January 2014

A white paper of the Association of Fish & Wildlife Agencies

Resource Guide to Federal Climate Adaptation Programs for State Fish & Wildlife Agencies

ASSOCIATION of FISH & WILDLIFE AGENCIES

Association of Fish & Wildlife Agencies
444 North Capitol Street, NW Suite 725
Washington, DC 20001
www.fishwildlife.org @fishwildlife

The voice of fish and wildlife agencies

Produced by: Davia Palmeri
dpalmeri@fishwildlife.org

Contents

Introduction

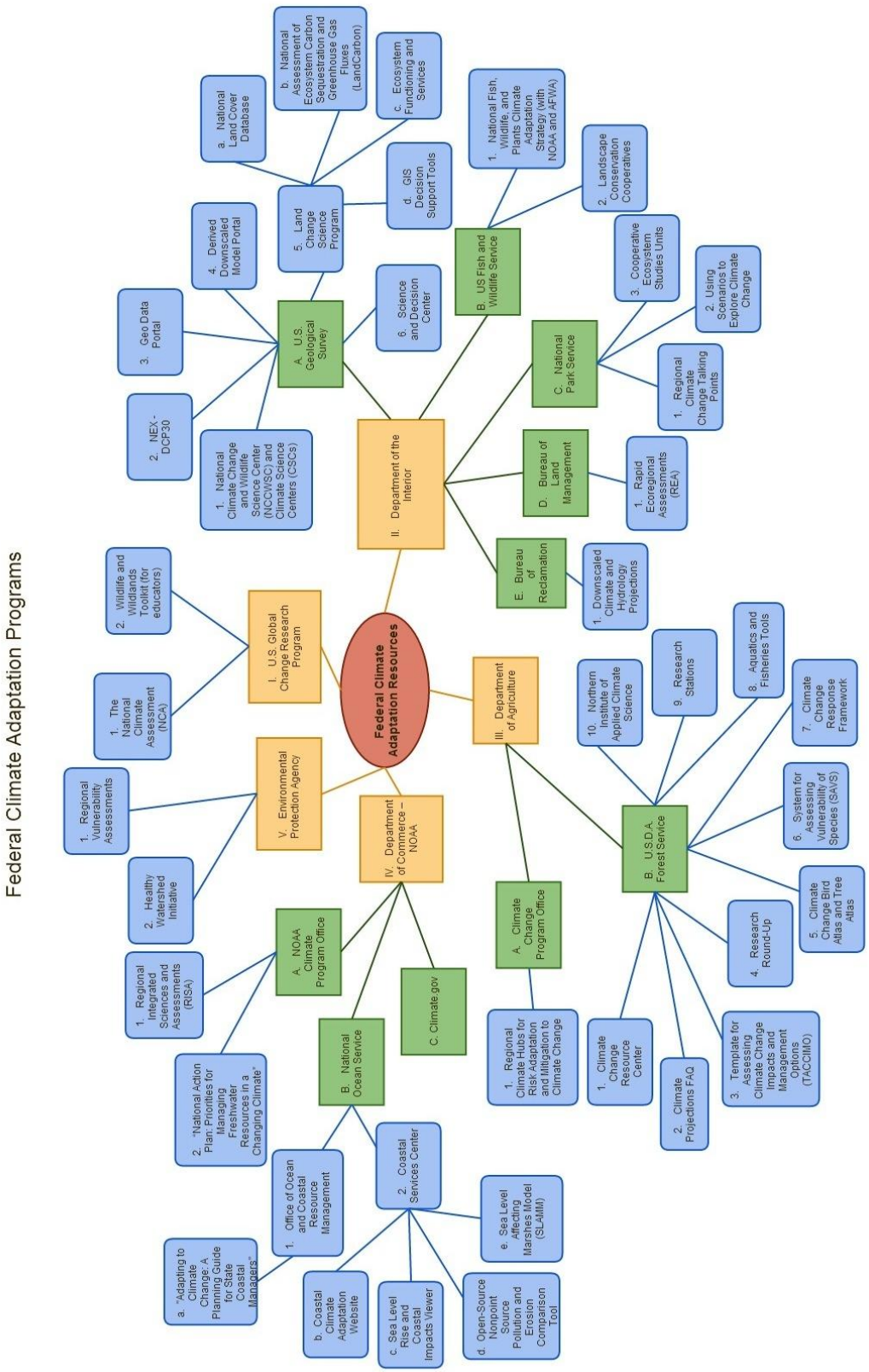
Fish and wildlife provide many important ecosystem and cultural services that support people, communities, and economies across the nation. Many observed changes in the global climate are already impacting the nation's valuable natural resources. These impacts are expected to increase with continued changes in the climate system, putting our nation's fish and wildlife at risk. Action is needed now to reduce these impacts and help sustain the natural resources and services on which the nation depends. Climate change adaptation, defined as an adjustment in natural and/or human systems to a new or changing environment that exploits beneficial opportunities and moderates negative impacts, is a new and rapidly expanding part of fish and wildlife conservation.

The federal government, particularly the administration, has emphasized the importance of preparing our nation's fish and wildlife for future climate conditions, as well as improving preparedness among human communities. For example, the Executive Order—Preparing the United States for the Impacts of Climate Change, created a federal Council on Climate Preparedness and Resilience. It also created a State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience, indicating that states will have an invaluable role in adaptation. State fish and wildlife agencies, having the major responsibility for fish and wildlife, can lead the nation in facilitating fish and wildlife adaptation to novel climate and other conditions.

The federal agencies with responsibilities for natural resources have, over the last five to ten years, begun to develop internal programs, tools, and networks for climate change adaptation science. These efforts have led to a large array of tools intended for use in climate adaptation planning. The Association of Fish and Wildlife Agencies (AFWA) climate change committee has cited the need for an understanding of these federal resources to which state fish and wildlife agency managers can refer when they need climate adaptation information. The goal of this document is to provide that understanding and to prevent duplication of federal climate adaptation work on the state level. Utilizing resources already provided at the federal level will free up time for state level managers to incorporate climate adaptation knowledge in to plans, rather than producing their own adaptation science.

The following figure (Figure 1) offers a simplified view of all of the information contained in this document. It is organized by department and agency. The numbers and letters on the image correspond to the numbered and lettered sections of this document. Only those resources that may be useful to state managers are included. Each tool or resource features a brief description and a link to the resource.

Figure 1


Federal Climate Adaptation Programs
Federal Climate Adaptation Resources
I. U.S. Global Change Research Program
1. The National Climate Assessment (NCA)
2. Wildlife and Wildlands Toolkit (for educators)
II. Department of the Interior
A. U.S. Geological Survey
1. National Climate Change and Wildlife Science Center (NCCWSC) and Climate Science Centers (CSCs)
2. NEX-DCP30
3. Geo Data Portal
4. Derived Downscaled Model Portal
5. Land Change Science Program
a. National Land Cover Database
b. National Assessment of Ecosystem Carbon Sequestration and Greenhouse Gas Fluxes (LandCarbon)
c. Ecosystem Functioning and Services
d. GIS Decision Support Tools
6. Science and Decision Center
B. US Fish and Wildlife Service
1. National Fish, Wildlife, and Plants Climate Adaptation Strategy (with NOAA and AFWA)
2. Landscape Conservation Cooperatives
3. Cooperative Ecosystem Studies Units
C. National Park Service
1. Regional Climate Change Talking Points
2. Using Scenarios to Explore Climate Change
D. Bureau of Land Management
1. Rapid Ecoregional Assessments (REA)
E. Bureau of Reclamation
1. Downscaled Climate and Hydrology Projections
III. Department of Agriculture
A. Climate Change Program Office
1. Regional Climate Hubs for Risk Adaptation and Mitigation to Climate Change
B. U.S.D.A. Forest Service
1. Climate Change Resource Center
2. Climate Projections FAQ
3. Template for Assessing Climate Change Impacts and Management Options (TACCIMO)
4. Research Round-Up
5. Climate Change Bird Atlas and Tree Atlas
6. System for Assessing Vulnerability of Species (SAVS)
7. Climate Change Response Framework
8. Aquatics and Fisheries Tools
9. Research Stations
10. Northern Institute of Applied Climate Science
IV. Department of Commerce – NOAA
A. NOAA Climate Program Office
1. Regional Integrated Sciences and Assessments (RISA)
2. "National Action Plan: Priorities for Managing Freshwater Resources in a Changing Climate"
B. National Ocean Service
1. Office of Ocean and Coastal Resource Management
a. "Adapting to Climate Change: A Planning Guide for State Coastal Managers"
2. Coastal Services Center
b. Coastal Climate Adaptation Website
c. Sea Level Rise and Coastal Impacts Viewer
d. Open-Source Nonpoint Source Pollution and Erosion Comparison Tool
e. Sea Level Affecting Marshes Model (SLAMM)
C. Climate.gov
V. Environmental Protection Agency
1. Regional Vulnerability Assessments
2. Healthy Watershed Initiative

I. U.S. Global Change Research Program (USGCRP)

http://www.globalchange.gov/

The U.S. Global Change Research Program (USGCRP) is a federal program that coordinates and integrates research on changes in the global environment and their implications for society across 13 government agencies to ensure that it most effectively and efficiently serves the nation and the world. USGCRP was mandated by Congress in the Global Change Research Act of 1990 (http://www.globalchange.gov/about/global-change-research-act). 'Global change' refers to changes in the global environment that include alterations in climate, but also focuses on changes in land productivity, oceans or other water resources, atmospheric chemistry, and ecological systems.

The stated aim of USGCRP is to "advance scientific knowledge of the integrated natural and human components of the Earth system to improve understanding and effective decision-making." The overarching goal is to "advance society's understanding of the Earth System, global change impacts, and vulnerabilities and responses." The four main branches of the program are advancing science, informing decisions, conducting sustained assessments, and communication and education.

The USGCRP defines adaptation as "an adjustment in natural and/or human systems to a new or changing environment that exploits beneficial opportunities and moderates negative impacts."

All of the climate change science products completed by the 13 participating federal agencies falls under the umbrella of the USGCRP, but a few products are produced collaboratively by the program. The most important of these is the National Climate Assessment.

1. The National Climate Assessment (NCA)

http://www.globalchange.gov/what-we-do/assessment http://ncadac.globalchange.gov/

The National Climate Assessment (NCA) is a status report about climate change science and climate change impacts. The report is delivered to the President, the Congress, and the public every four years. The next NCA is scheduled to be completed in early 2014.

The NCA provides an overview of the state of the climate and national climate science. It integrates information from across all of USGCRP's research activities to paint a comprehensive picture of the effects of change on many sectors of society from the environment and agriculture; to water resources and transportation; to human health, biodiversity, energy production, and more.

A good starting place for current climate-change related science is the draft NCA which contains numerous synthesis materials prepared by the U.S. Global Change Research Program. While still in draft form, the next NCA contains key references, including several technical reports (http://www.globalchange.gov/what-we-do/assessment/nca-activities/available-technical-inputs) organized by region and resource sector. Most of the technical reports are final products that have been peer reviewed and can be cited. Note that in addition to the full regional technical report, 2-page summaries of the Regional Climate Trends and Scenarios are also available at: http://scenarios.globalchange.gov/regions

2. Climate Change, Wildlife, and Wildlands Toolkit (for educators)

http://www.globalchange.gov/resources/educators/toolkit/materials

This tool kit is designed for classroom teachers and informal educators in parks, refuges, forest lands, nature centers, zoos, aquariums, science centers, etc., and is aimed at the middle school grade level. It is intended to aid educators in teaching how climate change is affecting our nation's wildlife and public lands, and how everyone can become climate stewards. This is a great tool for starting out on the basics of climate change for external education.

II. U.S. Department of the Interior (DOI)

http://www.doi.gov/index.cfm

The U.S. Department of the Interior (DOI) is the federal agency with the greatest responsibility for our nation's natural resources. The mission of the DOI is to "protect America's natural resources and heritage, honor our cultures and tribal communities, and supply the energy to power our future." DOI has responsibility to manage one-fifth of the land in the country, 35,000 miles of coastline, and 1.76 billion acres of the Outer Continental Shelf. The agency expressed its commitment to climate adaptation on the land for which it is responsible with a Secretarial Order on Sept. 14, 2009, which launched a coordinated strategy to address current and future impacts of climate change on America's land, water, wildlife, cultural-heritage, and tribal resources. The various bureaus under DOI have responded with many products and tools.

A. U.S. Geological Survey (USGS)

http://www.usgs.gov/climate_landuse/

The U.S. Geological Survey (USGS) is the main science organization of the DOI. USGS is tasked with providing impartial information on the health of our ecosystems and environment; the natural hazards that threaten us; the natural resources we rely on; the impacts of climate and land-use change; and the core science systems that help us provide timely, relevant, and useable information.

The USGS undertakes scientific research, monitoring, remote sensing, modeling, synthesis, and forecasting to address the effects of climate and land use change on the nation's resources. The resulting research and products are provided as the scientific foundation upon which natural resource managers can make informed decisions about the management of natural resources on which they and others depend.

1. National Climate Change and Wildlife Science Center (NCCWSC) and Climate Science Centers (CSCs)

http://www.doi.gov/csc/index.cfm https://nccwsc.usgs.gov/

The mission of the Climate Science Centers is to provide natural and cultural resource managers with the tools and information they need to develop and execute management strategies that address the impacts of climate change on a broad range of natural and cultural resources.

The CSCs aim to provide fundamental scientific information, tools, and techniques that land, water, wildlife, and cultural resource managers and other interested parties can apply to anticipate, monitor, and adapt to climate change impacts. Much of the information and tools provided by the CSCs, including physical and biological research, ecological forecasting, and multi-scale modeling, is tailored in response to the landscape-level priority needs identified by the Landscape Conservation Cooperatives, as well as the cross-sector needs of other agencies and communities in the region. One of the stated goals of the CSC network is to produce "actionable science" for use by their clients. This is an opportunity for states to promote work by their CSCs on projects that will benefit state managers.

The CSCs are managed by the National Climate Change and Wildlife Science Center (NCCWSC). They are located at universities and are often comprised of multi-institution consortia, including other universities, Tribal partners, and federal research labs. The CSCs have eight regions and each has a university as the lead institution.

Consult Figure 2 to identify your CSC.

Northeast CSC – Amherst, MA
http://www.doi.gov/csc/northeast/index.cfm

Southeast CSC – Raleigh, NC
http://www.doi.gov/csc/southeast/index.cfm

North Central CSC – Fort Collins, CO
http://www.doi.gov/csc/northcentral/index.cfm

South Central CSC – Norman, OK
http://www.doi.gov/csc/southcentral/index.cfm

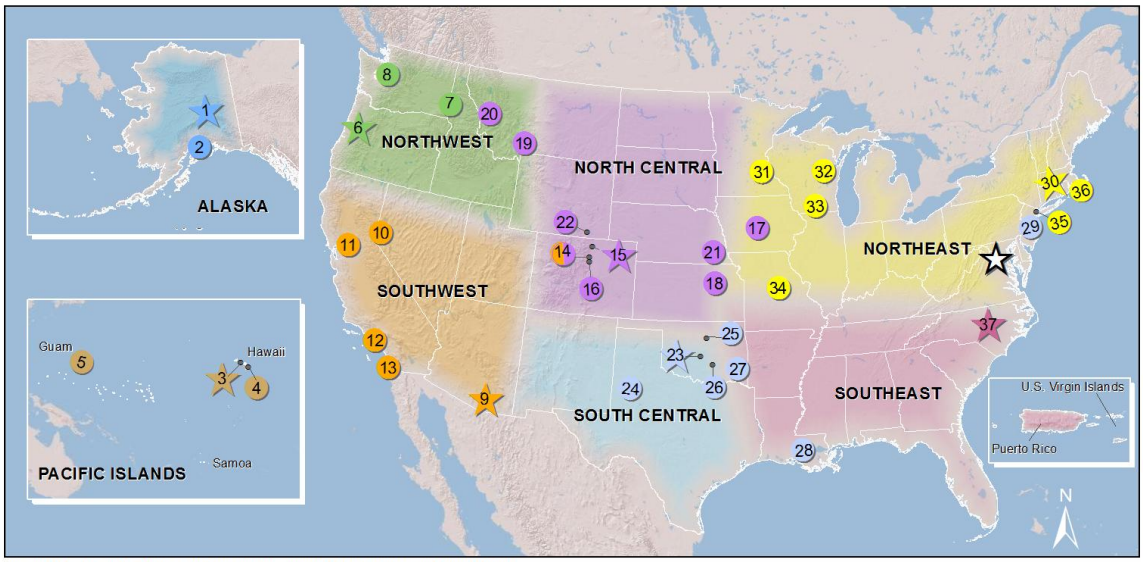
Northwest CSC – Corvallis, OR
http://www.doi.gov/csc/northwest/index.cfm

Southwest CSC – Tucson, AZ
http://www.doi.gov/csc/southwest/index.cfm

Pacific Islands CSC – Manoa, HI
http://www.doi.gov/csc/pacific/index.cfm

Alaska CSC – Anchorage, AK
http://www.doi.gov/csc/alaska/index.cfm

Figure 2



Base from ESRI, 2009, Albers Equal Area Conic Projection, North American Datum of 1983

EXPLANATION

National Climate Change and Wildlife Science Center

CSC Lead Institutions

CSC Institutions

Alaska CSC
1. University of Alaska - Fairbanks
2. University of Alaska - Anchorage

Pacific Islands CSC
3. University of Hawaii at Manoa
4. University of Hawaii at Hilo
5. University of Guam

Northwest CSC
6. Oregon State University
7. University of Idaho
8. University of Washington

Southwest CSC
9. University of Arizona
10. Desert Research Institute (Nevada)
11. University of California - Davis
12. University of California - Los Angeles
13. Scripps Institute of Oceanography
14. University of Colorado

North Central CSC
14. University of Colorado
15. Colorado State University
16. Colorado School of Mines
17. Iowa State University
18. Kansas State University
19. Montana State University
20. University of Montana
21. University of Nebraska - Lincoln
22. University of Wyoming

South Central CSC
23. University of Oklahoma
24. Texas Tech University
25. Oklahoma State University
26. Chickasaw Nation
27. Choctaw Nation of Oklahoma
28. Louisiana State University
29. NOAA Geophysical Fluid Dynamics Laboratory

Northeast CSC
30. University of Massachusetts Amherst
31. University of Minnesota
32. College of Menominee Nation
33. University of Wisconsin - Madison
34. University of Missouri Columbia
35. Columbia University
36. Marine Biological Laboratory

Southeast CSC
37. North Carolina State University

2. NEX-DCP30

http://www.usgs.gov/climate_landuse/clu_rd/apps/nex-dcp30_viewer.asp

This new tool from USGS provides maps and summaries of historical and projected temperature and precipitation changes for the 21st century for the continental United States. The data is downscaled to the county level and has a data viewing portal with easily understood maps, three-page summaries, and downloadable spreadsheet compatible data files for each U.S. state and county.

The maps and summaries are based on NASA downscaling of the 33 climate models used in the 5th Climate Model Intercomparison Project and the current Intergovernmental Panel on Climate Change (IPCC) Assessment Report. The IPCC data is generally on the scale of a grid of 1 to 3 square degrees of latitude and longitude. The USGS leveraged this massive dataset and distilled the information into a very fine 800 meter grid over the continental United States.

3. Geo Data Portal (GDP)

http://cida.usgs.gov/climate/gdp/

This data portal offers downscaled climate projections and other data resources.

The database has a polygon feature through which a user can supply a zipped shapefile or draw a polygon on a map and then get direct access to time series of data for the particular area of interest. The portal also includes a catalog of information about available gridded time series data.

The usual process for producing this sort of downscaled climate projects would require you to procure multiple large datasets, integrate those datasets in to one format and then extract data of interest. This portal intends to simplify this work in to one easy and efficient task.

4. Derived Downscaled Climate Projection Portal

http://cida.usgs.gov/climate/derivative/

This web portal allows for visualization and downloading of future climate projections from a group of statistically downscaled global climate models (GCMs), using multiple emissions scenarios, over three different time periods in the future. It also features overlay maps of existing regions such as the LCC network and the NCA regions. "Derived" refers to the fact that temperature and precipitation projections from these models have been used to derive climate indices that measure the number of days that exceed certain thresholds. For example, it will display the projected number of days in a year with a maximum temperature above 90° or projected future growing season length.

This tool is extremely useful for exploring multiple projected climate scenarios.

5. Land Change Science Program

http://www.usgs.gov/climate_landuse/lcs/

The Land Change Science Program monitors land use and land cover change at multiple scales, documenting the geographic variability of change and defining the environmental, social, technological, and political drivers of change as well as assessing the impacts of these changes. Current land cover monitoring activities include the National Land Cover Database (NLCD) and regional activities in areas such as the Great Plains, Rocky Mountains, and the Chesapeake Bay watershed. Regional assessments involve analyzing the impacts of land cover change on water quality, biodiversity, and community risk and vulnerability as well as conducting land cover change modeling, which allows for assessing the impacts of future resource usage and climate change.

a. National Land Cover Database (NLCD)

http://www.usgs.gov/climate_landuse/lcs/rt_lcma.asp

The National Land Cover Database (NLCD) serves as the definitive Landsat-based, 30-meter resolution, land cover database for the Nation. NLCD provides spatial reference and descriptive data for characteristics of the land surface such as thematic class (for example, urban, agriculture, and forest), percent impervious surface, and percent tree canopy cover. NLCD supports a wide variety of federal, state, local, and nongovernmental applications that seek to assess ecosystem status and health, understand the spatial patterns of land cover, predict effects of climate change, and develop land management policy. NLCD products are created by the Multi-Resolution Land Characteristics (MRLC)

Consortium, a partnership of federal agencies led by the U.S. Geological Survey. Data can be downloaded here: http://www.mrlc.gov/nlcd06_data.php

b. National Assessment of Ecosystem Carbon Sequestration and Greenhouse Gas Fluxes (LandCarbon)

http://www.usgs.gov/climate_landuse/land_carbon/

LandCarbon aims to improve understanding of carbon sequestration and greenhouse gas fluxes in and out of ecosystems related to land use.

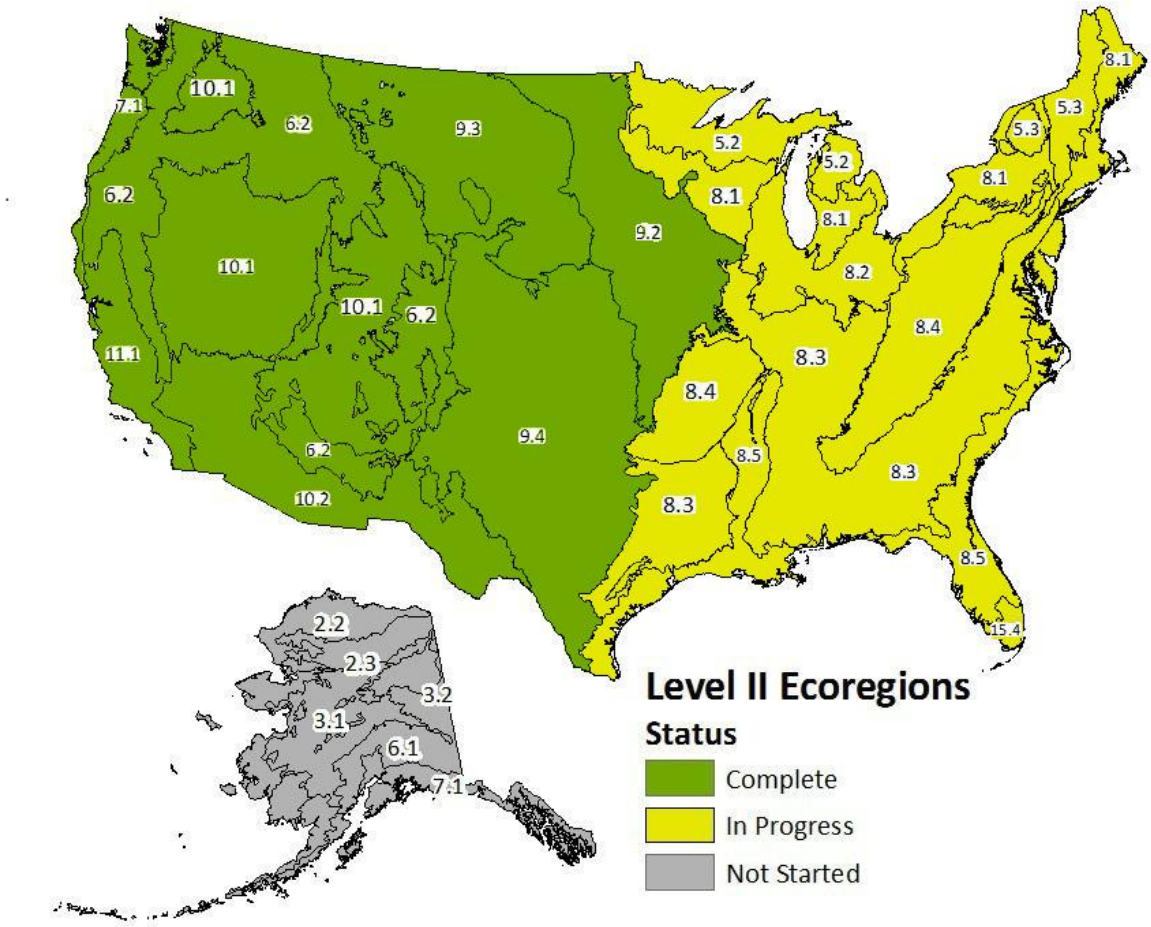
The assessment covers all major terrestrial and aquatic ecosystems, is conducted for all fifty states, provides estimates of baseline as well as future potential carbon storage and greenhouse gas fluxes, and conducts analysis of effects of major natural and anthropogenic processes that impact ecosystem carbon storage and greenhouse gas fluxes. Major natural and anthropogenic processes include climate change, wildfire, land use change, and land management activities.

Users will be able to visualize various data products, calculate simple statistics, and download the data for their areas of interest via a tool currently under construction. Data from the eight completed assessments can be seen here: http://www.usgs.gov/climate_landuse/land_carbon/Data.asp. See Figure 3 to find which assessment area applies to your state.

The output of the LandCarbon tool is a collection of time-series digital maps produced on an annual step from 2001 to 2050. These represent estimated or projected values that portray geographic patterns and temporal trends of the components of the assessment: land use and land cover, major ecosystems, wildland fire, carbon storage in the ecosystems, and fluxes of carbon and other greenhouse gases such as methane and nitrous oxide.

For managers beginning to plan for climate adaption, this tool can be used to assesses an ecosystem's capacity to increase carbon stocks and reduce greenhouse gas fluxes by looking at changes in land use and land cover (such as converting cropland to forest or grassland) and land management practices (such as tillage practices, cropland irrigation, and forest logging) and therefore help make decisions about which land cover and land management types to support. To assess the possible outcomes of land management under potential future climates, the analysis uses the SRES emissions scenarios as defined by the IPCC as well as a spatially explicit Land Use/Land Cover modeling framework to project the potential future changes in land use, land cover, and land management.

Figure 3



Map showing the status of the assessment of each ecoregion in the United States.

c. Ecosystem Functioning and Services

http://www.usgs.gov/climate_landuse/lcs/rt_ecosys.asp

Multiple projects under the Land Change Science umbrella monetize the value of ecosystem services and have tools such as the Ecosystem Portfolio Model (EPM). EPM is a decision support tool that uses land-use change scenarios and a suite of spatially-explicit models to explore the implications of future regional growth and development to various ecosystems through 2060.

Check the website for a list of similar ecosystem services driven projects that may be useful for adaptation planning in your region.

d. GIS Decision Support Tools

http://www.usgs.gov/climate_landuse/lcs/projects/web_gis.asp

This project emphasizes the development and application of a variety of web-based analysis and decision support tools.

One such tool is the USGS Flood Inundation Mapper, which estimates losses to buildings and other infrastructure from catastrophic flooding. This tool is intended to help local planners and emergency response personnel in cities and towns across the country better prepare for and respond to catastrophic floods. http://water.usgs.gov/osw/flood_inundation/

Check the website for other tools that may be relevant to natural resources in your region.

6. Science and Decision Center (SDC)

http://www.usgs.gov/sdc/

The Science and Decision Center is an interdisciplinary organization advancing the use of science in natural resource decision making. The SDC focuses on research and applications in three science areas: decision science (adaptive management and structured decision making), ecosystem services, and resilience/sustainability. The Center works with partners in DOI and other government agencies, universities, and nongovernmental organizations to develop methods, capacity, and institutional structures to integrate science more effectively with resource management. SDC and its partners examine resource management issues in a context that links physical, biological, and socioeconomic systems, and accounts for uncertainty in system behaviors and the effects of management.

B. U.S. Fish and Wildlife Service (FWS)

http://www.fws.gov/home/climatechange/

The U.S. Fish and Wildlife Service (FWS) is the bureau within DOI with the 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. The major functions of the FWS are to enforce federal wildlife laws; protect endangered species; manage migratory birds; restore nationally significant fisheries; conserve and restore wildlife habitat such as wetlands; help foreign governments with their international conservation efforts; and distribute the excise taxes on fishing and hunting equipment to state fish and wildlife agencies. The FWS's Climate Change Strategic Plan (http://www.fws.gov/home/climatechange/strategy.html) calls for the FWS to rise to the challenges at hand, lay the foundation for wise decisions in the future, and begin taking steps right now to begin a continuous and dynamic process of actions that will be crucial to conserving our nation's fish and wildlife resources in the years to come.

1. National Fish, Wildlife, and Plants Climate Adaptation Strategy (with NOAA and AFWA)

http://www.wildlifeadaptationstrategy.gov/index.php

FWS, NOAA, and the NY Division of Fish, Wildlife, & Marine Resources (representing state fish and wildlife agencies more broadly) co-led development of the National Fish, Wildlife, and Plants Climate Adaptation Strategy, with broad support from AFWA, many other federal agencies, and tribal agencies.

The Strategy identifies seven goals to help fish, wildlife, plants, and ecosystems cope with the impacts of climate change. These goals were developed collectively by diverse teams of federal, state, and tribal technical experts, based on existing research and understanding regarding the needs of our valuable natural resources. Each goal identifies a set of broad initial strategies and actions that should be taken or initiated over the next five to ten years. The Strategy goals are: (1) Conserve & Connect Habitat, (2) Manage Species & Habitats, (3) Enhance Management Capacity, (4) Support Adaptive Management, (5) Increase Knowledge & Information, (6) Increase Awareness & Motivate Action, and (7) Reduce Non-Climate Stressors. This document also provides progress check lists for each goal to help measure progress in adaptation and an extensive chapter cataloguing projected impacts on eight different ecosystem types.

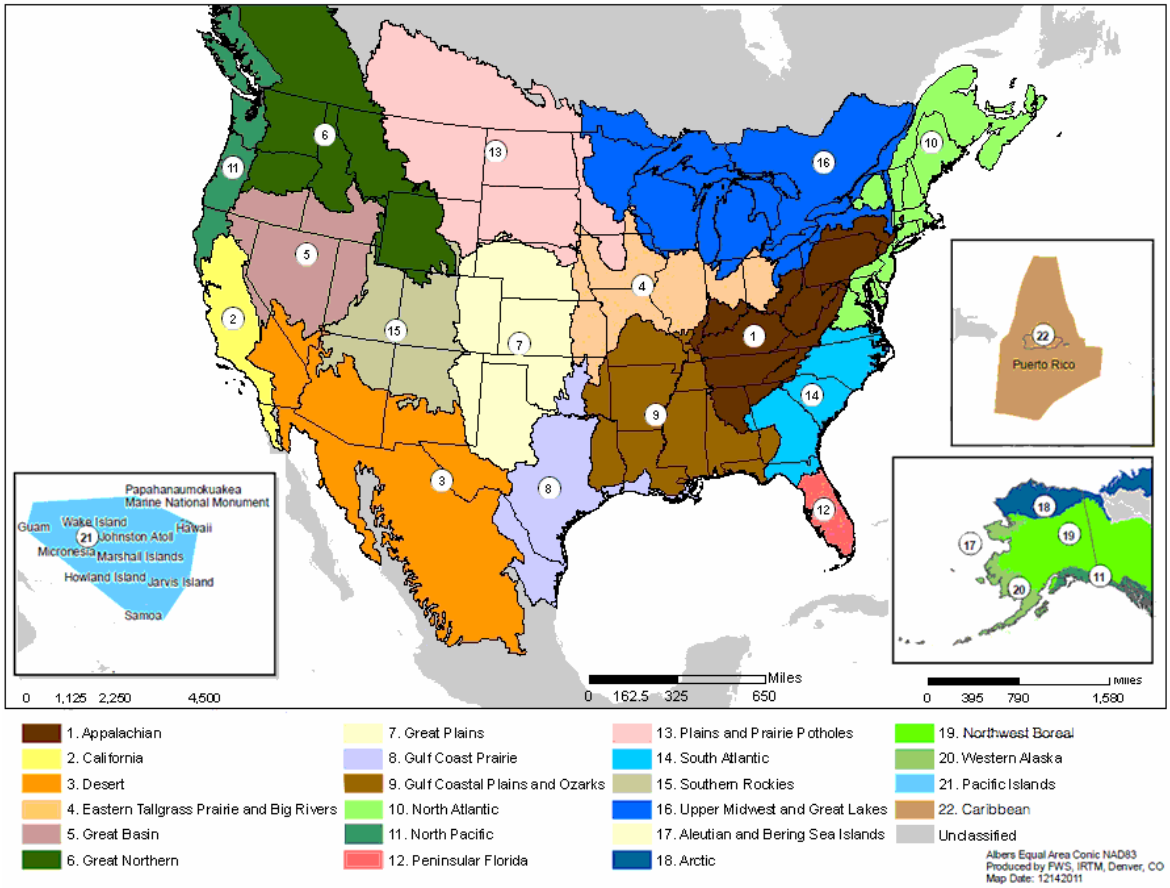
2. Landscape Conservation Cooperatives

http://lccnetwork.org/

The 22 Landscape Conservation Cooperatives (LCC) form a network of resource managers and scientists who share a common need for scientific information and interest in conservation. Each LCC brings together federal, state, and local governments along with Tribes and First Nations, non-governmental organizations, universities, and interested public and private organizations. The partners work collaboratively to identify best practices, connect efforts, identify science gaps, and avoid duplication through conservation planning and design.

As a network, the LCCs are working together to promote connections among conservation efforts across even wider geographic and political boundaries, and to address conservation issues, like climate adaptation, beyond their own borders. To find more information about LCC projects and products that can be applied to climate adaptation in your region, consult your local LCC (Figure 4).

Figure 4



Appalachian LCC –
http://applcc.org/workspace

California LCC
http://californialcc.org/

Desert LCC
http://www.usbr.gov/dlcc/

Eastern Tallgrass Prairie and Big Rivers LCC
http://www.tallgrassprairielcc.org/

Great Basin LCC
http://www.blm.gov/nv/st/en/prog/more_programs/GBLCC.html

Great Northern LCC
http://greatnorthernlcc.org/

Great Plains LCC
http://www.greatplainslcc.org/

Gulf Coast Prairie LCC
http://gulfcoastprairielcc.org/

Gulf Coastal Plains and Ozarks LCC
http://gcpolcc.org/

North Atlantic LCC
http://www.northatlanticlcc.org/

North Pacific LCC
http://www.northpacificlcc.org/

Peninsular Florida LCC
http://peninsularfloridalcc.org/

Plains and Prairie Potholes LCC
http://www.plainsandprairiepotholeslcc.org/

South Atlantic LCC
http://www.southatlanticlcc.org/

Southern Rockies LCC
http://southernrockieslcc.org/

Upper Midwest and Great Lakes LCC
http://greatlakeslcc.org/

Aleutian and Bering Sea Islands LCC
https://absilcc.org/SitePages/home.aspx

Arctic LCC
http://arcticlcc.org/

Northwest Boreal LCC
http://nwblcc.org/

Western Alaska LCC
https://www.westernalaskalcc.org/SitePages/Home.aspx

Pacific Islands LCC
http://hawaiiconservation.org/activities/pacific_island_climate_change_cooperative

Caribbean LCC
http://caribbeanlcc.org/

C. National Park Service (NPS)

http://www.nps.gov/subjects/climatechange/index.htm

The National Park Service's (NPS) Climate Change Response Program (CCRP) is a cross-disciplinary program that provides guidance, training, technical expertise, project funding, and educational products that support NPS actions to preserve the natural and cultural resources and values of the National Park Service.

The regional talking points are great starting points for regionally specific climate impacts. NPS also supports climate adaptation science at some of the Cooperative Ecosystem Study Units.

1. Regional Climate Change Talking Points

These regional talking points are a series of bio-regional summaries that provide key scientific findings about climate change and impacts to protected areas. The information is intended to provide a basic understanding of the science of climate change, known and expected impacts to resources, and actions that can be taken to mitigate and adapt to change. They are written with NPS employees as the target audience but provide strong summaries of projected regional impacts and adaptation options.

Alaska Boreal and Arctic
http://www.nps.gov/subjects/climatechange/upload/BorealarcticTalkingPoints.pdf

Alaska Maritime and Transitional
http://www.nps.gov/subjects/climatechange/upload/MaritimeTransitionalTalkingPoints.pdf

Arid Lands
http://www.nps.gov/subjects/climatechange/upload/AridLandsTP.pdf

Atlantic Coast
http://www.nps.gov/subjects/climatechange/upload/AtlanticCoastTP.pdf

Eastern Forests and Woodlands
http://www.nps.gov/subjects/climatechange/upload/EasternWoodlandsTP.pdf

Great Lakes
http://www.nps.gov/subjects/climatechange/upload/GreatLakesTP.pdf

Gulf Coast
http://www.nps.gov/subjects/climatechange/upload/GulfCoastTP.pdf

Pacific Coast
http://www.nps.gov/subjects/climatechange/upload/PacificCoastTP.pdf

Pacific Islands
http://www.nps.gov/subjects/climatechange/upload/PacificIslandsTP.pdf

Prairie Grasslands
http://www.nps.gov/subjects/climatechange/upload/PrairieGrasslandsTP.pdf

Western Mountains and Forests
http://www.nps.gov/subjects/climatechange/upload/WesternMountainsTP.pdf

2. Using Scenarios to Explore Climate Change: A Handbook for Practitioners

http://climate.calcommons.org/bib/using-scenarios-explore-climate-change-handbook-practitioners

Scenario planning is a valuable decision support method for integrating irreducible and uncontrollable uncertainties into climate change adaptation and other planning in natural resource management. This guide describes the five-step process for developing multivariate climate change scenarios taught by the Global Business Network (GBN) during a series of training workshops hosted by the National Park Service in 2010 and 2011. The authors created this guide as a reference for those who possess some familiarity with scenario planning. It represents a method for building climate change scenarios, since many valid methods exist to develop climate change scenarios. The technique presented here is just one effective and proven approach.

3. Cooperative Ecosystem Studies Units (CESU)

http://www.cesu.psu.edu/

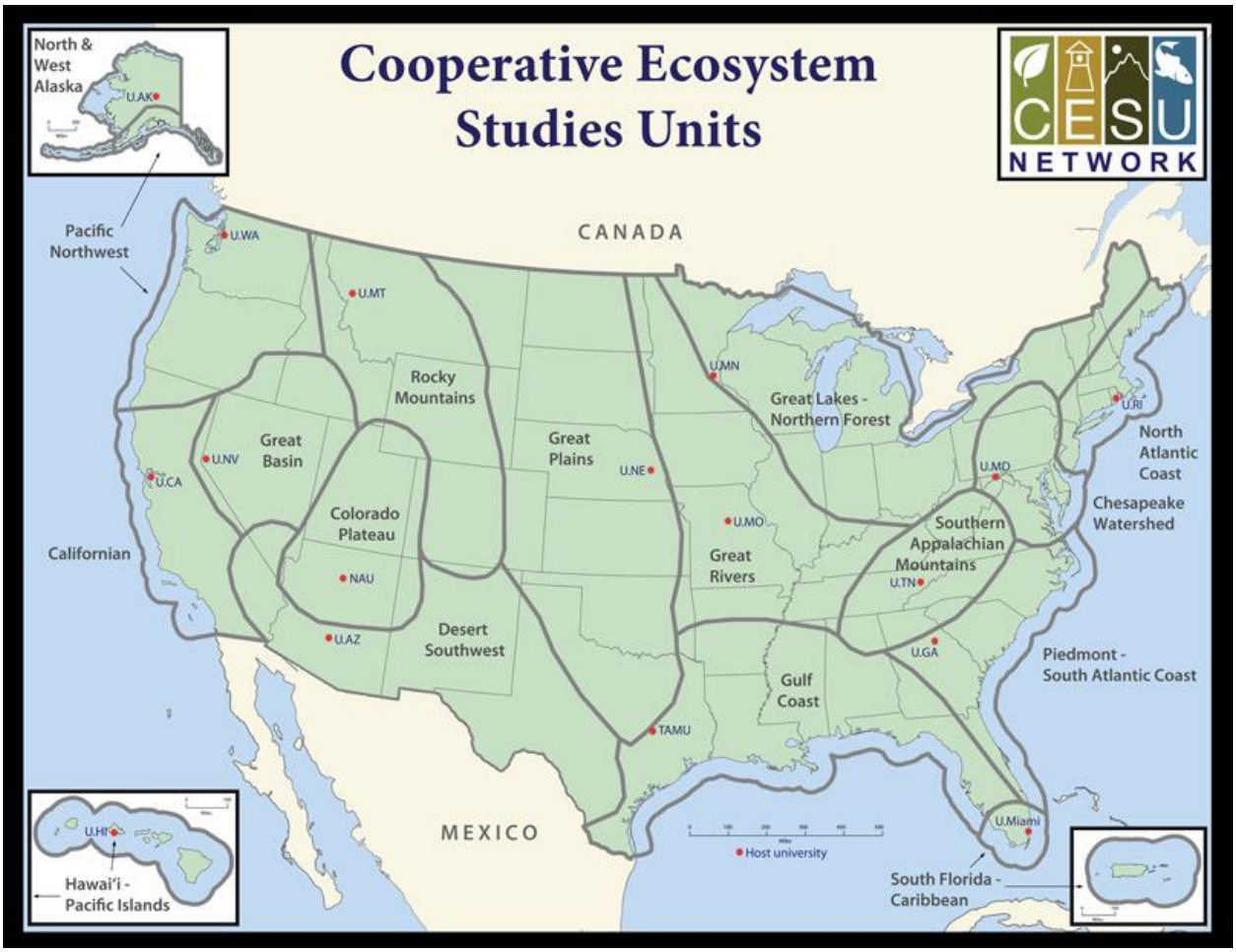
The Cooperative Ecosystem Studies Units (CESU) Network is a national consortium of federal agencies, tribes, academic institutions, state and local governments, nongovernmental conservation organizations, and other partners working together to support informed public trust resource

stewardship. The CESU Network represents 17 biogeographic regions encompassing all 50 states and U.S. territories (Figure 5). The CESU Network supports research, technical assistance, education, and capacity building that is responsive to long-standing and contemporary science and resource management priorities.

The CESUs bring together scientists, resource managers, students, and other conservation professionals, drawing upon expertise from across the biological, physical, social, cultural, and engineering disciplines to conduct collaborative and interdisciplinary applied projects that address natural and cultural heritage resource issues at multiple scales and in an ecosystem context. Each CESU is structured as a working collaborative with participation from numerous federal and nonfederal institutional partners. CESUs are based at host universities and focus on a particular biogeographic region of the country.

Check with your local CESU (Figure 5) to find out what climate adaptation resources they may be able to provide.

Figure 5



Californian CESU
http://www.cesu.psu.edu/unit_portals/CALI_portal.htm

Chesapeake Watershed CESU
http://www.cesu.psu.edu/unit_portals/CHWA_portal.htm

Colorado Plateau CESU
http://www.cesu.psu.edu/unit_portals/COPL_portal.htm

Desert Southwest CESU
http://www.cesu.psu.edu/unit_portals/DESO_portal.htm

Great Basin CESU
http://www.cesu.psu.edu/unit_portals/GRBA_portal.htm

Great Lakes-Northern Forest CESU
http://www.cesu.psu.edu/unit_portals/GLNF_portal.htm

Great Plains CESU
http://www.cesu.psu.edu/unit_portals/GRPL_portal.htm

Great Rivers CESU
http://www.cesu.psu.edu/unit_portals/GRRI_portal.htm

Gulf Coast CESU
http://www.cesu.psu.edu/unit_portals/GUCO_portal.htm

Hawaii-Pacific Islands CESU
http://www.cesu.psu.edu/unit_portals/HIPI_portal.htm

North and West Alaska CESU
http://www.cesu.psu.edu/unit_portals/NWAK_portal.htm

North Atlantic Coast CESU
http://www.cesu.psu.edu/unit_portals/NOAT_portal.htm

Pacific Northwest CESU
http://www.cesu.psu.edu/unit_portals/PANO_portal.htm

Piedmont-South Atlantic Coast CESU
http://www.cesu.psu.edu/unit_portals/PSAC_portal.htm

Rocky Mountains CESU

http://www.cesu.psu.edu/unit_portals/ROMO_portal.htm

Southern Appalachian Mountains CESU
http://www.cesu.psu.edu/unit_portals/SOAP_portal.htm

South Florida-Caribbean CESU
http://www.cesu.psu.edu/unit_portals/SOFL_portal.htm

D. Bureau of Land Management (BLM)

http://www.blm.gov/wo/st/en/prog/more/climatechange.html

The Bureau of Land Management is the agency tasked with sustaining the health, diversity, and productivity of America's public lands for the use and enjoyment of present and future generations. It administers more than 245 million surface acres of the United States. Most of this land is located in the 12 Western states, including Alaska. The mission of the BLM mandates that it manages public land resources for a variety of uses, such as energy development, livestock grazing, recreation, and timber harvesting, while protecting a wide array of natural, cultural, and historical resources including the fish and wildlife for which states have responsibility. To address climate change, the BLM has introduced Rapid Ecoregional Assessments (REA) and a landscape approach for managing public lands. The purpose of these initiatives is to help BLM managers and public land stakeholders understand environmental conditions and trends from a broader landscape perspective, and to use this information to inform, focus, and coordinate management efforts on-the-ground. The REAs offer a way to integrate the BLM's conservation, restoration, and development programs in a cohesive manner and produce products that will be extremely valuable to state fish and wildlife agencies.

1. Rapid Ecoregional Assessments (REA)

http://www.blm.gov/wo/st/en/prog/more/Landscape_Approach/reas.html

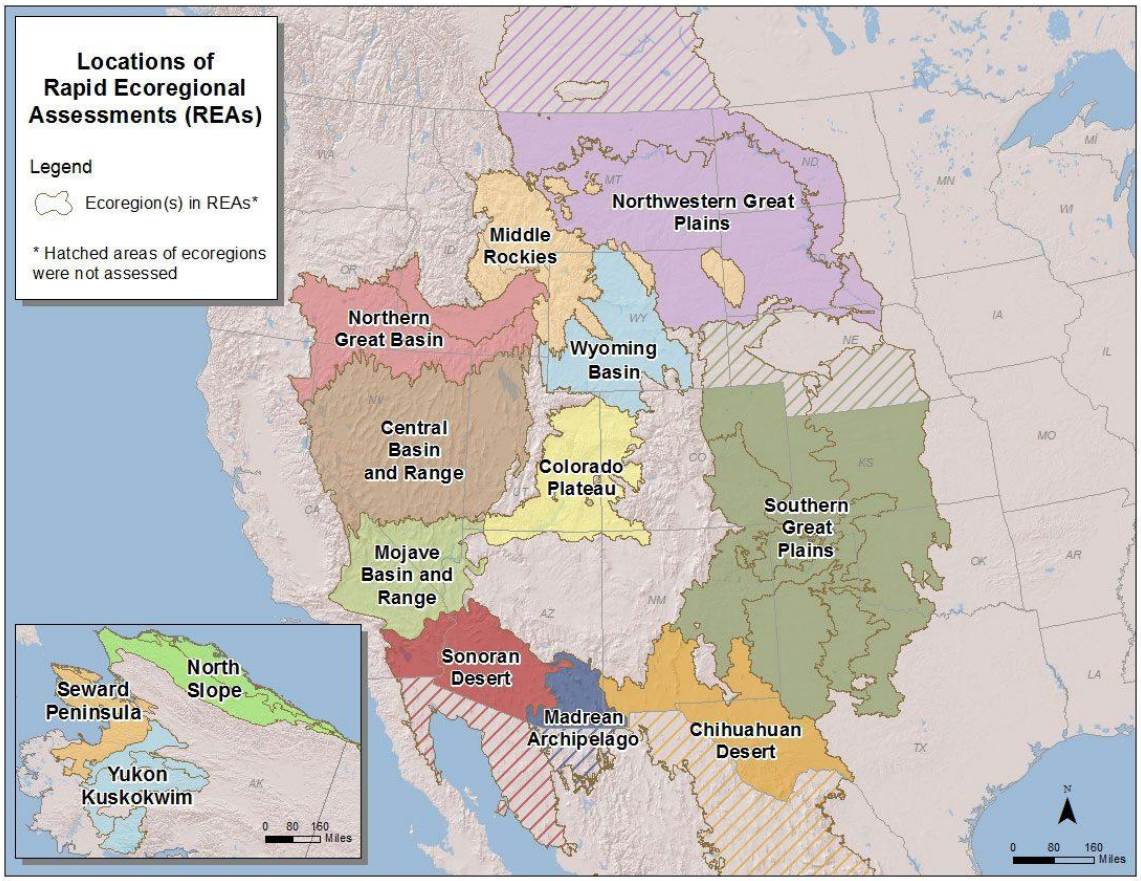
The Rapid Ecoregional Assessments (REA) examine ecological values, conditions, and trends within eco-regions, which are large, connected areas that have similar environmental characteristics. Examples of eco-regions include the Sonoran Desert and the Colorado Plateau (See Figure 6 for all regions). The eco-regions under assessment range in size from 11 million to 91 million acres. Assessments of these larger areas provide land managers additional information and tools to use in subsequent resource planning and decision-making.

REAs synthesize existing information rather than producing new data and are generally completed within 18 months. The assessments gauge the potential of habitats to be affected by four overarching environmental change agents*:* climate change, wildfires, invasive species, and development (both energy development and urban growth).

Because the BLM is a multi-use agency, REAs also help identify areas that do not provide essential habitat; that are not ecologically intact or readily restorable; and where development activities may be directed to minimize impacts to important ecosystem values.

Geospatial data, maps, and models used in and produced by the REAs are made available to the public through the REA Data Portal upon final completion of each individual assessment. The regions completed and released as of October 2013 are the Central Basin & Range, the Colorado Plateau, the Mojave Basin & Range, and the Sonoran Desert. All assessments are scheduled to be complete by late 2014.

Figure 6



E. Bureau of Reclamation (BOR)

http://www.usbr.gov/research/climate/

The Bureau of Reclamation (BOR) is the largest wholesaler of water in the country. Climate Change will impact the hydrology of the United States and BOR has recognized the need to help the western states meet new water needs while balancing the multitude of competing uses of water.

1. Downscaled CMIP3 and CMIP5 Climate and Hydrology Projections

http://www.usbr.gov/climate/ http://gdo-dcp.ucllnl.org/downscaled_cmip_projections/

This archive contains fine spatial resolution (12km^2) downscaled climate projects over the contiguous United States with monthly projections of hydrology over the Western United States. The modelled

variables are precipitation, minimum surface air temperature, maximum surface air temperature, mean daily precipitation rate during each month, and mean monthly surface air temperature.

The downscaled data use the climate models from IPCC AR4 (CMIP3) and AR5 (CMIP5). The archive is meant to provide access to climate and hydrologic projections at spatial and temporal scales relevant to some of the watershed and basin-scale decisions facing natural resource managers and planners dealing with climate change. Some goals include assessment of potential climate change impacts on natural systems, assessment of local to regional climate projection uncertainty, and risk-based exploration of planning and policy responses framed by potential climate changes exemplified by these projections.

III. U.S. Department of Agriculture (USDA)

http://www.usda.gov/wps/portal/usda/usdahome?navid=climate-change

The U.S. Department of Agriculture (USDA) has responsibility for dealing with food, agriculture, natural resources, rural development, nutrition, and related issues. The department's mission is to expand economic opportunity through innovation; to promote agriculture production sustainability; and to preserve and conserve our nation's natural resources through restored forests, improved watersheds, and healthy private working lands. The department addresses climate change through its Climate Change Program Office.

A. Climate Change Program Office

http://usda.gov/oce/climate_change/

The Climate Change Program Office (CCPO) coordinates USDA's responses to climate change, focusing on implications of climate change on agriculture, forests, grazing lands, and rural communities. CCPO ensures that USDA is a source of objective, analytical assessments of the effects of climate change and proposed response strategies both within USDA and for partners. CCPO is also responsible for coordinating activities with other federal agencies, interacting with the legislative branch on climate change issues affecting agriculture and forestry, and representing USDA on U.S. delegations to international climate change discussions. CCPO's responsibilities include analysis, planning, research coordination, and the development of climate change response strategies, and ensuring that recognition of the potential for climate change is fully integrated into USDA's research, planning, and decision-making processes.

1. Regional Climate Hubs for Risk Adaptation and Mitigation to Climate Change

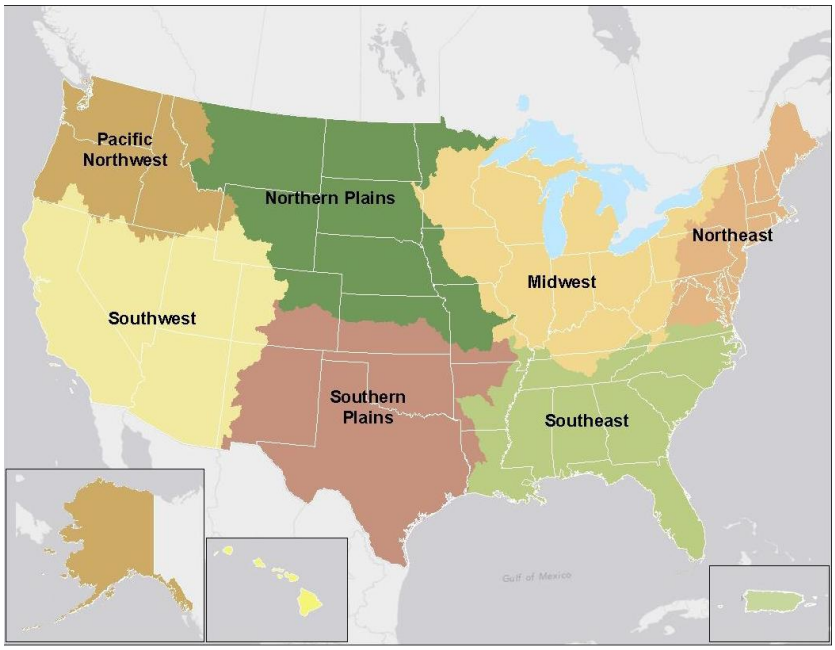
http://www.usda.gov/oce/climate_change/regional_hubs.htm

These seven regional hubs are not yet fully developed, but will eventually deliver science-based knowledge and practical information to farmers, ranchers, and forest landowners within each region to support decision-making in the context of climate change. These hubs intend to maintain and strengthen agricultural production, natural resource management, and rural economic development under increasing climate variability. The Hubs will build capacity within USDA to deliver information and guidance on technologies and risk management practices at regional and local scales. These hubs can be useful for producing information for private land owners with whom state natural resource managers frequently work.

Each Hub will be located at a soon-to-be announced location in the region (Figure 7) and will be supported by a network of public, academic, and private sector organizations, researchers, and outreach specialists. Current partners represent land grant universities; USDA researchers, programs, and field offices; private sector companies addressing climate change adaptation and mitigation; state, local and regional governments; NOAA and DOI regional climate change experts; and non-profits providing assistance to landowners.

These hubs are being designed to complement the work of the NOAA RISA Program and the DOI Climate Science Centers for fish and wildlife rather than replicate it.

Figure 7



B. U.S. Forest Service

http://www.fs.fed.us/climatechange/advisor/

The Forest Service manages 193 million acres of public National Forests and Grasslands, and shares responsibility for the stewardship of roughly 500 million acres of non-federal forests with States, Tribes and private landowners. The USFS mission is to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations. The agency's mission is implemented by three divisions: the National Forest System, State & Private Forestry, and Research & Development (R&D). R&D established a Global Change Research Program in the late 1980s and has collaborated extensively with other research partners and with land managers to understand the nature of climate change, its impacts on natural resources, and to produce practical tools that facilitate climate change adaptation.

1. Climate Change Resource Center (CCRC)

http://www.fs.fed.us/ccrc/

The Climate Change Resource Center (CCRC) provides natural resource managers with access to science based information and tools concerning ecosystem management and climate change. Its online portal offers original syntheses of land management topics written by scientists and resource specialists, in-depth video presentations that cover a wide range of climate change adaptation and mitigation topics, and access to a variety of tools and recommended literature.

The website compiles and creates educational resources, climate change and carbon tools, video presentations, literature, and briefings on management relevant topics ranging from basic climate change information to details on specific management responses.

Particular highlights of interest:

http://www.treesearch.fs.fed.us/pubs/39884 → Guidebook for developing adaptation options

http://www.fs.fed.us/ccrc/tools/ → List of climate change related tools

2. USDA Forest Service Climate Projections FAQ

http://www.fs.fed.us/rm/pubs/rmrs_gtr277.pdf

This FAQ serves as a plain-language introduction to the concepts embedded in downscaled climate projections. This online document serves as a reference that allows users to skip around within the content, depending on their particular questions and needs. It covers basic information about what climate projections are, how they are produced, and what their strengths and limitations are.

3. Template for Assessing Climate Change Impacts and Management Options (TACCIMO)

http://www.forestthreats.org/research/tools/taccimo

TACCIMO is a web-based tool that connects natural resource planning to current climate change science literature. It accesses the most current climate change projections and science including the likely range of projected future climate for any state, county, or National Forest and dynamically linked peer-reviewed scientific statements describing effects and management adaption options. It outputs detailed, custom reports based on user-defined criteria.

The literature-based science assessments include quotations from peer reviewed literature describing direct impacts of climate change and potential management options. The report generator produces an exportable report from the science literature content based on a series of user-defined selections of the subject, location, and type of information requested. This can include reports as detailed as one county and published reports on one species or as broad as all reports on all mammals in one state.

The climate reports offer a full range of potential future climate from different combinations of Global Climate Models and scenarios depending on the scale, location, and variable (precipitation or temperature) selected. The climate report function generates a standard report describing national, regional, and location specific (state, county, or National Forest) trends and boundaries in projected climate.

4. Research Round-Up

http://www.fs.fed.us/ccrc/roundup/index.php?org=

This website offers summaries of scientific research and collaborations on climate change questions being addressed. It offers a complete overview of the climate change work happening at the Forest Service research stations. Users can browse the research synopses by specific Forest Service Research

Station, topic, or using a search function. There is also an option to contact the scientists involved in each project for more information.

5. Climate Change Bird Atlas and Tree Atlas

http://www.nrs.fs.fed.us/atlas/

The Climate Change Atlases can help to answer a range of questions concerning current and projected suitable habitat to the year 2100 for 134 tree species and 150 bird species in the eastern United States. The atlases provide individual reports that provide species characteristics, life history traits, and current distribution as determined by the Breeding Bird Survey and Forest Inventory and Analysis surveys. Users can see which factors (temperature, elevation, soil type, etc.) help to drive species distributions, offering guidance on species sensitivity to large-scale climate changes.

The Atlases also output maps and summary data that show how each species' suitable habitat is projected to change under three different climate models (PCM, Hadley, GFDL) with high and low emissions scenarios (A1fi - High, B1 – reasonable energy conservation). They also show suitable habitat under an average future climate from all three models. Output maps can be viewed via the Atlas online interface or with Google Earth.

For certain pre-defined areas, the Atlases also present data on how the overall grouping of species' habitats within that area might change under future climates. These pre-defined areas currently include each state, national forests/grasslands, national parks, and eco-regions. This tool is very easy and quick to use because the user does not define any model inputs. Remember that the model is only predicting where suitable species habitat may be in the future! It does not consider barriers to migration, land use changes, biological factors, or disturbance.

6. System for Assessing Vulnerability of Species (SAVS)

http://www.fs.fed.us/rm/grassland-shrubland-desert/products/species-vulnerability/

The Forest Service's System for Assessing Vulnerability of Species uses an online questionnaire with 22 criteria to predict the vulnerability or population response of species to provide a framework for assessing vulnerability to future climate change. The 22 multiple-choice questions are grouped into four categories by theme: habitat, physiology, phenology, and biotic interactions. The questionnaire is completed using information that the user must gather from published materials, personal knowledge, or expert consultation. Submitting the questionnaire for a species provides the user with a quantitative score for species vulnerability or resilience. A positive score indicates vulnerability of the species to climate change, a negative score indicates resilience. In addition, SAVS identifies a level of uncertainty associated with the score, and the primary source(s) of species vulnerability by providing sub-scores for each of the four categories.

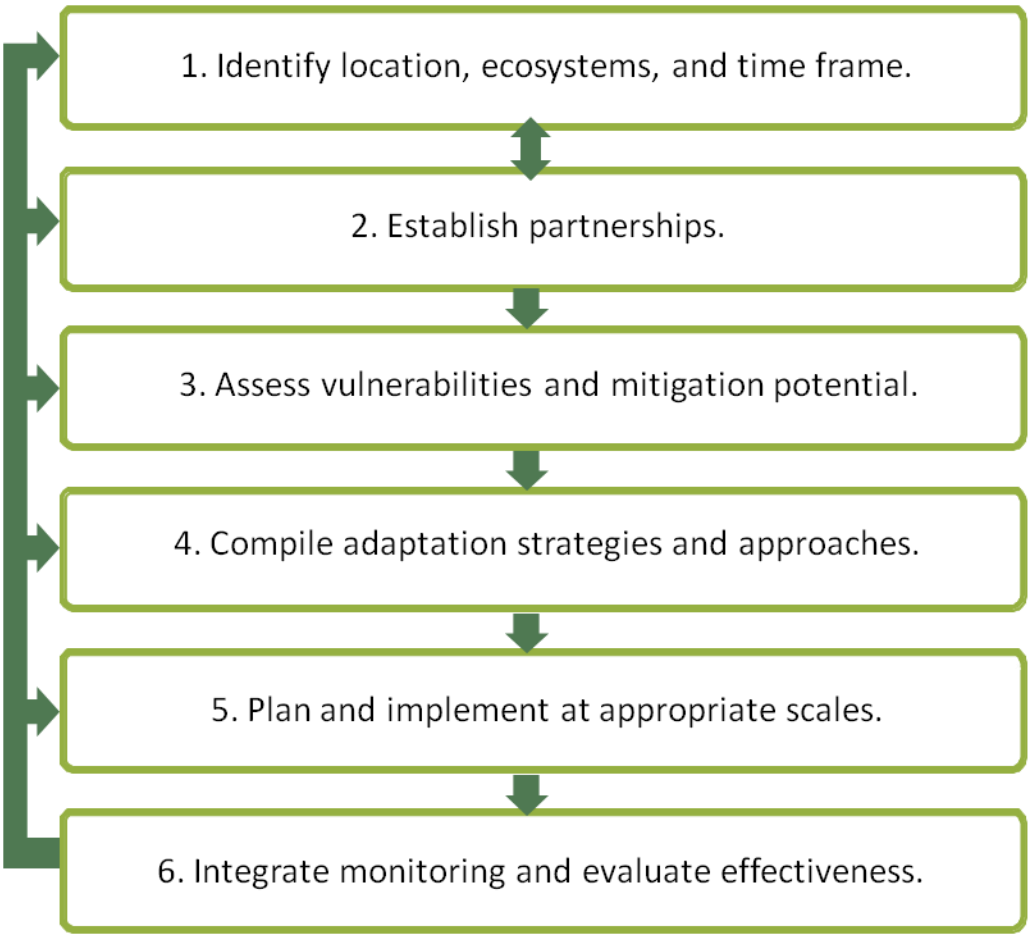
7. Climate Change Response Framework

http://www.climateframework.org/

http://climateframework.org/our-approach/framework-overview

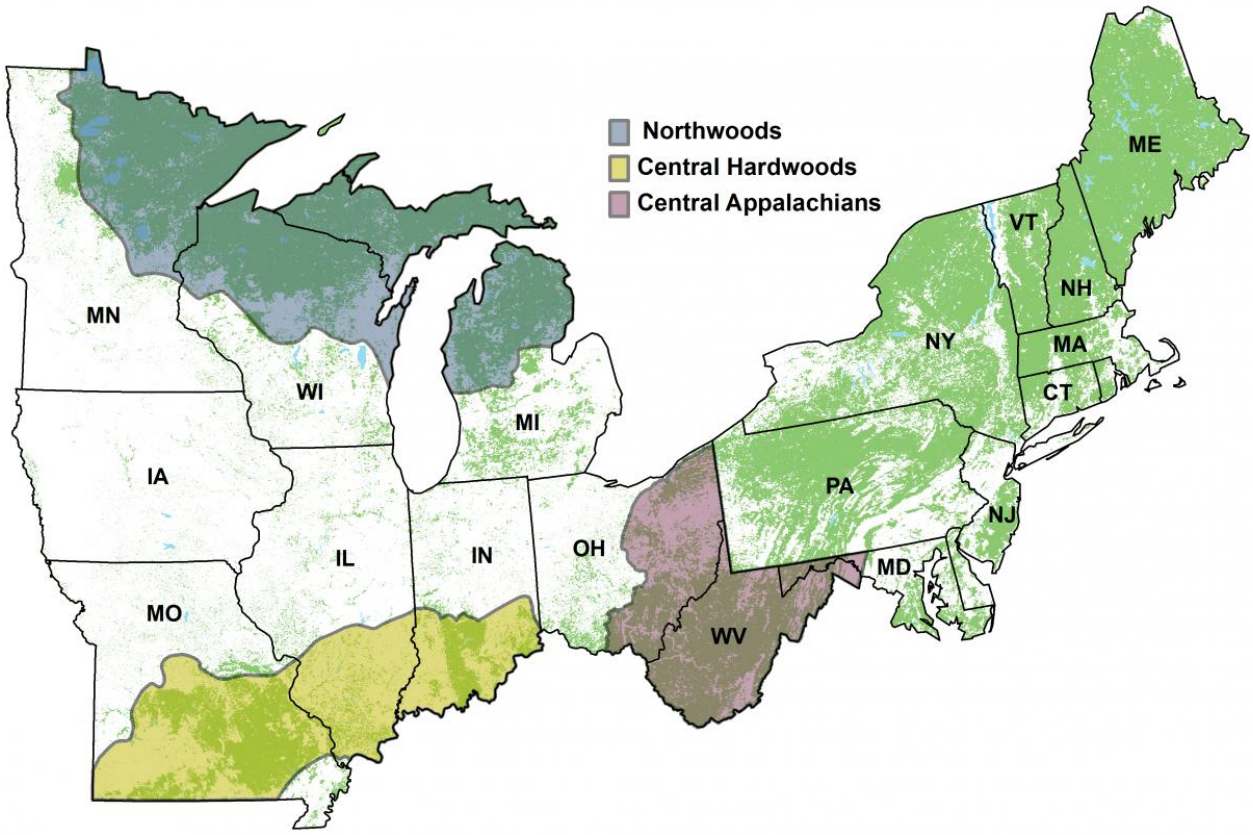
The Climate Change Response Framework is a collaborative, cross-boundary approach among scientists, managers, and landowners to incorporate climate change considerations into natural resource management. It provides an integrated set of tools, partnerships, and actions to support climate-informed conservation and forest management. See Figure 8 for the full framework.

Figure 8. Climate Change Response Framework



There are three ongoing regional projects that encompass nine states, including 11 National Forests and millions of acres of forestland. Each regional project interweaves four components: science and management partnerships, vulnerability assessments, adaptation resources, and demonstration projects. Consult the individual partnerships for more on the products or activities that may be relevant to your planning process (Figure 9)

Figure 9. Regional Projects Using the Climate Change Response Framework



8. Aquatics & Fisheries Tools

http://www.fs.fed.us/research/wildlife-fish/themes/aquatic.php

The USDA Forest Service has developed many resources for aquatic and fishery conservation. This website provides links for ongoing research projects looking at the impact of climate change and increasing stream temperatures on fish populations. The research can be used to improve management efficiency, identify the highest priority habitats for protection, and strategies for protecting unique aquatic species and ecosystems. Some examples are:

a. Climate change, forests, fire, water, and fish: Building resilient landscapes, streams, and managers

This report describes the framework of how fire and climate change work together to affect forest and fish communities. Learning how to adapt will come from testing, probing, and pushing that framework and then proposing new ideas. The western U.S. defies generalizations, and much learning must necessarily be local in implication. This report serves as a scaffold for that learning. It comprises three primary chapters on physical processes, biological interactions, and management decisions, accompanied by a special section with separately authored papers addressing interactions of fish

populations with wildfire. Any one of these documents could stand on its own. Taken together, they serve as a useful reference with varying levels of detail for land managers and resource specialists.

b. NetMap

http://www.terrainworks.com/

This is a decision support tool for rapidly conducting cost-effective watershed analysis. It aids climate smart management by identifying areas of watershed that are most likely to warm, are susceptible to erosion and mass wasting from wildfires and floods, and are currently most productive for fish.

c. NorWest

http://www.fs.fed.us/rm/boise/AWAE/projects/NorWeST.html

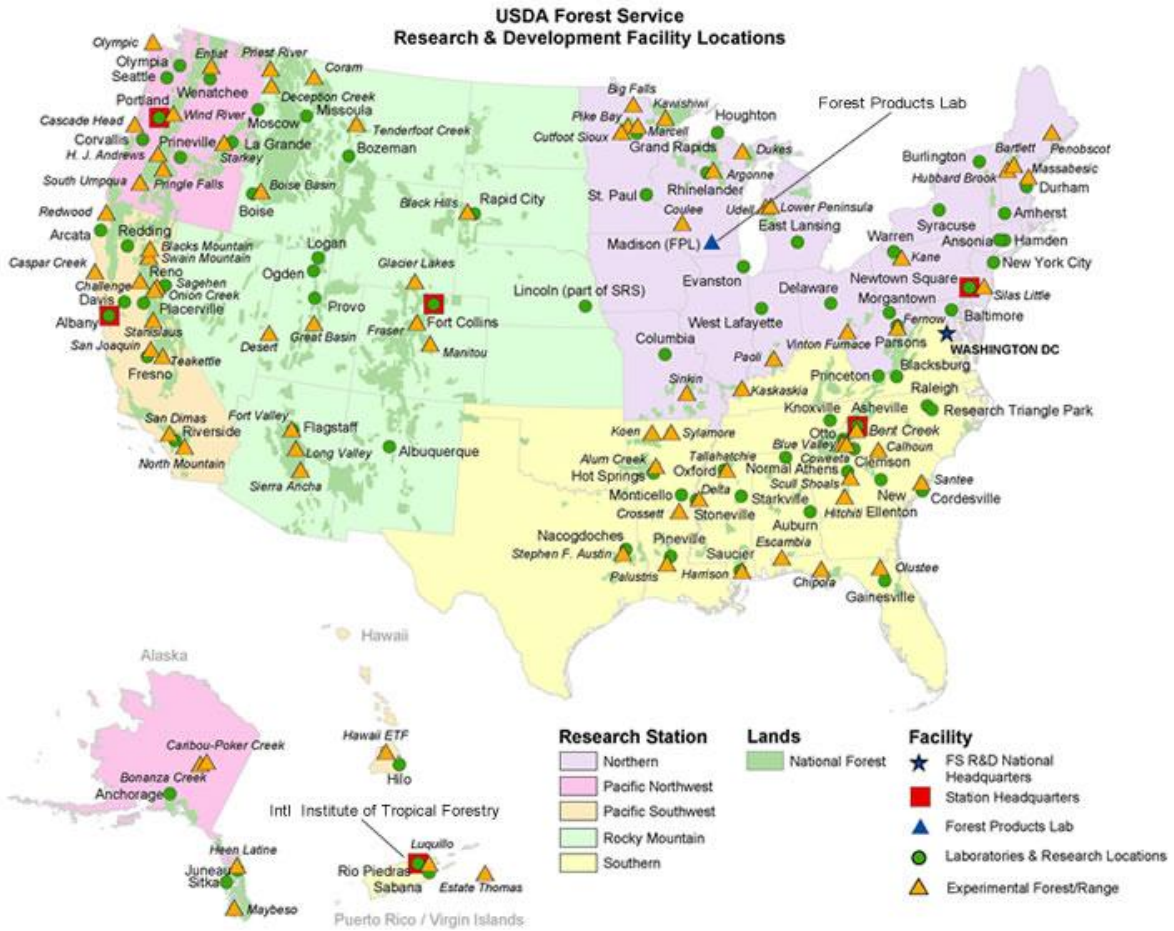
The Forest Service has one of the largest and most valuable stream temperature monitoring networks. This tool incorporates the network of Forest Service Experimental Forests and Ranges with climate and stream data of the past 50 to 100 years. The tool offers decades of stream temperature monitoring data collected by more than 60 state, federal, tribal, and private resource agencies. The goal of this tool is to facilitate better climate vulnerability assessments, enable coordinated management responses, and improve the efficiency by reducing redundancies.

9. Research Stations

http://www.fs.fed.us/research/

Research is conducted at more than 67 Forest Service research laboratories nationally. The labs are organized around five regional research stations plus the International Institute of Tropical Forestry in Puerto Rico and the Forest Products Laboratory in Madison, Wisconsin. The laboratories are complemented by a network of 80 experimental forests. Each Station has leaders in climate change, landscape conservation, and fish and wildlife science. Check with the research station in your region for any climate adaptation projects that may apply to your work (Figure 10).

Figure 10



Northern Research Station
http://www.nrs.fs.fed.us/locations/

Pacific Northwest Research Station
http://www.fs.fed.us/pnw/about/labs.shtml

Pacific Southwest Research Station
http://www.fs.fed.us/psw/locations/

International Institute of Tropical Forestry
http://www.fs.fed.us/global/iitf/

Rocky Mountain Research Station
http://www.fs.fed.us/rmrs/staff/laboratory-directory.php

Southern Research Station
http://www.srs.fs.usda.gov/locations/

Forest Products Laboratory
http://www.fpl.fs.fed.us/

a. Eastern Forest Environmental Threat Assessment Center (EFETAC)
http://www.forestthreats.org/

The goal of EFETAC is to generate, integrate, and apply knowledge to predict, detect, and assess environmental threats to the public and private forests of the East, and to deliver this knowledge to

managers in ways that are timely, useful, and user friendly. Center staff members are located in North Carolina but have regional, national, and international responsibilities.

The EFETAC scientists are evaluating the effects and consequences of multiple interacting stresses on eastern forest health; increasing knowledge and understanding of the risks, uncertainties, and benefits of multiple environmental stresses on eastern ecological conditions and socioeconomic values; providing science-based decision support tools for policy formulation and land management; and providing land managers with credible predictions of potential severe disturbance in the East with sufficient warning to take preventative actions.

There is a subset of projects from EFETAC that focus on Climate Change and Pollution. One example is "Detecting recent broad-scale changes in forest biodiversity" (http://www.forestthreats.org/research/projects/project-summaries/forest-biodiversity-changes). This project uses Forest Inventory and Analysis data at a variety of spatial scales to characterize forest tree phylogenetic diversity, a measure of community composition that incorporates evolutionary relationships among species. The results of this work can be used by other natural resource managers to assess the condition of and threats to existing habitats.

b. Western Wildland Environmental Threat Assessment Center (WWETAC)
http://www.fs.fed.us/wwetac/

The goal of WWETAC is to generate and integrate knowledge and information to provide credible prediction, early detection, and quantitative assessment of environmental threats in the western United States. The website provides information on ongoing and completed projects under the "Environmental Change" tab. For example "Probabilistic risk models for multiple disturbances: an example of forest insects and wildfires" (http://www.fs.fed.us/wwetac/projects/preisler.html). Users can browse through the results of all of the WWETAC studies. Natural Resource managers in the west can check this website for information on the status of and projected climate impacts to existing habitats.

10. Northern Institute of Applied Climate Science (NIACS)

http://www.nrs.fs.fed.us/niacs/

The Northern Institute of Applied Climate Science has been designed as a collaborative effort among the Forest Service, universities, and forest industry to provide information on managing forests for climate change adaptation, enhanced carbon sequestration, and sustainable production of bioenergy and materials. As a regional, multi-institutional entity, NIACS builds partnerships, facilitates research, and synthesizes information to bridge the gap between carbon and climate science research and the information and management needs of land owners and managers, policymakers, and members of the public. The bird and tree atlases are great examples of products from the NIACS. NIACS also sponsors a climate change short-course every year to assist managers in learning basic climate change science relevant to their role.

IV. U.S. Department of Commerce – National Oceanic and Atmospheric Administration (NOAA)

http://www.noaa.gov/climate.html

The U.S. Department of Commerce (DOC) is the federal department concerned with promoting economic growth. The department mission includes job creation, economic growth, sustainable development, and improved standards of living. The National Oceanic and Atmospheric Administration (NOAA) is the agency within DOC with responsibility for natural resources. NOAA's climate adaptation resources fall under the Climate Program Office and the National Ocean Service.

A. NOAA Climate Program Office (CPO)

http://cpo.noaa.gov/

The Climate Program Office manages competitive research programs in which NOAA funds high-priority climate science, assessments, decision support research, outreach, education, and capacity-building activities designed to advance our understanding of Earth's climate system, and to foster the application of this knowledge in risk management and adaptation efforts. The goal is to strengthen the production and delivery of climate data and information to inform the management of climate-related risks. The website allows users to browse currently funded and ongoing climate science projects.

Check the website to see if NOAA is funding research that may generate results that will be useful for natural resource management in your state.

1. Regional Integrated Sciences and Assessments (RISA)

http://cpo.noaa.gov/ClimatePrograms/ClimateandSocietalInteractions/RISAProgram.aspx

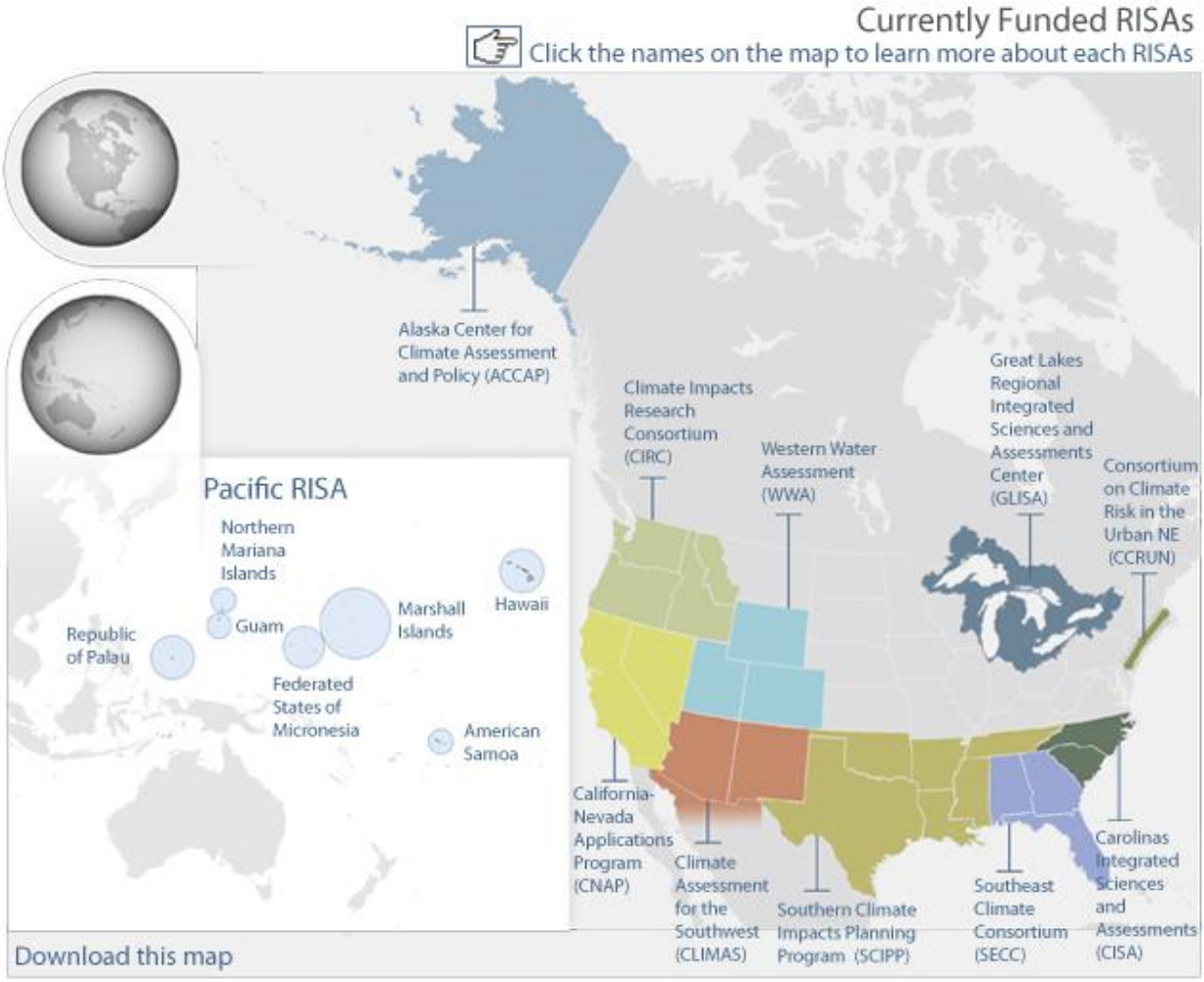
The RISA program supports research teams with the mission of expanding and building the nation's capacity to prepare for and adapt to climate variability and change. The emphasis is on producing science to support policy decisions.

RISA teams work with public and private user communities to advance understanding of policy, planning and management contexts; develop knowledge on impacts, vulnerabilities, and response options through interdisciplinary research and participatory processes; innovate products and tools to enhance the use of science in decision making; and test diverse governance structures for managing scientific research. In order to learn about specific decision contexts to better understand the use of climate science, RISAs form lasting relationships with decision makers from all sectors.

Some of the targeted outputs from RISAs include: scenario planning, participatory assessment, and experimental service development; translation of science into actionable knowledge and increased capacity for making decisions in a rapidly changing environment; climate impacts training; climate outlooks; communication tools (visualization, white papers, report, etc.); and decision support tools and information systems for drought, climate, water supply and availability, agriculture and other impacts.

There are 11 active RISA projects across the country (Figure 11), which are based at universities. None of the RISAs focus directly on impacts to fish and wildlife, but can serve as excellent sources of climate modeling and projection data, fire risk maps, flood risk, etc. To learn more about how your regional RISA can help with your climate adaptation planning, visit the individual project websites.

Figure 11



Alaska Center for Climate Assessment and Policy (ACCAP)
http://cpo.noaa.gov/ClimatePrograms/ClimateandSocietalInteractions/RISAProgram/RISATeams/ACCAP.aspx

California-Nevada Applications Program (CNAP)
http://cpo.noaa.gov/ClimatePrograms/ClimateandSocietalInteractions/RISAProgram/RISATeams/CNAP.aspx

Carolinas Integrated Sciences and Assessments (CISA)
http://cpo.noaa.gov/ClimatePrograms/ClimateandSocietalInteractions/RISAProgram/RISATeams/CISA.aspx

Climate Assessment for the Southwest (CLIMAS)
http://cpo.noaa.gov/ClimatePrograms/ClimateandSocietalInteractions/RISAProgram/RISATeams/CLIMAS.aspx

Climate Impacts Research Consortium (CIRC)
http://cpo.noaa.gov/ClimatePrograms/ClimateandSocietalInteractions/RISAProgram/RISATeams/CIRC.aspx

Consortium on Climate Risk in the Urban Northeast (CCRUN)
http://cpo.noaa.gov/ClimatePrograms/ClimateandSocietalInteractions/RISAProgram/RISATeams/CCRUN.aspx

Great Lakes Integrated Sciences and Assessments Center (GLISA)
http://cpo.noaa.gov/ClimatePrograms/ClimateandSocietalInteractions/RISAProgram/RISATeams/GLISA.aspx

Pacific RISA
http://cpo.noaa.gov/ClimatePrograms/ClimateandSocietalInteractions/RISAProgram/RISATeams/PacificRISA.aspx

Southeastern Climate Consortium (SECC)
http://cpo.noaa.gov/ClimatePrograms/ClimateandSocietalInteractions/RISAProgram/RISATeams/SECC.aspx

2. "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

This National Action Plan was released through the President's Interagency Climate Change Adaptation Task Force. It provides an overview of the challenges that a changing climate presents for the management of the nation's water resources and recommends actions for federal agencies to support water resource managers in understanding and reducing the risks of climate change.

The document provides six recommendations for reducing climate change risks to freshwater resources. These are: (1) Establish a planning process to adapt water resources management to a changing climate; (2) Improve water resources and climate change information for decision making; (3) Strengthen assessment of vulnerability of water resources to climate change; (4) Expand water use efficiency; (5) Support integrated water resources management; and (6) Support training and outreach to build response capability.

B. National Ocean Service

http://oceanservice.noaa.gov/

The mission of the National Ocean Service (NOS) is to provide science-based solutions through collaborative partnerships to address evolving economic, environmental, and social pressures on our

oceans and coasts. The three conservation priorities of the service reflect the demands of a changing climate. NOS offers multiple resources that may be useful to fish and wildlife agencies.

1. Office of Ocean and Coastal Resource Management (OCRM)

http://coastalmanagement.noaa.gov/climate.html

The Office of Coastal Resource Management provides national leadership to state and territory coastal programs and estuarine research reserves to keep America's coasts healthy and resilient.

a. "Adapting to Climate Change: A Planning Guide for State Coastal Managers"

http://coastalmanagement.noaa.gov/climate/adaptation.html

This guide was written in response to a request from state coastal managers for guidance from NOAA on adaptation planning in the coastal zone. The guide identifies and assesses the impacts of climate change that are likely to affect coastal areas; develops goals and actions to best minimize these impacts; and establishes a process to implement those actions. The document can be seen as a framework for coastal managers. Particularly useful may be this one page outline of the Adaptation Planning process (http://coastalmanagement.noaa.gov/climate/docs/planningprocess.pdf).

A companion to the planning guide provides more specificity on climate trends and potential climate change impacts in the Great Lakes region and includes examples of adaptation actions already being undertaken at the regional, state, and local level.

2. Coastal Services Center

http://www.csc.noaa.gov/

The NOAA Coastal Services Center works to protect coastal resources and keep communities safe from coastal hazards by providing data, tools, training, and technical assistance.

b. Coastal Climate Adaptation Website

http://collaborate.csc.noaa.gov/climateadaptation/default.aspx

The Coastal Climate Adaptation website provides a compiled list of completed adaptation plans at various levels of government, case studies of coastal adaptation, a page with resources to help with climate change communication, tools and examples for vulnerability assessments, and many other user created resources.

The Coastal Climate Adaptation Website is meant to be a community of practice. If you register for the community, you can contribute to the website by uploading your resources and sharing your thoughts on posts in the Blog. There is also a calendar on which you can see and post upcoming climate-related events (i.e. webinars and meetings). Registration is not required to browse the site but is required to post and interact.

c. Sea Level Rise and Coastal Impacts Viewer

http://www.csc.noaa.gov/slr/viewer/#

The purpose of this data viewer is to provide coastal managers and scientists with a preliminary look at sea level rise and coastal flooding impacts. The viewer is a screening level tool that uses nationally consistent data sets and analyses. It provides data at several different scales and multiple sea level rise scenarios. It is easy and quick to use and can provide excellent baseline estimates of likely flood zones under future climate scenarios. In addition to Sea Level, this viewer allows you to simulate coastal marsh migration and flood frequency.

This tool can be valuable in determining the vulnerability of coastal habitats required on which wildlife in your state may rely.

d. Open-Source Nonpoint Source Pollution and Erosion Comparison Tool

http://www.csc.noaa.gov/digitalcoast/tools/opennspect

This is a GIS tool that helps users to identify land areas that generate high sediment and nonpoint source pollutant loads. It provides estimates and maps of surface water runoff volumes, pollutant loads, pollutant concentrations, and total sediment loads; helps users identify areas that might benefit from changes to proposed development strategies; processes digital elevation data quickly; and provides a means to analyze "what if" land use change scenarios.

The “what if” tool may be useful in projecting success of various planned adaptation strategies.

e. Sea Level Affecting Marshes Model (SLAMM)

http://www.csc.noaa.gov/digitalcoast/tools/slamm

The Sea Level Affecting Marshes Model (SLAMM) simulates the dominant processes involved in wetland conversions and shoreline modifications during long term sea level rise. Distributions of wetlands are predicted under conditions of accelerated sea level rise, and results are summarized in tabular and graphical form. A complex decision tree is used to represent transfers among coastal classes. Most required data for the model are readily available (NOA tidal data, Fish & Wildlife Service National Wetland Inventory data, and USGS DEM data), making the tool easy to use.

The tool allows the user to address various wetland scenarios, including inundation, erosion, overwash, saturation, and salinity; compute relative sea level change for time sequences of five to 25 years; incorporate areas protected by dikes and other hard structures; incorporate sedimentation and accretion rates; and incorporate standard coastal wetland classes. The tool outputs require GIS software to be viewed and subjected to additional analysis.

C. Climate.gov

http://www.climate.gov/

NOAA’s climate.gov provides science and information for a general audience. The goal is to provide information that can help people make decisions on how to manage climate-related risks and opportunities.

The website seeks to provide timely and authoritative scientific data and information about climate. The broad goals are to promote public understanding of climate science and climate-related events; to make NOAA data products and services easy to access and use; to provide climate-related support to multiple sectors; and to provide decision makers with tools and resources that help them answer specific questions.

Each of the tabs in NOAA Climate.gov is designed to serve a different audience:

News & Features (http://www.climate.gov/news-features) is a popular-style magazine for the public covering topics in climate science, adaptation, and mitigation. It could be useful to provide this as a resource to the public in your state to support their understanding of your efforts to incorporate climate adaptation in to the fish and wildlife planning.

Maps & Data (http://www.climate.gov/data) is a gateway to climate maps and data for research and analysis.

Teaching Climate (http://www.climate.gov/teaching) offers learning activities and curriculum materials, multi-media resources, and professional development opportunities for formal and informal educators who want to incorporate climate science into their work.

Supporting Decisions (http://www.climate.gov/decision-support) is a clearinghouse of reports, resources, and decision-support tools for planners and policy leaders who want authoritative climate science information to help them understand and manage climate-related risks and opportunities. The reports focus on immediate climate rather than projected future climate and climate change

V. U.S. Environmental Protection Agency (EPA)

http://www.epa.gov/climatechange/

The U.S. Environmental Protection Agency (EPA) focuses on collecting data on emissions and developing policy to reduce those emissions. EPA collects various types of greenhouse gas emissions data. This data helps policy makers, businesses, and the Agency track greenhouse gas emissions trends and identify opportunities for reducing emissions and increasing efficiency. EPA offers a few climate change resources.

1. Regional Vulnerability Assessments (ReVA)

http://www.epa.gov/reva/

The Regional Vulnerability Assessment (ReVA) program conducted research on innovative approaches to the evaluation and integration of large and complex datasets and models to assess current conditions and likely outcomes of environmental decisions, including alternative futures.

The ReVA goals were to assess the overall condition of a region; assess the relative environmental condition given all variables or a subset; determine the current, most pressing environmental risks for a region; determine what and where the greatest risks would be in the future; and to determine the strategic planning or restoration priorities for a region. The broader goal was to identify ecosystems within a region that are most vulnerable to being lost or harmed in the next five to 25 years and to determine which stressors are likely to pose the greatest risks.

An example of the ReVA products is the Environmental Decision Support Toolkit for the Mid- Atlantic. This is a web-based environmental decision toolkit that allows decision makers to evaluate potential changes to ecosystems in response to various management decisions, under various future development scenarios out to the year 2020. The toolkit is now being used by states and EPA Region 3 to develop integrated management decisions. http://www.epa.gov/reva/vulnerability.html

2. Healthy Watershed Initiative

http://water.epa.gov/polwaste/nps/watershed/index.cfm

The Healthy Watersheds Initiative augments the watershed restoration approach with proactive, holistic aquatic ecosystem conservation and protection. The Healthy Watersheds Initiative includes both assessment and management approaches that encourage states, local governments, watershed organizations, and others to take a strategic, systems approach to conserve healthy components of watersheds, and, therefore, avoid additional water quality impairments in the future. This tool can be used in assessing the use of green infrastructure.

3. Climate Ready Estuaries Program

http://water.epa.gov/type/oceb/cre/index.cfm

The Climate Ready Estuaries program works with the National Estuary Programs and the coastal management community to assess climate change vulnerabilities, to develop and implement adaptation strategies, and to engage and educate stakeholders.

The Climate Ready Estuaries website offers information on climate change impacts to different estuary regions, access to tools and resources to monitor changes, and information to help managers develop adaptation plans for estuaries and coastal communities.