

---

## Appendix A: Supporting Materials

Below are supporting materials for the National Fish, Wildlife and Plants Climate Adaptation Strategy (*Strategy*). The supporting materials are made available to increase understanding of the development of the *Strategy* and to provide more detailed information about subjects mentioned in the *Strategy*. Each of these materials is available online on the *Strategy*'s web site: [www.wildlifeadaptationstrategy.gov](http://www.wildlifeadaptationstrategy.gov), or via the links listed in this appendix.

### **Ecosystem-Specific Background Papers**

These ecosystem-specific background papers were developed by the Technical Teams (see Appendix E for a listing of the Technical Teams and their members) as source material for the *Strategy* detailing the impacts of climate change on specific ecosystems as well as adaptation strategies and actions for those systems. These papers have been edited by the Management Team for length, style, and content, and the Management Team accepts responsibility for any omissions or errors. Please follow the links to access detailed information regarding climate change adaptation for specific ecosystems.

#### **Forest Ecosystems**

[www.wildlifeadaptationstrategy.gov/pdf/Forest\\_Ecosystems\\_Paper.pdf](http://www.wildlifeadaptationstrategy.gov/pdf/Forest_Ecosystems_Paper.pdf)

#### **Shrubland Ecosystems**

[www.wildlifeadaptationstrategy.gov/pdf/Shrubland\\_Ecosystems\\_Paper.pdf](http://www.wildlifeadaptationstrategy.gov/pdf/Shrubland_Ecosystems_Paper.pdf)

#### **Grassland Ecosystems**

[www.wildlifeadaptationstrategy.gov/pdf/Grassland\\_Ecosystems\\_Paper.pdf](http://www.wildlifeadaptationstrategy.gov/pdf/Grassland_Ecosystems_Paper.pdf)

#### **Desert Ecosystems**

[www.wildlifeadaptationstrategy.gov/pdf/Desert\\_Ecosystems\\_Paper.pdf](http://www.wildlifeadaptationstrategy.gov/pdf/Desert_Ecosystems_Paper.pdf)

#### **Arctic Tundra Ecosystems**

[www.wildlifeadaptationstrategy.gov/pdf/Tundra\\_Ecosystems\\_Paper.pdf](http://www.wildlifeadaptationstrategy.gov/pdf/Tundra_Ecosystems_Paper.pdf)

#### **Inland Water Ecosystems**

[www.wildlifeadaptationstrategy.gov/pdf/Inland\\_Water\\_Ecosystems\\_Paper.pdf](http://www.wildlifeadaptationstrategy.gov/pdf/Inland_Water_Ecosystems_Paper.pdf)

#### **Coastal Ecosystems**

[www.wildlifeadaptationstrategy.gov/pdf/Coastal\\_Ecosystems\\_Paper.pdf](http://www.wildlifeadaptationstrategy.gov/pdf/Coastal_Ecosystems_Paper.pdf)

#### **Marine Water Ecosystems**

[www.wildlifeadaptationstrategy.gov/pdf/Marine\\_Ecosystems\\_Paper.pdf](http://www.wildlifeadaptationstrategy.gov/pdf/Marine_Ecosystems_Paper.pdf)

#### **Legislation**

[www.wildlifeadaptationstrategy.gov/pdf/2010\\_Legislative\\_Language\\_for\\_Adaptation\\_Strategy.pdf](http://www.wildlifeadaptationstrategy.gov/pdf/2010_Legislative_Language_for_Adaptation_Strategy.pdf)

## **Related Reports and Materials**

### **Adaptive Management: The U.S. Department of Interior Technical Guide**

<http://www.doi.gov/initiatives/AdaptiveManagement/documents.html>

The Technical Guide presents adaptive management as a tool to help bureaus make better decisions in the context of uncertain or incomplete information.

### **America's Climate Choices**

<http://nas-sites.org/americasclimatechoices/>

The National Research Council of the National Academies is conducting a series of coordinated activities designed to advance the U.S. response to climate change.

### **Animal and Plant Health Inspection Service (APHIS): National Wildlife Research Center (NWRC)**

[www.aphis.usda.gov/wildlife\\_damage/nwrc/](http://www.aphis.usda.gov/wildlife_damage/nwrc/)

The APHIS's NWRC can work with conservation and land and resource management agencies and organizations to address invasive species damage management.

### **Climate Adaptation Knowledge Exchange (CAKE)**

[www.cakex.org](http://www.cakex.org)

CAKE is a joint project of Island Press and EcoAdapt. It is aimed at building a shared knowledge base for managing natural systems in the face of rapid climate change, and includes a large database of adaptation case studies, reports, and tools, as well as links to federal, state, and local adaptation plans.

### **Climate Science Centers (CSCs)**

<http://nccwsc.usgs.gov/csc.shtml>

Regional CSCs will provide scientific information, tools, and techniques that land, water, wildlife, and cultural resource managers can apply to anticipate, monitor, and adapt to climate and ecologically-driven responses at regional-to-local scales.

### **U.S. Environmental Protection Agency (EPA)**

[www.epa.gov/climatechange/](http://www.epa.gov/climatechange/)

The EPA provides a good overview of climate adaptation and links to related resources and materials.

### **Interagency Climate Change Adaptation Task Force (ICCATF)**

[www.whitehouse.gov/administration/eop/ceq/initiatives/adaptation](http://www.whitehouse.gov/administration/eop/ceq/initiatives/adaptation)

The Council on Environmental Quality is co-chairing the ICCATF which is comprised of over 200 federal agency staff.

### **Intergovernmental Panel on Climate Change (IPCC)**

[www.ipcc.ch](http://www.ipcc.ch)

The IPCC is the definitive scientific intergovernmental body tasked with reviewing and assessing the most recent scientific, technical, and socio-economic information produced worldwide relevant to the understanding of climate change. Work on the Fifth Assessment Report is currently underway.

### **Landscape Conservation Cooperatives (LCCs)**

[www.fws.gov/science/shc/lcc.html](http://www.fws.gov/science/shc/lcc.html)

LCCs are self-directed, applied conservation science partnerships that will support conservation at landscape scales.

### **National Action Plan: Priorities for Managing Freshwater Resources in a Changing Climate**

[http://www.whitehouse.gov/sites/default/files/microsites/ceq/2011\\_national\\_action\\_plan.pdf](http://www.whitehouse.gov/sites/default/files/microsites/ceq/2011_national_action_plan.pdf)

The Freshwater Action Plan recommends federal agency actions to aid freshwater resource managers in managing and protecting the nation's water resources.

### **National Ocean Policy**

[www.whitehouse.gov/administration/eop/oceans/policy](http://www.whitehouse.gov/administration/eop/oceans/policy)

A July 2010 Executive Order established a National Ocean Policy and tasked the interagency National Ocean Council with developing this strategic action plan.

### **Plant Protection Act (PPA)**

[www.aphis.usda.gov/brs/pdf/PlantProtAct2000.pdf](http://www.aphis.usda.gov/brs/pdf/PlantProtAct2000.pdf)

The PPA consolidates all or part of 10 existing U.S. Department of Agriculture plant health laws into one comprehensive law, including the authority to regulate plants, plant products, certain biological control organisms, noxious weeds, and plant pests.

### **U.S. Global Change Research Program (USGCRP)**

[www.globalchange.gov](http://www.globalchange.gov)

The USGCRP coordinates and integrates federal research on changes in the global environment and their implications for society.

---

## Appendix B: Glossary

**Adaptation (Climate Change)** – adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

**Adaptation (Biological)** – the process or the product of natural selection that changes the behavior, function, or structure of an organism physiological function or an anatomical structure of an organism that better suit it to its environment.

**Adaptive Capacity** – the ability of a species to become adapted (i.e., to be able to live and reproduce) to a certain range of environmental conditions as a result of genetic and phenotypic responses.

**Anthropogenic** – of, relating to, or resulting from the influence of human beings on nature.

**Biodiversity** – the variability among living organisms from all sources including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, among species, and of ecosystems.

**Carbon Sequestration** – describes long-term storage of carbon dioxide or other forms of carbon. It has been proposed as a way to slow the atmospheric and marine accumulation of greenhouse gases, which are released by burning fossil fuels.

**Clean Water Act** – the primary federal law in the United States governing water pollution. The Act established the goals of eliminating releases of high amounts of toxic substances into water, eliminating additional water pollution by 1985, and ensuring that surface waters would meet standards necessary for human sports and recreation by 1983.

**Climate Change** – a significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. It may be a change in average weather conditions or the distribution of events around that average (e.g., more or fewer extreme weather events). Climate change may be limited to a specific region or may occur across the whole Earth.

**Climate Modeling** – quantitative methods to simulate the interactions of the atmosphere, oceans, land surface, and ice. They are used for a variety of purposes from study of the dynamics of the climate system to projections of future climate.

**Coastal Zone Management Act** – an Act of Congress passed in 1972 to encourage coastal states to develop and implement coastal zone management plans. This act was established as national policy to preserve, protect, develop, and where possible, restore or enhance, the resources of the Nation's coastal zone for this and succeeding generations.

**Downscaling** – refers to techniques that take output from the model and add information at scales smaller than the grid spacing. Downscaling methods are developed to obtain local-scale surface weather from regional-scale atmospheric variables.

**Ecosystem** – a biological environment consisting of all the organisms living in a particular area, as well as all the nonliving (abiotic), physical components of the environment with which the organisms interact, such as air, soil, water, and sunlight.

**Ecosystem Services** – the benefits people obtain from ecosystems. These include provisioning services such as food, water, timber, and fiber; regulation services such as the regulation of climate, floods, disease, wastes, and water quality; cultural services such as recreation, aesthetic enjoyment, and spiritual fulfillment; and supporting services such as soil formation, photosynthesis, and nutrient cycling.

**Endangered Species Act (ESA)** – environmental law signed on December 28, 1973, and provides for the conservation of species that are endangered or threatened throughout all or a significant portion of their range, and the conservation of the ecosystems on which they depend. The ESA replaced the Endangered Species Conservation Act of 1969. It has been amended several times.

**Eutrophication** – the movement of a body of water’s trophic status in the direction of increasing biomass, by the addition of artificial or natural substances, such as nitrates and phosphates, through fertilizers or sewage, to an aquatic system.

**Evapotranspiration** – a term used to describe the sum of evaporation and plant transpiration from the Earth's land surface to atmosphere. Evaporation accounts for the movement of water to the air from sources such as the soil, canopy interception, and waterbodies. Transpiration accounts for the movement of water within a plant and the subsequent loss of water as vapor through stomata in its leaves.

**Exclusive Economic Zone** – a zone of an ocean or sea over which a state has special rights over the exploration and use of marine resources, including production of energy from water and wind. It stretches from the seaward edge of the state's territorial sea out to 200 nautical miles from its coast.

**Extreme Events** – includes weather phenomena that are at the extremes of the historical distribution, especially severe or unseasonal weather such as heat waves, drought, floods, storms, and wildfires.

**Farm Bill** – the primary agricultural and food policy tool of the federal government. The comprehensive omnibus bill is passed every five years or so by the United States Congress and deals with both agriculture and all other affairs under the purview of the U.S. Department of Agriculture. The current farm bill is known as the Food, Conservation, and Energy Act of 2008.

**Geomorphological Change** – changes observed in landforms and the processes that shape them. The study of geomorphological change can be used to understand landform history and dynamics, and to predict future changes through a combination of field observations, physical experiments, and numerical modeling.

**Globalization** – refers to the increasingly global relationships of culture, people, and economic activity.

**Green House Gas** – a gas in an atmosphere that absorbs and emits radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect. The primary greenhouse gases in the Earth’s atmosphere are water vapor, carbon dioxide, methane, nitrous oxide, and ozone.

**Habitat** – an ecological or environmental area that is inhabited by a particular species of animal, plant, or other type of organism. It is the natural environment in which an organism lives, or the physical environment that surrounds (influences and is utilized by) a species population.

**Habitat Degradation** – the process in which natural habitat is rendered functionally unable to support the species present. In this process, the organisms that previously used the site are displaced or destroyed, reducing biodiversity.

**Habitat Fragmentation** – describes the emergence of discontinuities in an organism's preferred habitat, causing population fragmentation. Habitat fragmentation can be caused by geological processes that slowly alter the layout of the physical environment or by human activity such as land conversion and road building.

**Harmful Algal Blooms** – a rapid increase or accumulation in the population of algae in an aquatic system forming visible patches that may harm the health of the environment, plants, or animals. They can deplete the oxygen and block the sunlight that other organisms need to live, and some algae blooms release toxins that are dangerous to animals and humans.

**Hydrology** – the movement, distribution, and quality of water, including the hydrologic cycle, water resources, and environmental watershed sustainability.

**Hypoxia** – a phenomenon that occurs in aquatic environments as dissolved oxygen becomes reduced in concentration to a point where it becomes detrimental to aquatic organisms living in the system.

**Invasive Species** – non-indigenous species of plants or animals that adversely affect the habitats and bioregions they invade economically, environmentally, and/or ecologically.

**Keystone Species** – a species that has a disproportionately large effect on its environment relative to its abundance. Such species play a critical role in maintaining the structure of an ecological community, affecting many other organisms in an ecosystem and helping to determine the types and numbers of various other species in the community.

**Maladaptation** – an adaptation that, whilst reasonable at the time, becomes less and less suitable and more of a problem or hindrance as time goes on. It is possible for an adaptation to be poorly selected or become less appropriate or even become, on balance, more of a dysfunction than a positive adaptation over time.

**Mitigation** – in the context of climate change, a human intervention to reduce the sources or enhance the sinks of greenhouse gases.

**Natural Disturbance Regimes** – the pattern and dynamics of disturbance events (e.g., fires, floods, landslides, etc.) that mold the structure and species composition of an ecosystem.

**Natural Resources** – materials and components that can be found within the environment. A natural resource may exist as a separate entity, such as fresh water and air, as well as a living organism, such as a fish, or it may exist in an alternate form which must be processed to obtain the resource, such as metal ores, oil, and most forms of energy.

**Non-climate Stressors** – in the context of climate adaptation, non-climate stressors refer to those current or future pressures and impacts threatening species and natural systems that do not stem from climate change, such as habitat fragmentation, pollution and contamination, disease, and over exploitation.

**Nonpoint Source Pollution** – refers to both water and air pollution from diffuse sources. Nonpoint source water pollution affects a water body from sources such as polluted runoff from agriculture areas draining into a river or wind-borne debris blowing out to sea. Nonpoint source air pollution affects air quality from sources such as smokestacks or car tailpipes. Although these pollutants have originated from a point source, the long-range transport ability and multiple sources of the pollutant make it a nonpoint source of pollution.

**Ocean Acidification** – the ongoing decrease in the pH and increase in acidity of the Earth's oceans, caused by the uptake of carbon dioxide from the atmosphere.

**Permafrost** – soil at or below the freezing point of water (0 °C or 32 °F) for two or more years.

**Phenology** – the study of periodic plant and animal life cycle events and how these are influenced by seasonal and inter-annual variations in climate.

**Resilience** – the capacity of an ecosystem to return to the pre-condition state following a perturbation, including maintaining its essential characteristics taxonomic composition, structures, ecosystem functions, and process rates.

**Resistance** – the capacity of the ecosystem to absorb disturbances and remain largely unchanged.

**Risk Assessment** – the determination of quantitative or qualitative value of risk related to a concrete situation and a recognized threat such as climate change.

**Sea Level Rise** – As water warms, it expands, and the ocean surface rises. The melting of inland glaciers and continental ice sheets, including those in Greenland and Antarctica, causes additional sea level rise. Sea level change is highly variable regionally. It depends on the relative increase in water levels as well as local land elevation changes caused by subsidence or uplift, and local rates of sediment accumulation. Relative sea level rise refers to a local increase in the level of the ocean due to the interaction of these factors.

**Sentinel Site** – A location that is selected to represent a certain, preferably large, class of ecosystems for intensive monitoring.

**Socioeconomics** – a word used to identify the importance of factors other than biology in natural resource management decisions. For example, if management results in more fishing income, it is important to know how the income is distributed between small and large boats or part-time and full-time fishermen.

**Stakeholders** – a person, group, organization, or system that affects or can be affected by an organization's actions.

**Stratification** – in relation to water, stratification occurs when water masses with different properties (salinity, oxygenation, density, temperature) form layers that act as barriers to water mixing. These layers are normally arranged according to density, with the least dense water masses sitting above the more dense layers.

**Vulnerability Assessment** – a tool used in adaptation planning and informing the development and implementation of resource management practices.



---

## Appendix C: Acronyms

ACIA	Arctic Climate Impact Assessment
AFWA	Association of the Fish and Wildlife Agencies
AMSA	Arctic Marine Shipping Assessment
ASCE	American Society of Civil Engineers
AZ CCAG	Arizona Climate Change Advisory Group
C	Carbon
CADFG	California Department of Fish and Game
CAKE	Climate Adaptation Knowledge Exchange
CEC	Commission for Environmental Cooperation
CEICC	Committee on Ecological Impacts of Climate Change
CEQ	Council on Environmental Quality
CESU	Cooperative Ecosystem Study Unit
CO <sub>2</sub>	Carbon Dioxide
CSCs	Climate Science Centers
CCSP	U.S. Climate Change Science Program
DOC	Department of Commerce
DOI	Department of the Interior
ECA	Economics of Climate Adaptation Working Group
ESA	Endangered Species Act
F	Fahrenheit
FAO	Food and Agriculture Organization of the United Nations
FWS	U.S. Fish and Wildlife Service
GAO	General Accountability Office
GHG and GHGs	Green House Gas/Gasses

HABs	Harmful Algal Blooms
IPCC	Intergovernmental Panel on Climate Change
ICCATF	Interagency Climate Change Adaptation Task Force
JVs	Migratory Bird Joint Ventures
LCC	Landscape Conservation Cooperative
NC NERR	North Carolina National Estuarine Research Reserve
NCA	National Climate Assessment
NERRS	National Estuarine Research Reserve System
NFHAP	National Fish Habitat Action Plan
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOC	National Ocean Council
NOP	National Ocean Policy
NRC	National Research Council
NRCS	National Resource Conservation Service
NSF	National Science Foundation
PCSGA	Pacific Coast Shellfish Growers Association
REDD	Reducing Emissions from Deforestation and Forest Degradation
RISAs	Regional Integrated Science Assessments
RMRS	U.S. Forest Service: Rocky Mountain Research Station
SAP	Synthesis and Assessment Product
SNAP	Scenarios Network for Alaska Planning
USDA	United States Department of Agriculture
USGCRP	United States Global Change Research Program
USGS	United States Geological Survey
WICCI	Wisconsin's Changing Climate: Impacts and Adaptation

---

## Appendix D: Scientific Names

alpine chipmunk	<i>Neotamias alpinus</i>
American oystercatcher	<i>Haematopus palliatus</i>
American robin	<i>Turdus migratorius</i>
Arctic fox	<i>Alopex lagopus</i>
arctic fox	<i>Vulpes lagopus</i>
Asian carp	<b>Bighead carp</b> ( <i>Hypophthalmichthys nobilis</i> )
	<b>Black carp</b> ( <i>Mylopharyngodon piceus</i> )
	<b>Grass carp</b> ( <i>Ctenopharyngodon idella</i> )
	<b>Silver carp</b> ( <i>Hypophthalmichthys molitrix</i> )
Atlantic croaker	<i>Micropogonias undulatus</i>
blue crab	<i>Callinectes sapidus</i>
brook trout	<i>Salvelinus fontinalis</i>
brown treesnake	<i>Boiga irregularis</i>
buffelgrass	<i>Cenchrus ciliaris</i>
California vole	<i>Microtus californicus</i>
caribou	<i>Rangifer tarandus</i>
cheatgrass	<i>Bromus tectorum</i>
checkerspot butterfly	<i>Euphydryas editha</i>
Chinook salmon	<i>Onchorhynchus tshawytscha</i>
cisco	<i>Coregonus artedi</i>
coho salmon	<i>Oncorhynchus kisutch</i>
Cope's gray treefrog	<i>Hyla chrysoscelis</i>
diamondback terrapin	<i>Malaclemys terrapin</i>
eastern tiger salamander	<i>Ambystoma tigrinum</i>
eelgrass	<i>Zostera marina</i>
feral hog	<i>Sus scrofa</i>
greater sage grouse	<i>Centrocercus urophasianus</i>
grizzly bear	<i>Ursus arctos horribilis</i>
hemlock woolly adelgid	<i>Adelges tsugae</i>
horseshoe crab	<i>Limulus polyphemus</i>
humpback chub	<i>Gila cypha</i>
kelp	<i>Laminariales</i>
kudzu	<i>Pueraria montana</i>
	<i>Pueraria lobata</i>
	<i>Pueraria edulis</i>
	<i>Pueraria phaseoloides</i>
	<i>Pueraria thomsoni</i>
lake trout	<i>Salvelinus namaycush</i>
least tern	<i>Sterna antillarum</i>
lesser prairie-chicken	<i>Tympanuchus pallidicinctus</i>
lodgepole pine	<i>Pinus contorta</i>
mountain pine beetle	<i>Dendroctonus ponderosae</i>
muskoxen	<i>Ovibos moschatus</i>
northern pike	<i>Esox lucius</i>
Pacific oyster	<i>Crassostrea gigas</i>
paper birch tree	<i>Betula papyrifera</i>

pinyon mouse	<i>Phragmites</i>
piping plover	<i>Peromyscus truei</i>
poison ivy	<i>Charadrius melodus</i>
polar bear	<i>Toxicodendron radicans</i>
Ponderosa pine	<i>Ursus maritimus</i>
quagga mussel	<i>Pinus ponderosa</i>
rainbow trout	<i>Dreissena rostriformis bugensis</i>
red fox	<i>Oncorhynchus mykiss</i>
red knot	<i>Vulpes vulpes</i>
ring seal	<i>Calidris canutus</i>
Rio Grande cutthroat trout	<i>Pusa hispida</i>
sagebrush	<i>Oncorhynchus clarki virginalis</i>
Saguaro	<i>Artemisia tridentata</i>
seabeach amaranth	<i>Carnegiea gigantea</i>
silver hake	<i>Amaranthus pumilus</i>
smallmouth bass	<i>Merluccius bilinearis</i>
southwestern willow flycatcher	<i>Micropterus dolomieu</i>
spruce	<i>Empidonax traillii extimus</i>
spruce bark beetle	<i>Picea</i>
surf clam	<i>Ips typographus</i>
walleye	<i>Spisula solidissima</i>
walrus	<i>Sander vitreus</i>
water hyacinth	<i>Odobenus rosmarus</i>
white spruce	<i>Eichhornia crassipes</i>
white-tailed deer	<i>Picea glauca</i>
Wilson's plover	<i>Odocoileus virginianus</i>
zebra mussel	<i>Charadrius wilsonia</i>
	<i>Dreissena polymorpha</i>

---

## Appendix E: Team Members and Acknowledgements

### Steering Committee Members

Anderson, Phil  
WA Department of Fish & Wildlife

Antonio, John  
Bureau of Indian Affairs

Boice, Peter  
U.S. Department of Defense

Boroja, Maria  
Animal & Plant Health Inspection Service

Brittell, Dave  
WA Department of Fish & Wildlife

Davidson, Margaret  
National Oceanic and Atmospheric Administration  
Ocean Service

Felder, Dwight  
Bureau of Land Management

Gould, Rowan (Co-chair)  
U.S. Fish and Wildlife Service

Grayum, Mike  
Northwest Indian Fisheries Commission

Hawkins Hoffman, Cat  
National Park Service

Houser, Paul  
Bureau of Reclamation

Hunting, Kevin  
CA Department of Fish & Game

Hyberg, Skip, Ph.D.  
Farm Service Agency

Jensen, Jay  
Council on Environmental Quality

Kinsinger, Anne  
U.S. Geological Survey

Lousberg, Macara  
U.S. Environmental Protection Agency  
Office of Water

Myers, Gordon  
NC Wildlife Resources Commission

Olson, Carolyn  
Natural Resources Conservation Service

Riexinger, Patricia (Co-Chair)  
NY Division of Fish, Wildlife & Marine Resources

Schwaab, Eric (Co-chair)  
National Oceanic and Atmospheric Administration  
National Marine Fisheries Service

Smith, Chip  
U.S. Army Corps of Engineers

Sullivan, Jack  
WI Department of Natural Resources

Vitello, John  
Bureau of Indian Affairs

Williams, Terry  
Tulalip Tribe  
Northwest Indian Fisheries Commission

Zimmermann, Anne  
U.S. Forest Service

Zorn, Jim  
Great Lakes Indian Fish & Wildlife Commission

### Management Team Members

Antonio, John  
Bureau of Indian Affairs

Babij, Eleanora, Ph.D.  
U.S. Fish and Wildlife Service

Barnhart, Gerald (Co-chair)  
Association of Fish & Wildlife Agencies

Blazer, Arthur  
Great Lakes Indian Fish & Wildlife Commission

Call, Jessica  
Council on Environmental Quality

Choudhury, Arpita, Ph.D.  
Association of Fish & Wildlife Agencies

Freund, Kate  
U.S. Fish and Wildlife Service

Griffis, Roger (Co-chair)  
National Oceanic and Atmospheric Administration  
National Marine Fisheries Service

Lettrich, Matt  
National Oceanic and Atmospheric Administration  
Office of Ocean & Coastal Resource Management

McGilvray, Laurie  
National Oceanic and Atmospheric Administration  
Office of Ocean & Coastal Resource Management

Penn, Kim  
National Oceanic and Atmospheric Administration  
Office of Ocean & Coastal Resource Management

Roessing, Megan  
Council on Environmental Quality

Ryan, Devon  
Association of Fish & Wildlife Agencies

Shaffer, Mark (Co-chair)  
U.S. Fish and Wildlife Service

Taylor, Gary  
Association of Fish & Wildlife Agencies

### Technical Team Members

#### Coastal Technical Team Members

Albertson, Joy  
U.S. Fish and Wildlife Service

Antoine, Adrienne  
National Oceanic and Atmospheric Administration  
Climate Program Office

Beavers, Rebecca, Ph.D.  
National Park Service

Hayum, Brian  
U.S. Fish and Wildlife Service

Hecht, Anne  
U.S. Fish and Wildlife Service

Honeycutt, Maria  
National Oceanic and Atmospheric Administration &  
National Park Service

Kline, Jennifer  
GA Department of Natural Resources

Lettrich, Matt  
National Oceanic and Atmospheric Administration  
Office of Ocean and Coastal Resource Management

Martin, Lynn  
U.S. Army Corps of Engineers

Mcperson, Matthew  
National Oceanic and Atmospheric Administration  
Social Sciences Branch

Moore, Amber  
National Oceanic and Atmospheric Administration  
Office of Habitat Conservation

Mumford, Sonia  
U.S. Fish and Wildlife Service

Parsons, Doug (Co-chair)  
FL Fish and Wildlife Conservation Commission

Penn, Kim (Co-chair)  
National Oceanic and Atmospheric Administration  
Office of Ocean and Coastal Resource Management

Phinney, Jonathan  
National Oceanic and Atmospheric Administration  
Southwest Fisheries Science Center

Stringer, Christina, Ph.D.  
Bureau of Indian Affairs

Thorne, Karen, Ph.D.  
U.S. Geological Survey

Trott, Katherine  
U.S. Army Corps of Engineers

#### Forest Technical Team Members

Auclair, Allan  
Animal & Plant Health Inspection Service

Bradford, John  
U.S. Geological Survey

Byers, Elizabeth  
WV Division of Natural Resources

De Angelis, Patricia, Ph.D.  
U.S. Fish and Wildlife Service

Eckert, Greg  
National Park Service

Gordh, Gordon, Ph.D.  
Animal & Plant Health Inspection Service

Kearney, Richard (Co-chair)  
U.S. Fish and Wildlife Service

Limpert, Dana  
MD DNR Wildlife and Heritage Service

McKelvey, Kevin (Co-chair)  
U.S. Forest Service

Morton, John M., Ph.D.  
U.S. Fish and Wildlife Service

Nowacki, Greg  
U.S. Forest Service

O'Leary, John (Co-chair)  
MA Division of Fisheries and Wildlife

Petruncio, Mark, Ph.D. (Co-chair)  
Yakama Nation

Schuurman, Gregor  
WI Department of Natural Resources

Tirpak, John  
U.S. Fish and Wildlife Service

Tuttle, Crawford  
CA Department of Forestry and Fire Protection

Walhovd, Gerald  
Bureau of Indian Affairs

**Grassland, Shrubland, Desert, Tundra Technical Team Members**

Balogh, Greg  
U.S. Fish and Wildlife Service

Gonzales, Armand (Co-chair)  
CA Department of Fish and Game

Gordon, Wendy, Ph.D.  
TX Parks and Wildlife Department

Green, Nancy  
U.S. Fish and Wildlife Service

Hohman, Bill  
Natural Resources Conservation Service

Iovanna, Richard  
Farm Service Agency

Jorgenson, Janet  
U.S. Fish and Wildlife Service

Karl, Michael "Sherm", Ph.D.  
Bureau of Land Management

Korth, Kim  
NJ Division of Fish and Wildlife

Manning, Mary  
U.S. Forest Service

Olson, Dave (Co-chair)  
U.S. Fish and Wildlife Service

Olwell, Peggy (Co-chair)  
Bureau of Land Management

Richards, Laura  
NV Department of Wildlife

Shenk, Tanya, Ph.D.  
National Park Service

Speaks, Pene  
WA Department of Natural Resources

Vines, Jeri  
Bureau of Indian Affairs

**Inland Water Technical Team Members**

Baker, Rowan  
U.S. Fish and Wildlife Service

Barrett, Paul, Ph.D.  
U.S. Fish and Wildlife Service

Beechie, Tim  
National Oceanic and Atmospheric Administration  
Northwest Fisheries Science Center

Blett, Tamara  
National Park Service

Buckley, Anna  
OR Department of State Lands

Chris Bujalski  
Bureau of Indian Affairs

Burnett, Kelly  
U.S. Forest Service

Cunningham, Cathy  
Bureau of Reclamation

Cushing, Janet  
U.S. Army Corps of Engineers

Day, David (Co-chair)  
PA Fish and Boat Commission

Feeney, Rory  
Miccossukee Tribe

Gabanski, Laura  
U.S. Environmental Protection Agency

Gephart, Laura (Co-chair)  
Columbia River Intertribal Fish Commission

Gorke, Roger  
U.S. Environmental Protection Agency  
Office of Water

Hagstrom, Neal  
CT Department of Environmental Protection  
Inland Fisheries Division

Hatch, Keith  
Bureau of Indian Affairs

Hudy, Mark  
U.S. Forest Service

Kiffney, Peter, Ph.D.  
National Oceanic and Atmospheric Administration  
Northwest Fisheries Science Center

Kolar, Cynthia  
U.S. Geological Survey

Lathrop, Richard, Ph.D.  
WI Department of Natural Resources

Lent, Bob  
U.S. Geological Survey

MacKenzie, Richard, Ph.D.  
U.S. Forest Service

Peterson, Jeffrey  
Council on Environmental Quality

Rosen, Barry H., Ph.D.  
U.S. Geological Survey

Shively, Dan (Co-chair)  
U.S. Fish and Wildlife Service

Stys, Beth  
Florida Fish and Wildlife Conservation Commission

#### **Marine Technical Team Members**

Babij, Eleanora, Ph.D.  
U.S. Fish and Wildlife Service

Chytalo, Karen (Co-chair)  
NY Department of Environmental Conservation

Cintron, Gil  
U.S. Fish and Wildlife Service

Crawford, Steve  
Passamaquoddy Tribe at Pleasant Point

DeMaster, Doug  
National Oceanic and Atmospheric Administration  
Alaska Fisheries Science Center

Fay, Virginia  
National Oceanic and Atmospheric Administration  
Southeast Habitat Conservation Division

Glazer, Robert  
FL Fish and Wildlife Conservation Commission

Littlefield, Naomi  
National Oceanic and Atmospheric Administration

McCreeedy, Cliff  
National Park Service

Merrick, Richard (Co-chair)  
National Oceanic and Atmospheric Administration  
National Marine Fisheries Service

Moore, Elizabeth  
National Oceanic and Atmospheric Administration  
Office of National Marine Sanctuaries

Nelson, Mark  
National Oceanic and Atmospheric Administration  
Office of Sustainable Fisheries

Nye, Janet, Ph.D.  
U.S. Environmental Protection Agency  
Office of Research and Development

Parker, Britt  
National Oceanic and Atmospheric Administration  
Coral Reef Conservation Program

Patrick, Wesley, Ph.D.  
National Oceanic and Atmospheric Administration  
Office of Sustainable Fisheries

Peterson, William  
National Oceanic and Atmospheric Administration  
Fish Ecology Division

Sullivan, Jim  
National Oceanic and Atmospheric Administration

West, Jordan  
U.S. Environmental Protection Agency  
Office of Research and Development

Williams, Terry  
Tulalip Tribe  
Northwest Indian Fisheries Commission

#### **Map Specialist**

Barnes, Christopher  
U.S. Geological Survey  
Earth Resources Observation and Science