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*A white paper of the
Association of Fish &
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Resource Guide to NGO Climate Adaptation Resources and Tools for State Fish & Wildlife Agencies



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Introduction

Many observed changes in the global climate are already impacting the natural resources managed by state fish and wildlife agencies. These impacts are expected to increase with accelerating changes in the climate system, putting fish and wildlife at risk. Action is needed now to reduce these impacts and help sustain the natural resources for which we are responsible. 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.

Natural Resource Conservation Non-governmental Organizations (NGOs) and universities are leading the way on climate adaptation planning and data management. Many NGOs have climate change and climate adaptation as the leading issue that they are addressing. This has led to a vast and growing system of resources that state fish and wildlife managers can and should be able to utilize in conservation planning, including in the revision of State Wildlife Action Plans. The Association of Fish and Wildlife Agencies (AFWA) has cited the need for greater understanding of the freely available resources to which state fish and wildlife agency managers can refer for climate adaptation assistance. The goal of this document is to provide that understanding and to encourage state fish and wildlife managers to fully engage with NGOs on climate adaptation work on the state level. State fish and wildlife managers can succeed in integrating climate adaptation in to their work by utilizing readily available resources and identifying NGOs with which to partner on climate adaptation.

This document is not intended to be an exhaustive list of climate adaptation resources. The climate adaptation field is growing very rapidly and it can be overwhelming to get started. The intent is to encourage state fish and wildlife agencies to consider climate change by highlighting the accessible and highly relevant resources that many state agencies are already using for climate adaptation planning.

The resources are organized in a generalized framework for stepping through a planning process. It starts with resources that provide free access to data for download and visualization. These resources can help establish what the likely impacts of climate change will be in your state. The next section lists resources for completing vulnerability assessments. The results of a vulnerability assessment will indicate the features of a habitat or the characteristics of a species that make it vulnerable or resistant to climate change impacts. This is followed by adaptation frameworks and planning resources. These offer guidance on the steps an agency can take in integrating climate change in to conservation planning. The final section features digital adaptation networks. These are forums for collaboration and communication on climate adaptation. Most of the networks are cross-sectoral and offer opportunities to discuss climate change issues with other individuals and organizations who are dealing with similar issues. They also act as repositories for examples of climate adaptation in action.

The resources suggested throughout this document can be combined with information from state climatologists, state-wide climate adaptation plans, and resources produced by federal agencies* to

* For a review of resources provided by federal agencies, see AFWA's "Resource Guide to Federal Adaptation Programs"

support efforts to understand and respond to the anticipated impacts of climate change on fish and wildlife.

Useful Terms

The terms SRES and RCPs are used throughout this report to describe scenarios that are used in climate projection.

Special Report: Emission Scenarios (SRES)

These emission scenarios were used as a basis for the climate projections shown in the IPCC Assessment Reports in 2001 and 2007. There are forty different scenarios that are organized in to four scenario families informed by future scenarios: A1- Rapid, globalized economic growth; A2- Rapid, regionally oriented economic development; B1- Global, environmental sustainability development; and B2- Local, environmental sustainability development.

Representative Concentration Pathways (RCPs)

These are the most recent emissions projections and are used in the Fifth Assessment IPCC report (2013-2014). RCP Scenarios include time series of emissions and concentrations of the full suite of greenhouse gases and aerosols and chemically active gases, as well as land use/land cover.

RCP2.6 is a pathway where emissions peak before 2100 and then decline.

RCP4.5 and RCP6.0 are two intermediate stabilization pathways in which emissions are stabilized at two possible levels after 2100.

RCP8.5 is a high emissions pathway for which radiative forcing reaches the highest levels by 2100 and continues to rise for some amount of time thereafter.

Data Portals

These websites compile data resources that may be useful for work in climate adaptation planning. This includes spatial datasets, climate projection datasets, repositories for conservation plans, and modeled impacts on species' ranges. These tools allow managers to explore a range of possible future climates and encourage the development of management actions that can help fish and wildlife remain resilient to uncertain futures.

Downscaled and Derived Climate Projections

Downscaled climate projections have an increased spatial resolution from coarse-scale global climate models. This allows for climate projections to be considered at a scale more relevant to managers. Derived climate projections take temperature and precipitation projections from global climate models to calculate derivative climate indicators such as the number of days that exceed certain thresholds, the quantity of snowfall, and many others.

Climate Wizard

<http://www.climatewizard.org/>

Climate Wizard, hosted by the Nature Conservancy, provides access to leading climate change information and allows for visualization of the impacts anywhere on Earth, with an emphasis on the United States. It allows the user to choose a state or country and see both the change in average climate that has occurred to date and the climate change that is projected to occur using a user-defined global climate model and emissions scenario as well as an option for a composite of all scenarios.

Climate Wizard Custom allows for the submission of a shapefile for analysis of a custom region. The downscaled data for a chosen area on multiple temperature and precipitation variables are available for download. Users can easily view and download maps of the projected changes as well as raw change data for a range of climate variables.

Central-Eastern North American Landscape Conservation Cooperatives (LCCs) Interactive Climate Change Mapping Website

http://ccr.aos.wisc.edu/resources/data_scripts/LCC/

This website from the Nelson Center for Climatic Research at University of Wisconsin-Madison shows plots of future projected trends in climate over central-eastern North America using downscaled data. The data cover more than thirty states and follow the boundaries of these 10 LCCs: North Atlantic, Plains & Prairie Potholes, Great Plains, Eastern Tallgrass Prairie, Big Rivers, Gulf Coastal Plains & Ozarks, Appalachians, South Atlantic, Peninsular Florida, Upper Midwest & Great Lakes, and Gulf Coast Prairie. The climate data were produced using nine global climate models and three future emission scenarios (SRES). The coarse climate projections were downscaled to a 0.1° latitude x 0.1° longitude grid over the ten LCCs.

The outputs show projections of change in 25 different derived variables. These are calculated as the difference in the mean of the variable as compared to 1961-2000, for two future times (1980-2055, 1980-2090). A few of these derived variables include: temperature, precipitation, maximum

temperature, growing season length, date of first fall freeze, growing degree days, freezing degree days, days above 100°F per year, snowfall, snow depth, and many more. The website also provide a graph for each LCC in the region that displays the mean and variability in projected temperature and precipitation. This gives users a sense of the variability in the projections. Seeing this variability allows users to consider a range of possible futures. Subsets of the data can be downloaded for a small region from the USGS Downscaled Climate Geo Data Portal (<http://cida.usgs.gov/climate/gdp/>).

ClimaScope Emissions Scenario Explorer

<http://climascope.tyndall.ac.uk/Map/Details?mapid=39946&overlayid=0>

ClimaScope is a downscaled climate data viewer that provides maps and data on projected climate changes. The maps display projections over a range of future emission scenarios (SRES and RCP) and global climate models. Available data include terrestrial temperature change (maximum, minimum, and average), sea-surface temperature, total precipitation, wet-day frequency, vapor pressure and cloud cover. This data can be visualized or downloaded as both observed climate and/or projected climate for various time periods.

The World Bank Climate Change Portal – Downscaled Data

http://sdwebx.worldbank.org/climateportal/index.cfm?page=country_historical_climate&ThisRegion=North%20America&ThisCCCode=USA

The World Bank created the Climate Change Knowledge Portal (CCKP) with support from the Global Facility for Disaster Reduction and Recovery and others. The Portal provides an online resource for access to comprehensive global, regional, and country climate change and development data. The CCKP consists of data visualized on a Google™ Maps interface. Monthly mean historical rainfall and temperature data can be mapped to show the observed climate and seasonality by month, for specific years, and for rainfall and temperature. Data are available on observed climate, projected climate, and downscaled projected climate. It also features a tool for comparison between climate projections and historical variability. In addition to climate, you can explore the future impacts of various scenarios for agricultural changes, natural hazards, and water management.

WorldClim

<http://www.worldclim.org/>

WorldClim is a set of downloadable global climate layers with a spatial resolution of about 1 square kilometer. The data can be used for mapping and spatial modeling in a GIS or other computer programs. The available data include climate projections from global climate models for four emissions scenarios (RCP). The variables produced are monthly minimum and maximum temperature, precipitation, and bioclimatic variables. The bioclimatic variables can represent annual trends (mean annual temperature, annual precipitation), seasonality (annual range in temperature and precipitation), and extreme or limiting environmental factors (temperature of the coldest and warmest month, and precipitation of the wet and dry quarters).

Northeast Climate Data

<http://www.northeastclimateimpacts.org/>

The Northeast Climate Impacts Assessment (NECIA) was a collaboration between the Union of Concerned Scientists and a team of independent experts. They developed an assessment of climate change impacts in the northeastern United States. It was launched in 2005 and published its last report in 2008. This web-based database provides registered users with free access to most of the climate data generated for the project, including projected changes in temperature, precipitation, relative humidity, and snow cover that can be expected in the Northeast under high and low emission scenarios (SRES).

Resources for Data Compilation and Analysis

Data Basin

<http://databasin.org/>

Data Basin is a science-based mapping and analysis platform that supports learning, research, and sustainable environmental stewardship. It was created for uploading, using, and visualizing conservation-related spatial data. It is a repository of data that connects users with spatial datasets, resources, and expertise. The database is searchable and allows individuals and organizations to download datasets as well as upload their own data. The website gives access to the spatial data as shapefiles and maps, non-technical resources, and collaborative networks.

The Gulf Coastal Plains and Ozarks LCC is making use of this website as a repository for its Conservation Planning Atlas data at: <http://gcpolcc.databasin.org/>.

The Conservation Registry

<http://www.conservationregistry.org/>

The Conservation Registry is a free online database that tracks and maps conservation, restoration and wildlife projects across the United States. Defenders of Wildlife initiated the Conservation Registry in 2008 to facilitate informed decision-making, inspire collaboration, and provide context and effectiveness for conservation work.

The Conservation Registry is a landscape-scale conservation tool, built on an open source, Google™ Maps platform. The Registry brings together data from groups ranging from small organizations and individual landowners to state and federal agencies. Anyone can create a conservation projects in the Registry, but an organizational portal provides a user with their own customized platform for tracking progress towards implementation of a conservation plan.

Federal, state and local agencies, policy-makers, forest industry, conservation organizations, foundations, land trusts and landowners are among the Registry's partners. Larger agencies and organizations can share and access data across boundaries that ordinarily keep disciplines, agencies and organizations apart. The Registry has a dedicated page for climate change projects.

Climate Central's Surging Seas

<http://sealevel.climatecentral.org/>

This online resource is based on a Climate Central study that makes mid-range projections of 1 to 8 inches of Sea Level Rise (SLR) by 2030, and 4 to 19 inches by 2050, depending upon location across the contiguous 48 states. The map-based pages of this website show threats from SLR and storm surge. Users can use a sliding scale bar to select water levels from 1-10 feet above current local high tide. This action updates the map to show how much land would be below water level at the selected level of Sea Level Rise. These best estimates of land under different water levels are based on the National Elevation Dataset from USGS. The estimates give an idea of how SLR will change the shape of the coast.

LandScope America

<http://www.landscape.org/>

LandScope America is an online resource from NatureServe and National Geographic for the land-protection community and the public. It brings together maps, data, photos, and stories about America's natural places and open spaces with the goal of informing and inspiring conservation. Every state has a page, as well as some cross state areas, such as the Delaware River, where partners can share information. There are currently more than 140 organizations participating, including five pilot state projects from: Colorado Natural Heritage Program, Florida Natural Areas Program, Virginia Division of Natural Heritage, Washington Natural Heritage Program, and a collaboration between the Maine Natural Areas Program and the Main Department of Inland Fisheries and Wildlife. Land trusts in these five pilot states have collaborated with LandScope to provide stories, photos, and insights about their work, much of which relates to climate adaptation.

Wisconsin Initiative on Climate Change Impacts (WICCI)

<http://www.wicci.wisc.edu/>

WICCI was formed in the fall of 2007 by the Wisconsin Department of Natural Resources and the University of Wisconsin Nelson Institute for Environmental Studies. The mission is to generate and share information that can limit vulnerability to climate change in Wisconsin and the Upper Midwest. WICCI engages citizens; private and public decision-makers; and scientists from Wisconsin and the region in a collaborative network to: (1) develop scientific understanding of climate impacts; (2) identify vulnerability to climate change and climatic variability; and (3) enable better planning, investment, and other adaptation activities.

The Coastal Resilience Network

<http://www.coastalresilience.org/>

The Coastal Resilience network is sponsored by The Nature Conservancy with multiple partners. It supports a community of practitioners around the world who are planning for coastal hazard and adaptation issues. The network provides access to peer practitioners, tools, information and training focused on nature-based solutions in a consistent and cost effective manner. The goal is to help integrate sea level rise and coastal hazards into decision-making. There are specific local projections of

sea level rise and storm surge inundation, spatial data on the natural and socio-economic resources that are vulnerable, and regulatory options for adapting to these changes. By managing natural resources and land use with future shoreline conditions in mind, users can enhance the resilience of human and natural communities simultaneously.

The most unique part of this website is the Coastal Resilience web mapping framework (<http://maps.coastalresilience.org/network/>). This tool offers highly detailed maps of the entire Coastal United States with optional layers on social and economic factors, habitats, coastal hazards, coastal exposure, TNC and UNESCO ecoregions, and multiple others from NOAA and USGS. In addition to the available map layers, the map viewer allows for scenario planning using current and future flooding and inundation maps and future habitats. Users can also choose to focus on specific areas where extra information is available. These areas are New York and Connecticut, the Florida Keys, New Jersey, Ventura County, CA, and the Puget Sound, WA.

WaterWorld

<http://www.policysupport.org/waterworld>

WaterWorld is an online system built by Kings College of London that provides water resources policy support for local to national scale water resources, water security, and hydrological ecosystem services. All of the necessary input data are already on the website and the analysis occurs online, so no downloading is necessary. The user simply provides a location and selects a future scenario (global climate model and emission scenario). The output is a hydrological baseline at a spatial resolution of 1 km². The tool can then examine the impact of scenarios for climate change, land use change, or land and water management on these baseline water resources. Fish and wildlife managers can use this to explore potential changes to hydrological networks.

Resources for Exploring Future Climate Impacts on Species

The Wallace Initiative

<http://wallaceinitiative.org>

The Wallace Initiative is a global-scale modelling effort to identify the potential impacts of climate change on biodiversity. It has examined the potential impacts of climate change on ~50,000 plants and animals (birds, mammals, reptiles, and amphibians). Some small, range-restricted species may not have data available, but the list of species is very comprehensive. The tool can be used to display the location of currently suitable climates (“climate space”) for individual species and to display projected changes in each species’ climate space based on four timelines, seven global climate models, and six future emission scenarios (SRES). In addition to displaying projections for the climate space of individual species, users can display the climate space of entire suites of taxonomically related species (i.e. all Cervidae).

Projected changes in climate space have been used to calculate (1) the percent of climate space lost (or gained) by a species, (2) the number of species gaining or losing certain amounts of space, and (3) spatial variation in loss of species richness. The data is displayed graphically as an overlay on Google™ Maps as well as being available for download from the site. The display can also show global climate model projections across 19 climate variables in addition to current biodiversity densities for the 50,000 species.

*Note that this tool bases future projected ranges on climate variables alone. Results from this tool can be combined with other information such as a species' dispersal ability as well as current habitat quality and availability to determine potential range shifts.

***PRBO's Modeling Bird Distribution Responses to Climate Change:
A mapping resource to assist land managers and scientists in California***
<http://data.prbo.org/cadc2/index.php?page=climate-change-distribution>

This interactive mapping resource from Point Blue Conservation Science, the Avian Knowledge Network, and the California Avian Data Center provides projections of avian species' ranges and future vegetation ranges within California under various emissions scenarios (SRES). It also allows the user to visualize projected climate (multiple temperature and precipitation related variables) impacts within California.

The tool uses climate models and multi-source bird data to predict current and future species distributions for California terrestrial breeding bird species. Currently, there are nearly 200 species available for viewing. These species represent seven major habitat types found within California including riparian, oak woodland, scrub, conifer, grassland, wetlands, and desert habitat types.

Resources for Vulnerability Assessments

Climate Change vulnerability assessments identify which species or systems are likely to be most strongly affected by projected climatic changes and why these resources are likely to be vulnerable. Vulnerability to climate change has three principle components: sensitivity, exposure, and adaptive capacity. A strong vulnerability assessment considers interactions between climate shifts and existing stressors. Vulnerability Assessments are a critical step in undertaking any climate change planning process.

Scanning the Conservation Horizon: A Guide to Climate Change Vulnerability Assessment

<http://www.nwf.org/~media/PDFs/Global-Warming/Climate-Smart-Conservation/NWFScanningtheConservationHorizonFINAL92311.ashx>

Scanning the Conservation Horizon is a guide for natural resource managers developed by the National Wildlife Federation with multiple partners. It was created to help assess climate change impacts on species and ecosystems and ways to safeguard them. It is designed to assist fish and wildlife managers and conservation and resource professionals to better plan, execute, and interpret climate change vulnerability assessments. The guide is linked to a very successful training program through the National Conservation Training Center

(<http://training.fws.gov/NCTCWeb/catalog/CourseDetail.aspx?CourseCodeLong=FWS-ALC3184>).

NatureServe's Climate Change Vulnerability Index

<https://connect.natureserve.org/science/climate-change/ccvi>

The Vulnerability Index allows for the identification of plant and animal species that are particularly vulnerable to the effects of climate change. By applying readily available information about a species' natural history, distribution, and landscape circumstances users can predict whether the species will likely suffer a range contraction, population reduction, or both due to climate change. In order to avoid replication, you can search for species for which vulnerability assessments have already been completed. This vulnerability assessment resource has been utilized by many states already. An example from Florida can be found here: *Integrating Climate Change Vulnerability into Adaption Planning* www.defenders.org/climatechange/flwildlife

NatureServe's Habitat Climate Change Vulnerability Index

<https://connect.natureserve.org/publications/hccvi>

NatureServe worked with federal, state, and NGO partners in the United States and Mexico to conduct climate change vulnerability assessments of major upland and aquatic community types from the Mojave and Sonoran deserts. This project served as the pilot for a new Habitat Climate Change Vulnerability Index (HCCVI), serving as a habitat-based companion to the Climate Change Vulnerability Index for species.

Assessments addressed climate change sensitivity and ecosystem resilience. Then, in a workshop setting, field specialists refined the assessments, clarified thinking on climate change scenarios and stressors, and documented potential strategies along a continuum from immediate “no regrets” actions to “anticipated” or “wait and watch” actions to monitor. By focusing on major natural community types, pragmatic strategies were identified for application across multiple managed lands.

NEAFWA Habitat Vulnerability Assessment Model

http://static.rcngrants.org/sites/default/files/final_reports/RCN%202009-01%20Final%20Report%20-%20NEreport%20%20THE%20MODEL.pdf

In a project extending from Maine to the Virginias, the Northeastern Association of Fish and Wildlife Agencies (NEAFWA), the Manomet Center for Conservation Sciences, and the National Wildlife Federation collaborated with other major northeastern stakeholders on a three-year effort to evaluate the vulnerabilities of the Northeast’s key habitats and species. The vulnerability assessment model was built utilizing an expert panel-based approach. Three final reports on the process and results were completed and are available for download at: <http://rcngrants.org/content/assessing-likely-impacts-climate-change-northeastern-fish-and-wildlife-habitats-and-species>. The NEAFWA Habitat Vulnerability Assessment Model is now being used by 6 states to complete state-wide vulnerability assessments.

Defenders of Wildlife’s “Wildlife Vulnerability to Climate Change”

http://www.defenders.org/publications/wildlife_vulnerability_to_climate_change.pdf

This document offers a brief but comprehensive summary of vulnerability assessments. Defenders of Wildlife has many additional resources for building capacity on their climate change issue page (<http://www.defenders.org/climate-change/climate-change-101>).

Pacific Northwest Climate Change Vulnerability Assessment and Climate Sensitivity Database

<http://www.climatevulnerability.org/>

<http://climatechangesensitivity.org/>

The University of Washington and partners conducted an assessment of the sensitivity of the species and ecological systems of the Pacific Northwest to climate change. The assessment covers an area that extends beyond the borders of Washington, Oregon, and Idaho and involves scientists, natural resource managers, and conservation planners. The outputs of the assessment are a Sensitivity Database, Case Studies, Habitat Suitability Modelling, and Species Population Modelling.

The sensitivity database summarizes the inherent climate-change sensitivities for species and habitats of concern throughout the Pacific Northwest and provides resource managers and decision makers with some of the most basic and most important information about how species and systems will likely respond to climate change. Each species report includes the natural history and physiological information that was entered and the scores for sensitivity under each of those parameters. The sensitivity data includes an overall sensitivity score and the scores for sensitivity based on each factor (physiology, life history, habitat, etc.). This provides information not only on how vulnerable that species is, but also which characteristics result in that vulnerability.

Adaptation Frameworks and Planning Resources

The resources listed below provide processes, resources, and guides for the development of useful climate change adaptation strategies and plans.

NWF's Climate-Smart Conservation Guide

http://www.nwf.org/pdf/Climate-Smart-Conservation/Climate-Smart_Consevation_Quick_Guide.pdf

Climate-Smart Conservation is the intentional and deliberative consideration of climate change in natural resource management, realized through forward-looking goals and linking actions to key climate impacts and vulnerabilities. The National Wildlife Federation built this introduction to designing and carrying out conservation in the face of a rapidly changing climate. The themes of the report are: (1) Act with intentionality, (2) Manage for change, not just persistence, (3) Reconsider goals, not just actions, and (4) Integrate adaptation in to existing work.

The Climate Smart Conservation Guide has been translated in to a three-day course (<http://nctc.fws.gov/NCTCWeb/catalog/CourseDetail.aspx?CourseCodeLong=FWS-ALC3195>) during which participants can engage in the process of the Climate Smart Conservation Cycle. The Climate-Smart Conservation Cycle, described in the Guide, depicts how the various parts of the adaptation process fit together. This cycle purposefully mirrors many existing conservation planning approaches, but is designed with climate change considerations in mind.

NWF offers a large variety of other adaptation reports with specific focus on coastal or riparian areas and a few with specific geographic focuses at: <http://www.nwf.org/What-We-Do/Energy-and-Climate/Climate-Smart-Conservation/Adaptation-Reports.aspx>

Adaptation for Conservation Targets (ACT) Framework

<http://kresge.org/sites/default/files/Climate-Change-Adaptation.pdf>

http://www.cakex.org/sites/default/files/CC%20adaptation%20framework%204-pager_9-23-10.pdf

ACT is a participatory framework designed by The Climate Change and Wildlife Conservation working group. The framework is for collaborative application in a given landscape by a multidisciplinary group of natural resource managers, conservation practitioners, scientists, and local stakeholders. It uses available scientific data on climate change and prompts analysis of multiple future scenarios of change to identify adaptation actions that will be useful regardless of uncertainties in predictions. It is based on the premise that effective adaptation of management to climate change can rely on local knowledge of an ecosystem and does not necessarily require detailed projections of climate change or its effects.

Scenario planning for climate change adaptation: A Guidance for Resource Managers

http://www.prbo.org/refs/files/12263_Moore2013.pdf

This document gives a step-by-step guide to using scenarios to plan for climate change adaptation. It is focused on the approach developed by the National Park Service Climate Change Response Program in collaboration with the Global Business Network. It provides specific details about how to carry out each

part of the process. The process allows users to take future possible climate change impacts and other important uncertainties into account in a collaborative, inclusive process.

Yale Framework: Integrating Climate Adaptation and Landscape Conservation Planning

<http://yale.databasin.org/>

The Yale Framework is a product from the Yale School of Forestry & Environmental Studies. A group of the nation's leading conservation biologists, modelers, and policymakers developed guidance for integrating climate-change adaptation strategies into the context of natural-resource planning and policymaking.

The Yale Framework provides assistance to conservation planners in selecting the assessment and modeling strategies that are most relevant to their specific needs. It provides simplified and flexible advice on models and data, and presents a list of commonly used datasets that can be helpful to planners. The Framework also provides a structured menu of options that assist resource managers in determining the best possible approach to conservation, as opposed to offering a prescriptive approach to natural resource management. The Framework is hosted by DataBasin.

EcoAdapt's Climate Adaptation Starter Kit

<http://ecoadapt.org/programs/awareness-to-action/climate-starter-kit/>

EcoAdapt's Climate Adaptation Starter Kit includes a list of resources and adaptation examples to help start the adaptation process. It is designed for any sector, so many of the resources might not be useful to fish and wildlife managers. But, natural resource managers should explore the section on "Getting Started" which provides some advice on where to begin, working with what you already have, and avoiding maladaptation (<http://ecoadapt.org/programs/awareness-to-action/climate-starter-kit/getting-started>). The Starter Kit also includes case studies of what they call "Adaptation Two-fers" which are strategies that include mitigation and adaptation action that can be mutually beneficial.

Awareness to Action (A2A) Program

<http://ecoadapt.org/programs/awareness-to-action>

This program, from EcoAdapt, is a series of interactive climate adaptation workshops to bring those engaged in the early stages of climate change adaptation from awareness to implementation. It is a program tailored uniquely for the community in which it is working and trains people from organizations and agencies how to develop and implement solutions to the challenges of climate change in their work. The program is based on the concept that adaptation needs to be incorporated into all aspects of existing programs and projects.

The program features EcoAdapt's Climate Savvy 10-Step Method (<http://ecoadapt.org/programs/awareness-to-action/climate-savvy-quick-course/10-steps>) that is designed to help participants to methodically think through what you want to do, why you want to do it, and how you can do it in a way that maximizes your likelihood of success in a changing world.

Considering Multiple Futures: Scenario Planning to Address Uncertainty in Natural Resource Conservation, USFWS report for the National LCC Network.

In press.

This guide presents a broad synthesis of scenario planning approaches. The guide has three major sections. The first introduces basic scenario planning concepts and phases in the process, discusses issues of uncertainty, outlines the range of scenario planning approaches, and develops the case for applying scenario planning to incorporate uncertainty into decisions. The next section breaks down scenario planning into a series of steps to assist the design of a process to address a specified problem. In the final section, examples drawn from 14 case studies from across the United States illustrate the diversity of approaches that have been tailored to fit a variety of needs.

ClimateWise

<http://www.geosinstitute.org/climatewiseservices.html/>

ClimateWise is a grant-funded planning service from the Geos Institute that helps community's prepare for and minimize impacts of climate change in all sectors. It includes climate change projections, a series of focused workshops, and vulnerability assessments. It offers a science-based process that emphasizes the local community's unique situation and needs, and integrates social, economic, and environmental issues in to developing local solutions to the threat of climate change. The process takes a non-political, risk assessment approach to planning for future conditions. Services are available to those that may not otherwise have the resources to take a proactive approach to climate change planning. Interested partners must submit a request for a ClimateWise project to occur in their region.

Adaptation Networks

These websites offer digital communities of practice, training, and resource repositories for working on climate adaptation. Some of these networks are multi-sectoral and others are more focused on natural resource management.

Climate Adaptation Knowledge Exchange (CAKE)

<http://cakex.org/>

CAKE is a website that was developed by Island Press and EcoAdapt with the intent to build an innovative community of practice around climate adaptation across sectors. It attempts to: (1) vet and clearly organize the best information available, (2) build a community via its interactive online platform, (3) create a directory of practitioners to share knowledge and strategies, and (4) identify and explain data, resources, and information available from other sites. The website consists principally of four components: a repository of case studies, a virtual library, a directory of members, and links to climate adaptation resources. Registered users can upload their own content to be shared as case studies. Another important feature of the website is that it houses forums for the discussion of current issues in climate adaptation.

Collaboratory for Adaptation to Climate Change

<https://adapt.nd.edu/>

This website is a resource for research, education, and collaboration in the areas of adaptation and climate change. It is funded by the National Science Foundation and the University of Notre Dame. The intent is for users to share information needs, ideas, resources, and experiences in climate change adaptation through facilitated interactions among researchers and decision makers. It includes an online medium that features simulations and visualizations of future scenarios and expert opinion. The website is also building an information clearinghouse of legal data and regulatory information about adaptation to climate change.

The Climate Impacts Group (CIG)

<http://cses.washington.edu/cig/>

The Climate Impacts Group is a part of the College of the Environment at the University of Washington and is an interdisciplinary research group studying the impacts of natural climate variability and global climate change. Research at the CIG considers climate impacts at spatial scales ranging from local communities to the entire western U.S. region, with most work focused on the Pacific Northwest. Through research and interaction with stakeholders, they work to increase community and ecosystem resilience to fluctuations in climate.

The Group performs fundamental research on climate and climate impacts and works with planners and policy makers to apply this information to regional decision making processes. Key areas of the group's collective expertise include downscaling global climate model data; regional climate modeling; hydrologic modeling; water resources and terrestrial/aquatic ecosystem modeling and impacts

assessment; coastal impacts assessment; climate change vulnerability assessment and adaptation planning; and outreach and education. There are many other resources to explore on the website.

Southeast Climate Consortium

<http://www.seclimate.org/>

The goal of the Southeast Climate Consortium is to develop a climate information and decision support system for the Southeast that will contribute to an improved quality of life, increased profitability, decreased economic risks, and more ecologically sustainable management of agriculture, forestry, and water resources. One major product of this Consortium is a book entitled Climate of the Southeast

United States: Variability, Change, Impacts, and Vulnerability (<http://www.seclimate.org/pdfpubs/2013/island%20Press/Climate%20of%20the%20Southeast%20United%20States.pdf>). The book is a comprehensive review of the latest scientific findings on the climate of the Southeast and how it affects people and natural ecosystems of the region.

Georgetown Climate Center's Adaptation Clearinghouse

<http://www.georgetownclimate.org/adaptation/clearinghouse>

The Georgetown Climate Center is working with the Coastal States Organization and the American Association of State Highway and Transportation Officials on this network for climate adaptation. The Clearinghouse is a great way to find white papers on topics you need, planning and assessment resources, organizations working on climate adaptation in your area, case studies, and reports on many other adaptation activities that may be relevant to you. Users can find resources using the search, mapping, and browsing features. The Georgetown Climate Center has many other resources for climate adaptation that spans all sectors. This can be a good place to go when you are beginning to familiarize yourself with climate change and climate adaptation.

Ecosystem Based Management Resources Network (EBM)

<http://ebmresourcesdatabase.org/>

The Coastal-Marine Ecosystem-Based Management Resources Network is an online hub for resources and projects for innovative interdisciplinary coastal-marine spatial planning and ecosystem-based management. It is compiled by an alliance of resource users, providers, and researchers to help find, share, and contribute to decision support for interdisciplinary management. It is organized into five areas: tools, projects, resources, organizations, and practitioners. Many of these resources are geared toward improving the decision making process.

Climate Central

<http://www.climatecentral.org/>

Climate Central is an independent organization of leading scientists and journalists researching and reporting the facts about our changing climate and its impact on the American public. Climate Central surveys and conducts scientific research on climate change and informs the public of key findings via its websites. The Climate Central scientists publish on climate science, energy, sea level rise, wildfires,

drought, and related topics. The website provides links to research, media, and social science research on climate change science.

The National Adaptation Forum

<http://nationaladaptationforum.org/>

The National Adaptation Forum is a biannual conference, the first was in 2013 and the next will be May 12-14, 2015. The Forum features formal trainings, facilitated practitioner presentations, and informal exchanges of information. The goals of the Forum are to provide a professional development opportunity for the adaptation inclined, (1) to contribute to the development of a community of practice around climate change adaptation, (2) to create a venue for practitioners to share information, progress and strategy together, (3) building capacity of the community as a whole and the individual, and (4) supporting on the ground implementation by providing managers and regional experts with a venue to exchange knowledge of and resources for incorporating climate change into their work.

American Society of Adaptation Professionals (ASAP)

<http://adaptationprofessionals.org/>

The American Society of Adaptation Professionals (ASAP) brings together the leading professionals from a variety of sectors who are working to increase climate resilience across the United States. Joining this free association offers an opportunity to connect and collaborate with others working on climate change adaptation throughout the country. ASAP offers monthly webinars on cross-sectoral climate adaptation issues and a monthly newsletter with climate adaptation news.

weAdapt

<http://weadapt.org/>

This website offers an international online open platform on climate change adaptation issues. It includes innovative resources for knowledge integration to show who is doing what on climate change adaptation. The website is focused on adaptation efforts internationally but state fish and wildlife managers could use it to peruse case studies of ongoing climate adaptation activities.