



PEW CENTER  
ON  
Global CLIMATE  
CHANGE

# Climate Change Adaptation: What Federal Agencies Are Doing

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# A Report by the Pew Center on Global Climate Change

## About the Pew Center

The Pew Center on Global Climate Change is a non-profit, non-partisan, and independent organization established by the Pew Charitable Trusts to bring a new cooperative approach and critical scientific, economic, and technological expertise to the global climate change debate. We inform this debate through wide-ranging analyses that add new facts and perspectives in four areas: policy (domestic and international), economics, environment, and solutions.

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# Climate Change Adaptation

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## What Federal Agencies Are Doing

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# Introduction

There is a growing consensus that regardless of our efforts to reduce greenhouse gas emissions, significant climate change is unavoidable. Although climate mitigation remains critical, we must also be thinking about and planning for ways to limit the adverse impacts from unavoidable changes in our climate. By taking steps now to adapt to climate change, we will be better able to limit future damages and their associated costs.

In March 2010, the Pew Center released the report, *Adapting to Climate Change: A Call for Federal Leadership*.<sup>1</sup> The Pew Center's report was developed with the understanding that while many efforts to adapt to climate change will occur at the state and local level, the federal government is a critical player in an effective and coordinated approach to climate change adaptation in the United States. In this report, the authors called for a National Adaptation Program and recommended new institutional mechanisms and roles for federal agencies to mainstream the consideration of climate change across agency operations, programs, and services. Also released this year was the National Academies' report, *Adapting to the Impacts of Climate Change*, which emphasized that the federal government should not only serve as a "role model", but also play a significant role as a "catalyst and coordinator" in identifying vulnerabilities to climate change impacts and the adaptation options that could increase our resilience to these changes.<sup>2</sup>

Federal agencies are stepping forward to meet this challenge and are beginning to "mainstream" consideration of climate change adaptation across their programs and policies. Some agencies are also taking a leadership role in enabling others—state, local and tribal governments, businesses, and communities—in their adaptation planning and projects. These federal actions are still diffuse and as such, this report attempts to capture and highlight these efforts to facilitate communication and collaboration across federal agencies as well as with numerous non-federal stakeholders focused on domestic adaptation policy. Not all federal projects addressing climate change impacts or adaptations are included in this report. However, where a federal department or agency has implemented institutional mechanisms specifically for climate change adaptation, developed an agency-wide adaptation plan or set of policies, or provides adaptation resources or tools, it is our intent to represent it within this report. The authors are continuously working to expand on the information included here, and sincerely hope this report will serve as a resource for collaboration and information sharing among the growing adaptation community.

The report content is organized by major Department within the Federal government (e.g., the Department of Agriculture, Department of Commerce, etc.) with the exception of the adaptation efforts led by the Executive Office of the President and related interagency initiatives, which are listed separately at the beginning of the report. For each Department, the report highlights specific adaptation initiatives (such as a program office or strategic plan) that are in place at the Department level. These are followed by an overview of each agency or bureau within that Department and relevant adaptation activities, which are typically divided into: (1) initiatives and strategies, (2) programs and institutional mechanisms, and (3) tools and resources. The Figure on the following page provides some examples of mainstreaming activities within the Departments that are included in this report.

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<sup>1</sup> For more information on the Pew Center's report and to download a free copy, visit <http://www.pewclimate.org/publications/report/adapting-to-climate-change-call-for-federal-leadership>

<sup>2</sup> For more information on the adaptation report of America's Climate Choices, see <http://americasclimatechoices.org/paneladaptation.shtml>

## Examples of Mainstreaming Activities at Selected Federal Agencies



### Department of Agriculture (USDA)

- USDA Climate Change Program Office coordinates climate-related activities
- U.S. Forest Service Roadmap for Responding to Climate Change and Performance Scorecard



### Department of Commerce (DOC)

- DOC Strategic Plan 2007-2012 has a focus on climate services
- DOC Energy and Climate Working group facilitates integration of climate-related activities



### Department of Defense (DoD)

- DOD Quadrennial Defense Review includes climate change impacts
- DOD Readiness and Training Policy and Programs Office explores climate change adaptation



### Department of Energy (DOE)

- DOE Office of Climate Change Policy and Technology is a focal point for collaboration on clean energy and adaptation
- DOE Office of Fossil Energy is assessing the impacts of climate change on DOE facilities



### Department of Health and Human Services (HHS)

- CDC Climate Change and Public Health Program helps to develop climate change preparedness across CDC's workforce, partners and research, and health departments



### Department of Homeland Security (DHS)

- DHS Climate Change Adaptation Task Force is examining climate change implications for missions and operations
- FEMA is developing a Risk MAP to provide data, increase awareness, and reduce risk to life and property



### Department of Housing and Urban Development (HUD)

- HUD Partnership for Sustainable Communities is improving planning efforts, land use, and zoning
- Long-term Disaster Recovery Working Group (w/DHS) is helping communities protect against effects of climate change



### Department of the Interior (DOI)

- DOI Secretarial Order to develop an integrated strategy to respond to the impacts of climate change
- DOI Landscape Conservation Cooperatives support integrated adaptation efforts across landscapes



### Department of Transportation (DOT)

- Center for Climate Change and Environmental Forecasting (CCCEF) is focal point for climate change
- CCCEF Strategic Plan includes actions to prepare for the impacts of climate change



### Environmental Protection Agency (EPA)

- National Water Program Strategy identifies water impacts and goals and objectives to respond to these impacts
- Global Change Impacts & Adaptation Program assesses impacts of climate change on human health and environment

# Executive Office of the President and Interagency Initiatives

## Interagency Climate Change Adaptation Task Force

In the spring of 2009, the White House Council on Environmental Quality (CEQ), the Office of Science and Technology Policy (OSTP), and the National Oceanic and Atmospheric Administration (NOAA) initiated the Interagency Climate Change Adaptation Task Force (ICCATF), which includes representatives from more than 20 Federal Agencies.<sup>3</sup> When the President signed the Executive Order on Federal Leadership in Environmental, Energy, and Economic Performance on October 5, 2009, he called on the ICCATF to develop, within one year, recommendations on how the policies and practices of Federal agencies can be made compatible with and reinforce a national climate change adaptation strategy. The Task Force formed multiple workgroups to consider the capabilities of the Federal Government to respond to the impacts of climate change on select sectors, institutions, and agency responsibilities, and conducted numerous listening sessions and public outreach events with a wide range of stakeholders. The ICCATF released an Interim Progress Report in March 2010.<sup>4</sup> In October 2010, the Task Force released its report to the President on the Task Force's recommendations to advance a national approach to adaptation.<sup>5</sup>

## Executive Order 13514 - Federal Leadership In Environmental, Energy, and Economic Performance

On October 5, 2009, President Obama signed the Federal Leadership in Environmental, Energy, and Economic Performance Executive Order (EO) requiring each federal agency to develop, implement, and annually update an integrated Strategic Sustainability Performance Plan. Each plan is to include an evaluation of federal agency climate change risks and vulnerabilities to manage the effects of climate change on the agency's operations and mission in both the short and long term. The EO also requires agencies to actively participate in the interagency Climate Change Adaptation Task Force and "develop approaches through which the policies and practices of the agencies can be made compatible with and reinforce that strategy."<sup>6</sup>

## Council on Environmental Quality

### Overview

The Council on Environmental Quality (CEQ) was established by Congress in the Executive Office of the President by the National Environmental Policy Act (NEPA) of 1969 to provide oversight to federal agency activities affecting the environment, including agency implementation of the environmental impact assessment process.

### Selected Initiatives and Strategies

In addition to co-chairing the Interagency Climate Change Adaptation Task Force, CEQ is engaged in a number of initiatives related to climate change adaptation including the following:

**NEPA Guidance (Feb 2010).** In February 2010, CEQ issued draft guidance revisions regarding the applicability of the statute and regulations to greenhouse gas (GHG) emissions and climate change impacts. In the guidance CEQ proposes to advise Federal agencies that they should: 1) consider opportunities to reduce GHG emissions caused by proposed and alternative actions, and 2)

<sup>3</sup> For more information on the Task Force, see <http://www.whitehouse.gov/administration/eop/ceq/initiatives/adaptation>

<sup>4</sup> To read the Task Force's Interim Report, visit <http://www.whitehouse.gov/sites/default/files/microsites/ceq/20100315-interagency-adaptation-progress-report.pdf>

<sup>5</sup> To read the Task Force's report to the President, visit <http://www.whitehouse.gov/sites/default/files/microsites/ceq/Interagency-Climate-Change-Adaptation-Progress-Report.pdf>

<sup>6</sup> To read the Executive Order, visit [http://www.whitehouse.gov/the\\_press\\_office/President-Obama-signs-an-Executive-Order-Focused-on-Federal-Leadership-in-Environmental-Energy-and-Economic-Performance](http://www.whitehouse.gov/the_press_office/President-Obama-signs-an-Executive-Order-Focused-on-Federal-Leadership-in-Environmental-Energy-and-Economic-Performance)

consider the effects of climate change impacts to their proposed actions, “including the relationship to proposal design, environmental impacts, mitigation and adaptation measures.” The draft guidance excludes federal land and resource management actions.<sup>7</sup>

**Interagency Oceans Policy Task Force (June 2009).** Established by the President in June 2009, and chaired by CEQ, the Interagency Oceans Policy Task Force (OPTF) was charged with developing a national policy that “ensures the protection, maintenance, and restoration of the health of ocean, coastal, and Great Lakes ecosystems and resources, enhances the sustainability of ocean and coastal economies, preserves our maritime heritage, provides for adaptive management to enhance our understanding of and capacity to respond to climate change, and is coordinated with our national security and foreign policy interests.” The OPTF was also charged with developing a national framework for policy coordination with other levels of government involved (state, local, etc.) and developing an implementation strategy.<sup>8</sup> On July 19, 2010, President Obama signed an Executive Order establishing a National Policy for the Stewardship of the Ocean, Coasts, and Great Lakes (National Policy) and a National Ocean Council (NOC) to strengthen ocean governance and coordination.<sup>9</sup> This Executive Order adopts the *Final Recommendations of the Interagency Ocean Policy Task Force* and directs Federal agencies to take the appropriate steps to implement them. One of the nine national priority objectives outlined in the *Final Recommendations* is “resiliency and adaptation to climate change and ocean acidification.”

**Revised Principles and Guidelines for Water and Related Resources Implementation Studies.** In December 2009, CEQ released proposed revisions to the Economic and Environmental Principles and Guidelines for Water and Related Land Use Projects used by the Army Corp of Engineers, Bureau of Reclamation, USDA’s Natural Resources Conservation Services and the Tennessee Valley Authority in the “formulation, evaluation and implementation of water resource projects.” Proposed revisions include such items as expanding coverage to all federal agencies that undertake water resource projects, allowing consideration of non-monetary benefits in the calculation of net benefits for project justification, and consideration of non-structural approaches to reduce flooding impacts. NAS is expected to complete its review by November 2010.<sup>10</sup>

## **Office of Science and Technology Policy**

### **Overview**

The Office of Science and Technology Policy (OSTP) was established to “advise the President and others within the Executive Office of the President on the effects of science and technology on domestic and international affairs.” OSTP oversees the National Science and Technology Council (NSTC) and its Committees and Subcommittees, which are the primary mechanism for interagency coordination on science and technology policy issues.

### **Selected Initiatives and Strategies**

In addition to co-chairing the Interagency Climate Change Adaptation Task Force, OSTP is engaged in a number of initiatives related to climate change adaptation through the NSTC.

**U.S. Global Change Research Program.** OSTP provides oversight for the U.S. Global Change Research Program (USGCRP), consisting of 13 federal agencies, to prioritize and provide climate change research, and to conduct climate impact assessments every four years. The program is governed by the NSTC’s Subcommittee on Global Change Research and its activities on adaptation are described in more detail below.

<sup>7</sup> For more information on the Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas (GHG) Emissions, see <http://www.whitehouse.gov/sites/default/files/microsites/ceq/20100218-nepa-consideration-effects-ghg-draft-guidance.pdf>

<sup>8</sup> For more information on the Oceans Task Force, see [http://www.whitehouse.gov/sites/default/files/page/files/2009ocean\\_mem\\_rel.pdf](http://www.whitehouse.gov/sites/default/files/page/files/2009ocean_mem_rel.pdf)

<sup>9</sup> For more information on the Ocean Task Force’s recommendations, visit [http://www.whitehouse.gov/files/documents/OPTF\\_FinalRecs.pdf](http://www.whitehouse.gov/files/documents/OPTF_FinalRecs.pdf)

<sup>10</sup> See “Proposed National Objectives, Principles, and Standards for Water and Related Resources Implementation Studies” at <http://www.whitehouse.gov/sites/default/files/microsites/091203-ceq-revised-principles-guidelines-water-resources.pdf>



**Interagency Climate Services Coordination.** OSTP is working with NOAA and other federal agencies to define a process for improved coordination and collaboration on climate services across the federal government. This process would most likely be established under the Committee on Environment and Natural Resources, which is in the process of being re-chartered as the Committee on Environment, Natural Resources, and Sustainability.

## United States Global Change Research Program

### Overview

The Global Change Research Act (GCRA) of 1990 established the interagency U.S. Global Change Research Program (USGCRP) “to understand, assess, predict, and respond to human-induced and natural processes of global change.”

### Selected Initiatives and Strategies

**Interagency Coordination.** Under the USGCRP, federal research is coordinated among the 13 participating federal agencies with a focus on understanding and modeling the physical science of climate, as well as the impacts of climate change on human and natural systems. The program is undergoing a strategic realignment that will maintain its traditional strengths in observations, modeling, and basic research, but will also increase its capabilities in support of adaptation and climate services. As part of this realignment, a new leadership structure has been put in place that includes a new Vice-Chair for Adaptation who will shepherd this process. As part of its function, the USGCRP has taken on the work of the Science workgroup of the Adaptation Task Force, which focused on translating science for adaptation decision making.<sup>11</sup>

**Interagency Cross-Cutting Group on Climate Change and Human Health.** This group was chartered under the USGCRP in December 2009, as a pilot effort to improve research for decision making. The group is co-chaired by NIEHS, EPA, and OSTP, and it focuses in large part on adaptation and assessments. This group was called upon to work as the Health workgroup for the Adaptation Task Force and provided inputs and recommendations for the Task Force’s report to the President. It will spearhead any additional health-related adaptation activities that follow from that report.

**National Assessment.** Also required by the GCRA is a full National Assessment of the impacts of global change in the United States every four years. The First National Assessment (2000) identified key vulnerabilities of United States regions and sectors to climate change and variability in the 21<sup>st</sup> century.<sup>12</sup> The USGCRP is currently conducting a Strategic Planning process for the next National Assessment, which is scheduled to be completed in January 2013.<sup>13</sup>

### Tools and Resources

**Global Change Website.** The site contains general information about and links to USGCRP publications such as the latest regional and sectoral impact assessments, and reports on extreme weather and abrupt climate change. Other recent news and events are also maintained on this site.<sup>14</sup>

**Synthesis and Assessment Products.** Between 2001 and 2008, 21 reports known as Synthesis and Assessment Products (SAPs) were completed under what was called the U.S. Climate Change Science Program (CCSP). Of these 21 reports, the following were related to climate change adaptation:

- SAP 4.1 - Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region (Jan 2009) – Lead Agency: EPA.<sup>15</sup>
- SAP 4.2 – Thresholds of Climate Change in Ecosystems (Jan 2009) – Lead Agency: USGS.<sup>16</sup>

<sup>11</sup> For more information on the agencies involved and their work, visit <http://www.globalchange.gov/agencies>

<sup>12</sup> For more information on the first National Assessment, see <http://www.globalchange.gov/publications/reports/scientific-assessments/first-national-assessment>

<sup>13</sup> For more information on the current National Assessment process, visit <http://www.globalchange.gov/what-we-do/assessment/nca-overview>

<sup>14</sup> <http://www.globalchange.gov>

<sup>15</sup> <http://www.climatechange.gov/Library/sap/sap4-1/default.php>

- SAP 4.3 - The Effects of Climate Change on Agriculture, Land Resources, Water Resources and Biodiversity (May 2008) - Lead Agency: USDA.<sup>17</sup>
- SAP 4.4 – Preliminary Review of Adaptation Options for Climate-Sensitive Ecosystems and Resources (June 2008) – Lead Agency: EPA.<sup>18</sup>
- SAP 4.5 – Effects of Climate Change on Energy Production and Use in the United States (Oct 2007) – Lead Agency: DOE.<sup>19</sup>
- SAP 4.6 - Analyses of the Effects of Global Change on Human Health and Welfare and Human Systems (July 2008) – Lead Author: EPA.<sup>20</sup>
- SAP 4.7 – Impacts of Climate Variability and Change on Transportation Systems and Infrastructure (Mar 2008) – Lead Agency: DOT.<sup>21</sup>

**Global Climate Change Impacts in the United States (June 2009).** The latest impact assessment report from the USGCRP summarizes the most up-to-date research on current and projected impacts to the United States. In order to facilitate use by decision makers, the report is organized into separate sections by U.S. regions as well as by sectors such as agriculture, health and water.<sup>22</sup>

### **National Climate Adaptation Summit**

The National Adaptation Summit brought together a community of users and providers of climate adaptation information from diverse climatological regions and economic sectors to provide insights into what is needed for effective climate adaptation and vulnerability assessments in the United States and to provide input into federal adaptation planning, policy and research programs. Convened by the University Corporation for Atmospheric Research (UCAR), and largely funded by USGCRP, the Summit took place in May 2010 and was co-chaired by Jack Fellows (UCAR), Rosina Bierbaum (University of Michigan), and Shere Abbott (OSTP). Using the best available information about projected climate change and impacts, participants were asked to examine the needs, knowledge, and roles that must be addressed at all levels of government and in the private sector, in both the near-term and long-term, to enable climate adaptation and vulnerability assessments.<sup>23</sup> A report based on the summit recommends that decision-makers at all levels of government develop and coordinate climate change adaptation measures.<sup>24</sup>

<sup>16</sup> <http://www.globalchange.gov/publications/reports/scientific-assessments/saps/sap4-2>

<sup>17</sup> <http://www.globalchange.gov/publications/reports/scientific-assessments/saps/sap4-3>

<sup>18</sup> <http://www.globalchange.gov/publications/reports/scientific-assessments/saps/sap4-4>

<sup>19</sup> <http://www.climatescience.gov/Library/sap/sap4-5/default.php>

<sup>20</sup> <http://www.climatescience.gov/Library/sap/sap4-6/default.php>

<sup>21</sup> <http://www.climatescience.gov/Library/sap/sap4-7/default.php>

<sup>22</sup> To read the report, visit <http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts>

<sup>23</sup> To read the synthesis report of the summit or to view video and presentations from the event, visit <http://www.ioss.ucar.edu/events/2010/ncas/index.html>

<sup>24</sup> To read the adaptation summit report, visit [http://www.ioss.ucar.edu/events/2010/ncas/ncas\\_report.pdf](http://www.ioss.ucar.edu/events/2010/ncas/ncas_report.pdf)

# United States Department of Agriculture (USDA)

## Department-wide Initiatives

**USDA Strategic Plan for 2010-2015.** The USDA strategic plan includes a number of goals related to climate change. For example, the Plan sets a departmental goal to “Ensure our national forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing our water resources.”<sup>25</sup>

**Climate Change Program Office.** The Climate Change Program Office (CCPO) operates within the Office of the Chief Economist and functions as the Department-wide coordinator of agriculture, rural and forestry-related global change programs and policy issues facing USDA. The Office ensures that USDA is a source of objective, analytical assessments of the effects of climate change and proposed response strategies. The Office also serves as USDA's focal point for climate change issues and is 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. Adaptation-focused efforts include coordinating inquiries specific to the economic impacts of climate change and potential costs of adaptation; serving as the lead agency in the production of Synthesis and Assessment Product 4.3, *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity*; and collaborations with CEQ, DOE, EPA and others on policy and practice issues related to adaptation in the agriculture and forestry sectors.<sup>26</sup>

## Animal and Plant Health Inspection Service

### Overview

The USDA Animal and Plant Health Inspection Service (APHIS) regulates trade consistent with rules of the World Trade Organization and United Nations Food and Agriculture Organization, and requires that commodities be free of quarantine pests. Disease organisms are central to effective trade policy adaptation, including the ability of the United States to export crops, animals, and animal products. Animal diseases have a direct link to human health, and are expected to show early, and in some cases, marked response to climate shifts. Recent examples include Avian Flu, West Nile Virus, Swine Flu, and Bovine Spongiform Encephalopathy.

### Selected Initiatives and Strategies

**Climate Change Research and Regulatory Initiative (April 2010).** An APHIS-wide review identified 94 issues/concerns on how climate change would impact the APHIS mission of safe-guarding U.S. agriculture and natural resources. These issues now form the basis for a plan to address key needs as pests respond to shifts in climate.

**APHIS-NCSU Five-Year Proposal - System to Integrate Climate Change Scenarios into Response Programs for Invasive Plant Pests (June 2010).** The goal of this work is to incorporate climate change models into plant pest forecasting systems and response programs for invasive plant pests in the United States; it focuses on wheat diseases, but tools developed will be applied to other invasive species.

**International Research Program on Pest Response to Climate Change (July 2010).** APHIS has engaged major trading partners (Canada, Australia, and New Zealand) in a cooperative exchange of data and research on pest response to climate change.

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<sup>25</sup> To read the strategic plan, visit <http://www.ocfo.usda.gov/usdasp/sp2010/sp2010.pdf>

<sup>26</sup> For more information on the CCPO, visit [http://www.usda.gov/oce/climate\\_change/index.htm](http://www.usda.gov/oce/climate_change/index.htm)

## **Agricultural Research Service**

### **Overview**

The Agricultural Research Service (ARS) is the principal in-house research agency of the USDA. ARS has approximately 1,200 research projects working at over 100 locations across the country. ARS conducts research to develop and transfer solutions to agricultural problems of high national priority through 22 National Programs in 4 areas: Nutrition Food Safety and Quality, Animal Production and Protection, Natural Resources and Sustainable Agriculture Systems, Crop Production and Protection.<sup>27</sup> ARS conducts climate change adaptation research to 1) understand the impact of climate change on agricultural systems including crops, animal systems, ecosystem services, and soil, water and air resources; 2) develop genetic resources for crop and animal varieties for increased production quantity and quality under changing climate conditions; 3) develop sustainable production systems to maintain, and where possible improve, soil, water and air quality; 4) develop risk management tools for countering climate-driven threats from pathogens, insects, weeds and invasive species; and 5) improve the efficiency of water management and use.

### **Selected Initiatives and Strategies**

**ARS Strategic Plan.** The ARS Strategic Plan for 2006–2011 includes climate change as a major factor in the Service’s goals and objectives throughout the Plan, and adaptation is mentioned.<sup>28</sup> Specifically, Objective 6.2: Improve Soil and Air Quality to Enhance Crop Production and Environmental Quality which calls for the Service to: “Measure and predict the impact of atmospheric composition and climate variation on agricultural systems, and develop technologies to enable agricultural systems to adapt to change.” Additional objectives and goals in the Plan, while not mentioning adaptation, are consistent with adaptation goals, such as water conservation strategies, to support both water quantity and quality for agricultural purposes.

### **Programs and Institutional Mechanisms**

**Networked Research Facilities.** ARS maintains a network of research facilities that provide a wide-range of scientific programs to improve risk assessment, pest/disease detection and eradication. Examples include the Center on Epidemiology and Animal Health (Fort Collins, CO), the National Veterinary Services Laboratories and Center for Veterinary Biologics (Ames, IA), the Center for Plant Health Science and Technology (Raleigh, NC), and several National Pest Identification Centers.

**National Program 212: Climate Change, Soils, and Emissions.** The mission of this program is to improve the quality of atmosphere and soil resources affected by, and having an effect on, agriculture, and to understand the effects of, and prepare agriculture for, adaptation to climate change.<sup>29</sup>

**Pest Detection Surveys and Collaborative Efforts.** Cooperative Agricultural Pest Surveys (CAPS), Emergency and Domestic Programs (EDP), and Interceptions Beyond Ports (IBP) enhance preparedness to chance pest introductions through domestic detection surveys; these programs will be a critical mechanism to ensure early detection of new pests as they respond to shifts in climate. Offshore Pest Information System (OPIS) works collaboratively with International Services to provide early warning of new pest outbreaks in other countries that pose a threat to U.S. agriculture, including those responding to climate changes. APHIS works cooperatively with DHS Customs and Border Protection on inspection of commodities in international trade; it maintains PestID, an archive of intercepted quarantine pests used widely as a source of updated information on origins of and commodities of infested products.

**Plant Protection and Quarantine.** This program within APHIS has incorporated climate change forecasts into the "climatic suitability" portion of fruit and vegetable pest risk evaluations. ‘Suitability’ now includes climate change scenarios; development of international guidelines is underway to supplement existing standards to accommodate climate change scenarios.

<sup>27</sup> <http://www.ars.usda.gov/main/main.htm>

<sup>28</sup> To read the Strategic Plan, see: <http://www.ars.usda.gov/SP2UserFiles/Place/00000000/ARSstrategicPlan2006-2011.pdf>

<sup>29</sup> A map of projects by state is available at [http://www.ars.usda.gov/research/programs/programs.htm?NP\\_CODE=212](http://www.ars.usda.gov/research/programs/programs.htm?NP_CODE=212)

## Tools and Resources

**Exotic Pest Information Collection and Analysis (EPICA).** This effort uses open-source data mining for early detection of vectors and diseases (e.g., new virus on tomatoes).

**Plant Pest Forecasting system (NAPPFASST).** The APHIS - NCSU system uses a web-based graphical user interface that links global to national climatic and geographic databases with interactive templates for biological modeling. NAPPFASST has been used to develop high resolution global risk maps for 2010 to 2090 derived from the IPCC SRB1 and SRAB1 scenarios.<sup>30</sup>

## Farm Services Agency

### Overview

The Farm Services Agency (FSA) provides market-oriented programs dedicated to developing economically and environmentally sound American agriculture; delivering an abundant, safe, and affordable food and fiber supply; and sustaining quality agricultural communities. FSA manages the Nation's largest private lands conservation program.

### Selected Initiatives and Strategies

**Conservation Reserve Enhancement Program Partnerships.** Since 2005, FSA has negotiated four Conservation Reserve Enhancement Program (CREP) agreements whose main objective is conserving agricultural irrigation water. The agreements with the governors of Kansas, Colorado, Idaho, and Nebraska, respectively, would remove a total of 255,000 acres from irrigated crop production. Incentives from state and local water use authorities to pay to retire the water from agricultural irrigation in three states for the duration of the CREP contract and permanently in the other.

### Programs and Institutional Mechanisms

**State and county FSA office and county FSA committees.** FSA administers voluntary programs impacting agricultural land through nearly 2,350 county offices supported by 50 state offices and headquarters. Local county offices perform many administrative duties, including determining land and producer eligibility for programs, maintaining records, and providing the opportunity for face-to-face interaction with agricultural producers as they consider program participation. Farmer-elected county committees are charged with making certain program decisions, such as changing harvest dates to reflect changes in the growing season, and fairly and equitably resolving local issues.

## Forest Service

### Overview

The Forest Service is responsible for the health, diversity and productivity of publicly managed forests and grasslands within 193 million acres across the United States. It also partners with states, tribes and private landowners to support an additional 430 million acres of privately owned lands.

### Selected Initiatives and Strategies

**Roadmap for Responding to Climate Change (July 2010).** In order to guide the Forest Service in achieving its goal of making the nation's national forests and private working lands more resilient to climate change, the agency developed a Roadmap that will integrate land management, science, outreach, and sustainable operations.<sup>31</sup> The focus will be on three types of initiatives: (1) assessing current risks, vulnerabilities, policies, and gaps in knowledge; (2) engaging partners in seeking solutions and learning from as well as educating the public and employees on climate change issues; and (3) managing for resilience, in ecosystems as well as in

<sup>30</sup> To access the NAPPFASST interface, visit <http://www.nappfast.org>

<sup>31</sup> To read the Roadmap, visit <http://www.fs.fed.us/climatechange/pdf/roadmap.pdf>

human communities, through adaptation, mitigation, and sustainable consumption strategies. The Forest Service has also developed a Performance Scorecard to measure its progress in moving toward these goals. The scorecard will address agency capacity, partnerships, adaptation, and mitigation. It includes development of capacity to incorporate climate change adaptation into the Forest Service operations.

**A new vision for the U.S. Forest Service (August 2009).** In August 2009 Secretary Vilsack outlined a new vision for the Forest Service based on restoration to combat the threats of fire, drought, pests, and disease.<sup>32</sup> Through ecological restoration, the key functions and processes of healthy ecosystems are repaired to make them better adapted to the stresses exacerbated by climate change. This vision includes an “all lands” approach that does not stop at the boundary of a national forest or grassland, but calls for the integration of forest restoration efforts across property boundaries. The Forest Service and other USDA agencies will continue to expand efforts to work with partners to sustain the entire matrix of federal, state, tribal, county, municipal, and private forests and grasslands.

**Forest Service Global Change Research Strategy (2009).** In 2009, Forest Service Research and Development released its 2009-2019 Global Change Research Strategy. The fundamental research focus of the Strategy is to increase understanding of forest, woodland, and grassland ecosystems so that they can be managed in a way that sustains and provides ecosystem services for future generations. The Strategy balances research across a range of management, science, and science delivery actions aimed at developing adaptation and mitigation approaches to sustain healthy ecosystems. The Strategy focuses on four elements: research to enhance ecosystem sustainability (adaptation); research to increase carbon sequestration (mitigation); research to provide decision support; and shared research needs for infrastructure, scientific collaboration, and science delivery.<sup>33</sup>

**Climate Change Strategic Framework (2008).** In 2008, the Forest Service produced “A Strategic Framework for Responding to Climate Change” which is the basis for its subsequent climate change Roadmap, Scorecard, and agency initiatives. Given impacts to forests and grasslands such as increased wildfires, pest infestations, drought, water supply issues and sea-level rise, the Framework calls for the consideration of climate change across agency planning and actions. Additionally, the Framework calls for facilitated adaptation measures to help forests and grasslands adapt to environmental stresses and to help maintain ecosystem services. Major adaptation components of the Framework include Ecological Restoration and Research and Development.<sup>34</sup>

## Programs and Institutional Mechanisms

**Climate Change Advisor’s Office.** The Climate Change Advisor was appointed by the Chief to lead Forest Service efforts to manage forests and watersheds in the face of climate change, represent the agency in climate change matters with partners, and coordinate climate change activities and communication within the agency. The Climate Change Advisor’s Office is working to bring climate change knowledge into agency planning and actions, and improve the agency’s response to climate change through existing national programs and not to create a separate program. The Climate Change Advisor’s Office oversees the development and implementation of the National Roadmap and Scorecard. *Engaging a Climate Ready Agency* is an internal newsletter published by the Office monthly.<sup>35</sup>

**Research Stations.** U.S. Forest Service Research Stations provide national coverage for regional research, scientific information and tools that can be used by managers and policymakers to address climate change impacts to forests and rangelands. Research on the possible impacts of climate change on forests in the United States and the development of adaptation strategies has been carried out at the U.S. Forest Service for the last 20 years. Since then, assessments of climate change, its impacts and subsequent consequences to natural resource management have been the focus of continuous research efforts. Considerable effort is being put

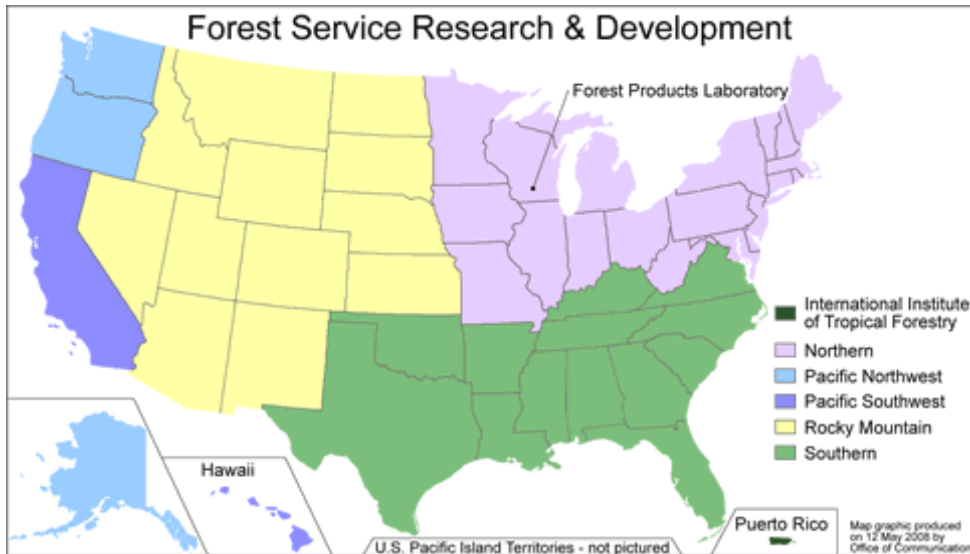
<sup>32</sup> For more on the announcement by the Secretary, see: <http://www.usda.gov/wps/portal/usda/usdahome?contentidonly=true&contentid=2009/08/0382.xml>

<sup>33</sup> To read the Strategy, visit: <http://www.fs.fed.us/climatechange/documents/global-change-strategy.pdf>

<sup>34</sup> To read the Framework, visit: <http://www.fs.fed.us/climatechange/documents/strategic-framework-climate-change-1-0.pdf>

<sup>35</sup> To read the first newsletter, see <http://www.fs.fed.us/climatechange/updates/cc-news-july7.pdf>

into understanding how vegetation, water, and wildlife are expected to respond to a changing climate so that adaptive management strategies can be developed. Forest Service Research also contributes to the research goals of the U.S. Climate Change Science Program.



Source: U.S. Forest Service, <http://www.fs.fed.us/research/climate/>

**Environmental Threat Assessment Centers.** Two centers were created to predict, detect, and assess existing and potential environmental threats to forests across the United States and to develop and share information and tools to support policy and management decisions: the Western Wildlands Environmental Threat Assessment Center (WWETAC) and the Eastern Forest Environmental Threat Assessment Center (EFETAC).<sup>36</sup>

**The Northern Institute of Applied Climate Science (NIACS).** NIACS is a collaborative effort among the U.S. Forest Service Northern Research Station, U.S. Forest Service Eastern Region, U.S. Forest Service Northeastern Area State and Private Forestry, universities, and the forest industry to provide ecological, economic and social information that can be used to facilitate the development and implementation of forest carbon management and climate adaptation. Adaptation-related projects conducted by NIACS include climate change training programs for forest managers and the development of a Climate Change Response Framework for the Chequamegon-Nicolet National Forest.<sup>37</sup>

## Tools and Resources

**Climate Change Resource Center.** A joint project of the Forest Service Research Stations and the Environmental Threat Assessment Centers, this clearinghouse was developed to provide Forest Service resource managers and decision makers with information and tools to address climate change mitigation and adaptation in planning and project implementations.<sup>38</sup> The site provides climate change science information and an overview of adaptation management options. The Tools section provides access to USFS tools such as the Forest Vegetation Simulator, Stream Temperature Modeling, Fish Xing, and the Climate Change Tree and Bird Atlases, as well as other non-agency climate projection and climate impact tools. There is also an extensive library of annotated bibliographies for publications on global climate change, climate variability, climate models, and climate effects.

<sup>36</sup> For more information, see <http://www.fs.fed.us/wwetac/wwetac.html> and <http://www.forestthreats.org/>

<sup>37</sup> For more information on Environmental Threat Assessment Centers, see <http://www.nrs.fs.fed.us/niacs/>

<sup>38</sup> <http://www.fs.fed.us/ccrc/>

**Template for Assessing Climate Change Impacts and Management Options (TACCIMO).** TACCIMO is a web-based assessment and reporting tool designed to integrate the most current climate change science with forest planning to meet the needs of a variety of users.<sup>39</sup> TACCIMO is a collaborative effort between the USDA Forest Service EFETAC researchers and Southern Region planners and resource managers. TACCIMO fits within the National Environmental Policy Act (NEPA) process and can be used in land management plan revision, environmental assessments, environmental impact statements, and reasonable alternatives.

**MAPSS Global Vegetation Model.** The MAPSS model is a landscape- to global-scale vegetation distribution model providing simulations under both stable and changing climates.<sup>40</sup> Model output from MAPSS has been used in the Intergovernmental Panel on Climate Change's (IPCC) regional and global assessments of climate change impacts on vegetation.

**Climate Change Tree Atlas.** The Tree Atlas is an online spatial database providing an assessment of the current status and potential future suitable habitat of 134 tree species in the eastern United States.<sup>41</sup> Based on U.S. Forest Service inventory data with 38 environmental variables to generate models of current suitable habitat for each species, the Atlas uses three climate models (HADCM3, PCM & GFDL) and two emission scenarios (A1FI and B1) to model potential future habitat distributions.

**Climate Change Bird Atlas.** The Bird Atlas is an online spatial database providing an assessment of the current and projected future status of 147 bird species in the eastern United States.<sup>42</sup> The Bird Atlases uses the same climate models and emission scenarios as the Climate Change Tree Atlas to model potential future habitat.

**Adapting to Climate Change – A Short Course for Land Managers.** This course is available on the web through the CCRC with video lectures, quizzes, literature citations, and more information regarding the impacts of climate change on forests and grasslands.<sup>43</sup>

## **National Institute of Food and Agriculture**

### **Overview**

The National Institute of Food and Agriculture (NIFA) is an agency within the U.S. Department of Agriculture (USDA). Congress created NIFA through the Food, Conservation, and Energy Act of 2008. NIFA replaced the former Cooperative State Research, Education, and Extension Service (CSREES), which had been in existence since 1994. NIFA's mission is to advance knowledge for agriculture, the environment, human health and well-being, and communities by supporting research, education, and extension programs in the Land-Grant University System and other partner organizations.<sup>44</sup>

NIFA-funded projects generate knowledge to develop an agriculture system that maintains high productivity in the face of climate change. This will help producers plan for and make decisions to adapt to changing environments, sustain economic vitality, and take advantage of emerging economic opportunities offered by climate change mitigation technologies. Agriculture science at NIFA integrates research, education and extension to ensure that ground breaking research discoveries go beyond the laboratory and make their way into the classroom and to people who can put the knowledge into practice and improve lives.

### **Selected Initiatives and Strategies**

**Climate Research Initiative: Earth System Modeling.** The National Science Foundation (NSF), Department of Agriculture (USDA), and Department of Energy (DOE), have agreed to align resources to create a joint research program to develop climate system models to provide insights into climate variability and impacts on ecosystems. Under NIFA, grants will be provided beginning in 2010 that are

<sup>39</sup> <http://www.forestthreats.org/tools/taccimo>

<sup>40</sup> <http://www.fs.fed.us/pnw/mdr/mapss/>

<sup>41</sup> [http://nrs.fs.fed.us/atlas/tree/tree\\_atlas.html](http://nrs.fs.fed.us/atlas/tree/tree_atlas.html)

<sup>42</sup> <http://nrs.fs.fed.us/atlas/bird/index.html>

<sup>43</sup> To access course information, see <http://www.fs.fed.us/ccrc/hjar/>

<sup>44</sup> For more information on NIFA, see <http://www.nifa.usda.gov/>



focused on developing models that can be linked to existing crop, forestry, aquaculture and livestock models to assess the adequacy of potential outcomes of risk management strategies and support reliable yield and production forecasting.

## **Natural Resources Conservation Service**

### **Overview**

The Natural Resources Conservation Service (NRCS) is a mission-oriented agency whose primary role it is to provide technical and financial assistance to help private land owners to care for their land through the application of conservation systems. NRCS provides products and services that enable people to be better stewards of the air, soil, water, and related natural resources on private agricultural lands. Climate change is an important and an overarching theme that cuts across Agency programs and activities.<sup>45</sup>

### **Selected Initiatives and Strategies**

***Climate Change Literacy and Improving Awareness.*** NRCS has designed a climate change curriculum built around a basic introductory course integrating three inherently linked topics: air quality, energy, and climate change. This basic course is online and available to the public and for credit through AgLearn, the Department of Agriculture's online training system.<sup>46</sup> The curriculum of advanced discipline-specific courses within each of the three areas of air quality, energy concerns, and climate change are also available online and new relevant courses will be added in the coming months.

### **Programs and Institutional Mechanisms**

***Conservation Programs.*** NRCS's natural resources conservation programs help people reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters. Programs such as the Environmental Improvement Programs, Conservation Stewardship Program, Water Resource Programs, and Easement Programs are working to help states and localities address the impacts that are now exacerbated by climate change.<sup>47</sup> Examples include:

*Conservation Stewardship Program (CSP)* - The program, authorized in the 2008 Farm Bill, offers payments to producers who maintain a high level of conservation on their land and who agree to adopt higher levels of stewardship. Eligible lands include cropland, pastureland, rangeland and nonindustrial forestland. The program provides many conservation benefits including improvement of water and soil quality, wildlife habitat enhancement and adoption of conservation activities that address the effects of climate change.

*Emergency Watershed Protection* - The purpose of the Emergency Watershed Protection (EWP) program is to undertake emergency measures, including the purchase of flood plain easements, for runoff retardation and soil erosion prevention to safeguard lives and property from floods, drought, and the products of erosion on any watershed whenever fire, flood or any other natural occurrence is causing or has caused a sudden impairment of the watershed.<sup>48</sup>

*Wildlife Habitat Improvement Program (WHIP)* - The Wildlife Habitat Incentive Program (WHIP) is a voluntary program for conservation-minded landowners who want to develop and improve wildlife habitat on agricultural land, nonindustrial private forest land, and Indian land. The Natural Resources Conservation Service administers WHIP to provide both technical assistance and up to 75 percent cost-share assistance to establish and improve fish and wildlife habitat.

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<sup>45</sup> For more information on the NRCS, visit <http://www.nrcs.usda.gov>

<sup>46</sup> See [http://www.extension.org/pages/NRCS\\_Online\\_Air\\_Quality\\_and\\_Energy\\_Courses](http://www.extension.org/pages/NRCS_Online_Air_Quality_and_Energy_Courses) and [http://www.aglearn.usda.gov/registration\\_directions.html](http://www.aglearn.usda.gov/registration_directions.html) for more information.

<sup>47</sup> <http://www.nrcs.usda.gov/programs/>

<sup>48</sup> <http://www.nrcs.usda.gov/programs/ewp/>

***Inventory Observations and Monitoring Networks.*** NRCS has responsibility for a number of surveys and monitoring networks all of which are integral to climate change activities: National Resources Inventory (NRI), a statistical survey of land use and natural resource conditions and trends on U.S. non-Federal lands; Web Soil Survey, soil maps and data produced by the NRCS and its National Cooperative Soil Survey for the United States; and SNOwpack TElemetry (SNOTEL). NRCS installs, operates, and maintains an extensive, automated system designed to collect snowpack and related climatic data in the Western United States and Alaska.<sup>49,50,51</sup> These products are used for forecasting and management of water supplies. The Soil Climate Analysis Network (SCAN) consists of automated remote sites which collect soil moisture and soil temperature data along with precipitation, wind, and solar radiation data. This data is used for the management and prediction of climatic issues affecting our natural resources.

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<sup>49</sup> <http://www.nrcs.usda.gov/technical/NRI/>

<sup>50</sup> <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>

<sup>51</sup> <http://www.wcc.nrcs.usda.gov/products.html>

# Department of Commerce (DOC)

## Department-wide Initiatives

**Strategic Plan 2007-2012.** The Strategic Plan identifies promotion of environmental stewardship, including advancing our nation's understanding about climate variability and change, as one of the primary strategic goals for the Department of Commerce (DOC). While the Plan does not specifically discuss the need for adaptation, an important underpinning is the translation of climate science into services, tools, and products to provide decision-makers with the information that they need to help the economy and ecosystems adapt to climate variability and change. The Plan identifies NOAA and NIST as the primary climate change organizations within DOC that contribute to the USGCRP.<sup>52</sup>

**Energy and Climate Working Group.** DOC has established an Energy and Climate Working Group that is responsible for facilitating the integration of climate-related activities across all of its bureaus, with the goal of providing the principal actors in the United States economy with environmental data and information on climate change to make informed decisions. DOC seeks to leverage the stakeholder networks and service offerings of economics-based bureaus, as well as the National Institute of Standards and Technology (NIST) resiliency programs, to amplify the provision of climate services from the National Oceanic and Atmospheric Administration (NOAA). This allows the private, public, and not-for-profit sectors to:

- Anticipate and adapt their operations to the effects of climate change
- Mitigate risks of climate change (financial, operational, reputational, and environmental)
- Set research priorities and strategies to deal with climate change
- Create new businesses, services, and products, where applicable, to meet the needs of a nation and world experiencing climate change.

**Proposed Climate Service Line Office.** In February 2010, DOC Secretary Locke and NOAA Administrator Lubchenco announced the intent to create a Climate Service within NOAA to bring together the agency's strong climate science and service delivery capabilities into a new line office. The proposed Climate Service would provide climate science, information, data, and services to industry, governments, and individuals in order to better understand, plan for, and adapt to climate change.<sup>53</sup> The climate information and services would facilitate adaptation decision making at all scales to better help communities prepare for climate change impacts, such as future heat waves, drought, forest fires, and coastal inundation, with the aid of products such as inundation maps, heat projections, climate and precipitation models, and vulnerability and risk assessments for climate-sensitive sectors and regions of the United States. In September 2010, Secretary Locke and Administrator Lubchenco announced six new Regional Climate Services Directors, whose primary role is to enhance NOAA's ability to deliver regional services. Taking input from many users, partners, and employees over the past year, as well as new information from the National Academy of Public Administration's study on establishing a National Climate Service within NOAA, DOC and NOAA are currently in the process of fine-tuning the proposal to establish the Climate Service.

The Climate Service, as proposed, will partner with DOC bureaus to provide information, products, and services to foster, serve, and promote the nation's economic development and technological advancement. Opportunities for incorporating climate information into DOC mission interests include: improving the understanding of the influence of climate on regional economic development activities, interpreting the influence of climate on the nation's changing demographics, and facilitating the growth of a green economy by meeting the climate information needs of specialized businesses and the public sector. DOC partners would include the Economic Development Agency, the Census Bureau, the International Trade Agency, and the National Institute of Standards and

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<sup>52</sup> To read the plan, visit <http://www.osec.doc.gov/bmi/budget/07strplan/DOC07strplan.pdf>

<sup>53</sup> For more information about the NOAA Climate Service, visit <http://www.noaa.gov/climate.html>

Technology. The Climate Service would also work with Departmental leadership to explore mechanisms to advance the DOC-wide goal and collaborative framework for understanding the climate needs of U.S. commercial interests and for providing reliable, high-quality products and services to address those needs.

***Memorandum of Understanding (MOU) between DOI and DOC to Coordinate and Cooperate on Climate Related Activities Involving Science, Services, Mitigation, Adaptation, Education, and Communication (August 2010).*** DOI Secretary Salazar and DOC Secretary Locke signed this MOU in August 2010. The MOU provides a framework to build upon existing partnerships that bring together the Departments' best available climate science and services to inform adaptation strategies and response decisions to manage America's oceans, coasts, Great Lakes, and public lands. This agreement will also draw on national and regional programs and partnerships of each Department, including DOI's emerging Climate Science Centers and Landscape Conservation Cooperatives and DOC/NOAA's climate science and services, Regional Integrated Sciences and Assessments program, and Regional Climate Centers.<sup>54</sup>

## **Economic Development Administration**

### **Overview**

The Economic Development Administration (EDA) was established under the Public Works and Economic Development Act of 1965 to lead the federal economic development agenda. EDA's mission is to advance the economic revitalization of communities and regions suffering from economic distress by making grant-based investments to attract private capital investment and create higher-skill, higher-wage jobs.

### **Selected Initiatives and Strategies**

***Global Climate Change Mitigation Incentive Fund (GCCMIF).*** The GCCMIF was established to strengthen the linkages between economic development and environmental quality. The mission of the GCCMIF is to finance projects that foster economic development by advancing the green economy in distressed communities. The GCCMIF supports projects that create jobs through, and increase private capital investment in, efforts to limit the nation's dependence on fossil fuels, enhance energy efficiency, curb greenhouse gas emissions, and protect natural systems (i.e. build adaptive capacity).

## **National Institute of Standards and Technology**

### **Overview**

NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life.

### **Selected Initiatives and Strategies**

***NIST-NOAA Resilient Communities.*** This collaboration addresses wildland fires, wind, storm surges, tsunamis, and earthquakes. Understanding and reducing the vulnerability of buildings and infrastructure systems to extreme events also improves adaptive capabilities for a changing climate.

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<sup>54</sup> To read the MOU, visit <http://www.noaa.gov/climate/resources/resources/doidocclimatemoufinal.pdf>

## **National Oceanic and Atmospheric Administration**

### **Overview**

The National Oceanic and Atmospheric Administration (NOAA) generates value to the nation by advancing our understanding of and ability to anticipate changes in Earth's environment, improving society's ability to make scientifically-informed decisions, and conserving and managing ocean and coastal resources. From daily weather forecasts, severe storm warnings, and climate monitoring to fisheries management, integrated coastal restoration and management, and supporting marine commerce, NOAA's products and services play an important role in protecting life and property and in conserving and restoring ecosystems.

### **Selected Initiatives and Strategies**

**NOAA Next Generation Strategic Plan (NGSP).** The draft NOAA NGSP was open for public comment through Aug. 10, 2010. The NGSP is designed to reset the course for the agency by aligning NOAA around 4 focus areas: Climate Adaptation and Mitigation, Resilient Coastal Communities and Economies, Healthy Oceans, and Weather Ready Nation; and 2 cross-cutting foundational areas: Science and Technology Enterprise, and an Engagement Enterprise focused on public education, regional services, and international collaboration. These areas demonstrate NOAA's emphasis on informing decisions, assessing vulnerabilities, and building resilience to climate change and other stressors.<sup>55</sup>

**Incorporating climate change into NOAA's stewardship responsibilities.** NOAA is working to assess the impacts of climate change on its stewardship responsibilities and to incorporate climate change into planning, prioritization, and management strategies.<sup>56</sup> NOAA's Office of Habitat Conservation (OHC) and Office of Ocean and Coastal Resource Management (OCRM) recently released a programmatic framework for considering climate change impacts in coastal habitat restoration, land acquisition, and facility-development investments. In September 2010, OCRM released a new guide to help state and territorial coastal managers develop and implement adaptation plans to reduce the risks of climate change impacts on their coasts.<sup>57</sup>

**Providing information and training on climate change for coastal and ocean decision makers.** Decision makers need access to the best-available scientific information and user-friendly tools to effectively reduce vulnerabilities of communities and ecosystems. NOAA provides foundational climate change information through observations, monitoring, research, assessment, and modeling to increase understanding of current and future impacts of climate change and variability on coastal and marine ecosystems and coastal communities. In addition, NOAA makes this information accessible through user-friendly tools, services, and training to support and inform decision-making. For example, NOAA Sea Grant extension agents, National Estuarine Research Reserve staff, and National Marine Sanctuary staff regularly interact with the public and other resource managers in coastal states to directly connect science and users.

**Working with global partners to adapt to climate impacts.** NOAA works directly with foreign governments through both bilateral and multilateral agreements on a breadth of critical issues that address climate adaptation. Of significant importance are NOAA's contributions to international observing and data stewardship and access programs, which ensure that high-quality climate information is consistently available to decision makers in the international adaptation community (e.g. Global Earth Observation System of Systems -GEOSS). NOAA supports the U.S. involvement in the development and coordination of international climate adaptation policy through initiatives such as the World Meteorological Organization's (WMO) Global Framework for Climate Services and the United Nations' Framework Convention on Climate Change (UNFCCC). NOAA also directly builds the capacity of other nations to respond to climate change by training foreign scientists, meteorologists, and stakeholders to produce, analyze, interpret, and use climate information, products, and services to manage risks and support practical decision-making (e.g. bilateral

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<sup>55</sup> To read the NGSP, visit [http://www.ppi.noaa.gov/NGSP2/NOAA\\_NGSP.pdf](http://www.ppi.noaa.gov/NGSP2/NOAA_NGSP.pdf)

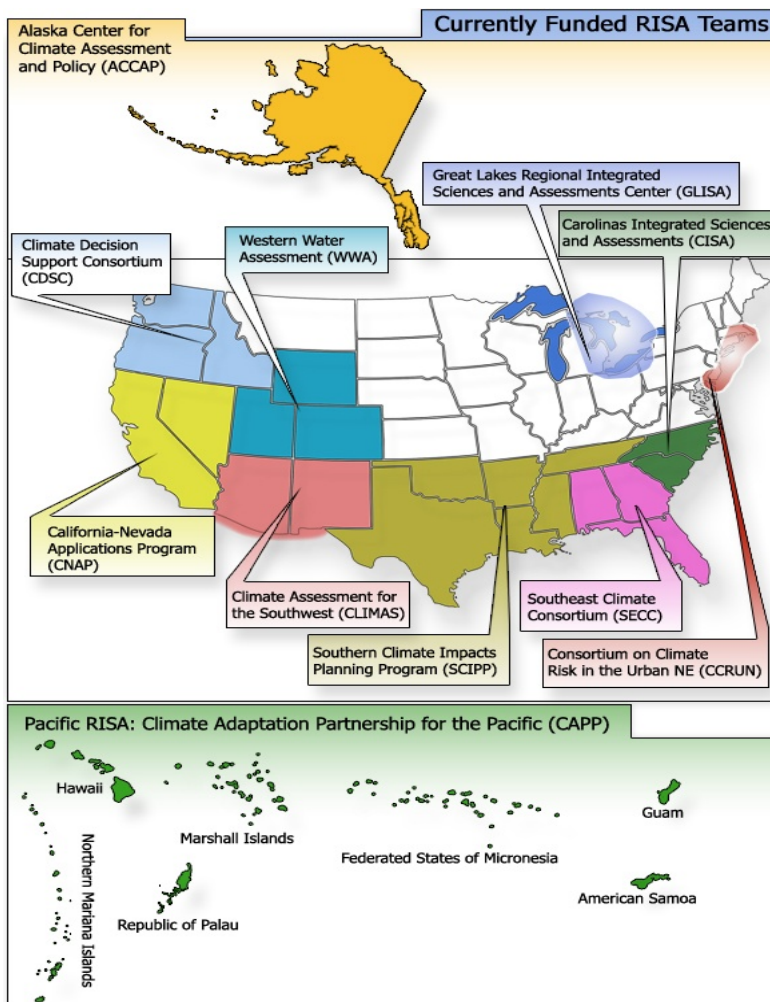
<sup>56</sup> For examples, see <http://spo.nmfs.noaa.gov/tm/spo95.pdf> and <http://spo.nmfs.noaa.gov/tm/TM%20SPO%2089.pdf>

<sup>57</sup> To read the guide, visit <http://coastalmanagement.noaa.gov/climate/adaptation.html>

agreements, NOAA's Africa Desk, and Pacific Climate Information System-PaCIS). The NOAA-funded International Research Institute for Climate and Society (IRI) is a program that connects research to applications for the purpose of climate adaptation. NOAA's technical and applied capabilities provide end-to-end support for climate adaptation and resilience planning and activities around the globe.

## Programs and Institutional Mechanisms

**Climate and Societal Interactions (CSI) Program.** CSI provides national leadership in developing interdisciplinary science, services, and assessments for application in climate-sensitive sectors and regions. The Regional Integrated Sciences and Assessments (RISA) teams are regional, university-based research groups that analyze the impacts of climate variability and change on resource management, planning, and policy decisions in key sectors.<sup>58</sup> CSI-Water and CSI-Coasts support research to understand and reduce vulnerability to climate change and inform decision-making for water and coasts. The NOAA-sponsored International Research Institute for Climate and Society (IRI) focuses on advancing climate risk management in countries around the world where vulnerabilities to a changing climate have the most immediate and lasting effect on human welfare.<sup>59</sup> Finally, the CSI-Transitions program supports projects that transition knowledge, tools, and products into operations.



Source: National Oceanic and Atmospheric Administration at [http://www.climate.noaa.gov/cpo\\_pa/risa](http://www.climate.noaa.gov/cpo_pa/risa)

<sup>58</sup> [http://www.climate.noaa.gov/cpo\\_pa/risa/](http://www.climate.noaa.gov/cpo_pa/risa/)

<sup>59</sup> <http://portal.iri.columbia.edu/portal/server.pt>

**Coastal Services Center (CSC).** CSC was created to bring information, technology and services to coastal resource managers across the United States. CSC's efforts include understanding needs and providing the data, tools, and training to make coastal information useful to end users through communication, visualization, and ongoing dialogue. To foster collaboration and interaction at all scales, CSC has a strong local-to-regional presence, based in the Southeast and including staff in the Northeast, Mid-Atlantic, Gulf of Mexico, West Coast, Great Lakes, and Hawaii.<sup>60</sup>

**National Weather Service (NWS) Climate Services.** Although NWS Climate Prediction Center (CPC) has primary operational responsibilities at short climate timescales (weeks, months, seasons) in support of the NWS preparedness and response mission, the CPC also has capabilities to provide climate information for the intermediate timescales (e.g. seasons, years, decades) at which preparedness and adaptation meet or overlap. This includes activities to link seasonal and decadal modeling and prediction (e.g. frequency and intensity of droughts and floods) and efforts to develop prediction techniques for regional climate information across timescales.<sup>61</sup>

**National Integrated Drought Information System (NIDIS).** Led by NOAA, NIDIS is an interagency effort to: integrate and foster drought coping strategies through research and education; integrate drought data and predictions; and develop pilot programs for design and implementation of drought early-warning systems.<sup>62</sup>

**Regional Climate Centers (RCCs).** Currently, there are 6 Regional Climate Centers (RCCs) managed by the National Climatic Data Center (NCDC). These centers are a federal-state cooperative effort to produce and deliver timely climate products and services to users at local, state, regional and national levels.<sup>63</sup>

## Tools and Resources

**NOAA Climate Services Portal.** The NOAA Climate Services portal is currently in its prototype phase, with the goal of becoming the "go-to" website for climate data, products, and services for all users. The portal will enhance access to climate data and services, timely articles and information, educational resources, and tools. In addition to fostering inter and intra-agency collaboration, the site is intended to better support decision-making at all scales.<sup>64</sup>

**Coastal Climate Adaptation Resources Website.** A database of adaptation resources is available by category, such as adaptation plans, case studies and vulnerability assessments, or by state. Visitors have the opportunity to share resources and dialog on these issues.<sup>65</sup>

**Digital Coast.** The Digital Coast is used to address timely coastal issues, including land use, coastal conservation, hazards, marine spatial planning, and climate change. This partnership network is not only a website, but also a strong collaboration of coastal professionals intent on addressing coastal resource management needs. Website content is provided by numerous organizations and includes data, tools, training and assistance opportunities, and success stories. Partners include: NOAA Coastal Services Center<sup>66</sup>, American Planning Association<sup>67</sup>, Association of State Floodplain Managers<sup>68</sup>, Coastal States Organization<sup>69</sup>, National Association of Counties<sup>70</sup>, National States Geographic Information Council<sup>71</sup>, and The Nature Conservancy<sup>72</sup>.

<sup>60</sup> For more information on NOAA's Coastal Services Center, see <http://www.csc.noaa.gov/>

<sup>61</sup> For more information on the Climate Prediction Center, see <http://www.cpc.noaa.gov/>

<sup>62</sup> For more information see [www.drought.gov](http://www.drought.gov)

<sup>63</sup> For more information on NOAA's Regional Climate Centers, see <http://www.ncdc.noaa.gov/oa/climate/regionalclimatecenters.html>

<sup>64</sup> To access the Climate Services portal, visit <http://www.climate.gov/#climateWatch>

<sup>65</sup> For coastal state adaptation resources, see <http://collaborate.csc.noaa.gov/climateadaptation/>

<sup>66</sup> <http://www.csc.noaa.gov/>

<sup>67</sup> <http://www.planning.org/>

<sup>68</sup> <http://www.floods.org/>

<sup>69</sup> <http://www.coastalstates.org/>

<sup>70</sup> <http://www.naco.org/Pages/default.aspx>

**Drought Portal.** NIDIS maintains a web-based U.S. Drought Portal, providing information on U.S. drought conditions, forecasts, effects of drought on local communities, and mitigation measures.<sup>73</sup>

**Legislative Atlas.** The Legislative Atlas is an online, GIS-based tool that provides users with coastal and ocean laws, policies and jurisdictions applicable to their geographic area of interest. The database can be searched by region or state, as well as by state or federal agency.<sup>74</sup>

**Sea Grant Climate Network.** This website includes informational resources, a discussion forum, links to upcoming events, and social networking opportunities for the broader Sea Grant community, including extension agents.<sup>75</sup>

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<sup>71</sup> <http://www.nsgic.org/>

<sup>72</sup> <http://www.nature.org/>

<sup>73</sup> To access the NIDIS Drought Portal, visit [www.drought.gov](http://www.drought.gov)

<sup>74</sup> To access the Legislative Atlas, see <http://www.csc.noaa.gov/digitalcoast/tools/legatlas/>

<sup>75</sup> For more information, see <http://sgccnetwork.ning.com/>



# Department of Defense (DoD)

## Department-wide Initiatives

Climate change will require the Department of Defense (DoD) to examine issues related to climate change adaptation with respect to both its installations and missions. DoD's built and natural infrastructure serves as the basis for sustaining military readiness. Maintaining this infrastructure in the face of climate change impacts is of critical importance to DoD. Likewise, climate change will shape the operating environment, roles, and missions that DoD undertakes.

***Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP).*** SERDP is DoD's environmental science and technology program, planned and executed in partnership with DOE and EPA, with participation by numerous other federal and non-federal organizations.<sup>76</sup> ESTCP is DoD's environmental technology demonstration and validation program. The Program's goal is to identify and demonstrate cost-effective technologies that address DoD's highest priority environmental requirements. SERDP and ESTCP's Resource Conservation and Climate Change program area supports the development of the science, technologies, and methods needed to manage DoD's installation infrastructure in a sustainable way. One of the program's areas of investment is developing the models and tools necessary to understand infrastructure vulnerabilities to and the impacts from climate change.

***Readiness and Training Policy and Programs Office.*** The DoD Readiness and Training Policy and Programs Office is exploring adaptive approaches to climate change to help better prepare for future risks to the training environment and ensure continued military readiness.

***Quadrennial Defense Review.*** In February 2010, the Pentagon released its Quadrennial Defense Review, and noted that climate change will affect the DoD in two broad ways. First, it will shape the operating environment and missions by acting as "an accelerant of instability or conflict, placing a burden to respond on civilian institutions and militaries around the world." And second, the military will need to adjust to the impacts of climate change on its facilities and capabilities.<sup>77</sup>

## Army Corps of Engineers

### Overview

The U.S. Army Corps of Engineers (USACE) is charged with missions to protect more than 11 million acres of public lands, more than 900 ports and harbors, nearly 12,000 miles of levees and 12,000 miles of commercial inland waterways, and 400 miles of coastal shoreline. In addition, USACE provides roughly 3% of the nation's electrical power from hydroelectric plants at its dams and has a key, first-responder role in times of national emergencies. Nearly all of these missions are at some risk from potential effects of future climate change.<sup>78</sup>

Over the last several years, and in active cooperation with other Federal agencies with water or land resource management responsibilities, USACE has been surveying the vulnerability and resilience of its installed infrastructure, and of the water and land resources it manages. The goal of this work is to produce practical, nationally consistent, and cost-effective measures to reduce vulnerability and enhance resilience.

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<sup>76</sup> <http://www.serdp.org/>

<sup>77</sup> To read the QDR, visit [http://www.defense.gov/qdr/images/QDR\\_as\\_of\\_12Feb10\\_1000.pdf](http://www.defense.gov/qdr/images/QDR_as_of_12Feb10_1000.pdf)

<sup>78</sup> <http://www.usace.army.mil/Pages/default.aspx>

## Selected Initiatives and Strategies

**Interagency Workgroup on Climate Change and Water Resources.** USACE formed an interagency workgroup on climate change and water resources with the Bureau of Reclamation, USGS, and NOAA to evaluate how climate change considerations can be incorporated into activities related to the Nation's water resources. The group released a report—*Climate Change and Water Resources Management: A Federal Perspective*—in February 2009 that was published as USGS Circular 1331.<sup>79</sup> This product describes current uses of climate information by water operations agencies and delineates gaps in the climate science and engineering needed in order to enable more efficient and effective adaptation measures.

**Guidance on Incorporating Future Sea-Level Change Projections into Planning and Design.** The USACE has developed new guidance together with other agencies, including USGS and NOAA, to institute a nationwide, consistent vertical datum. USACE is now performing comprehensive evaluations of all relevant USACE project elevations to ensure that heights of projects (levees, dams, jetties, etc.) are known accurately and precisely against current sea levels and for tracking sea level changes. An Engineering Circular (1165-2-211) was produced and an Engineering Technical Letter is under development now to guide USACE operations on responses to sea-level change at vulnerable projects.

**Adaptation Pilot Projects.** Adaptation pilot projects are underway to support agency planning and operations within the context of climate change adaptation, including the development of policies, technologies and other management options. Different project types are being selected, such as reservoir resiliency, back bay flooding protection, and shoreline protection feasibility, as a way to extract results that can be deployed across the agency. By way of example, the Apalachicola-Chattahoochee-Flint interagency project led by NOAA intends to develop a drought information system for “better informed and more timely drought-related decisions.” For this project, USACE is tasked with developing tools to meet the identified needs of the pilot district and its stakeholders to enable agreement on drought conditions before they begin developing adaptation strategies.

**International Climate Change Adaptation Efforts.** The USACE works internationally on climate change adaptation issues through the International Center for Integrated Water Resource Management (ICIWaRM) at USACE Institute for Water Resources. This work involves a wide range of projects extending from extensive hydrology and hydrodynamics work with Canada on the Great Lakes and Columbia River under changed future conditions; with Peru on water availability and means for potential conflict resolution under future increased drought strain; and with Mexico on its first baseline national wetlands inventory and potential climate change effects.

## Programs and Institutional Mechanisms

**Responses to Climate Change Program and website.** Building on existing science and knowledge, the Responses to Climate Change (RCC) Program is developing methods, policies and processes for effective adaptation of USACE projects, systems and programs to climate change. USACE is also planning to develop methods, policies and processes to assess the effectiveness of climate change adaptation, and anticipate that assessment will include an evaluation of how well alternative adaptation measures improve system flexibility to perform well over a wide range of future scenarios. The RCC will also identify knowledge and technology gaps to guide research and development activities, and will transfer knowledge and technology to other USACE programs.<sup>80</sup> For example, the Program will provide immediate knowledge transfer to the FY11-20 Sustainability Under Global Change Program which addresses different classes of projects (e.g., of authorized but not yet constructed), additional classes of change (e.g., demographic, social values, land use, political values), and climate change mitigation.

<sup>79</sup> <http://pubs.usgs.gov/circ/1331>

<sup>80</sup> <http://www.corpsclimate.us/index.cfm>

## Navy

### Overview

Climate change is a national security challenge with strategic implications for the Navy. While climate change alone is not likely to lead to future conflict, it may be a contributing factor. Climate change is affecting, and will continue to affect, U.S. military installations and access to natural resources worldwide. It will affect the type, scope, and location of future Navy missions.

### Programs and Institutional Mechanisms

**Task Force Climate Change.** The Chief of Naval Operations established Task Force Climate Change (TFCC) in May 2009 to address the implication of climate change for national security and naval operations, to answer the question “when” in terms of Navy decisions regarding climate change, and to ensure the Navy is ready and capable to meet all mission requirements in the 21<sup>st</sup> century.

### Selected Initiatives and Strategies

**Navy Arctic Roadmap (November 2009).** TFCC developed this 5-year strategic plan to respond to changing climatic and landscape conditions in the region which affect maritime security, naval readiness, and resource management policies, strategies and investments and contribute to a safe, stable, and secure Arctic region.<sup>81</sup>

**Navy Arctic Strategic Objectives.** Taking into account federal and DoD guidance, the Navy Arctic Strategic Objectives were signed by the Vice Chief of Naval Operations in May 2010. This document outlines the desired end-state and strategic objectives for the Navy in the changing Arctic region.

**U.S. Navy Climate Change Roadmap (May 2010).** This second roadmap released by TFCC examines the broader issues associated with climate change impacts on Navy missions, force structure and infrastructure, with an emphasis on collaborative partnerships within DoD, the federal government, academia, and NGOs.<sup>82</sup>

**Naval Studies Board FY09 Study.** The Navy recently sponsored a Naval Studies Board study on the National Security Implications of Climate Change on U.S. Naval forces (Navy, Marine Corps and Coast Guard), to be completed late 2010.

**Wargames, Table-top Exercises, and Limited Objective Experiments.** Navy conducted a July 2010 wargame at the Naval War College that examined climate change as an Irregular Warfare dimension shaping security environments in different regions of the world; the Navy has also participated in table-top exercises and limited objective experiments related to the changing Arctic.

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<sup>81</sup> To read the 2009 Arctic Roadmap, see [http://www.navy.mil/navydata/documents/USN\\_artic\\_roadmap.pdf](http://www.navy.mil/navydata/documents/USN_artic_roadmap.pdf)

<sup>82</sup> To read the Navy Climate Change Roadmap, see <http://www.navy.mil/navydata/documents/CCR.pdf>

# Department of Energy (DOE)

## Department-wide Initiatives

**Office of Climate Change Policy and Technology (CCP&T).** CCP&T is the Department's focal point for the analysis of policy and technology options to address global climate change. CCP&T delivers timely analysis of domestic and international climate change developments, and serves as the Department's lead representative in interagency, intergovernmental, and international activities related to climate change and energy. In this capacity, the Office provides analytical and technical support for Cabinet and sub-Cabinet-level committees that provide strategic direction for participating Federal agencies on climate change related policy, science, technology, and other change on the energy sector, and collaboration on issues related to adaptation and the transition to a clean energy economy.

**Climate Change and Potential Impact on Energy Security.** DOE's Office of Policy and International Affairs is examining, on a national and regional basis, the energy-water interdependences and the systems implications of the full portfolio of energy technologies as it evolves under various energy and climate policy scenarios in order to inform policy development and future research and development planning.

**Climate change impacts, adaptation and vulnerability research database.** Oak Ridge National Laboratory (ORNL) is developing a comprehensive database on climate change impacts, adaptation, and vulnerability research and science.<sup>83</sup>

**Impact of climate change on DOE facilities.** DOE's Office of Fossil Energy is assessing the impact of climate change, including sea level rise, subsidence and increased frequency and severity of hurricanes on oil storage and delivery infrastructure and operations, including current and future response capabilities of the Nation's Strategic Petroleum Reserve along the Gulf Coast.<sup>84</sup>

**Joint Climate Prediction Research Program.** DOE, USDA and the National Science Foundation (NSF) are working together to develop climate system models (as part of the Decadal and Regional Climate Prediction Using Earth System Models) more powerful than existing models to provide insights into climate variability and resulting impacts.<sup>85</sup>

**Research and Development Activities.** DOE Program Offices support a broad range of research and development activities at DOE National Laboratories, universities, and with the private sector. DOE, as the landlord of the Nation's largest civilian National Laboratory system, supports climate change mitigation and adaptation research and development activities ranging from the most basic to the most applied at various sites across the United States. For example, DOE supports integrated assessment modeling of climate change impacts and adaptations beyond a national focus to better inform regional integrated planning, including the development of different measures of impacts, techniques for accommodating thresholds and tipping points, concepts and approaches to addressing probabilities and uncertainties, and methods for addressing data limitations.

**Water Efficient Power Plants.** The Office of Fossil Energy and the National Energy Technology Laboratory (NETL) is developing advanced water management technologies applicable to fossil and other power plants in three specific areas: non-traditional sources of process and cooling water to demonstrate the effectiveness of utilizing lower-quality water for power plant cooling and processing needs; innovative water reuse and recovery research explores advanced technologies for the recovery and reuse of water from power plants; and advanced cooling technology research examines advanced wet, dry, and hybrid cooling technologies.

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<sup>83</sup> GAO, GAO-10-114SP, Climate Change Adaptation: Information On Selected Federal Efforts To Adapt To A Changing Climate, an E-supplement to GAO-10-113, Oct. 7, 2009, <http://www.gao.gov/new.items/d10114sp.pdf>

<sup>84</sup> For more information, see GAO, GAO-10-114SP, Climate Change Adaptation: Information On Selected Federal Efforts To Adapt To A Changing Climate, an E-supplement to GAO-10-113, Oct. 7, 2009, <http://www.gao.gov/new.items/d10114sp.pdf>

<sup>85</sup> For more information on the Joint Climate Prediction Research Program, see <http://www.energy.gov/news/8777.htm>

**Building Technologies and Energy STAR.** DOE's Office of Renewable Energy and Energy Efficiency supports building technologies, including technologies that reduce energy and water consumption, and works with the USEPA on the ENERGY STAR program. The ENERGY STAR label appears on products that have met strict requirements for energy efficiency, thus reducing GHG emissions (i.e. mitigation), and in some cases direct water savings (i.e. adaptation). DOE is responsible for the labeling programs for commercial and residential ENERGY STAR clothes washers and residential dishwashers.

# Department of Health and Human Services (HHS)

## Centers for Disease Control and Prevention

### Overview

The Centers for Disease Control and Prevention (CDC) is responsible for protecting health and promoting quality of life through health promotion, prevention of disease, injury and disability, and preparedness for new health threats. As it pertains to climate change, CDC leads efforts to anticipate the health effects of climate change, to assure that systems are in place to detect and track them, and to take steps to prepare for, respond to, and manage associated risks.

### Selected Initiatives and Strategies

***CDC Policy on Climate Change and Public Health.*** This document provides a list of priority actions for health and climate change.<sup>86</sup>

***Climate-Ready States and Cities Initiative.*** CDC is using its prevention expertise to help state and city health departments investigate, prepare for, and respond to the health effects that climate change may have on people. Through their first climate change cooperative agreements in 2010, CDC awarded \$5.25 million to ten state and local health departments to assess risks, make plans and develop programs to address challenges over the next three years. CDC will help states and cities partner with local and national climate scientists to understand the potential climate changes in their areas. CDC will assist states and cities in developing and using models to predict health impacts, to monitor health effects, and to identify the areas that are most vulnerable to these effects.<sup>87</sup>

### Programs and Institutional Mechanisms

***Climate Change and Public Health Program.*** CDC has created a Climate Change and Public Health Program within the Division of Environmental Hazards and Health Effects of the National Center for Environmental Health. CDC's expertise and programs in environmental health, infectious disease and global health form the foundation of public health efforts in climate change. CDC's work addresses five broad areas: building climate change capacity at state and local health departments; developing partnerships; promoting workforce development; building the science base through research; and communicating health-related aspects of climate change.

### Tools and Resources

***CDC Climate Change and Public Health website.*** The website provides information on major health effects from climate change with additional resources and publications related to each.<sup>88</sup> Funding opportunities (e.g. for state and local public health offices), links to partnering organizations, and workforce development opportunities and educational materials are also available.

***Climate Change and Public Health Webinar series.*** CDC, along with the American Public Health Association (APHA), National Association of County and City Health Officials (NACCHO), Association of State and Territorial Health Officials (ASTHO), and the Society for Public Health Education (SOPHE), co-sponsored and hosted a series of webinars titled "Climate Change: Mastering the Public Health Role." The series focuses on effectively communicating the health-related aspects of climate change, promoting workforce development, and ensuring capacity building at local levels. Five webinars are available on-line for viewing.<sup>89</sup>

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<sup>86</sup> To read the CDC Policy on Climate Change and Public Health, visit <http://www.cdc.gov/climatechange/policy.htm>

<sup>87</sup> To learn more about Climate-Ready States and Cities and awards, visit: [http://www.cdc.gov/climatechange/climate\\_ready.htm](http://www.cdc.gov/climatechange/climate_ready.htm)

<sup>88</sup> To access the CDC Climate Change and Public Health website, visit <http://www.cdc.gov/climatechange/>

<sup>89</sup> To view the webinars and other workforce development initiatives, visit: <http://www.cdc.gov/climatechange/workforce.htm>

**Preparing for Heat Waves.** CDC scientists have developed tools for local emergency planners and decision-makers to use in preparing for and responding to the threats posed by heat waves in urban areas. With FEMA and NOAA, CDC helped develop the *Excessive Heat Events Guidebook* released by the EPA in 2006.<sup>90</sup> Sample related publications include *Evaluating Models of Heat Vulnerability & Heat Island Impact in NYC* and *Developing a Modular Web-based Preparedness Modeling Tool for Heat Waves*.<sup>91</sup>

## **National Institutes of Health**

### **Overview**

The National Institute of Environmental Health Sciences (NIEHS) within the National Institutes of Health (NIH) conducts basic, applied, and clinical research on the health effects of environmental exposures. The NIEHS is engaged in multiple activities with other federal agencies, international research and policy organizations, academia, and nongovernmental organization stakeholders to better understand the links between climate change and adverse human health impacts, and to communicate findings, and work with decision makers to incorporate this information into sound health policy and actions.

### **Tools and Resources**

**NIEHS Climate Change and Human Health website.** This site provides information on NIEHS activities and events, as well as links to other useful organizations for both mitigation and adaptation.<sup>92</sup>

**NIH Challenge Grants.** The NIH has increased support for research on the health effects of climate change through NIH Challenge Grants in Health and Science Research. Grants support research to quantify the impact of climate change on disease burden and health outcomes, project the health impacts of different climate scenarios, and evaluate the effectiveness of proposed adaptation strategies on human health and well being. Awards were announced in October and November of 2009.<sup>93</sup>

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<sup>90</sup> [http://www.epa.gov/heatisland/about/pdf/EHEguide\\_final.pdf](http://www.epa.gov/heatisland/about/pdf/EHEguide_final.pdf)

<sup>91</sup> For more information, see GAO, GAO-10-114SP, Climate Change Adaptation: Information On Selected Federal Efforts To Adapt To A Changing Climate, an E-supplement to GAO-10-113, Oct. 7, 2009, <http://www.gao.gov/new.items/d10114sp.pdf>

<sup>92</sup> To access the NIEHS Climate Change and Human Health website, go to <http://www.niehs.nih.gov/about/od/programs/climatechange/index.cfm>

<sup>93</sup> [http://www.fic.nih.gov/recovery/challenge/climate\\_change.htm](http://www.fic.nih.gov/recovery/challenge/climate_change.htm)

# Department of Homeland Security (DHS)

## Department-wide Initiatives

**Climate Change Adaptation Task Force.** The Department of Homeland Security (DHS) has established a Climate Change Adaptation Task Force to examine the implications of climate change for homeland security missions and department operations and to make recommendations for adaptation planning and actions. Program areas affected by climate change the department is analyzing include: human migration, workforce health, and infrastructure protection.

**Sustainability and Efficiency Task Force Recommendations (Feb 2010).** This report makes recommendations for the Department to comply with EO 13514 and recognizes the impacts climate change, specifically extreme weather events, can have on national security and stability. The report makes general operational and organizational recommendations to support sustainability as well as specific recommendations pertaining to water and energy, transportation, procurement and waste management.<sup>94</sup>

## Federal Emergency Management Agency

### Overview

The Federal Emergency Management Agency (FEMA) has a stated mission to reduce the loss of life and property and protect communities nationwide from all hazards, including natural disasters, acts of terrorism, and other man-made disasters. FEMA leads and supports the nation in a risk-based, comprehensive emergency management system of preparedness, protection, response, recovery and mitigation.

### Selected Initiatives and Strategies

**NFIP Reform Working Group.** FEMA established the National Flood Insurance Program Reform Working Group to identify and analyze options for the future of the program. This internal work group is a cross-section of the Federal Insurance and Mitigation Administration. Phase I began with the NFIP Listening Session. The analysis of comments culminated in a report entitled “Content Analysis of Breakout Session Comments” and Phase I concluded with release of a final report entitled “NFIP Stakeholder Listening Session: Findings and Next Steps”. Phase II began in March 2010 with the formation of the NFIP Reform Working Group. The Working Group was scheduled to conclude its initial analysis in May 2010, and begin Phase III in June 2010. This phase will last 18 to 24 months, and result in a comprehensive NFIP reform package that will be delivered to Congress.<sup>95</sup>

**Risk MAP (Mapping, Assessment, and Planning) Multi Year Plan (March 2009).** FEMA is initiating Risk MAP and has developed a multiyear plan spanning FY10-FY14. The vision for Risk MAP is to deliver quality data that increases public awareness and leads to action that reduces risk to life and property. Risk MAP builds on flood hazard data and maps produced during the Flood Map Modernization program. Risk Mapping, Assessment, and Planning (Risk MAP) Multi-Year Plan: Fiscal Years 2010 - 2014 was approved on March 16, 2009.<sup>96</sup>

**Coastal Construction Manual.** FEMA published a Coastal Construction Manual (FEMA 55) that documents state-of-the-art and best practices in coastal construction in accordance with information and recommendations contained in several pertinent publications. The last major update to the Coastal Construction Manual was published in 2000. Currently FEMA's Mitigation Directorate is in the

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<sup>94</sup> For Task Force recommendations, see [http://www.dhs.gov/xlibrary/assets/hsac\\_sustainability\\_efficiency\\_task\\_force\\_recommendations\\_2010.pdf](http://www.dhs.gov/xlibrary/assets/hsac_sustainability_efficiency_task_force_recommendations_2010.pdf)

<sup>95</sup> For more information on NFIP reform, see [http://www.fema.gov/business/nfip/nfip\\_listening\\_session.shtm](http://www.fema.gov/business/nfip/nfip_listening_session.shtm)

<sup>96</sup> For more information on Risk MAP, see <http://www.fema.gov/plan/ffmm.shtm#2>



preliminary stages of substantially revising the Coastal Construction Manual. This revision will include a new section (or subsection) that addresses climate change.<sup>97</sup>

**Community Rating System.** FEMA has a program component of the NFIP, called the Community Rating System (CRS), which provides financial incentives for implementing practices beyond the minimum NFIP floodplain management standards. It is likely that the next revision of the CRS manual (which will probably be issued in 2011) will contain new climate change-specific language describing certain CRS activity credits.<sup>98</sup>

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<sup>97</sup> <http://www.fema.gov/rebuild/mat/fema55.shtm>

<sup>98</sup> <http://www.fema.gov/business/nfip/crs.shtm>

# Department of Housing and Urban Development (HUD)

## Department-wide Initiatives

**Partnership for Sustainable Communities.** In June 2009, HUD, the Department of Transportation and the Environmental Protection Agency formed a partnership focused on ensuring that housing and transportation goals are met while simultaneously protecting the environment, promoting equitable development, and helping to address the challenges of climate change.<sup>99</sup> HUD's 2010 appropriations included \$150 million for their Sustainable Communities Initiative to improve regional planning efforts that integrate housing and transportation decisions and increase the capacity to improve land use and zoning.<sup>100, 101</sup>

**Long-Term Disaster Recovery Working Group.** At the President's request, the Secretaries of Homeland Security and Housing and Urban Development are co-chairing a Long-Term Disaster Recovery Working Group composed of the Secretaries and Administrators of more than 20 departments, agencies and offices.<sup>102</sup> This high-level, strategic initiative will provide operational guidance for recovery organizations as well as make suggestions for future improvement. As a part of this effort, Secretary Donovan indicated in a Feb 2010 speech:

“With the Long-term Disaster Recovery Working Group I co-chair with Secretary Napolitano, we are working with communities to protect against the effects of climate change by strengthening building codes, considering new approaches to land use, and incentivizing economic development in more climate-resilient places. And we expect to deliver our report to the President in April -- and then get to work implementing it.”

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<sup>99</sup> <https://www.fhwa.dot.gov/livability/partnerships/>

<sup>100</sup> To read about funding opportunities available from each agency associated with this partnership, go to [http://portal.hud.gov/portal/page/portal/HUD/program\\_offices/sustainable\\_housing\\_communities/SustainableCommunitiesPrograms4-29-10.pdf](http://portal.hud.gov/portal/page/portal/HUD/program_offices/sustainable_housing_communities/SustainableCommunitiesPrograms4-29-10.pdf)

<sup>101</sup> To read NOFA describing the roles of each agency in the Partnership and HUD's FY10 Grant process, go to <http://www.hud.gov/offices/adm/grants/nofa10/scrpgsec.pdf>

<sup>102</sup> <http://www.disasterrecoveryworkinggroup.gov/>

# Department of the Interior (DOI)

## Department-Wide Initiatives

The U.S. Department of Interior (DOI) is responsible for managing and sustaining U.S. public lands, water, wildlife, and energy resources representing one-fifth of the land in the country, 35,000 miles of coastline, 1.76 billion acres of the Outer Continental Shelf and water supplies for more than 30 million people. It also manages the federal government's trust responsibilities to 562 Indian tribes. Bureaus and offices in the DOI include: Bureau of Indian Affairs, Bureau of Land Management (BLM), Bureau of Ocean Energy Management, Regulation and Enforcement, Bureau of Reclamation (REC), National Park Service (NPS), Office of Surface Mining, Reclamation and Enforcement, U.S. Fish and Wildlife Service (USFWS), and U.S. Geological Survey (USGS), most of which have a role to play in climate change adaptation. Through efforts described below, the Department is developing a framework to be able to make a difference in the resiliency of natural resources by bringing resources together in a more strategic manner to make better decisions.

**Secretarial Order 3226 Amendment No. 1 – Climate Change and the Department of Interior.** This order was signed on January 16 2009, by former Secretary Kempthorne, replacing the original order from January 2001.<sup>103</sup> This amended order lists a number of directives intended to mainstream the consideration of climate change projections and impacts across the Department's operations and responsibilities, including requiring bureaus and offices to:

“Consider and analyze potential climate change impacts when undertaking long-range planning exercises, setting priorities for scientific research and investigations, and/or when making major decisions affecting DOI resources; and

“Review all existing programs, facilities, boundaries, policies, and authorities under the respective bureau or office to identify potential impacts of climate change on the bureau's or office's areas of responsibility and to recommend a set of response actions; and

“Use *Adaptive Management: The U.S. Department of the Interior Technical Guide* as a framework for managing natural resources.”

**Secretarial Order 3289 - Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources.** Secretarial Order 3289 was signed September 14, 2009 and amended February 22, 2010.<sup>104</sup> The Order established a Climate Change Response Council, renamed Energy and Climate Change Council, within the Office of the Secretary to coordinate the development of an integrated strategy across Department agencies and bureaus to respond to the impacts of climate change on tribes and on the land, water, ocean, fish and wildlife, and cultural heritage resources that the Department manages.

**Memorandum of Understanding (MOU) between DOI and DOC to Coordinate and Cooperate on Climate Related Activities Involving Science, Services, Mitigation, Adaptation, Education, and Communication.** DOI Secretary Salazar and DOC Secretary Locke signed this MOU in August 2010. The MOU provides a framework to build upon existing partnerships that bring together the Departments' best available climate science and services to inform adaptation strategies and response decisions to manage America's oceans, coasts, Great Lakes, and public lands. This agreement will also draw on national and regional programs and partnerships of each Department, including DOI's emerging Climate Science Centers and Landscape Conservation Cooperatives and DOC/NOAA's climate science and services, Regional Integrated Sciences and Assessments program, and Regional Climate Centers.<sup>105</sup>

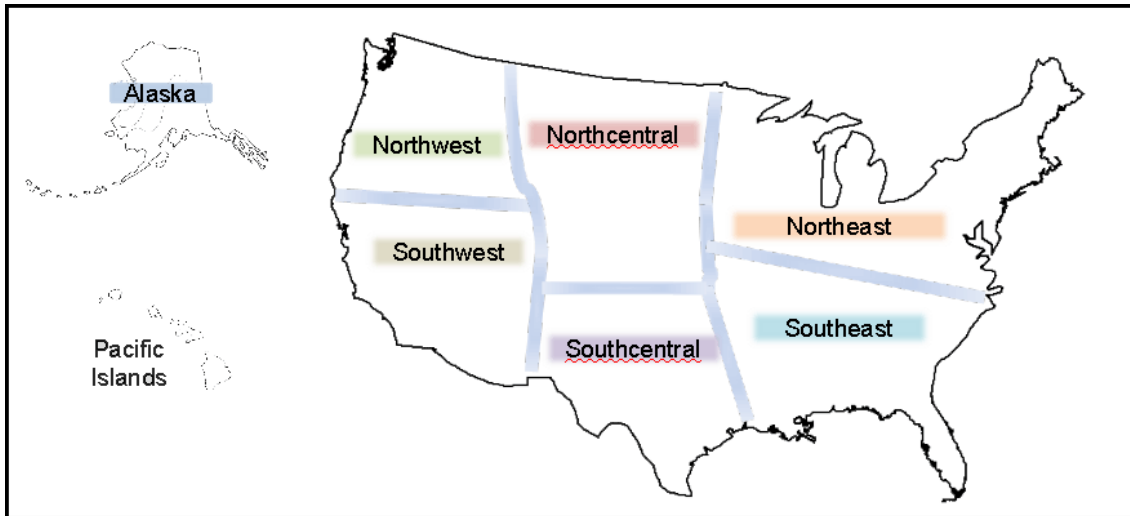
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<sup>103</sup> To read Secretarial Order 3226 Amendment 1, visit [http://www.blm.gov/pgdata/etc/medialib/blm/wy/programs/science.Par.46189.File.dat/SO\\_3226A1.pdf](http://www.blm.gov/pgdata/etc/medialib/blm/wy/programs/science.Par.46189.File.dat/SO_3226A1.pdf)

<sup>104</sup> To read Secretarial Order 3289 visit [http://elips.doi.gov/app\\_so/act\\_getfiles.cfm?order\\_number=3289A1](http://elips.doi.gov/app_so/act_getfiles.cfm?order_number=3289A1)

<sup>105</sup> To read the MOU visit <http://www.noaa.gov/climate/resources/resources/doioclimatemoufinal.pdf>

**DOI Climate Science Centers.** DOI is working with USGS to broaden the current USGS Wildlife and Climate Center scope to include an additional 8 regional DOI centers. These centers will provide climate change impact data and tools to support Department managers and other partners responsible for managing the Department's land, water, fish and wildlife, and cultural heritage resources. Basic climate change impact science will be provided by the CSCs to the Landscape Conservation Cooperatives (LCCs) within their respective regions, based primarily on the priorities defined by the LCCs, including physical and biological research, ecological forecasting, and multi-scale modeling.<sup>106</sup>

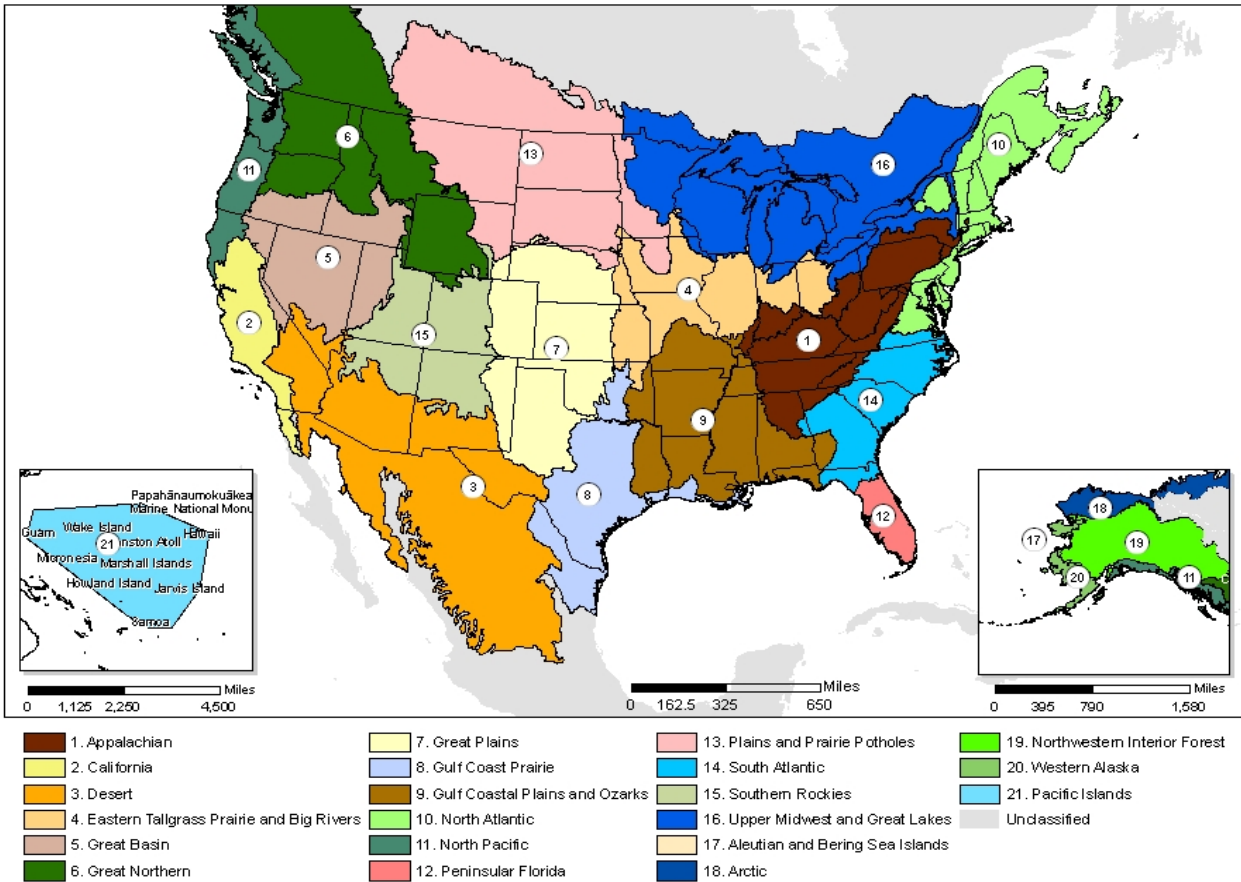


Source: Department of Interior Climate Science Centers at <http://www.doi.gov/whatwedo/climate/strategy/CSC-Map.cfm>

**Landscape Conservation Cooperatives (LCCs).** The 22 LCCs will cover the continental U.S., Pacific Islands, and parts of Mexico and Canada. LCCs are intended to be the applied-science and adaptive management arm of the department; a self-directed partnership of land, water, wildlife and cultural resource managers and interested public and private organizations. The goal is for the LCCs to be supported by bureaus and offices that pool their resources in order to support a more integrated resource management approach, on both public and private lands, to support climate change mitigation and adaptation efforts within and across landscapes.<sup>107</sup>

<sup>106</sup> For more on DOI's Climate Science Centers, see <http://www.doi.gov/whatwedo/climate/strategy/CSC-Map.cfm>

<sup>107</sup> For more on DOI's Landscape Conservation Cooperatives, see <http://www.doi.gov/whatwedo/climate/strategy/LCC-Map.cfm>



Source: Department of Interior Landscape Conservation Cooperatives at <http://www.doi.gov/whatwedo/climate/strategy/LCC-Map.cfm>

## Tools and Resources

**Climate Change Website.** The site provides a summary of department level climate change actions, both mitigation and adaptation, and access to updates on key initiatives such as the Landscape Conservation Cooperatives (LCCs) and Climate Science Centers (CSC).<sup>108</sup>

**DOI Adaptive Management Technical Guide.** This guide was issued in March 2007 and provides technical guidance for using adaptive management in decision making. The guide includes case studies, such as the Bureau of Reclamation’s management of Glen Canyon Dam and the FWS’ determination of annual waterfowl harvests, to demonstrate how adaptive management can be applied.<sup>109</sup>

<sup>108</sup> DOI’s Climate Change website is available at <http://www.doi.gov/whatwedo/climate/>

<sup>109</sup> To view the guide, visit <http://www.doi.gov/initiatives/AdaptiveManagement/documents.html>

## **Bureau of Land Management**

### **Overview**

The Bureau of Land Management (BLM) manages more federal land than any other agency – 253 million surface acres of public lands found primarily in the Western United States, as well as 700 million sub-surface acres of mineral estate located throughout the country. Responsibilities include program areas such as wildland fire management, land use planning, landscape conservation, and invasive species.<sup>110</sup>

### **Selected Initiatives and Strategies**

**Regional Strategic Plans.** BLM is organized into 10 regions comprised of 17 western states, not including eastern states for mining and minerals management. The Oregon-Washington region has a strategic plan that incorporates climate change mitigation and adaptation.<sup>111</sup>

## **Bureau of Reclamation**

### **Overview**

The Bureau of Reclamation is the largest wholesaler of water in the country, bringing water to more than 31 million people, and providing one out of five Western farmers (140,000) with irrigation water for 10 million acres of farmland that produce 60% of the nation's vegetables and 25% of its fruits and nuts. The Bureau is also the second largest producer of hydroelectric power in the western United States.

### **Selected Initiatives and Strategies**

**Climate Change and Western Water Group (CCAWWG).** The CCAWWG is a coordinated federal interagency R&D workgroup to provide scientific collaboration in support of Western water management and adaptation strategies in response to climate change. Principal partners are the Bureau of Reclamation, USGS, NOAA, and USACE.<sup>112</sup>

**Water Supply Predictability under Climate Change.** Reclamation has developed a program and is working together with four NOAA National Weather Service (NWS) River Forecast Centers (RFCs) – Colorado Basin, Northwest, Missouri Basin, and California-Nevada – the USDA Natural Resource Conservation Service (NRCS) National Water and Climate Center, U.S. Army Corps of Engineers (USACE) Portland District, and Bonneville Power Administration to understand and adapt to expected changes. The approach is to translate downscaled climate projections over eight western U.S. basins into runoff and snowpack projections, using hydrologic simulation models provided by collaborating RFCs.<sup>113</sup>

## **Fish and Wildlife Service**

### **Overview**

The U.S. Fish and Wildlife Service (FWS) is the principal federal agency responsible for conserving, protecting, and enhancing fish, wildlife, and plants and their habitats for the continuing benefit of the American people. The vast majority of fish and wildlife habitat is on lands not owned by the federal government, thereby making partnerships with Native American tribes, state and local governments, nongovernment organizations and private citizens a crucial element to the Service fulfilling their mission. The Service also manages the 95 million acre National Wildlife Refuge System that consists of 545 National Wildlife Refuges and thousands of

<sup>110</sup> <http://www.blm.gov/wo/st/en/prog/more/weeds.html>

<sup>111</sup> [http://www.blm.gov/or/news/files/2015\\_SPOT.pdf](http://www.blm.gov/or/news/files/2015_SPOT.pdf)

<sup>112</sup> [http://www.esrl.noaa.gov/psd/workshops/mwwcc/docs/CCAWWG\\_Vision\\_Paper.pdf](http://www.esrl.noaa.gov/psd/workshops/mwwcc/docs/CCAWWG_Vision_Paper.pdf)

<sup>113</sup> For information, see GAO, GAO-10-114SP, Climate Change Adaptation: Information On Selected Federal Efforts To Adapt To A Changing Climate, an E-supplement to GAO-10-113, Oct. 7, 2009, <http://www.gao.gov/new.items/d10114sp.pdf>

small wetlands and other special management areas. Approximately 7,500 people are employed by the Service across the United States, with seven regional offices, and nearly 700 field units including 81 ecological services field stations, 69 national fish hatcheries, and 63 fish and wildlife management offices.

## Selected Initiatives and Strategies

**National Fish and Wildlife Climate Adaptation Strategy (In-Progress).** The Service has defined the proposed adaptation strategy as a collaborative framework (among major conservation interests such as local governments, states, tribes, conservation organizations, federal agencies, industry and private landowners) that “identifies and defines principles and methods to maintain key terrestrial, freshwater and marine ecosystems and functions needed to sustain fish, wildlife and plant resources in the face of accelerating climate change.”<sup>114</sup> Strategy development was initiated from Conservation Leadership Forums focused on climate change adaptation that occurred in June 2009 and January 2010.<sup>115</sup>

**Fish and Wildlife Service Climate Change Strategic Plan (September 2010).** The U.S. Fish and Wildlife Service's Strategic Plan identifies key goals and objectives for the agency centered around three areas: adaptation, mitigation, and engagement.<sup>116</sup> Key adaptation goals included not only efforts to create the CSCs and LCCs described above that are now broader than FWS efforts, but also development of a National Fish and Wildlife Adaptation Strategy over a 5 year period (see above), conducting habitat vulnerability assessments, and incorporating climate change into agency activities and decisions. A draft supplemental, “Appendix: 5-Year Action Plan for Implementing the Climate Change Strategic Plan,” details the specific actions the Service will take during the next five years to achieve each of the goals and objectives.<sup>117</sup>

## Tools and Resources

**National and Regional Climate Change Websites.** The Service maintains a Climate Change website with access to six regional climate change sites, resources and information, as well as updates on the Service’s climate change and adaptation strategies, and links to other Service and non-Service resources.<sup>118</sup> Regional sites include: Alaska, Midwest, Northeast, Pacific, Southeast and Southwest covering 40 states; providing regional impacts, resources and FWS related updates and activities.

**Climate Change Learning Center (CCLC).** The agency’s National Conservation Training Center (NCTC) is in the process of modifying training opportunities for FWS staff to increase their knowledge of climate science and climate change as it relates to resource management; providing new landscape-scale approaches to planning, design, delivery, monitoring and research, as well as new tools for managers. A Climate Change Learning Center webpage provides information on upcoming and archived webinars, courses, workshops and other training opportunities offered through the NCTC.<sup>119</sup>

**Sea Level Affecting Marshes Model (SLAMM).** SLAMM-View is a browser-based application that allows the public to view simulations of sea level rise from the SLAMM model output, and helps people understand the potential impacts of climate change on sea levels.<sup>120</sup> The Service is able to determine potential effects of sea level rise on coastal National Wildlife Refuges and use results to help develop refuge and landscape scale adaptation strategies and revising refuge conservation plans.

<sup>114</sup> For more information, see <http://www.fws.gov/nfwcas.html>

<sup>115</sup> See [http://training.fws.gov/branchsites/lkm/climate\\_change/index.html](http://training.fws.gov/branchsites/lkm/climate_change/index.html)

<sup>116</sup> To read the Climate Change Strategic Plan, go to [http://www.fws.gov/home/climatechange/strategic\\_plan.html](http://www.fws.gov/home/climatechange/strategic_plan.html)

<sup>117</sup> <http://www.fws.gov/home/climatechange/pdf/CCDraftActionPlan92209.pdf>

<sup>118</sup> see <http://www.fws.gov/home/climatechange/>

<sup>119</sup> see [http://training.fws.gov/CSP/Resources/CSP\\_Climate\\_Change\\_Series/index.htm](http://training.fws.gov/CSP/Resources/CSP_Climate_Change_Series/index.htm)

<sup>120</sup> For more information on SLAMM, visit <http://www.fws.gov/slamm/>

## **U.S. Geological Survey**

### **Overview**

As the Nation's largest water, earth, and biological science and civilian mapping agency, the U.S. Geological Survey (USGS) collects, monitors, analyzes, and provides scientific understanding about natural resource conditions, issues, and problems. With approximately 10,000 scientists, researchers and staff in 400 locations across the United States the USGS conducts large-scale, multi-disciplinary investigations and provides impartial scientific information to resource managers, planners, and other customers. On-the-ground scientific information is provided from observation and monitoring networks and research activities. These observations and related research efforts support efforts to build climate models, especially those that deal with the impacts of climate change to terrestrial, freshwater, and marine ecosystems. USGS is recognized for its research and monitoring efforts in the fields of hydrology, climate history, land-use and land-cover changes, wildlife health, ecosystem science, and carbon and other geochemical and nutrient cycles.

### **Selected Initiatives and Strategies**

**USGS 10-Year Strategy.** The 2007-2017 Strategy sets the direction for the agency in six areas including: Ecosystems, Climate, Natural Hazards, Environment and Human Health, Water, and Energy and Minerals.<sup>121</sup>

### **Programs and Institutional Mechanisms**

**National Climate Change and Wildlife Science Center (NCCWSC).** USGS established a National Climate Change and Wildlife Science Center to understand fish and wildlife responses to changing climate and to test and validate related adaptation decisions by land managers and other stakeholders.<sup>122</sup> As part of the new DOI Climate Change strategy, USGS is taking the lead for the Department on the selection of host institutions for the DOI Regional Climate Science Centers. The National Climate Change and Wildlife Science Center (NCCWSC) will provide the initial staffing and startup capabilities to these centers. The NCCWSC science agenda will focus on the linkage of global climate information with fundamental ecological knowledge, and the application of this understanding to the particular species, habitats, and ecosystems present in each region.

**DOI National Climate Effects Network.** The USGS leads DOI's effort to build a Climate Effects Network focused on the monitoring and understanding of causes and impacts of climate change and variability on physical and biological resources. This integrated monitoring and research program will provide a national system for early detection and management/adaptation to changes before they become chronic or catastrophic. The prototype for this effort is underway in the Yukon River Basin, as a partnership among the USGS, USFS, the Department resource management agencies, the University of Alaska, the Yukon River Inter-Tribal Watershed Council, and several other partners.

### **Tools and Resources**

**GAP Analysis Program.** The Gap Analysis Program (GAP) national land cover viewer displays data on the vegetation and land use patterns of the continental United States.<sup>123</sup> The map depicts the extent of forests, grasslands, wetlands and other habitats from coast to coast. The national map contains 551 Ecological Systems containing 39 land use classes and is searchable by state and region at three different levels of detail using eight, 43 or 590 classification categories. The map can be used to support large-scale planning at federal and state agencies, helping them to see where large tracts of diverse ecosystems still exist so they can work to preserve whole habitats, rather than just single species.

<sup>121</sup> To read the USGS Strategy, go to <http://pubs.usgs.gov/circ/2007/1309/>

<sup>122</sup> To learn more about NCCWSC and the DOI CSCs, visit [http://nccwsc.usgs.gov/documents/NCCWSC\\_5\\_year\\_strategy\\_ver\\_7-13-09b.pdf](http://nccwsc.usgs.gov/documents/NCCWSC_5_year_strategy_ver_7-13-09b.pdf)

<sup>123</sup> To learn more about the GAP Analysis Program tool, visit <http://www.gap.uidaho.edu/landcoverviewer.html>



**National Assessment of Coastal Vulnerability to Sea-Level Rise.** This project, within the USGS Coastal and Marine Geology Program's National Assessment, seeks to objectively determine the relative risks due to future sea-level rise for the U.S. Atlantic, Pacific, and Gulf of Mexico coasts.<sup>124</sup>

## **National Park Service**

### **Overview**

The National Park Service (NPS) has responsibility for 392 national parks and 40 national heritage sites, spanning over 84 million acres of land, 4.5 million acres of oceans, lakes, reservoirs and 43,000 miles of shoreline.

### **Selected Initiatives and Strategies**

**Climate Change Response Strategy.** The NPS released its Climate Change Response Strategy in September 2010.<sup>125</sup> The Strategy details long and short-term actions in three major areas: mitigation, adaptation, and public communication. To support this effort, the NPS has hired a Climate Change Coordinator, created six ad-hoc working groups – Legal & Policy; Planning; Science; Resource Stewardship; Greenhouse Gas Emission & Sustainable Operations, and Communication – to explore key goals and strategic actions that need to be addressed at park, regional, and national levels; and has held a series of regional and interagency workshops to explore climate change impacts and coping strategies and to develop action plans.

**Adaptation and Scenario Planning.** One of four Climate Change Response Program areas, Adaptation and Scenario Planning describes the approach the NPS plans to take going forward to help manage uncertainty around future climate and potential impacts to the nation's parks. Adaptation goals are provided with recommended management actions by the Service, including "Incorporate climate change consideration and responses in all levels of the NPS planning framework".<sup>126</sup>

### **Programs and Institutional Mechanisms**

**Climate Change Response Program.** To preserve the future health of parks in the face of global climate change, National Park Service (NPS) leadership created the Climate Change Response Program (CCRP) led by a Climate Change Response Steering Committee representing parks, regions, managers, and subject-matter experts.<sup>127</sup> The CCRP site currently provides basic science information as it pertains to parks. Information on the effects of climate change, called Impact Briefs for 32 U.S. regions, are available on the Program's site and are based on NPS defined "eco-regions". The site also details what the Service is doing to respond to climate change in terms of policy and planning, as well as around four new programmatic areas: science, adaptation, mitigation and education. Specifically, the NPS acknowledges the need to move to a systems-based management approach that will require significant cooperation across jurisdictional boundaries, a greater emphasis on partnerships and multi-agency collaboration, and increased use of interdisciplinary teams.

**Inventory and Monitoring Program (I&M).** To facilitate collaboration, information sharing, and economies of scale in inventory and monitoring, the NPS has organized more than 270 parks with significant natural resources into 32 eco-regional networks to conduct expanded inventory and monitoring activities.<sup>128</sup> Two primary goals of the program are to 1) inventory the natural resources under National Park Service stewardship to determine their nature and status and 2) to monitor park ecosystems to better understand their dynamic nature and condition and provide reference points for comparisons with other, altered environments.<sup>129</sup> The Program also makes data collected into useable information through analysis, synthesis, and modeling.

<sup>124</sup> To read the Assessment, go to <http://woodshole.er.usgs.gov/project-pages/cvi/>

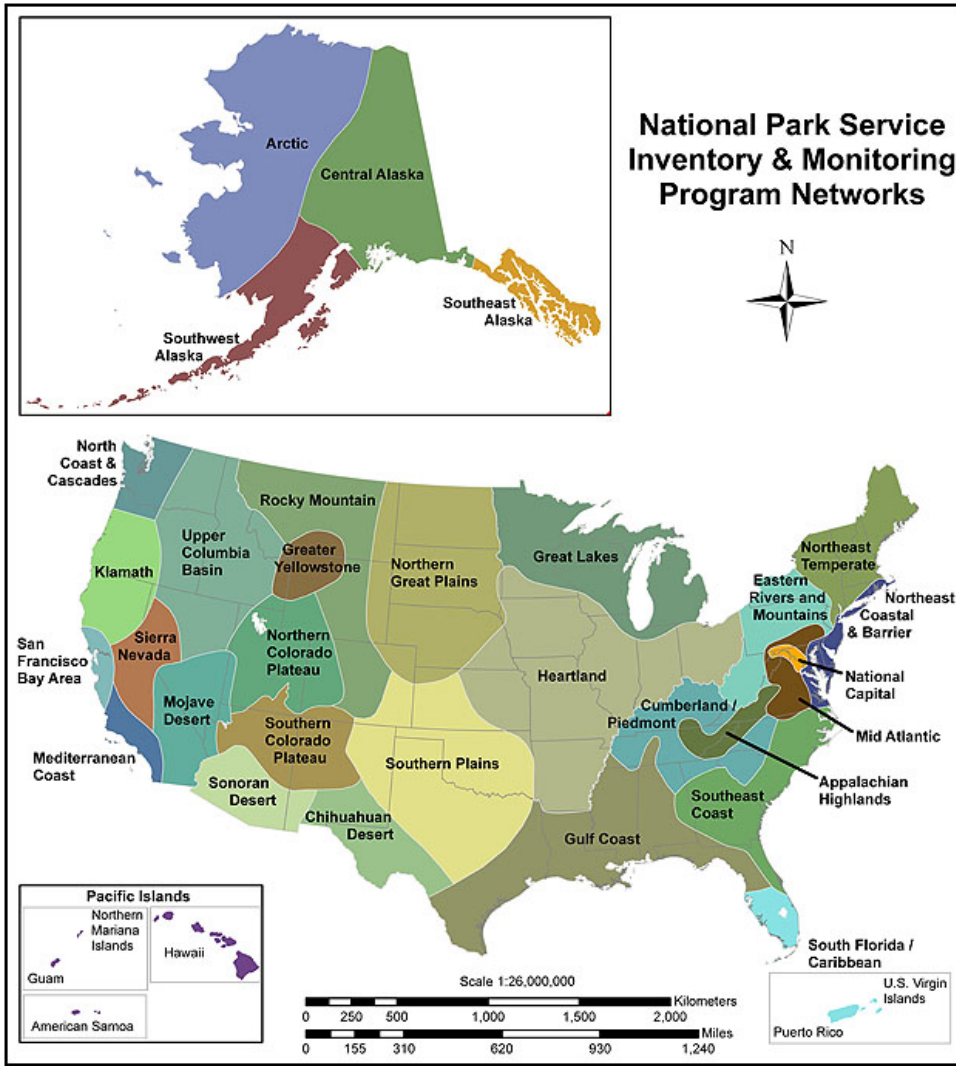
<sup>125</sup> To read the Strategy, go to [http://www.nature.nps.gov/climatechange/docs/NPS\\_CCRS.pdf](http://www.nature.nps.gov/climatechange/docs/NPS_CCRS.pdf)

<sup>126</sup> For more information on Scenario Planning, visit <http://www.nature.nps.gov/climatechange/adaptationplanning.cfm>

<sup>127</sup> For more information on CCSP, visit <http://www.nature.nps.gov/climatechange/index.cfm>

<sup>128</sup> <http://science.nature.nps.gov/im/networks.cfm>

<sup>129</sup> For more information on the Inventory and Monitoring Program, visit <http://science.nature.nps.gov/im/index.cfm>



Source: National Park Service Inventory and Monitoring Networks, at <http://science.nature.nps.gov/im/networks.cfm>

# Department of Transportation (DOT)

## Department-wide Initiatives

**Center for Climate Change and Environmental Forecasting (CCCEF) Strategic Plan 2006-2010.** The DOT established the Center for Climate Change and Environmental Forecasting (CCCEF) in 1999. The Center has become the focal point within USDOT for information and technical expertise on transportation and climate change, working with its component organizations to coordinate related research, policies, and actions. This plan focused on both greenhouse gas emission reductions as well as preparing for the impacts to climate change, and included both short and long term actions in areas such as research and planning. Long-term actions included completing Phase II of the Gulf Coast Study, and conducting research to “understand how more extreme temperatures may affect transportation operations and infrastructure, and what steps should be taken to avoid or mitigate those potential affects. Short term actions included the development of the Transportation Climate Change Clearinghouse, which is now available.”<sup>130</sup>

**DOT Transportation and Climate Change Clearinghouse.** The new DOT Transportation and Climate Change Clearinghouse website replaced the Center for Climate Change and Environmental Forecasting website.<sup>131</sup> While the current content is largely mitigation-focused, the site provides resources that identify potential impacts of climate change on transportation infrastructure, as well as state and local planning efforts and approaches for integrating climate change considerations into transportation decision making, of which some address adaptation.

## Federal Highway Administration

### Overview

Climate change and related effects are complex—there is no single, 'one-size-fits-all' approach to addressing these issues. Acknowledging this complexity, the Federal Highway Administration (FHWA) focuses its resources on supporting transportation and climate change research and disseminating the results, providing technical assistance to stakeholders, and coordinating its activities within DOT and with other Federal agencies.

### Selected Initiatives and Strategies

**FHWA Strategy to Address Adaptation to Climate Change Effects.** The Strategy is being developed by the FHWA Adaptation Working Group. The Strategy will include the relevance of impacts/adaptation to FHWA program areas, identify program vulnerabilities, and discuss ongoing, planned activities by FHWA.

**Vulnerability and Risk Assessment Pilots.** This project is funding pilots for DOTs and MPOs to implement a conceptual model to use in conducting vulnerability and risk assessments of infrastructure to the projected impacts of global climate change. The purpose of the pilots is twofold: 1) to assist State DOTs and MPOs in more quickly advancing existing adaptation assessment activities and 2) to assist FHWA in "test-driving" the model. Based on the feedback received through the pilots, FHWA will revise and finalize the model for national application.<sup>132</sup>

### Programs and Institutional Mechanisms

**FHWA Adaptation Working Group.** FHWA formed a multi-disciplinary internal working group in the fall of 2008, to coordinate policy and program activities to address climate change impacts to transportation infrastructure. Climate change is an interdisciplinary

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<sup>130</sup> To read DOT's Climate Change Strategic Plan, go to [http://climate.dot.gov/documents/splan\\_2006.pdf](http://climate.dot.gov/documents/splan_2006.pdf)

<sup>131</sup> To access the DOT Climate Change Clearinghouse, visit <http://climate.dot.gov/>

<sup>132</sup> For more information, visit: <http://www.fhwa.dot.gov/hep/climate/pilots.htm>

issue, cutting across many programs in FHWA. Many offices are represented in the Adaptation Working Group, including: Environment, Planning, and Realty; Infrastructure (Asset Management, Bridge, Design, and Emergency Response); Operations; and Safety. The primary activity to date has been focused on developing the Adaptation Strategy.

## Tools and Resources

**FHWA Climate Change website.** This web site provides information on FHWA research, publications, and resources related to climate change science, policies, and actions. It also includes some current state and local practices in adapting to climate change and reducing greenhouse gas (GHG) emissions.<sup>133</sup>

**Regional Climate Change Effects: Useful Information for Transportation Agencies (May 2010).** This document provides basic information on projected future climate change effects (changes in temperature, precipitation, storm activity and sea level rise) over the near term, mid-century and end-of-century. The report includes two appendices: maps for some of the climate change effects, and a "typology" of projected climate change information gleaned from recent reports.<sup>134</sup>

**Atlantic Coast Study - The Potential Impacts of Global Sea Level Rise on Transportation Infrastructure (2008).** The study uses multiple data sources to identify the potential impacts of sea level rise on land and transportation infrastructure along the Atlantic coast, from Florida to New York.<sup>135</sup>

**Gulf Coast Study, Phase 1 (2008) and Phase 2 (expected 2012).** Phase 1 of the Gulf Coast Study analyzed how changes in climate over the next 50 to 100 years could affect transportation systems in the U.S. central Gulf Coast region and discussed how to account for potential impacts in transportation planning.<sup>136</sup> Phase 2 of the Gulf Coast study is underway and seeks to develop more definitive information about multimodal impacts at the local level in a single MPO (the Mobile, AL area) as well as precise tools and guides on how to adapt to climate impacts.

**Integrating Climate Change into the Transportation Planning Process (June 2008).** The final report summarizes a review of the state-of-the-practice in State DOTs and Metropolitan Planning Organizations (MPOs), including statutes and regulations, and interviews with several planning agencies. The report includes information on both mitigation and adaptation.<sup>137</sup>

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<sup>133</sup> To access the FHWA Climate Change website, visit <http://www.fhwa.dot.gov/hep/climate/index.htm>

<sup>134</sup> To read the report, go to [http://www.fhwa.dot.gov/hep/climate/climate\\_effects/](http://www.fhwa.dot.gov/hep/climate/climate_effects/)

<sup>135</sup> To read the report, go to <http://climate.dot.gov/impacts-adaptations/forcasts.html#potentialImpacts>

<sup>136</sup> To read the Gulf Coast Study, go to <http://www.climate-science.gov/Library/sap/sap4-7/final-report/sap4-7-final-all.pdf>

<sup>137</sup> To read the report, go to <http://www.fhwa.dot.gov/hep/climatechange/index.htm>

# Environmental Protection Agency (EPA)

## Overview

The Environmental Protection Agency (EPA) has responsibility for programs and policies that span air quality, human health, and coastal and land-use related water resources specifically focused on protecting human health and safeguarding the environment.

## Selected Initiatives and Strategies

**National Water Program Strategy.** The strategy identifies impacts of concern to water programs in the United States, defines goals and objectives to respond to such impacts, and provides specific actions in the areas of mitigation, adaptation, research, education, and program management.<sup>138</sup> Adaptation proposed actions are aligned with five key areas: Drinking water, Water quality and effluent standards; Watershed protection; Adapting the National Pollutant Discharge Elimination System program; Water infrastructure; and Wetlands protection. Annual Implementation Progress Reports and related adaptation products are posted as they become available.<sup>139</sup>

**Climate Change Impacts on Water Quality and Aquatic Ecosystems.** In collaboration with EPA's Office of Water, the Global Change Research Program is conducting a major assessment of the sensitivity of goals articulated in the Clean Water Act and the Safe Drinking Water Act to climate change, and opportunities for adaptation to the anticipated impacts. This assessment will be completed in 2013.

**HUD-DOT-EPA Interagency Partnership for Sustainable Communities.** Part of EPA's Smart Growth Program, EPA formed a partnership with HUD and DOT in 2009 focused on ensuring housing and transportation goals are met while simultaneously protecting the environment, promoting equitable development, and helping to address the challenges of climate change.<sup>140</sup>

## Programs and Institutional Mechanisms

**Climate Ready Estuaries Program.** The Climate Ready Estuaries (CRE) program is a partnership between EPA and the National Estuary Programs (NEPs) to address climate change in coastal areas.<sup>141</sup> Climate Ready Estuaries is supporting NEPs and coastal communities in becoming "climate ready" by providing tools and assistance to: assess climate change vulnerabilities, engage and educate stakeholders, develop and implement adaptation strategies, and share lessons learned with other coastal managers.

**Climate Ready Water Utilities (CRWU).** The CRWU program provides technical resources and tools for the water sector to develop and implement long-range plans that account for climate change impacts. By applying emergency management principles and sustainable infrastructure practices to the water sector's response to climate change, utilities will have the capability to assess risk, determine vulnerability, evaluate consequences, develop effective adaptation and mitigation strategies, and take necessary action to strengthen their critical infrastructure.

**Planning for Heat Health-Related Climate Change Impacts in American Cities.** EPA is developing a program to assist American cities with understanding and planning for the public health impacts of climate change, focusing mainly on extreme heat events.<sup>142</sup> EPA's OAR produced the *Excessive Heat Events Guidebook* (2006) with NOAA, CDC, and the Department of Homeland Security (DHS).<sup>143</sup> Designed to help community officials, emergency managers, meteorologists, and others plan for and respond to excessive heat

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<sup>138</sup> To read the Strategy, go to <http://www.epa.gov/water/climatechange/strategy.html> and <http://water.epa.gov/scitech/climatechange/upload/NWP-Key-Action-Update-2010-2011.pdf>

<sup>139</sup> [http://www.epa.gov/water/climatechange/docs/NWP\\_CC\\_2009\\_Key\\_Actions\\_Status\\_Report\\_Full\\_Report.pdf](http://www.epa.gov/water/climatechange/docs/NWP_CC_2009_Key_Actions_Status_Report_Full_Report.pdf)

<sup>140</sup> <http://www.epa.gov/smartgrowth/partnership/>

<sup>141</sup> To learn more about the Climate Estuaries Program, visit <http://www.epa.gov/cre/>

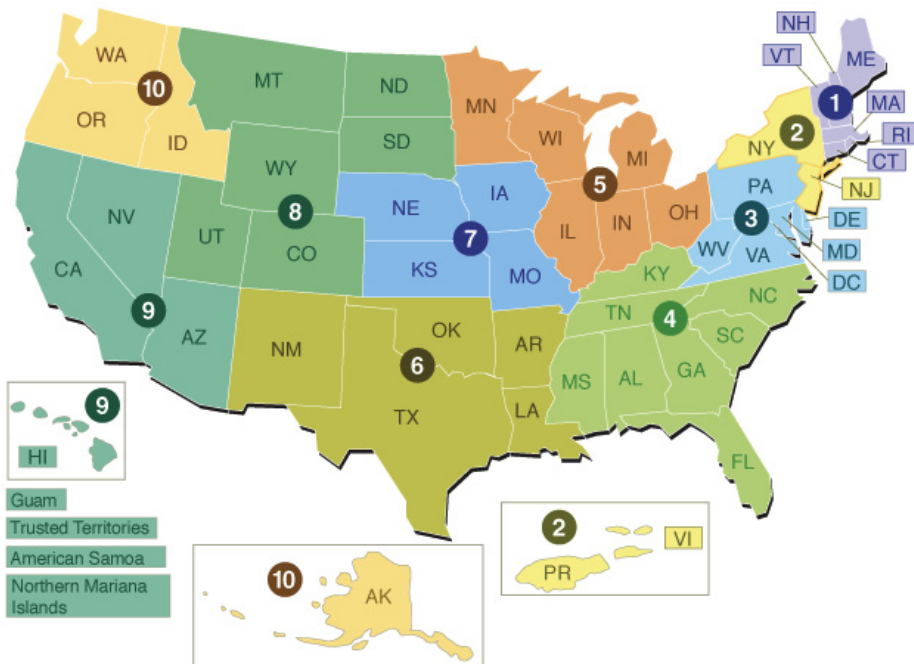
<sup>142</sup> To learn more about EPA's efforts and extreme heat events, visit <http://www.epa.gov/naturalevents/extremeheat.html>

<sup>143</sup> To read the Excessive Heat Guidebook, go to <http://www.epa.gov/heatisland/about/heatguidebook.html>

events, the guidebook highlights best practices that have been employed to save lives during excessive heat events in different urban areas and provides a menu of options that officials can use to respond to these events in their communities.

**Global Change Impacts and Adaptation Program.** Situated in the EPA's Office of Research and Development (ORD), this Global Change Research Program is a stakeholder-oriented research and assessment program that addresses the potential consequences climate variability and change on air and water quality, aquatic ecosystems, human health, and socioeconomic systems in the United States.<sup>144</sup> EPA uses the results of these studies to investigate adaptation options to improve society's ability to effectively respond to the risks and opportunities presented by global change, and to develop decision support tools for resource managers coping with a changing climate.

**Regional Climate Change Efforts.** EPA maintains regional offices across the United States organized within 10 defined regions, with most regions taking action or providing adaptation-related resources and developing regional resiliency. A number of EPA regions have developed specific adaptation strategies and initiatives. For example, Region 1 is working with the EPA-funded New England Environmental Finance Center to develop tools for coastal communities to identify sea-level rise and coastal storm vulnerabilities to make informed adaptation planning and zoning decisions. In addition, Region 8 completed their *Climate Change Strategic Plan* in 2008, setting adaptation goals for the regional office. Information on EPA Regional adaptation activities are summarized in a highlights document available online.<sup>145</sup>



Source: EPA regions at: <http://www.epa.gov/epahome/wheretheyoulive.htm>

**State and Local Climate and Energy Program.** EPA's State and Local Climate and Energy Program provides technical assistance, analytical tools, and outreach support to state, local, and tribal governments interested in both mitigation and adaptation planning efforts, specifically where a project will reduce GHGs while demonstrating economic, environmental or public health benefits such as improvements to air quality.

<sup>144</sup> To learn more about EPA's Global Climate Impacts and Adaptation Program, visit <http://www.epa.gov/ncea/global/index.htm>

<sup>145</sup> [http://water.epa.gov/scitech/climatechange/upload/Region\\_Highlights\\_Fact\\_Sheet.pdf](http://water.epa.gov/scitech/climatechange/upload/Region_Highlights_Fact_Sheet.pdf)

**Water Resources Adaptation Program (WRAP).** Through this new program, launched by the EPA in the summer 2010, scientists and engineers investigate the potential effects of climate change on the nation's watersheds and water infrastructure. Based on the results of these investigations, practical and effective adaptation solutions are being developed. The program's research is also a part of the Drinking Water Research Program and the Global Change Research Program in EPA's Office of Research and Development. The research supports EPA's Sustainable Water Infrastructure Initiative to ensure our nation's water infrastructure meets future needs of demographic and economic development. WRAP researchers collaborate with academic institutions, water utilities, and other internal and external stakeholders.<sup>146</sup>

## Tools and Resources

**Climate Change website.** The EPA developed and maintains a website synthesizing educational information and links to EPA and non-EPA publications and resources for climate change adaptation science, U.S. policy, U.S. regions, and sectors impacted by climate change including Health, Agriculture and Food Supply, Forests, Ecosystems and Biodiversity, Coastal Zones and Sea Level Rise, Water Resources, Energy Production and Use, and Public Lands and Recreation.<sup>147</sup> The site also includes an adaptation page.

**Climate Change Indicators in the United States (April 2010).** Focused primarily on the United States, this report presents 24 indicators, each describing trends related to the causes and effects of climate change, in order to support monitoring, evaluation and policy development.<sup>148</sup> Included are indicators such as U.S. and global temperatures, precipitation, drought, heat waves, sea level, snowpack, and growing seasons. Other federal agencies contributing to this report include CDC, NOAA and USGS.

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<sup>146</sup> <http://www.epa.gov/nrmrl/wswrd/wqm/wrap/index.html>

<sup>147</sup> To access EPA's Climate Change website, go to <http://www.epa.gov/climatechange/> and for additional adaptation information see <http://www.epa.gov/climatechange/effects/adaptation.html>

<sup>148</sup> [http://www.epa.gov/climatechange/indicators/pdfs/ClimateIndicators\\_full.pdf](http://www.epa.gov/climatechange/indicators/pdfs/ClimateIndicators_full.pdf)