
Federal Actions for a Climate Resilient Nation



**Progress Report of the Interagency
Climate Change Adaptation Task Force**

October 28, 2011

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Title Page Photos (from left to right): Aurora, NC, September 13, 2011 - The elevated house on the right received only minor damage when Hurricane Irene pushed 5 feet of storm surge ashore. The house on the left was completely destroyed (Credit: FEMA, Tim Burkitt); 2002 Valley Fire that burned San Juan National Forest lands and many homes located at the urban interface (Credit: U.S. Forest Service, Craig Goodell); Local business along Las Olas Boulevard in downtown Fort Lauderdale, FL inundated by sea water (Credit: Broward County Natural Resources Planning and Management Division); The fast attack submarine USS Providence (SSN 719) is moored at the North Pole in the Arctic Ocean to commemorate the 50th anniversary of the first submarine polar transit completed by the USS Nautilus (SSN 571) in 1958 (Credit: U.S. Navy, Petty Officer 1st Class J. Thompson).

LIST OF ACRONYMS

BLM – Bureau of Land Management
CDC – Centers for Disease Control
CEQ – Council on Environmental Quality
CSC – Climate Science Centers
DOE – Department of Energy
DOI – Department of the Interior
DOT – Department of Transportation
EPA – Environmental Protection Agency
FEMA – Federal Emergency Management Agency
FTA – Federal Transit Administration
HUD – Department of Housing and Urban Development
LCC – Landscape Conservation Cooperatives
MCC – Millennium Challenge Corporation
NASA – National Aeronautics and Space Administration
NCA – National Climate Assessment
NFIP – National Flood Insurance Program
NOAA – National Oceanic and Atmospheric Administration
NOC – National Ocean Council
NPS – National Park Service
OSTP – Office of Science and Technology Policy
REA – Rapid Ecoregional Assessments
RISA – Regional Integrated Sciences and Assessments
RPA – Regional Plan Association
Task Force – Interagency Climate Change Adaptation Task Force
USACE – U.S. Army Corps of Engineers
USAID – U.S. Agency for International Development
USDA – U.S. Department of Agriculture
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
USGCRP – U.S. Global Change Research Program
USGS – U.S. Geological Survey
WARN – Water/Wastewater Agency Response Network

Executive Summary

In October 2009, President Obama signed Executive Order 13514, *Federal Leadership in Environmental and Energy Performance*, which sets sustainability goals for Federal agencies and focuses on making improvements in agency environmental, energy, and economic performance. The Executive Order charged the Interagency Climate Change Adaptation Task Force with providing recommendations on how Federal policies, programs, and planning efforts can better prepare the United States for climate change. In October 2010, the Task Force recommended a set of policy goals and actions in its Progress Report to the President. The Task Force outlined how the Federal Government should work with local, state, and tribal partners to provide leadership, coordination, science, and services to address climate risks to the Nation as well as Federal assets and operations. In the 2010 Report, the Task Force committed to providing an update on Federal Government adaptation progress in 2011. This report provides that update in five key adaptation areas that align with the policy goals set forth by the Task Force in 2010:

Integrating Adaptation into Federal Government Planning and Activities: Agencies are taking steps to manage climate impacts to Federal agency missions, programs, and operations to ensure that resources are invested wisely and Federal services remain effective for the American people. Agencies are developing climate adaptation plans to identify their vulnerabilities and prioritize activities that reduce climate risk.

Building Resilience to Climate Change in Communities: Recognizing that most adaptation occurs at the local level, Federal agencies are working with diverse stakeholders in communities to prepare for a range of extreme weather and climate impacts (e.g. flooding, drought, and wildfire) that put people, property, local economies, and ecosystems at risk.

Improving Accessibility and Coordination of Science for Decision Making: To advance understanding and management of climate risks, the Federal Government is working to develop strong partnerships, enhance regional coordination of climate science and services, and provide accessible information and tools to help decision makers develop strategies to reduce extreme weather impacts and climate risks.

Developing Strategies to Safeguard Natural Resources in a Changing Climate: Recognizing that American communities depend on natural resources and the valuable ecosystem services they provide, agencies are working with key partners to create a coordinated set of national strategies to help safeguard the Nation's valuable freshwater, ocean, fish, wildlife, and plant resources in a changing climate.

Enhancing Efforts to Lead and Support International Adaptation: To promote economic development, regional stability, and U.S. security interests around the world, the Federal Government is supporting a range of bilateral and multilateral climate change adaptation activities and coordinating defense, development and diplomacy policies to take into account growing climate risks.

Extreme weather and other climate change impacts pose significant social, economic, and environmental risks to the United States. The U.S. Government has a responsibility to reduce climate risks to public health and safety, economic well-being, natural resources, and Federal programs and services. While much work remains, this report describes important Federal progress toward the Task Force's strategic vision of a *resilient, healthy, and prosperous Nation in the face of a changing climate*.

Introduction

The Interagency Climate Change Adaptation Task Force (hereafter Task Force) was established in 2009 to assess key steps needed to help the Federal Government understand and adapt to climate change. The Task Force is comprised of senior representatives from over 20 Departments and Agencies (Appendix A) and is co-chaired by the Council on Environmental Quality (CEQ), the Office of Science and Technology Policy (OSTP), and the National Oceanic and Atmospheric Administration (NOAA). As part of Executive Order 13514, President Obama directed the Task Force to examine how the Federal Government can better prepare the United States for climate impacts. In October 2010, the Task Force submitted a Progress Report to the President outlining a set of Federal climate adaptation policy goals (Appendix B) and guiding principles (Appendix C). This report provides an update on Federal Government adaptation.

In the 2010 Progress Report, the Task Force called on Federal agencies to demonstrate leadership on climate change adaptation. Rising sea levels, drought, extreme weather events, loss of land and sea ice, and other climate-related impacts threaten communities, ecosystems, and Federal services and assets. As people in the United States and around the globe experience these impacts, the Federal Government will face growing demands for accurate climate information, disaster risk reduction, and preparedness and response support. Through stakeholder and public listening sessions, outreach events, and online comments, the 2010 Task Force Report determined that the Federal Government has a responsibility to safeguard Federal services and resources and to help states, tribes, and communities manage climate-related risks by improving access to climate information, enhancing coordination and capacity, and leading and supporting actions that reduce vulnerability and increase resilience.

Federal agencies are taking steps to prepare the Nation for the impacts of climate change and have demonstrated significant progress towards the Task Force's adaptation policy goals in five key areas. These efforts are informed by the guiding principles developed by the Task Force and ensure that Federal resources are invested wisely and that the Federal Government's operations and services remain effective in a changing climate. Going forward, the Task Force will continue to support and coordinate these and other Federal actions to realize the Task Force's vision of *a resilient, healthy, and prosperous Nation in the face of a changing climate*.

Key Areas of Federal Adaptation Progress

- **Integrating Adaptation into Federal Government Planning and Activities**
- **Building Resilience to Climate Change in Communities**
- **Improving Accessibility and Coordination of Science for Decision Making**
- **Developing Strategies to Safeguard Natural Resources in a Changing Climate**
- **Enhancing Efforts to Lead and Support International Adaptation**

The Task Force has played an important leadership and coordination role in the Federal Government's adaptation activities. The Task Force directly supports Federal adaptation efforts related to communities, public health, insurance, science and services, natural resources (e.g., freshwater, oceans, fish, wildlife and plants), international contexts, and non-Federal partnerships and outreach. In addition, the Task Force

provides a forum for interagency collaboration on adaptation and is consulted regularly by Federal agencies and non-Federal entities for adaptation expertise, coordination, and partnership opportunities.

The Need to Adapt

Climate change impacts pose significant social, economic, and environmental risks to the United States and the global community. As documented in the latest U.S. National Climate Assessment (NCA) report, *Global Climate Change Impacts in the United States*, and the National Research Council's report series on *America's Climate Choices*, communities across the Nation are already experiencing a range of climatic changes, including more frequent and extreme precipitation events, longer wildfire seasons, reduced snowpack, extreme heat events, increasing ocean temperatures, and rising sea levels.^{1,2} The impacts from these changes are affecting livelihoods, infrastructure, ecosystems, food production, energy supply, national security, and the cultural heritage of populations and communities. Certain communities and ecological systems are particularly vulnerable to these impacts. We know enough about climate risks to take actions now that ensure a safer, more resilient and prosperous future.

Definitions of Key Terms

Adaptation: Adjustment in natural or human systems to a new or changing environment that exploits beneficial opportunities or moderates negative effects.

Resilience: A capability to anticipate, prepare for, respond to, and recover from significant multihazard threats with minimum damage to social well-being, the economy, and the environment.

Risk: A combination of the magnitude of the potential consequence(s) of climate change impact(s) and the likelihood that the consequence(s) will occur.

Vulnerability: The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity.

Source: National Research Council. 2011. *America's Climate Choices*: www.nap.edu/catalog.php?record_id=12781

Climate change is expected to significantly affect the United States. By the end of this century, global sea level is expected to rise by more than 2 feet in a low emissions scenario or nearly 3.5 feet in a higher emissions scenario.³ Higher sea levels, especially in combination with storm surge, will increasingly inundate U.S. coastal communities and threaten coastal ecosystems and infrastructure, such as military installations.⁴ Heat waves are expected to become more frequent and intense, posing a threat to human health and agriculture.⁵ For rivers fed by snowpack, runoff will continue to occur earlier, with reduced flows late in the summer, and the potential for water shortages that can affect the supply of water for drinking, agriculture, electricity production, and ecosystems.⁶ Economic, social, and natural systems are also inter-connected on a global scale, meaning that climate impacts in other regions of the world can pose serious economic and security risks to the United States. Increases in extreme weather and climate

¹ USGCRP. (2009). *Global Climate Change Impacts in the United States*. www.globalchange.gov/publications/reports

² National Research Council. (2011). *America's Climate Choices*. The National Academies Press. Washington, DC www.nap.edu/catalog.php?record_id=12781

³ USGCRP. (2009). *Global Climate Change Impacts in the United States*. www.globalchange.gov/publications/reports

⁴ US Department of Defense. (2010). *Quadrennial Defense Review*. www.defense.gov/qdr/

⁵ USGCRP. (2009). *Global Climate Change Impacts in the United States*. www.globalchange.gov/publications/reports

⁶ USGCRP. (2009). *Global Climate Change Impacts in the United States*. www.globalchange.gov/publications/reports

events will contribute to food and water scarcity, which can intensify existing tensions over access to life-sustaining resources.

Extreme weather and greater climate variability is expected to become more common in the future.⁷ While it is not possible to attribute any individual extreme event to climate change, these events do provide valuable insight into the climate-related vulnerabilities and challenges faced by the United States. In April 2011, the United States experienced record-breaking floods, tornadoes, drought, and wildfires all within a single month. As of September 2011, NOAA's National Climatic Data Center had already reported ten weather events from 2011 for which damages and/or costs reached or exceeded \$1 billion each,⁸ exceeding the previous *annual* record of nine events recorded over the entire year in 2008. NOAA estimates the total damage of property and economic impacts for all weather-related disasters during the spring and summer of 2011 at more than \$45 billion.⁹ The severe and costly losses suffered during recent extreme weather events demonstrate the importance of increasing the resilience of the United States to climate variability and change in order to reduce economic damages and prevent loss of life.

The Obama Administration is committed to reducing the magnitude of future climate impacts by curbing greenhouse gas emissions and advancing a clean energy economy. However, a range of climate impacts are unavoidable. To manage these risks, we must identify key threats, prioritize activities that reduce our vulnerability, initiate actions that promote resilience, and enhance preparedness capabilities.¹⁰

"The City of Grand Rapids is addressing various climate-related threats such as extreme heat and more intense precipitation events. We see these climate strategies as an extension of responsible governance and an imperative investment in the future prosperity of our city. As an inland watershed city, we have focused on restoring and maintaining a high quality of water in the Grand River with over \$240 million in combined sewer separation investment. This prepares us for ever-increasing precipitation levels now and into the future."

- George K. Heartwell
Mayor, Grand Rapids, MI

Adaptation can involve a range of actions taken by individuals, businesses, and governments, such as: a farmer choosing to grow a different crop variety better suited to warmer or drier conditions; a company deciding to relocate key facilities away from coastal areas vulnerable to sea level rise and hurricanes; a community updating its ordinances to protect wetland habitat that provides critical ecosystem services like flood protection; a city developing early warning systems for severe storms; and a Federal agency increasing its water-use efficiency at regional facilities to prepare for more frequent and severe drought. As demonstrated by these examples, there are management strategies at all levels of government and in all sectors that can help communities and businesses adapt to climate variability and change.

Local, State, and Private Sector Adaptation

Across the country, cities, towns, tribes, and states are leading efforts to reduce climate change risks. As of January 2011, eleven states had completed adaptation plans, four had plans in progress, and eight had

⁷ USGCRP. (2009). *Global Climate Change Impacts in the United States*. www.globalchange.gov/publications/reports

⁸ NOAA. (2011). *Billion Dollar US Weather Disasters*. National Climatic Data Center. www.ncdc.noaa.gov/oa/reports/billionz.html

⁹ NOAA. (2011). *Billion Dollar US Weather Disasters*. National Climatic Data Center. www.ncdc.noaa.gov/oa/reports/billionz.html

¹⁰ National Research Council. (2011). *America's Climate Choices*. The National Academies Press. Washington, DC: www.nap.edu/catalog.php?record_id=12781

recommended developing adaptation plans in their State Climate Action Plans.¹¹ Local adaptation efforts are emerging as well. The City of Chicago, for example, anticipating a hotter and wetter future, is already taking steps to adapt such as repaving alleyways with permeable materials to handle greater rainfall and reduce flood risks, and planting trees that can tolerate warmer conditions.¹²

The private sector is also taking action to adapt to climate change. Investors are increasing pressure on firms, as evidenced by a record 101 shareholder resolutions in 2010 calling on North American companies to manage climate change risks.¹³ Mounting losses from natural disasters are also shifting the business environment. In a 2011 global survey of businesses, nearly nine out of ten firms reported that they suffered climate impacts in the last three years.¹⁴ Businesses are starting to take preventive action to protect their assets, employees, and operations from climate change risks. In the same survey, approximately 22 percent of North American firms reported actively making changes within their business to minimize climate risks and damages.

“With the multiplier effect [of economic growth, subsidence, and climate change], the amount of economic loss to the Gulf Coast could rise to \$700 billion, the gross domestic product for the entire region for one year. No region in the country can afford to lose their entire GDP once every 20 years...Doing nothing is not an acceptable plan. That's a plan to put Entergy out of business, a plan for misery and suffering for our customers and a plan that would devastate a region already economically impaired.”

- J. Wayne Leonard
Chairman and CEO, Entergy Corporation
www.entergy.com/news_room/newsrelease.aspx?nr_id=1906

As highlighted throughout this report, the Task Force and its member agencies interact with business, local government, tribes, and other decision makers to learn from their successes and challenges and to understand what science and services they need to manage the impacts of climate change. Promoting and coordinating this dialogue will continue to be an essential element of the Federal Government's role moving forward.

Report Scope

This report provides a Task Force update on progress in five key areas at the core of Federal efforts to advance a national climate adaptation strategy and build a climate resilient Nation. These five areas closely align with the recommended policy goals in the 2010 Task Force Report (Appendix B) and also reflect how adaptation actions complement and intersect with one another. The examples of progress described in this report include technical assistance projects, regional partnerships, scientific advancements, and programs that foster adaptation. All of these efforts, with their diversity and breadth, demonstrate the Federal Government's progress toward the Task Force's 2010 policy goals.

¹¹ Pew Center on Global Climate Change. (2011). www.pewclimate.org/what_s_being_done/in_the_states/adaptation_map.cfm

¹² Kaufman, L. (2011). *A City Prepares for a Warm Long-Term Forecast*. The New York Times. www.nytimes.com/2011/05/23/science/earth/23adaptation.html?pagewanted=1

¹³ CERES. (2010). *Investors Achieve Record Results on Climate Change*. Boston. www.ceres.org/incr/news/climate-resolutions-2010.

¹⁴ UK Trade and Investment and The Economist Intelligence Unit. (March 2011). *Adapting to an Uncertain Climate: A World of Commercial Opportunities*. London, UK. Link: www.ukti.gov.uk/uktihome/item/128100.html.

Integrating Adaptation into Federal Government Planning and Activities

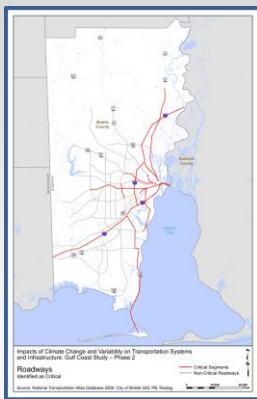
Highlights

- Federal agencies are beginning to more closely identify and manage climate-related risks and to implement actions that reduce climate change vulnerability and increase resilience of the Nation.
- Federal agencies are developing agency-specific plans to strengthen existing adaptation efforts and establish long-term priorities to respond to the challenges and opportunities that climate change poses to their missions, operations, and programs.

Climate change will challenge the missions, operations, and programs of Federal agencies. To ensure resilience and save taxpayer dollars in the long-run, the Federal Government has a responsibility to reduce climate risks as part of ongoing agency planning. Federal agencies play a significant role in managing our Nation's natural resources and infrastructure, including roads, airports, national parks, fisheries, dams, levees, and military installations. These natural and built assets are increasingly threatened in a changing climate, for example, by floods, droughts, hurricanes, and other disasters. Federal agencies are partnering with tribes, states, and communities to better prepare for and manage these risks.

As directed by Executive Order 13514 and recommended by the Task Force, Federal agencies are evaluating how climate variability and change are impacting their operations and services, and they are beginning to integrate adaptation into agency planning processes. Federal progress is evident from (1) newly established Federal agency adaptation policies; (2) increased sharing of climate adaptation expertise and information across agencies; and (3) ongoing development of adaptation plans in accordance with the Task Force's guiding principles, including applying risk management methods and tools to their adaptation efforts. These adaptation plans will include assessments of how climate change may impact agency missions and operations, as well as identify necessary adjustments to reduce risk, avoid unnecessary costs, and take advantage of opportunities.

U.S. Department of Transportation Assists Mobile, Alabama with Infrastructure Protection



In 2003, the U.S. Department of Transportation (DOT) initiated the first part of the Gulf Coast Study, a comprehensive analysis of climate risks to transportation infrastructure in the Gulf Coast region and its communities. Phase 1 assessed transportation climate vulnerability in the Gulf Coast Region and was completed in 2008. Phase 2, conducted in cooperation with the South Alabama Regional Planning Commission, is focused on assessing potential climate change impacts and vulnerability of transportation in Mobile, Alabama. This effort will develop transferable tools that will help transportation planners assess the vulnerability of transportation systems to climate risks and determine how best to safeguard critical infrastructure. The study is expected to be completed in 2013.

Map: Roadways Identified as Critical: National Transportation Atlas Database (2009, City of Mobile GIS, PB, Rextag)

Each adaptation plan will reflect the agency's core mission. For example, agencies with emergency management and health missions will likely focus on planning that reduces climate change risks to communities; those with infrastructure responsibilities will emphasize planning that enhances resilience and minimizes disruption; and agencies that support particular sectors (e.g. agriculture, energy) will focus on climate risks to production and security. The plans will help agencies integrate climate considerations into their existing planning and risk management processes.

Climate variability and change are already impacting Federal programs and operations, as well as the citizens they serve. For example, the U.S. Forest Service (USFS) recognizes that climate change is a major challenge to its mission of sustaining the health, diversity, and productivity of the Nation's forests and grasslands for present and future generations. Current climate change impacts, including changing temperatures and water flow patterns, can affect USFS-managed resources through increases in fire, drought, insect infestations, plant diseases, and invasive species. These impacts put at risk the many benefits Americans receive from forests, such as wood products, clean air, drinking water, and opportunities for recreation and tourism. The USFS National Roadmap for Responding to Climate Change identifies short- and long-term actions to reduce climate change risks to our Nation's forests and grasslands. A scorecard tracks Roadmap implementation to ensure the agency is accountable for incorporating climate change considerations into existing programs.

Federal agencies have continued to make progress on the adaptation pilot projects outlined in the 2010 Task Force Report as well. The U.S. Army Corps of Engineers (USACE) is currently updating guidance on how the agency's projects, systems, and programs can respond to future changes in sea level.¹⁵ In the long-term, USACE will use this information to incorporate climate change considerations into existing and new civil

San Juan Public Lands Center: Forest Service and Bureau of Land Management Integrating Climate Science into Land Management



2002 Valley Fire that burned San Juan National Forest lands and many homes located at the urban interface (Credit: Craig Goodell, U.S. Forest Service)

The average temperature in the Southwest has increased roughly 1.5°F since the 1970s (USGCRP 2009: www.globalchange.gov/publications/reports). As a result, snowmelt is occurring earlier and more spring flooding and lower summer stream levels are projected for the future. Under the Service First initiative, the Bureau of Land Management's (BLM) San Juan Field Center and the U.S. Forest Service are working together at the San Juan Public Lands Center, which covers over 2.5 million acres in Southwestern Colorado. In the past year, the partners have developed a drought vulnerability model, a carbon storage map, an alpine monitoring program, and projections of future temperature and precipitation patterns. These tools and information will be used to adjust the timing of grazing allotments to ensure adequate vegetation and help land managers choose different tree species to plant that are more resilient to drought, fire, and pests.

¹⁵ U.S. Army Corps of Engineers. (2011). *Procedures to Evaluate Sea Level Change Impacts, Responses, and Adaptation - Engineering Technical Letter*: www.corpsclimate.us/etl.cfm and *Water Resource Policies and Authorities Incorporating Sea-Level Change Considerations in Civil Works Programs*: 140.194.76.129/publications/eng-circulars/ec1165-2-211/entire.pdf

works infrastructure and ecosystem restoration projects in coastal areas to improve safety and resilience.

Federal agencies are at different stages of adaptation planning. Those with more experience are sharing lessons learned with their counterparts in other agencies. To respond to the 2010 Task Force's recommendations, Federal agencies participated in a series of workshops during the summer of 2011 to share information and best practices for managing climate risks to public health, land and water resources, and infrastructure. Each agency is also adopting an internal policy to establish an adaptation planning goal and better understand the challenges and opportunities presented by a changing climate. Agencies have already begun initial actions to reduce climate impacts to their mission and operations, and they will develop and publish climate adaptation plans in the summer of 2012 to strengthen those efforts. This initial planning lays the foundation for agencies to more fully integrate actions into their operations and management to reduce climate risks to Federal programs, services, and the Nation.

Building Resilience to Climate Change in Communities

Highlights

- **Federal agencies are developing ways to incorporate climate adaptation into planning, emergency preparedness, and disaster recovery to protect communities and reduce losses.**
- **Federal agencies are providing data, information, and decision tools to reduce health and insurance risks related to climate impacts.**

The 2010 Task Force Report recommended that the Federal Government help communities build resilience to climate change by integrating adaptation considerations into relevant Federal programs, policies, and guidance. Across the United States, many communities are recognizing the social and economic importance of increasing resilience to climate-related impacts. A 2011 survey of 396 mayors from all 50 states found that over 30 percent are already taking climate impacts into account within their capital planning and improvement programs, demonstrating growing local concern about climate risks.¹⁶ A climate-resilient community has the capability to anticipate, prepare for, and recover from climate impacts on public health and safety, the local economy, and natural resources. Planning for climate-related impacts is economically advantageous because it reduces the cost of disaster relief, improves infrastructure safety and reliability, and anticipates changes in ecosystems and the valuable services they provide.

The Task Force identified as a guiding principle in its 2010 Progress Report the need to prioritize the most vulnerable communities and create adaptation plans with meaningful involvement from all parts of society. Over the past year, the Task Force hosted workshops and listening sessions to solicit input from a wide variety of state, tribal, and local leaders on how the Federal Government can best support local adaptation efforts. Overwhelmingly, community stakeholders said they need reliable and accessible information to evaluate their vulnerabilities to climate change and to understand the costs and benefits of taking action to reduce local risks.

"In many smaller coastal towns that are going to be affected, the concern is not about expanding the current water and sewer infrastructure systems in a smart way. Rather, it is about moving infrastructure that has been in the ground for decades. Some of my pipes are over 100 years old. Smaller, low-wealth communities cannot possibly undertake the financial burden of system relocations without grants from the Federal government."

- Brian A. Roth
Mayor, Plymouth, NC on sea level rise

Through the Task Force and related interagency efforts, and in response to input from non-Federal partners and stakeholders, the Federal Government is making progress in enhancing the ability of communities to promote resilience to climate impacts. This progress is evident from (1) use of existing Federal resources, programs, and leadership to help communities reduce climate risks; (2) availability of information and decision support from Federal agencies to protect public health, livelihoods, and well-being in a changing climate; and (3) initial steps to integrate climate change risks into insurance mechanisms. The actions discussed below are important steps toward meeting the 2010 Progress Report policy goal to address key cross-cutting issues related to climate change adaptation.

¹⁶ U.S. Conference of Mayors. (2011). *Clean Energy Solutions for America's Cities: A summary of survey results prepared by GlobeScan Incorporated and sponsored by Siemens*: www.usmayors.org/cleanenergy/report.pdf

Working with communities to reduce climate risks

Communities and the Federal Government are now working in partnership to improve the ability of communities to prepare for climate change. For example, the U.S. Forest Service and the National Association of State Foresters co-sponsor Firewise Communities, a program that educates residents, planners, and community leaders about how to enhance safety and preparedness for wildfires.

NOAA and Partners Support Drought Preparedness



The National Oceanic and Atmospheric Administration (NOAA), the National Integrated Drought Information System, National Drought Mitigation Center, and state partners created a Guide to Community Drought Preparedness, a free resource that helps communities with drought monitoring, communication, and education on drought mitigation and response. The guide has been used successfully in drought-prone communities that range in size from 7,000 residents (Nebraska City, NE) to larger urban areas including Decatur, IL (population: 75,000) and Norman, OK (population: 100,000). The guide provides valuable examples of how municipalities can reduce the economic impacts of future droughts by building community resilience.

www.drought.unl.edu/Planning/PlanningProcesses/DroughtReadyCommunities.aspx

Federal agencies are also developing ways to incorporate climate adaptation into emergency preparedness and disaster recovery to protect communities and reduce losses. The Federal Emergency Management Agency (FEMA) has found that every dollar spent by the agency on hazard mitigation provides the Nation with about four dollars in future benefits.¹⁷ FEMA, the U.S. Army Corps of Engineers (USACE), and state agencies are helping to address flood risks through the Silver Jackets program, which creates interagency teams to simplify access to critical flood risk mitigation and planning resources. It also provides communities with a single point of contact to the Federal Government on these issues. Additionally, the NOAA-led U.S. Integrated Ocean Observing System Program partners Federal agencies with Regional Coastal Ocean Observing Systems across the country to provide coastal communities with more accurate estimates of the environmental effects of climate variability to inform community planning and reduce potential hazards.

Ensuring the health and safety of communities both before and after a disaster also depends on transportation and water infrastructure remaining safe and functional in the case of extreme events. As the intensity and frequency of severe storms increase in a changing climate, transportation and water infrastructure will need to be more resilient to climate impacts. To respond to this challenge, the Federal Transit Administration (FTA) provides public transportation officials across the country with information on transit use during emergency response and on how to build the resilience of public transportation assets and services to weather and climate risks. The Environmental Protection Agency's (EPA) Water/Wastewater Agency Response Network (WARN) helps water utility managers respond to and recover from emergencies that affect water system integrity and can lead to health risks from sewer system failures.

¹⁷ Multihazard Mitigation Council. (2005). *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities*. National Institute of Building Sciences, Washington, DC: www.nibs.org/client/assets/files/mmc/Part1_final.pdf

People and businesses depend on secure and reliable energy supplies for social well-being and economic prosperity. More frequent and longer periods of drought anticipated with climate change will impact water supplies needed for energy production.¹⁸ The Department of Energy (DOE) is working with the Western Governors' Association, the Western Electricity Coordinating Council, and the Electric Reliability Council of Texas on an energy-water initiative that supports electricity transmission planning in the western United States, taking into account reductions in water availability in a changing climate. The project will yield a comprehensive package of regional planning models and data that supplement interconnection-wide transmission planning studies with information on regional water availability and demand. These resources will help to shape climate resilient electricity generation options to meet the energy needs of a growing economy and population.

Federal agencies are also considering how existing grant programs can be used to encourage community adaptation. For example, the Department of Housing and Urban Development's (HUD) Sustainable Communities Regional Planning Grants encourage grant recipients to integrate climate adaptation into their regional housing, land use, and transportation planning. The Regional Plan Association (RPA) of New York City is one of a number of HUD grantees incorporating climate information to enhance resilience of critical infrastructure to severe storms and coastal flooding. The RPA will also assess urban design implications of flood protection standards to develop new example standards, codes, and regulations for municipalities that will better equip them to adapt to extreme climate conditions.

"Swinomish people are inheritors of the traditional knowledge of the Skagit territory...our people carry over 10,000 years of knowledge of our traditional area. We are experienced in the adaptation methods within our respected homelands and waters. So we urge you to invest in our knowledge. We have survived many challenges impacting the sustainability of our way of life, and we are still here, still adapting."

- Brian Cladoosby
Chairman, Swinomish Tribe

While Federal agencies have made progress in helping communities build resilience to climate change impacts, much more can be done, particularly for vulnerable populations. Within communities, some populations – such as children, elderly and low-income citizens – are more vulnerable to climate impacts due to higher sensitivity to health threats.¹⁹ Tribal nations are also disproportionately affected by climate change because of their strong dependence on natural resources for economic development, subsistence, social cohesion, and culture.²⁰

To help respond to these impacts on tribes, the Department of the Interior's (DOI) Bureau of Indian Affairs announced a competitive climate change tribal grant program in Fiscal Year 2011. These grants will enable tribal participation and representation in climate change-related activities occurring around the country. The funds will also help tribes develop and implement climate change projects and strategies to benefit tribal resources and communities. Partners will include the U.S. Forest Service (USFS), Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (USFWS), National Park Service (NPS), and tribes. The Federal Government will continue to strengthen partnerships with communities and tribes to reduce climate change risks, particularly those that disproportionately affect vulnerable populations.

¹⁸ USGCRP. (2009). *Global Climate Change Impacts in the United States*. www.globalchange.gov/publications/reports

¹⁹ USGCRP. (2009). *Global Climate Change Impacts in the United States*. www.globalchange.gov/publications/reports

²⁰ USGCRP. (2009). *Global Climate Change Impacts in the United States*. www.globalchange.gov/publications/reports

Protecting public health in a changing climate

Recognizing that climate variability and change pose health risks, the 2010 Task Force Report recommended that the Federal Government address climate change in public health activities. Climate change can heighten the risk of illnesses and injuries, exacerbate many existing health conditions, and change the patterns of where diseases are transmitted by insects and other vectors. Health is also affected by the safety and availability of food, water, indoor air quality, and energy, which may be compromised during and after extreme weather events. Extreme weather events, intense heat waves, and climate-induced degradation of air and water quality may overwhelm our already overburdened public health systems.²¹ Protecting public health is an integral part of reducing the climate risks facing communities.

Federal agencies are making progress to address these challenges and promote healthy communities in the face of a changing climate. For example, the Center for Disease Control and Prevention (CDC) has launched the Climate-Ready States and Cities Initiative to help state and city health departments prepare for and monitor emerging health risks exacerbated by climate change. The CDC is currently connecting ten city and state health departments with climate scientists to understand potential impacts and identify health risks to their specific geographic area. Participating health departments are also developing strategies to determine the effects of climate change on human health and vulnerable populations.

Federally-provided tools are helping communities develop cost-effective ways to reduce health risks from climate impacts as well. The U.S. Forest Service provides decision-making tools that help communities plan tree plantings as low-cost ways of improving storm water management and flood control while reducing the urban “heat island” effect. By lowering air temperatures and increasing shade, the new trees improve quality of life.

Flooding Impacts to Iowa Infrastructure



Flooding Impact on Bridge in Cedar Rapids, Iowa, July 2008
(Credit: Susie Shapira, FEMA)

Iowa has experienced catastrophic flooding three times in the past 17 years. The floods of 2008 rank in the top ten natural disasters in U.S. history and highlight the risks of Iowa’s changing climate. The EPA and FEMA worked with stakeholders in Iowa in 2010 to coordinate hazard mitigation with current and future land-use decisions to increase community safety and help reduce economic losses from future flooding. EPA and FEMA are also coordinating to help other communities make cost-effective choices for housing and infrastructure systems that reduce climate risks to communities.

Integrating climate change risks into insurance mechanisms

Insurance is one of several options available to individuals, businesses, and communities to manage risks posed by extreme weather and climate change. However, with continued development in areas exposed to flood hazards, especially in coastal areas, our nation’s flood risk is increasing. In the 2010 Progress Report, the Task Force recommended facilitating the incorporation of climate change risks into insurance

²¹ USGCRP. (2009). *Global Climate Change Impacts in the United States*. www.globalchange.gov/publications/reports

mechanisms. The Federal Government is assessing ways to develop more realistic risk-based pricing signals for public insurance and to raise public awareness of climate and extreme weather-related risks.

With Task Force leadership, a Federal interagency group is exploring options for a public-private partnership to develop an open-source risk assessment model. This strategy aims to provide a consistent, accessible, no-cost resource for communities and insurance providers to assess risks from extreme weather events and climate change. The work on the risk assessment model will continue under the National Science and Technology Council's Subcommittee on Disaster Reduction.

Recent extreme events also highlight the need for a strong National Flood Insurance Program (NFIP: administered by FEMA), which enables homeowners in participating communities to purchase insurance protection against losses from flooding. In spring 2011, persistent rainfall combined with melting snowpack caused widespread flooding in some of the major rivers across the United States, including the Ohio, Mississippi, and Missouri.²² FEMA is currently analyzing options to address concerns about the NFIP, including the inherent weaknesses caused by program subsidies and the cost of insurance, the methods by which flood risks are modeled and depicted on maps given expected changes in future hydrological conditions, and the low market penetration of flood insurance in floodplains.

FEMA is currently working with other Federal agencies and academic experts to assess the impacts of climate change on the NFIP. Additionally, FEMA is undertaking a study on reforming the NFIP to reduce flood risks, improve flood risk communication, remove barriers for greater private sector participation in flood insurance, address affordability of insurance, and ensure fiscal soundness. FEMA will publish recommendations on these two issues in 2011.

²² NOAA. (2011). *Spring 2011 U.S. Climate Extremes*. National Climatic Data Center. www.ncdc.noaa.gov/special-reports/2011-spring-extremes/index.php#flooding

Improving Accessibility and Coordination of Science for Decision Making

Highlights

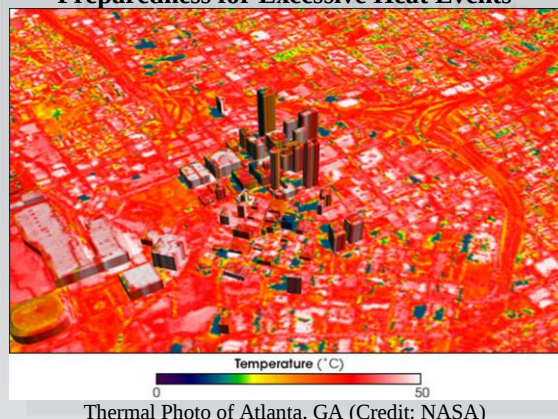
- **The Federal Government is working to improve the accessibility and utility of climate information and tools to meet the needs of decision makers.**
- **The U.S. Global Change Research Program is advancing a process for timely climate research, assessments, and services to support adaptation planning across the country.**

Decision makers need science that effectively informs and supports actions to enhance resilience to extreme events as well as climate variability and change.²³ The Federal Government plays an important role in ensuring that climate-related information and tools are accessible, timely, and relevant for decisions at multiple scales and in different contexts.

The Federal Government has made substantial progress towards the Task Force's 2010 policy goals of improving the integration of science into decision making and coordinating Federal capabilities to support adaptation. Specifically, this progress is evident from (1) development of an interagency initiative to enhance coordination of regional climate science and services; (2) substantial strengthening of the National Climate Assessment; and (3) emergence of coordinating bodies and programs for addressing critical information needs and improving the utility and accessibility of Federal science in support of adaptation. All of these efforts align with the Task Force's guiding principles that adaptation requires strong partnerships and should be grounded in the best-available science.

With Task Force leadership, Federal agencies are undertaking efforts to enhance regional coordination of climate science and services. Under this initiative, partnerships between Federal and non-Federal climate-related programs will expand and strengthen in eight regions that cover the entire United States. These collaborations will support efficient and effective delivery of climate science, tools, services, and assessments to meet stakeholder needs and support adaptation planning within each region,

Preparedness for Excessive Heat Events



Climate change is expected to exacerbate threats to health by increasing the frequency, intensity, and duration of excessive heat events. However, most adverse health outcomes are preventable. Federal agencies are working with state and local officials to develop preparedness plans and tools that local emergency planners and decision makers can use to prepare for and respond to heat waves.

An Excessive Heat Event Guidebook developed by EPA, NOAA, DHS, and CDC helps community officials, emergency managers, and scientists develop city-specific heat response plans and early-warning systems. NASA and CDC are also working with Indiana University on pilot projects with Philadelphia, PA, Dayton, OH, and Phoenix, AZ to improve their heat watch/warning systems by integrating satellite measurements with social and health data to improve preparedness.

²³ National Research Council. (2010). *America's Climate Choices: Panel on Informing an Effective Response to Climate Change*. www.americasclimatechoices.org/panelinforming.shtml

integrating and leveraging the existing coordination efforts described below.

Science in Support of Fire Response



Satellite Image of Texas Fires (Credit: NASA)

Federal agencies are providing scientific information and tools to help decision makers prepare for, respond to, and reduce the threat of fire to minimize fire-related loss of life and damages.

With seasonal forecasting, NOAA scientists warned Texas fire managers in December 2010 of impending extreme drought conditions that would lead to high fire risk. This long-range forecast helped decision makers pre-position local fire-fighting assets so that when the fire season arrived, first responders could act quickly to save lives and property.

When the burning escalated in spring 2011, as predicted, NOAA deployed specially trained National Weather Service (NWS) meteorologists to support forecasts that helped first responders battle the fires. The 13 NWS forecast offices serving Texas also provided drought information, high wind warnings, and short- and long-term weather forecasts.

Throughout the 2011 fire season, the U.S. Forest Service and DOI used science-based tools to provide information about expected fire behavior, risks of damage, and assistance needs.

These collaborative efforts helped fire managers develop strategic responses and on-the-ground tactical actions for fires across the nation, including large fires in Texas, Arizona, New Mexico, and Georgia.

A number of Federal efforts are already underway to strengthen regional partnerships on climate science and services. For example, DOI has initiated a landscape-level, science-based approach to informing management of natural resources through the development of a nationwide network of Climate Science Centers (CSC) and Landscape Conservation Cooperatives (LCC). DOI works in close partnership with NOAA's Regional Integrated Sciences and Assessments (RISA) teams to maximize cost-effectiveness while enhancing the Federal government's collective ability to develop and provide critical science to a diverse array of stakeholders. CSCs will provide fundamental scientific information, tools, and techniques for land, water, wildlife, and cultural resource managers to anticipate, monitor, and adapt to climate change impacts. RISAs will contribute information and advance understanding within the regions by performing interdisciplinary research that addresses the diverse needs of decision makers, such as local farm and ranch organizations and emergency planners.

The National Climate Assessment (NCA), an interagency effort within the U.S. Global Change Research Program (USGCRP), is another core element of the Federal Government's effort to advance climate science and services. As mandated by the Global Change Research Act of 1990, the 2013 NCA synthesis report will include an evaluation of Federal climate science activities and an assessment of current and future climate impacts on critical sectors (e.g. water, agriculture, energy, etc.). The newly redesigned NCA process is working to expand engagement of partners from every sector and region of the United States. Moving forward, the NCA is exploring options for increasing the accessibility and utility of its products through web-based deployment and other forms of communications. The NCA is also working to establish sustained capacity to deliver

consistent and accurate impact, vulnerability, and risk information in support of adaptation decision-making. In addition, the NCA is working with Federal agencies and other partners to develop physical, ecological, and societal indicators for tracking U.S. climate change impacts and vulnerabilities through time.

Last year, the Federal Government launched another major effort to address critical adaptation information needs of practitioners and managers. An interagency Adaptation Science Workgroup, initiated by the Task Force and transitioned to the USGCRP in 2010, is coordinating science in support of adaptation across Federal agencies, identifying ways to improve the deployment of adaptation-relevant science, providing scientific support for agencies as they implement adaptation plans required under EO 13514, and developing metrics and guidance that practitioners can use to evaluate the success of their adaptation efforts.

Addressing Climate Risks in Southeast Florida



Inundation (right) from a high tide in Fort Lauderdale, Florida (Credit: Broward County)

Southeast Florida is already experiencing the impacts of extreme weather and sea level rise, compromising drainage systems and sea walls during high tide events. With continued sea level rise and the prospect of more intense hurricanes and heavy downpours, the region faces greater risks of flooding, safe water supply shortages, infrastructure damage, and natural resource degradation. In response, Broward, Miami-Dade, Palm Beach, and Monroe Counties entered into the Southeast Florida Regional Climate Change Compact in 2010 to address these threats collaboratively. The South Florida Water Management District and Climate Leadership Initiative have been prominent partners in this effort.

Local and regional offices of Federal agencies—including USACE, NOAA, USGS, and EPA—have supported these counties with regional adaptation planning. For example, USACE and NOAA provided technical assistance to evaluate threats of future sea level rise. USGS applied advanced hydrologic models and provided financial resources to support projects related to saltwater intrusion of groundwater supplies and flood risks. EPA provided coordination support, helping connect the Compact partners with critical technical, planning, and programmatic resources.

Many other Federal efforts are also underway to provide decision-relevant climate information in easily understood and useful formats. The Extension Disaster Education Network,²⁴ a multi-state Extension Services effort supported by U.S. Department of Agriculture's (USDA) National Institute of Food and Agriculture and NOAA Sea Grant, provides county educators with science-based tools and information to help communities prepare for, respond to, and recover from natural and manmade disasters. The USGS's LandSat program provides satellite imagery online²⁵ that helps land owners and managers observe and

²⁴ Extension Disaster Education Network (EDEN). (2011). *Reducing the Impact of Disasters Through Education*. www.eden.lsu.edu/Pages/default.aspx

²⁵ USGS. (2011). LandSat. glovis.usgs.gov/

better manage forests and agricultural lands. NOAA also recently updated its U.S. Climate Normals data online.²⁶ Access to this information helps farmers make planting decisions and electricity utility managers set appropriate rates. Through the Prediction of Worldwide Energy Resource (POWER) project and web portal,²⁷ NASA provides user-friendly weather and solar data that help the energy, building, and agricultural industries plan for climate impacts. The USGCRP is also exploring options for developing and maintaining an online interagency global change information portal/system to provide “one-stop shopping” for climate-related information.

A great deal of work is still required to provide accessible information that meets the diverse set of adaptation planning, implementation, and evaluation challenges faced by communities and practitioners. Building upon and strengthening partnerships between Federal and non-Federal entities will be key to advancing adaptation efforts across the country. Developments in information, tools, and services, particularly at local-to-regional scales, will be needed to better support planning needs. These challenges also create opportunities and incentives to improve coordination among Federal agencies, leverage existing and future efforts, and develop the innovative partnerships required to integrate climate information into public and private planning, evaluation, and investment.

“The Harris County Flood Control District and many other local and state flood risk reduction agencies look to the Federal government for unified, targeted climate change research to establish public policy and guidance based on best-available scientific research. We encourage the inclusion of local and state officials in the research, policy, and guidance development since all of the impact and much of the cost of any decision to incorporate, or not incorporate, climate change as a design factor will be borne by local and state entities.”

- Steve Fitzgerald
Chief Engineer
Harris County Flood Control District, Texas

²⁶ NOAA. (2011). *U.S. Monthly Climate Normals*. www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

²⁷ NASA. (2011). *Power Of Worldwide Energy Resources*. www.power.larc.nasa.gov/

Developing Strategies to Safeguard Natural Resources in a Changing Climate

Highlights

- The Federal Government worked with stakeholders to develop a *National Action Plan* for managing freshwater resources in a changing climate in order to assure adequate water supplies and protect water quality, human health, property, and aquatic ecosystems.
- Federal agencies are partnering with state, tribal and local representatives to develop strategies for safeguarding our Nation's oceans, fish, wildlife, and plants.

Over the coming decades, the valuable natural resources and ecosystem services on which people depend will be increasingly affected by warming temperatures, rising seas, and more frequent and severe drought, among other expected climatic changes. In some cases, major, rapid disruptions to ecosystems may occur when ecological thresholds are crossed due to climate change in combination with other stressors.²⁸ The Federal Government has made significant progress in developing strategies to safeguard natural resources as recommended under the Task Force's policy goal to address key cross-cutting issues. This progress is evident from (1) completion of a *National Action Plan* to strengthen climate change adaptation for freshwater resources; (2) development of a strategic action plan to strengthen the resilience of coastal, ocean and Great Lakes communities and ecosystems to climate change; and (3) design of a strategy to reduce climate change impacts on the Nation's fish, wildlife and plant resources and their habitats. The Task Force and the Council on Environmental Quality (CEQ) are regularly convening the groups charged with the development of these strategies to foster collaboration and to ensure that the plans are complementary.

Managing Water Resources in a Changing Climate

Climate impacts pose significant challenges for water resource managers. These challenges include ensuring adequate groundwater and surface water supply for human consumption, ecological integrity, agriculture, industry, and energy as hydrologic conditions shift and drought becomes more prevalent. New problems may also arise for water managers working to protect human health and property, such as increased water- and vector-borne disease, increased difficulty in treating drinking water, and disruptions of power, water, sewer, and emergency services as a result of more extreme rainfall events. Changing water resource conditions will also create challenges for protecting the availability and quality of freshwater resources, habitat, and aquatic life.

"The Trinity River COMMON VISION Program has been a vanguard for effective floodplain management in North Central Texas...but our continued partnership with Federal agencies like the U.S. Army Corps of Engineers and FEMA with our local governments is the key ingredient to our ongoing progress and accomplishment. Our agency, on behalf of our member local governments, remains committed to partnership to meet the public safety, environmental stewardship and overall quality of life needs of our region. We hope our Federal partners are equally as committed in this effort to deal with the significant challenges of climate resilience in watershed and floodplain management."

- John Promise
Director of Environment & Development
North Central Texas Council of Governments

²⁸ USGCRP. (2009). *Global Climate Change Impacts in the United States*. www.globalchange.gov/publications/reports

Federal agencies have made substantial progress in improving water resource management in a changing climate. Member agencies of the Task Force developed a *National Action Plan: Priorities for Managing Freshwater Resources in a Changing Climate*. The *Plan* includes a national goal and six recommendations to help freshwater resource managers understand and reduce the risks of climate change to our Nation's freshwater resources. It is designed to help freshwater resource managers assure adequate water supplies, safeguard water quality, and protect human life, health, and property. Key recommendations call for strengthening Federal water data systems, building tools to help water facilities assess vulnerability to climate change, expanding water use efficiency, and supporting training and outreach to build climate change response capability in the water sector.

New York City Pilot for Climate Resilience Evaluation and Awareness Tool



Treated sewage backed-up at Bronx Water Pollution Control Plant (Credit: NYC DEP)

In 2009, EPA worked with the New York City Department of Environmental Protection (DEP) to pilot the Climate Resilience Evaluation and Awareness Tool (CREAT). CREAT is a software tool designed to assist drinking water and wastewater utility owners and operators in understanding potential climate change threats to their utilities. CREAT allows users to assess adaptation options to address climate-related impacts using both traditional risk assessment and scenario-based decision making. The DEP is now using the tool to complement a comprehensive study to develop an adaptation strategy to address increasing population demand for water services and minimize impacts of heavy rain and storm surge to New York City's drainage and wastewater management systems.

water.epa.gov/infrastructure/watersecurity/climate/creat.cfm

The *Plan* will be a foundation for Federal agency efforts to manage water resources as the climate changes. In a related effort, the Department of Interior (DOI) delivered a report to Congress on how to strengthen data and information systems to better understand climate impacts on water.²⁹ DOI also produced a report on the risks and impacts to water supplies and management in the eight major river basins in the western United States.³⁰

In addition, the Federal Government has made important progress toward improving water-use efficiency to reduce climate change impacts. For example, DOI's WaterSMART program continues to provide support to help states deal with rapid population growth, climate change, aging infrastructure, and land use changes. As part of that effort, DOI awarded \$24 million in funding for new water conservation and energy efficiency projects in Western states, saving enough water annually to serve a population of 400,000. Many of the WaterSMART projects involve relatively inexpensive improvements and conventional technology. An irrigation company in Washington State, for instance, will simply replace open ditches with pipes. By preventing seepage loss and reducing pumped water demands, the project will save approximately 2.5 billion gallons of water and 4.3 million kWh of electricity per year. EPA's WaterSense program also provides tools to

²⁹ Federal Interagency Panel on Climate Change and Water Data and Information. (2011). *Report to Congress: Strengthening the Scientific Understanding of Climate Change Impacts on Freshwater Resources of the United States*.

www.doi.gov/news/pressreleases/loader.cfm?csModule=security/getfile&pageid=260567

³⁰ U.S. Department of Interior. (2011). *Reclamation SECURE Water Act Section 9503(c) – Reclamation Climate Change and Water, Report to Congress*. www.usbr.gov/climate/SECURE/docs/SECUREWaterReport.pdf

decrease indoor and outdoor residential water use through more efficient products and practices. In 2010, WaterSense helped consumers save more than 79 billion gallons of water, \$1.3 billion in water and sewer bills, and 10.8 billion kWh of electricity.

In the agricultural sector, the USDA is working with farmers in the Environmental Quality Incentives Program (EQIP) to improve water-use efficiency through measures that allow farmers to grow more crops with less water. In 2010, 28 projects totaling more than \$60 million supported water conservation efforts in nine states. In Colorado, for example, technology funded under EQIP helps farmers monitor water-use data in real-time. This information helps them decide how much water to use on their crops, when to apply irrigation water, and what types of irrigation equipment to use.

Federal agencies are also working with communities to address challenges associated with managing water in a changing climate. NOAA's Lake Champlain Sea Grant program has educated local businesses and community leaders, residents, and students about how climate change can affect their communities. Climate models project an increase in heavy rainfall events in the Lake Champlain basin within the next century, leading to an increase in surface runoff, stream channel instability, flooding, pollutant loading, and altered aquatic ecosystems. Sea Grant has partnered with churches, small businesses, and medical parks to implement stormwater management best practices at three demonstration projects in Vermont.

Enhancing Resilience and Adaptation of the Nation's Coasts, Oceans, and Great Lakes to Climate Change and Ocean Acidification

Climate-related impacts pose serious threats to coastal communities and coastal, ocean and Great Lakes ecosystems. Coastal communities are projected to face significant risks of inundation from the combined impacts of sea level rise and storm surge from increased intensity of extreme events. The distribution and productivity of fish, invertebrate, and plant species are shifting in response to warming ocean waters.³¹ Climate change is expected to lower the water levels of the Great Lakes, thereby altering habitat, water cycles and supply, and related economic activities. Ocean acidification is expected to have significant and largely negative impacts on marine biological diversity.³²

In July 2010, President Obama signed Executive Order 13547, which established the Nation's first-ever National Policy for Stewardship of the Ocean, our Coasts, and the Great Lakes, as well as an interagency National Ocean Council (NOC) to advance the Policy. The NOC is co-chaired by CEQ and OSTP, and includes representatives from 26 Federal agencies. The NOC is currently developing a *Strategic Action Plan for Resiliency and Adaptation to Climate Change and Ocean Acidification*. The draft *Plan* proposes a coordinated approach to conducting research, observations, modeling, vulnerability assessments, and to providing information and guidance to support adaptation efforts. These advances will help communities and ecosystem stewards manage risks related to climate change and ocean acidification.

The Federal Government is working with partners to make progress toward improving the resilience of coastal communities and ecosystems to climate change risks. For instance, NOAA provides funds and

³¹ USGCRP. (2009). *Global Climate Change Impacts in the United States*. www.globalchange.gov/publications/reports

³² National Research Council. (2010). *Ocean Acidification: A National Strategy to Meet the Challenges of a Changing Ocean*. www.nap.edu/catalog.php?record_id=12904

technical assistance to support coastal states and communities to improve their resilience to climate change and coastal hazards. NOAA also supports Maryland's Coast-Smart Communities Initiative, which provides local decision makers with information and resources to plan for and adapt to sea level rise and coastal hazards. As a result of this effort, a number of Maryland communities have recently amended their building codes to require elevation buffers (i.e. freeboard) ranging from 1.5 to 2 feet for new and re-development projects to account for future sea level rise and more frequent flooding and inundation.

In coastal ecosystems across the country, Federal agencies are supporting adaptation efforts. EPA's Climate Ready Estuaries program (CRE), for instance, has supported more than 30 coastal adaptation projects in collaboration with 19 National Estuary Programs from Charlotte Harbor, Florida to Puget Sound, Washington.³³ These projects have used the best-available science for the development of climate change vulnerability assessments and have developed ecosystem-based adaptation strategies. As another example, the U.S. Geological Survey (USGS) is mapping the distribution of key species in the low-lying islands and atolls of the Papahānaumokuākea Marine National Monument in the Pacific, identifying those most vulnerable to sea level rise.

Restoring Tidal Processes to Nisqually Estuary in Washington State



(Credit: Mark Gamba)

After a century of blocking tidal flow, the Brown Farm Dike was removed to inundate 762 acres of Nisqually National Wildlife Refuge in Washington State in October 2009. Along with 140 acres of tidal wetlands restored by the Nisqually Indian Tribe, this represents the largest tidal marsh restoration project in the Pacific Northwest to assist in recovery of Puget Sound salmon and wildlife populations. During the past decade, the refuge and partners have restored more than 22 miles of tidal slough systems and re-connected historic floodplains to the Puget Sound, enabling an increase of up to 50 percent in salt marsh habitat in this part of the Sound.

Partners have initiated restoration of more than 70 acres of riparian surge plain forest, an extremely depleted type of tidal forest important for juvenile salmon and songbirds. Restoration of the estuary is an adaptation approach that helps promote system resilience to climate change effects such as increased winter storms, loss of forest cover due to increases in insect infestations and fire, and sea level rise resulting in loss of shoreline.

Safeguarding our Nation's Fish, Wildlife and Plants

Ecosystems are already significantly impacted by climate change. These impacts include large-scale shifts in species ranges and more fires, insect pests, disease pathogens, invasive species, and habitat loss.³⁴ Species respond differently to changes in climate, leading to alterations in community composition and mismatches in life history events (e.g. migration and blooming).³⁵ Climate change is likely to exacerbate existing stresses (e.g. habitat fragmentation and pollution) and negatively impact communities that rely on

³³ U.S. Environmental Protection Agency. (2011). *Climate Ready Estuaries*. www.epa.gov/cre

³⁴ USGCRP. (2009). *Global Climate Change Impacts in the United States*. www.globalchange.gov/publications/reports

³⁵ USGCRP. (2009). *Global Climate Change Impacts in the United States*. www.globalchange.gov/publications/reports

natural resources for their livelihood and economic prosperity. Some of these impacts will be irreversible, such as species extinctions and loss of coastal land as sea levels rise.

With state and tribal partners, the Federal Government has made significant progress toward developing a *National Fish, Wildlife, and Plants Climate Adaptation Strategy*.³⁶ Congress called for this *Strategy* in 2010, and it was endorsed by the Task Force in its 2010 Progress Report. The U.S. Fish and Wildlife Service (USFWS), NOAA, CEQ, and state wildlife agencies are co-leading the development of the *Strategy* using the best-available science and applying ecosystem-based approaches, in line with Task Force guiding principles. A draft *Strategy* is scheduled for public release in late 2011 and a final draft will be published by summer 2012.

While this *Strategy* takes shape, the Federal Government is taking actions to manage climate-related risks to natural resources. For instance, a collaborative group of Federal agencies and non-governmental organizations developed guidance for natural resource managers and other decision makers on climate change vulnerability assessments.³⁷ In addition, the USGS initiated a study to examine climate change influences on the survival of native trout and salmon across 11 Western states. The results of this study will support managers and stakeholders in developing appropriate adaptation strategies.

In the Sierra Nevada, California, the National Park Service (NPS) is leading a collaborative effort with the U.S. Forest Service and the USGS to analyze the vulnerability of ecosystems to changes in fire associated with climate change. Also, the Bureau of Land Management (BLM) is currently conducting ten Rapid Ecoregional Assessments (REAs) across the Western U.S and Alaska to promote cross-boundary collaboration and informed decision-making through the rapid synthesis of scientific data, identification of resource locations, and description of ecological status on a broad scale. These efforts facilitate collaborative development and prioritization of regional conservation, restoration, and climate adaptation strategies and actions.

Sea Level Rise and Conservation Strategies for the Piping Plover



(Credit: G. Nieminen, U.S. Fish and Wildlife Service)

Current and near-term decisions regarding coastal stabilization will strongly influence the effects of sea level rise on the Atlantic Coast Piping Plover, a threatened beach-nesting bird.

The U.S. Fish and Wildlife Service, U.S. Geological Survey, and National Park Service are collaborating with Virginia Tech University, state wildlife agencies, and non-governmental organizations to assess the effects of accelerating sea level rise on piping plover habitat. The effort uses cutting-edge models to develop piping plover habitat conservation recommendations that can be implemented by land managers and inform regulatory authorities. Collaborators anticipate that the model results may be readily translated to inform habitat management for other beach-dwelling species around the country.

³⁶ U.S. Fish and Wildlife Service. *National Fish, Wildlife, and Plants Climate Adaptation Strategy*. www.wildlifeadaptationstrategy.gov

³⁷ Glick, P., Stein, B.A., and Edelson, N.A. ed. (2011). *Scanning the Conservation Horizon: A Guide to Climate Change Vulnerability Assessment*. National Wildlife Federation, Washington D.C.

Enhancing Efforts to Lead and Support International Adaptation

Highlights

- **The Federal Government is working to identify and address the impacts of climate change that exacerbate conflict and social, economic, and political instability abroad.**
- **Select Federal agencies have dedicated resources to support and build the capacity of partner countries and communities as they craft and implement climate-resilient development strategies.**

In addition to domestic impacts, climate change exacerbates threats to communities, human development, and regional stability internationally. The impacts of climate change and extreme weather abroad can have serious economic and security implications for the United States. Conversely, actions that help countries reduce climate risks benefit broader U.S. development and foreign policy objectives.

The Federal Government has made progress toward the Task Force's policy goal of enhancing efforts to lead and support international adaptation. This progress is evident from (1) the development of a government-wide strategy to support multilateral and bilateral adaptation activities and to integrate adaptation into relevant U.S. foreign assistance programs; (2) delivery of targeted adaptation finance to support activities that reduce the risks of climate change and extreme weather through multilateral and bilateral channels; (3) design and implementation of complementary development, diplomacy and defense policies and actions that form an integrated approach to climate adaptation; and (4) outcomes from engagement in international climate negotiations and the global Adaptation Partnership.



Woman gathering low-quality water from an open well in Matameye, Niger
(Credit: John Furlow, USAID)

In September 2010, President Obama issued the Presidential Policy Directive on Global Development (PPD). The PPD calls for the elevation of development as a core pillar of American foreign policy and addressing global climate change as a key development initiative. Adaptation to climate change is a central component and one of three important pillars of the PPD's Global Climate Change Initiative.

As part of the Global Climate Change Initiative, the Federal Government seeks to empower vulnerable developing countries and communities to strengthen their climate resilience, and therefore, their prospects for development and economic growth. Toward this goal, the Department of State, U.S. Agency for International Development (USAID), and the Department of the Treasury have dedicated resources to programs that support and build the capacity of partner countries and communities as they craft and implement climate-resilient development strategies. Other Federal agencies,

such as the Millennium Challenge Corporation (MCC) and the Overseas Private Investment Corporation, are also ensuring that their programs take climate change into consideration as appropriate.

The Federal Government is also working to reduce the potential impact of climate change on fragile or vulnerable countries to enhance stability and security. The National Security Staff convened technical, international development, intelligence, and defense agencies to coordinate actions to address international climate change impacts and strengthen their shared understanding of climate change risks to development, diplomacy, and defense. The Chairman of the Joint Chiefs of Staff, Admiral Mullen, released an updated National Military Strategy in 2010. The Strategy notes climate change in its description of the future security environment, and discusses conflict prevention in detail, emphasizing the savings associated with preventive action. With this strategic guidance, combatant commanders are able to consider climate risks in their theater campaign plans and undertake environmental cooperation with foreign militaries.

In 2010, the United States joined the rest of the world in taking an important step in meeting the climate and clean energy challenge at the United Nations Framework Convention on Climate Change Conference. All major economies agreed to take actions to reduce their emissions in a transparent way, which is key to limiting the magnitude of future climate change. Significant progress on how to address adaptation, finance, and technology transfer will help reduce climate change risks.

The United States is also engaging with global development partners and the private sector to promote knowledge sharing and coordinate adaptation investments. In 2010, the United States joined Costa Rica and Spain in chairing the global Adaptation Partnership. More than 20 developing and developed countries have participated in the Partnership to identify common adaptation priorities and improve coordination to scale up actions and financing. The State Department, USAID, NOAA, and EPA are collaborating to provide U.S. leadership to the Partnership by delivering workshops that address key adaptation challenges and by supporting communities of adaptation practitioners.

Examples of Progress to Reduce International Climate Risks



Pastoruri Glacier, Peru (Credit: John Furlow, USAID)

- The United States is helping countries prepare for potentially severe climate change impacts to water security. For example, glacier retreat could have a devastating impact on water supply in Andean nations, India, Nepal, Bangladesh, Afghanistan, Pakistan, and Central Asia. The United States is building capacity for water resource management and supporting research on hydrological cycles, glacier dynamics, and adaption for downstream communities.
- The United States is building climate resilience in Least Developed Countries (LDCs) that are most vulnerable to extreme weather and climate impacts. Support to the multilateral Pilot Program for Climate Resilience has leveraged \$285 million in contributions from other developed country governments to help vulnerable developing countries, including several LDCs, pilot and demonstrate approaches for incorporating climate risk and resilience into development policies and planning.
- NASA and USAID's SERVIR program combines satellite and ground-based observations with models, providing environmental information that supports adaptation in developing countries in Central America and the Caribbean, East Africa, and the Hindu-Kush Himalayan region of South Asia.
- The United States is negotiating an updated Great Lakes Water Quality Agreement with Canada that will address climate change impacts.

Going forward, the U.S. Government will continue to help developing country partners assess and manage climate change risks. The U.S. Government will integrate climate adaptation across its development assistance portfolio, making investments more cost-effective and robust. The Federal Government is also committed to bringing its full capacities—including technical assistance, science, and technology—to support climate-resilient development programming around the world.

Conclusion

Preparing for climate change will enhance the safety, well-being, and livelihoods of American citizens and minimize disruption of the services on which they depend. With leadership and coordination from the Task Force, Federal agencies are making important progress on identifying and managing risks associated with climate change. In particular, significant interagency efforts are underway to make information on climate impacts more accessible and useful to communities and decision makers across the country, effectively manage natural resources and critical U.S. infrastructure, and enhance efforts to promote adaptation internationally.

Over the next several years, the Task Force's efforts to reduce the Nation's vulnerability to climate change will focus on enhancing regional coordination, strengthening and leveraging non-Federal partnerships, and implementing Federal agency adaptation planning. The Task Force will provide an update on Federal adaptation progress in March 2014, following the release of the 2013 National Climate Assessment Synthesis Report.

Partnerships and actions across all scales will be necessary to more fully realize the Task Force's vision of *a resilient, healthy, and prosperous Nation in a changing climate*. Agencies across the Federal Government are developing a diversity of non-Federal partnerships to maximize opportunities for coordination and collaboration, and to exchange information and lessons learned with cities, states, tribes, and other nations that are incorporating adaptation into their own decision processes. The Task Force will work to align Federal efforts with those of communities, states, tribes, and regions to reduce the risks of extreme events and climate impacts through adaptation. These collective efforts will help advance the Nation toward a more sustainable future.

APPENDIX A. INTERAGENCY CLIMATE CHANGE ADAPTATION TASK FORCE MEMBERSHIP

Co-chair Agencies

Council on Environmental Quality
National Oceanic and Atmospheric Administration
Office of Science and Technology Policy

Member Departments and Agencies

Agency for International Development
Army Corps of Engineers
Council of Economic Advisors
Department of Agriculture
Department of Commerce
Department of Defense
Department of Education
Department of Energy
Department of Health and Human Services
Department of Homeland Security
Department of Housing and Urban Development
Department of the Interior
Department of State
Department of Transportation
Department of the Treasury
Environmental Protection Agency
Millennium Challenge Corporation
National Aeronautics and Space Administration
National Intelligence Council
National Economic Council
National Security Staff
Office of Management and Budget

APPENDIX B. 2011 PROGRESS REPORT STRUCTURE

The 2011 report discusses progress towards the Task Force's 2010 policy goals in a way that recognizes their synergies and interconnectedness. As the table outlines below, progress toward the 2010 cross-cutting goals related to community resilience, human health, and insurance is described in the *Building Resilience to Climate Change in Communities* section of the 2011 report, given the local relevance and benefits of these efforts. Progress toward the complementary goals of integrating science into decision-making and coordinating capabilities of the Federal Government are discussed together in the 2011 report section on *Improving Accessibility and Coordination of Science*. Finally, progress on freshwater, oceans, fish, wildlife, and plants adaptation efforts are discussed in the 2011 report section on *Strategies to Safeguard Natural Resources*, as these efforts represent components of national strategic action planning related to natural resources.

2011 Progress Report Structure (in Bold) *2010 Policy Goals and Cross-Cutting Issues (in Italics)*

Integrating Adaptation into Federal Government Planning and Activities

- *Encourage and Mainstream Adaptation Planning across the Federal Government*

Building Resilience to Climate Change in Communities

- *Cross-cutting issue: Build resilience to climate change in communities*
- *Cross-cutting issue: Protect human health by addressing climate change in public health activities*
- *Cross-cutting issue: Facilitate incorporation of climate change risks into insurance mechanisms*

Improving Accessibility and Coordination of Science for Decision Making

- *Improve Integration of Science into Decision Making*
- *Coordinate Capabilities of the Federal Government to Support Adaptation*

Developing Strategies to Safeguard Natural Resources in a Changing Climate

- *Cross-cutting issue: Improve water resource management in a changing climate*
- *Cross-cutting issue: Develop a strategic action plan focused on strengthening the resilience of coastal, ocean, and Great Lakes communities and ecosystems to climate change*
- *Cross-cutting issue: Develop a strategy for reducing the impacts of climate change on the Nation's fish, wildlife, and plant resources and their habitats*

Enhancing Efforts to Lead and Support International Adaptation

- *Enhance Efforts to Lead and Support International Adaptation*

APPENDIX C. INTERAGENCY CLIMATE CHANGE ADAPTATION TASK FORCE GUIDING PRINCIPLES

Guiding Principles for Adaptation

Adopt Integrated Approaches: Adaptation should be incorporated into core policies, planning, practices, and programs whenever possible.

Prioritize the Most Vulnerable: Adaptation plans should prioritize helping people, places and infrastructure that are most vulnerable to climate impacts and be designed and implemented with meaningful involvement from all parts of society.

Use Best-Available Science: Adaptation should be grounded in the best-available scientific understanding of climate change risks, impacts, and vulnerabilities.

Build Strong Partnerships: Adaptation requires coordination across multiple sectors and scales and should build on the existing efforts and knowledge of a wide range of public and private stakeholders.

Apply Risk-Management Methods and Tools: Adaptation planning should incorporate risk management methods and tools to help identify, assess, and prioritize options to reduce vulnerability to potential environmental, social, and economic implications of climate change.

Apply Ecosystem-based Approaches: Adaptation should, where relevant, take into account strategies to increase ecosystem resilience and protect critical ecosystem services on which humans depend to reduce vulnerability of human and natural systems to climate change.

Maximize Mutual Benefits: Adaptation should, where possible, use strategies that complement or directly support other related climate or environmental initiatives, such as efforts to improve disaster preparedness, promote sustainable resource management, and reduce greenhouse gas emissions including the development of cost-effective technologies.

Continuously Evaluate Performance: Adaptation plans should include measureable goals and performance metrics to continuously assess whether adaptive actions are achieving desired outcomes.