supply infrastructure and allocations to meet human needs for water. As these human adaptations are crafted, we will work with partners, including water management agencies, to ensure water resources of adequate quantity and quality to support biological objectives for fish and wildlife are incorporated. This will be a critical issue for our National Wildlife Refuges, National Fish Hatcheries, threatened and endangered species, migratory birds, and fish and aquatic species conservation. We will work to acquire key water rights and to ensure water management authorities provide adequate in-stream flows to address priority needs as determined by vulnerability assessments. We will work to improve water quality, e.g., by reducing environmental contaminant loads.

Objective 2.5: Manage Genetic Resources

Conservation genetics information will help the Service and its partners to better measure and assess the taxonomic status and population relationships of fish and wildlife. Understanding genetic variation provides the raw material which enables the Service to better understand species adaptation and evolutionary flexibility in response to environmental change. As genetic diversity declines, a species' ability to adapt to change decreases and extinction risk increases. Furthermore, when habitat shifts occur, managers can use genetic information to conserve the genetic diversity and variability of a species. We must increase our capacity to gather, interpret and apply genetic information for the conservation of climate-vulnerable species. We must strengthen and expand our genetic analysis and cryopreservation capabilities. We must continue to expand our partnerships with States, zoos, botanical gardens, and other partners to develop other effective ways to manage genetic resources of both captive and wild fish and wildlife populations and to build the policy framework and decision-support needed to determine when and how to apply these measures in a transparent, responsible, and ethical manner.

[i] Land Management Research and Demonstration areas are places on a small number of our National Wildlife Refuges where new habitat management techniques and approaches are developed, implemented and showcased.

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Objective 2.6: Reduce Susceptibility to Diseases, Pathogens, and Pests

Climate-induced stress will compromise species' resistance to diseases and pests and will likely increase mortality. In addition, changing climate will allow pathogens and pests to spread to areas where they are currently limited by climate (e.g., by low temperatures in the winter). Working with our partners and using our existing disease surveillance and diagnostic infrastructure, we will improve surveillance and response capabilities; improve predictions of climate change impacts on the biology of wildlife and vector species; and identify and implement management measures to reduce wildlife vulnerabilities to climate change and susceptibility to disease, pathogens, and pests.

Objective 2.7: Conserve Coastal and Marine Resources

Coastal habitats—including estuarine, wetlands (freshwater, brackish, and saline), and beaches—are among the most important habitats for fish and wildlife, including a myriad of migratory bird species and many endangered species, such as marine turtles and manatees. As such, a large number of our National Wildlife Refuges are along coastlines; and coastlines, especially those in the East, are particularly susceptible to sea-level rise, as well as to increasing intensity and frequency of storms and storm surges. To begin planning for future management, we must understand the vulnerability of our coastal resources to sea-level rise and storms. We will make sea-level rise models (e.g., Sea Level Affecting Marshes Model[j]) available to all coastal Refuges and expand modeling to additional coastal areas, including the Coastal Barrier Resources Act units, to determine the relative vulnerability of these areas. We will work with partners to develop new strategies for coastal management and restoration. We will implement these strategies as part of conservation designs developed by Landscape Conservation Cooperatives and National Wildlife Refuge planners.

Marine ecosystems, especially coral reefs, are among the most biologically diverse in the world. These resources are threatened by upper-ocean warming, sea-ice retreat, sea-level rise, ocean acidification, altered freshwater distributions, and perhaps even strong storms and altered storm tracks, all due to rising levels of atmospheric carbon dioxide and climate change. We must determine the vulnerability to climate change of our marine National Wildlife Refuges, National Monuments, other protected areas, and other priority marine resources. We will work with partners to develop and implement new strategies for marine management and restoration.

Objective 2.8: Address Fish and Wildlife Needs in Renewable Energy Development

As wildlife management professionals, we believe that renewable sources of energy are a key element in mitigating emissions of greenhouse gases, which are the root cause of the climate crisis and its consequences for fish and wildlife. While we understand that the expansion of renewable energy development will contribute to the nation's energy needs with lower net atmospheric release of greenhouse gases per unit of energy (as compared to nonrenewable sources), we recognize that such development will result in impacts to fish and wildlife. Therefore, we will facilitate balanced renewable energy development by providing timely and effective information on impacts to fish and wildlife. We will consider renewable energy project proposals in the context of their expected cumulative impacts to fish and wildlife populations, applying the shared expertise within Landscape Conservation Cooperatives; and we will be an objective source of information on avoiding, minimizing, and off-setting those effects. We will work with industry, agencies, and other stakeholders to facilitate siting, construction, operation and maintenance of renewable energy projects that explicitly evaluate and avoid, or otherwise compensate for significant impacts to fish and wildlife.

Objective 2.9: Reduce Non-Climate Change Ecosystem Stressors

Successful adaptation strategies for fish and wildlife will require success in understanding and reducing the combined and cumulative effects of climate change and non-climate stressors such as land-use changes (e.g., agricultural conversion, energy development, urbanization); invasive species; unnatural wildfire; contaminants; and wildlife crime. Reducing these non-climate stressors is a fundamental objective of many current Service programs and activities; however, in the face of climate change, it essential that we and our partners be strategic in targeting our efforts where they will do the most good in conserving what we identify as priority species and landscapes. We can no longer afford to simply work to reduce non-climate stressors on an ad hoc or opportunistic basis. Our work must be targeted to reduce specific stressors that our predictive tools indicate will be key limiting factors in an overall adaptation strategy for priority species or landscapes. Reducing these key non-climate stressors will be an important component of conservation designs for priority landscapes, as developed by Landscape Conservation Cooperatives.

[j] The Sea Level Affecting Marshes Model (SLAMM) simulates the dominant processes involved in wetland conversions and shoreline modifications during long-term sea level rise. Map distributions of wetlands are predicted under conditions of accelerated sea level rise, and results are summarized in tabular and graphical form.

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Objective 2.10: Foster International Coordination for Landscape Conservation

To fully succeed in conserving the fish and wildlife resources for which we have responsibility, we must look beyond our borders to the rest of North America, the western hemisphere, and indeed, the whole world. We believe that strategic landscape conservation will be the key to conserving needed habitats beyond our borders, whether for migratory songbirds in Central America, jaguars along the U.S.-Mexican border, tigers in Southeast Asia, or elephants in Africa. We will foster international landscape conservation on the North American continent by working through the Trilateral Committee and the Western Hemisphere Migratory Species Initiative. In other regions of the world, we will work through our Wildlife Without Borders[k] and Migratory Bird programs to promote landscape conservation to reduce climate change effects on priority species and landscapes.

GOAL 3

We will develop monitoring and research partnerships that make available complete and objective information to plan, deliver, evaluate, and improve actions that facilitate fish and wildlife adaptations to accelerating climate change.

Objective 3.1: Develop a National Biological Inventory and Monitoring Partnership

Biological inventory and monitoring is an essential tool to understand the status and trends of fish, wildlife, and plant populations and their habitats, as well as to help determine large-scale patterns of ecosystem health and response to climate change. To address this need, we will advocate for and lead efforts to develop a national, integrated inventory and monitoring partnership to monitor continental changes in key populations and biological diversity. Our efforts will be driven by the inventory and monitoring priorities developed by Landscape Conservation Cooperatives and the National Wildlife Refuge System, as well as priorities developed collaboratively among many agencies within a National Fish and Wildlife Adaptation Strategy. We will play a key role in working with Interior Department Regional Climate Change Response Centers to synthesize existing climate change impact data and management strategies, help resource managers make informed decisions, and engage the public through education initiatives. We will leverage our efforts with those of existing Federal monitoring programs with proven track records and relevance to climate change (e.g., the Forest Service's Forest Inventory and Analysis Program and the U.S. Geological Survey's National Phenology Network). We will incorporate new inventory and monitoring approaches as necessary and practical, with the ambitious goal of having within 10 years complete plant and vertebrate species inventories and inventories of select subsets of invertebrate species for all Service lands.

Objective 3.2: Promote Physical Science and Remote-sensing Monitoring Programs

Remote sensing of abiotic and biotic change will be a key component of any comprehensive monitoring program, particularly for larger landscapes. We will work with partners and experts, such as the U.S. Geological Survey, the National Oceanic and Atmospheric Administration, and the National Aeronautics and Space Administration, to define remote-sensing monitoring priorities. We will support existing physical science and remote-sensing monitoring programs that have proven track records and are relevant to climate change (e.g., Remote Automated Weather Stations, the Terrestrial Observation and Prediction System).

Objective 3.3: Develop Research and Monitoring Capability for Use in Landscape Conservation

Monitoring and research are key components of the Service's strategic habitat conservation framework. By measuring the effect of conservation efforts against explicitly predicted outcomes, managers can learn from both success and failure, thereby increasing the probability of success in future actions. We will develop appropriate research and monitoring capability, primarily with Landscape Conservation Cooperatives, to ensure that the adaptation efforts we undertake within the strategic habitat conservation framework are evaluated and that key uncertainties are identified, prioritized and targeted for research. We will provide relevant education and training opportunities to Service managers and ensure that this learning component is incorporated into all of our landscape conservation efforts.

[k] Wildlife Without Borders is a program within the Service's International Affairs Program

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Objective 3.4: Further Develop Collaborative Research Partnerships

We will enhance existing and develop new collaborative partnerships to conduct research related to fish and wildlife adaptation to climate change. We will enhance our use of existing Federal research capability (e.g., U.S. Geological Survey National Climate Change and Wildlife Science Center, U.S. Geological Survey/U.S. Fish and Wildlife Service Science Support Partnership, Cooperative Research Units) and develop new partnerships with universities and university consortiums (e.g., Cooperative Ecosystem Studies Units) in designing and implementing a climate research program in conjunction with Landscape Conservation Cooperatives. In addition, we will designate areas that are long-term sites for integrated research on climate change (e.g., Research Natural Areas, National Wildlife Refuge System Land Management and Research Demonstration areas).

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Mitigation

GOAL 4

We will change our business practices to achieve carbon neutrality by the Year 2020.

Objective 4.1: Assess and Reduce the Carbon Footprint of the Service's Facilities, Vehicles, Workforce, and Operations

We are committed as an agency to achieving carbon neutrality[l] by the Year 2020. To do this, we must reduce the energy use and carbon footprint[m] of our buildings, facilities, vehicle fleet, workforce, and operations to the maximum extent possible. We have ongoing efforts to inventory, monitor, evaluate, and reduce our energy usage. By expanding these efforts and embarking upon new and innovative efforts across the Service, we anticipate success in reducing our carbon footprint by approximately 10 percent annually between now and 2020.

Objective 4.2: Assess and Reduce the Service's Land Management Carbon Footprint

The Service's land management activities for wildlife have an associated carbon footprint. To achieve carbon neutrality, we must assess and reduce this footprint to the maximum extent possible while still achieving the Service's mission. Because our understanding of the carbon footprint associated with our land management activities is rudimentary, the first step will be to inventory, monitor, and evaluate our emissions of greenhouse gases through these activities. We will then be in a position to consider how to reduce emissions while we achieve the Service's highest land-management priorities, a process that will involve evaluating "green energy" alternatives, considering trade-offs, and making difficult choices.

Objective 4.3: Offset the Remaining Carbon Balance

After we minimize the carbon footprint of the Service's facilities, vehicles, operations, and land management activities, a residual carbon footprint may remain. We will offset our residual carbon footprint through carbon sequestration and other measures, such as buying offsets, to become carbon neutral by the Year 2020.

GOAL 5

To conserve and restore fish and wildlife habitats at landscape scales, we will build our capacity to understand, apply, and share biological carbon sequestration science; and we will work with partners to sequester atmospheric greenhouse gases in strategic locations.

Objective 5.1: Develop Biological Carbon Sequestration Expertise

Biological carbon sequestration has the potential to simultaneously accomplish both adaptation and mitigation objectives. For example, by reforesting a corridor between two protected areas with an appropriate mix of native trees, we not only sequester carbon, we create viable habitat as well. When the restored habitat contributes to attainment of explicit population objectives for climate-vulnerable species or species assemblages, then we are achieving both mitigation and adaptation objectives. Landscape Conservation Cooperatives will provide the basic scientific and

[l] Being "carbon neutral" is typically defined as having a net zero carbon footprint, i.e., achieving net zero carbon emissions by balancing a measured amount of carbon released with an equivalent amount that is sequestered or offset.

[m] A "carbon footprint" is typically defined as "the total set of GHG (greenhouse gas) emissions caused directly and indirectly by an individual, organization, event or product" (UK Carbon Trust 2008).

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technical capabilities and expertise needed to accomplish this dual vision within priority landscapes; but we will also need to develop specific expertise in biological carbon sequestration to address the tasks outlined in Objectives 5.2 through 5.5. This expertise will be used to foster habitat restoration and sequestration in key locations, such as National Wildlife Refuge System lands; and priority landscapes, such as the Lower Mississippi Valley.

Objective 5.2: Develop Standards, Guidelines, and Best Management Practices for Biological Carbon Sequestration

Our carbon sequestration expertise will enable us to identify scientific approaches, standards, guidelines, and best management practices for biological carbon sequestration activities, both domestically and internationally, that provide optimal fish and wildlife habitat through strict requirements for use of native vegetation. This information will be shared domestically and internationally to encourage large-scale partnerships in science-driven biological carbon sequestration that supports fish and wildlife adaptation to climate change.

Objective 5.3: Integrate Biological Carbon Sequestration Activities into Landscape Conservation Approaches

We will work to ensure that biological carbon sequestration activities, whether initiated by the Service or others, are implemented within an adaptive, landscape-conservation context, including biological planning and conservation design, on-the-ground delivery, and research and monitoring to evaluate success. Applying our strategic habitat conservation framework through Landscape Conservation Cooperatives will help us in our work with partners to determine where, when, how much, and what habitat types should be conserved, protected, and enhanced in a given area to achieve both species and carbon-sequestration objectives.

Objective 5.4: Facilitate Biological Carbon Sequestration Internationally

One of our most important roles in carbon sequestration may well be to facilitate habitat conservation through carbon sequestration at the international level. By working with international partners and stakeholders to help reduce deforestation rates in key areas, such as tropical forests, and by providing technical assistance and funding for carbon sequestration through reforestation, we will help preserve areas critical to biodiversity conservation and support greenhouse gas mitigation. We will work through our Wildlife Without Borders and Multinational Species Programs to provide funding and technical assistance to increase carbon sequestration, restore habitat, and increase habitat connectivity internationally.

Objective 5.5: Facilitate Biological Carbon Sequestration Research

There are still gaps in our understanding of biological carbon sequestration and its benefits for wildlife habitat, especially in regard to wetlands and grasslands. Our carbon sequestration experts and managers will work with others, such as the U.S. Geological Survey, to identify and fill information gaps regarding biological carbon sequestration.

Objective 5.6: Evaluate Geologic Carbon Sequestration

Geologic carbon sequestration is the isolation and/or removal of carbon dioxide from industrial processes, and its long-term storage underground to reduce or prevent increasing levels of carbon dioxide in the atmosphere. The Department of the Interior (Department) owns or has a material interest in more than 500 million acres of land in the United States, including National Wildlife Refuges. Beneath some of these lands exists the potential to sequester carbon dioxide in oil and gas reservoirs, deep saline reservoirs, and un-mineable coal seams. The Department may undertake an inventory of geologic carbon sequestration potential on its lands and may conduct research on the feasibility and environmental risks associated with geologic sequestration. We will participate in the Department's geologic carbon sequestration efforts to help ensure that potential impacts to fish, wildlife, plants and their habitats are considered and minimized.

Engagement

GOAL 6

We will engage Service employees; our local, state, national, and international partners in the public and private sectors; our key constituencies and stakeholders; and everyday citizens in a new era of collaborative conservation in which, together, we seek solutions to the impacts of climate change and other 21st century stressors of fish, wildlife and habitats.

Objective 6.1: Provide Service Employees with Climate Change Information, Education, and Training

Climate change is ushering in a new era of conservation for the Service that involves novel ways of thinking and bold innovations in the way we do business. We will view all of our endeavors through the lens of climate change and be willing to question the status quo, re-examine priorities and make difficult choices regarding where we can make a difference and where we cannot. We will communicate our climate change

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Strategic Plan to employees Service-wide. Every employee will be challenged to be engaged and to contribute to the plan's development and implementation. Our highly dedicated employees and our field-based organizational structure are our core strengths in addressing the impacts of climate change on wildlife resources. Building awareness within our workforce about the challenges and threats from a changing climate and developing the expertise to address these impacts are priorities.

We will establish a U.S. Fish and Wildlife Service Climate Education Team that will develop and implement a comprehensive employee engagement plan addressing internal needs for information, education, and training about climate change. The plan will be aimed at ensuring every Service employee understands basic climate change science, the urgency of the climate change challenge to our mission, and what actions each of us can take professionally and personally to engage in mitigation and adaptation activities.

The Climate Education Team will work through the National Conservation and Training Center to develop and implement a climate change curriculum to train Service employees in methods to address climate change in their day-to-day activities. The training will also prepare our employees to serve as a resource for our partners, stakeholders, and the public as these groups engage in climate change adaptation and mitigation activities. The National Conservation Training Center will incorporate climate change information from this curriculum into other course offerings as appropriate.

Objective 6.2: Share Climate Change Information, Education, and Training Opportunities with External Audiences

To effectively address climate change nationally, every conservation partner must be both a learner and a teacher. As we in the Service learn, we will also step up to fulfill our teaching role with our national and international partners, our stakeholders, our key constituencies, and the public, anticipating that they will do the same for us. To accomplish our teaching role, our Climate Education Team will develop and implement a comprehensive engagement plan for external information, education, and communication about climate change. The plan will help to create a broad-scale awareness of the urgent nature of the effects of accelerating climate change on fish and wildlife and habitats; and will engage others in becoming part of the solution through such means as minimizing their carbon footprints.

The Climate Education Team will develop climate change materials and provide informational, educational, and training opportunities to external audiences, using the National Wildlife Refuge System, National Fish Hatcheries, the Service website, and employee presentations as primary venues for this engagement with the public.

To become a better, more informed partner, we will actively seek knowledge from State, Federal, Tribal, and local government agencies; non-governmental organizations; business and industry already engaged in addressing climate change; and individual citizens. We will put the same energy into learning from others as we do teaching others what we know.

We will provide technical assistance to public and private landowners, conservation organizations, business and industry, and governments at all levels to help them understand impacts to fish, wildlife and habitats as a result of climate change; and to encourage them to undertake adaptation, mitigation, and engagement activities to address those impacts.

Objective 6.3: Forge Alliances and Create Forums on Climate Change to Exchange Information and Knowledge and to Influence International Policy

Working principally through our International Affairs and Migratory Birds programs, we will engage other countries in sharing state-of-the-art knowledge on climate change adaptation, mitigation, and education strategies. We will seek to learn from their experiences and will share our experiences with them to achieve a common understanding and common ground for moving forward together on climate change policy and action. We will also seek ways to address climate change more effectively through the United Nations Framework Convention on Climate Change; international conventions, such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the Ramsar Convention on Wetlands, and other international agreements.

By also engaging with our international partners and foreign governments in informing and educating their citizens about the causes and consequences of climate change, the Service will have an opportunity to further wildlife adaptation and climate change mitigation around the world. With our partners, we will help to create worldwide support for minimizing deforestation and for creating new habitat through carbon sequestration activities; and we will encourage local community participation in international carbon markets that reduce greenhouse gas emissions.

Rising to the Challenge

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Our plan is ambitious—rightfully and necessarily so. When it comes to climate change, we cannot afford a failure of imagination.

If we are to accomplish our vital mission of "working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people," addressing the greatest threat to that mission--climate change--must be our highest priority.

We must treat climate change as the national security issue that it is. Going forward, we must dedicate our energies, our resources, and our creativity to a long-term campaign to reduce emissions of greenhouse gases as a first line of attack in a battle against an enemy that threatens the sustainability of fish and wildlife populations, the viability of ecosystems, and the wellbeing of every citizen. We must mobilize efforts to help fish and wildlife adapt to changes that have already occurred in their habitats as a result of climate change, and changes that we foresee in the future. We must confront climate change as a communal problem, engaging all segments of society as partners and potential partners. We must implement our Strategic Plan and 5-Year Action Plan, reaching inward to every part of our organization and outward to the larger conservation community to build the will, the relationships, the capabilities and the resources we need to succeed.

We will carry out our responsibilities with humility and gratitude—humility in recognizing how much we have yet to learn about climate change and its impacts on wildlife; and gratitude that if we act now, it is not too late to do something about it. We honor our employees for the important strides they have already made in addressing climate change on the ground before Service plans were formalized, and we will build on those efforts. We respect our conservation partners for the ways in which they are taking action to address climate change as organizations and as individuals, and we will join our efforts with theirs.

As daunting as the issue of climate change may seem, we accept that every generation has faced environmental challenges, and this is ours to deal with. We will remember those conservation heroes upon whose shoulders we stand, and like them, we will rise up to confront the conservation challenge of our day with courage and resolve. We will move forward with enthusiasm and optimism borne of confidence in the soundness of the plans we have created, in the ingenuity of our work force, and in the results we will achieve in collaboration with our partners. We will remain inspired by keeping the future of fish, wildlife, and habitats at the forefront of our thinking. And we will look forward to that day when we can speak of climate change as yesterday's crisis.

"We stand now where two roads diverge. But unlike the roads in Robert Frost's familiar poem, they are not equally fair. The road we have long been traveling is deceptively easy, a smooth superhighway on which we progress with great speed, but at its end lies disaster. The other fork of the road / the one less traveled by / offers our last, our only chance to reach a destination that assures the preservation of the earth."

—Rachel Carson (1907–1964), world-famous environmentalist, celebrated author, and one-time employee of the U.S. Fish and Wildlife Service

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The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people. We are both a leader and trusted partner in fish and wildlife conservation, known for our scientific excellence, stewardship of lands and natural resources, dedicated professionals and commitment to public service. For more information on our work and the people who make it happen, visit <www.fws.gov>.

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