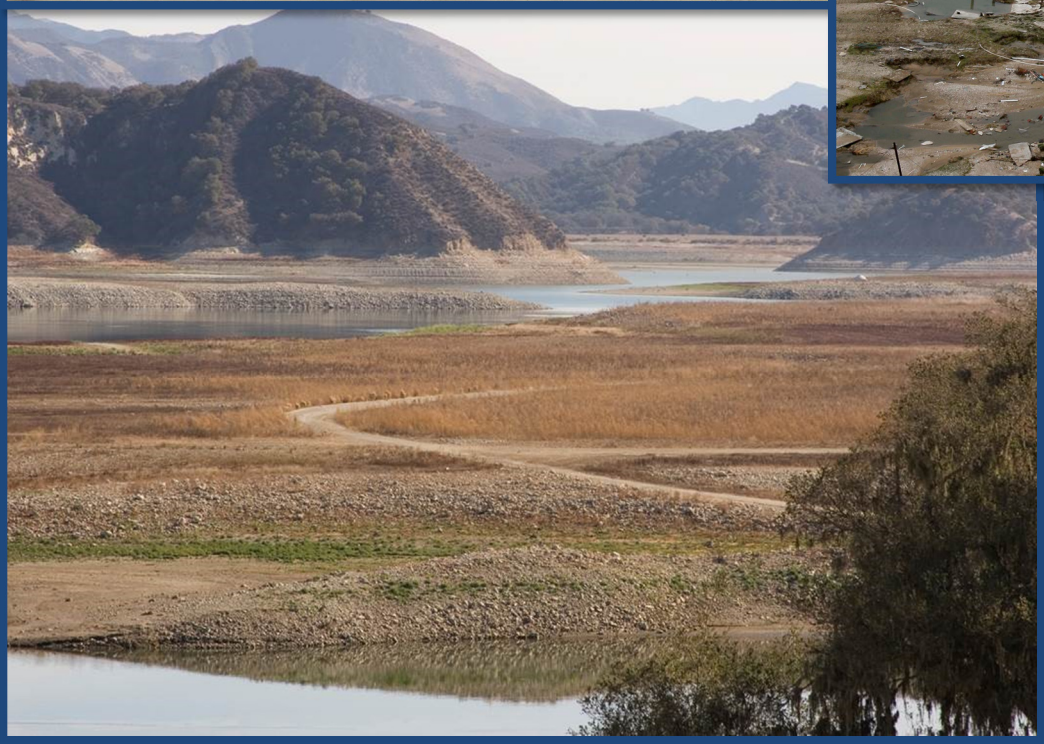
PRESIDENT'S STATE, LOCAL, AND TRIBAL LEADERS TASK FORCE ON CLIMATE PREPAREDNESS AND RESILIENCE

Recommendations to the President



November 2014

About the State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience

The State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience (Task Force) was established by Executive Order 13653[1], *Preparing the United States for the Impacts of Climate Change,* on November 1, 2013. The President charged the Task Force with providing recommendations on how the Federal Government can respond to the needs of communities nationwide that are dealing with the impacts of climate change by removing barriers to resilient investments, modernizing Federal grant and loan programs to better support local efforts, and developing the information and tools they need to prepare, among other measures.

Co-chaired by the Chair of the White House Council on Environmental Quality (CEQ) and the Director of the White House Office of Intergovernmental Affairs (IGA), the Task Force consists of 26 governors, mayors, county officials, and tribal leaders from across the United States. Members brought first-hand experiences in building climate preparedness and resilience in their communities and conducted broad outreach to thousands of government agencies, trade associations, planning agencies, academic institutions, and other stakeholders, to inform their recommendations to the Administration.

The Task Force met in person on four occasions between December 2013 and July 2014 in Washington DC, Los Angeles, and Des Moines, to develop and refine their recommendations. Recognizing that climate change will affect virtually all aspects of the Nation's future, the Task Force focused on opportunities to build climate preparedness and resilience in key domains, including disaster recovery, infrastructure investment, natural resource management, human health, community development, and agriculture.

For more information about the State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience, please see: www.whitehouse.gov/administration/eop/ceq/initiatives/resilience/taskforce.

Cover Photos: Top Left: Vermonters celebrate the re-building of a historic covered bridge washed away by Tropical Storm Irene (2011). Photo Credit: *Bill Caswell, President, National Society for the Preservation of Covered Bridges.* Top Right: A home is left standing among debris from Hurricane Ike (2008) in Galveston County, Texas. Floodwaters from Hurricane Ike were as high as eight feet in some areas causing widespread damage across the coast of Texas. Photo Credit: *David J. Phillip-Pool/Getty Images.* Bottom Left: Lake Cachuma, in California, at 30% capacity under drought conditions. Photo Credit: *Lael Wageneck, County of Santa Barbara.* Bottom Right: Children in Philadelphia enhance local green stormwater infrastructure with spring plantings. Photo Credit: *Philadelphia Water Department.*

[1] See "Executive Order 13653: Preparing the United States for the Impacts of Climate Change", http://www.whitehouse.gov/the-press-office/2013/11/01/executive-order-preparing-united-states-impacts-climate-change

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Acknowledgements[2]

The Task Force's work benefited greatly from the contributions of its active and dedicated membership and their staff. Particular recognition is due to the members who chaired the Task Force's four subgroups: Governor Edmund Brown, Chairwoman Karen Diver, Commissioner Kristin Jacobs, Governor Jack Markell, Mayor Michael Nutter, Governor Peter Shumlin, and Mayor Karen Weitkunat.

Gratitude also goes to the Task Force designees and staff who led and supported the subgroup efforts: Louise Bedsworth, Kathy Dervin, Katherine Gajewski, Jennifer Jurado, Sarah McKearnan, Sue Minter, and Dan Weinhiemer.

The Task Force further extends its appreciation to the following leaders and contributors:

Founding co-chairs David Agnew, former Director of IGA and Nancy Sutley, former Chair of CEQ.

The IGA and CEQ staff who supported this effort, including Elias Alcantara, Shira Miller, and Susan Ruffo.

Members and staff of the interagency Council on Climate Preparedness and Resilience, whose participation in Task Force meetings and additional support and consultation was critical to this effort.

And a wide range of stakeholders from non-profits, think tanks, academia, the private sector, and state, local, and tribal government agencies and elected officials who work to make communities across the country resilient in the face of climate change and who shared their experiences with the Task Force and provided input that informed the development of these recommendations.

Task Force Members with Federal officials after meeting with President Obama, July, 2014. Photo Credit: *Shira Miller.*

[2] See Appendix C for additional acknowledgements.

THE WHITE HOUSE

WASHINGTON

Dear Mr. President,

We are pleased to share with you the recommendations of the State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience (Task Force) on how the Federal Government can better support local climate preparedness and resilience-building efforts, as called for in your Climate Action Plan. These recommendations reflect the collective opinions of the 26 Governors, mayors, county officials and tribal leaders who served on the Task Force, as well as the input they received from across State, local, tribal and territorial governments, private businesses, trade associations, academic organizations, civil society, and many other stakeholders.

As you know, climate change is already affecting communities in every region of the country and in key sectors of our economy. For example, Task Force members have dealt with catastrophic floods, fires, and drought. They have experienced flooding and erosion due to sea level rise, diminishing water storage in mountain snowpack, and loss of culturally significant crops and other resources. And they are not alone - leaders across the country face similar challenges. That is why, even as we take aggressive steps to cut the carbon pollution that drives climate change, we must act now to prepare for the impacts we can no longer avoid.

Task Force members have approached this challenge with creativity and pragmatism in their own communities, often making bold choices informed by the best available science, much of which originates in Federal agencies. They have invested in more resilient infrastructure, building smarter and stronger so their communities can withstand the next storm. They have adopted innovative stormwater management techniques that use green infrastructure to store water, strengthened building codes, and planned for rapid recovery from extreme weather events. The enclosed recommendations include examples of their specific successes and challenges we can all learn from.

The Federal Government has a critical role to play in supporting these efforts by establishing policies that promote climate preparedness, advancing science to help inform local actions, and protecting critical infrastructure and public resources. Over the past year, we have listened to their ideas and started taking action. This includes launching Federal grant competitions that encourage investments in community resilience and making vast Federal data resources on climate change impacts more accessible. The enclosed recommendations offer Task Force members' consolidated guidance on how the Federal Government can support communities by modernizing programs and policies to incorporate climate change, incentivizing and removing barriers to community resilience, and providing useful, actionable information and tools.

As you have made clear, responding to the threats of climate change requires bold action and collaboration across all levels of government. The enclosed recommendations will help guide the Administration as we continue our work to help build a safer, healthier, and more resilient Nation.

Sincerely,

Michael Boots
White House Council on Environmental Quality

Rohan Patel
White House Office of Intergovernmental Affairs

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Executive Summary

As the Third National Climate Assessment makes clear, climate change is already affecting communities in every region of the country as well as key sectors of the economy. Recent events like Hurricane Sandy in the Northeast, flooding throughout the Midwest, and severe drought in the West have highlighted the vulnerability of many communities to the impacts of climate change. In 2012 alone, the cost of weather disasters exceeded $110 billion in the United States, and climate change will only increase the frequency and intensity of these events. That is why, even as efforts to reduce greenhouse gas emissions continue, communities must prepare for the impacts of climate change that can no longer be avoided.

At state, local, tribal, and territorial levels, leaders are making bold decisions on ways to invest in more resilient infrastructure, revise land use, update building codes, and adjust natural resource management and other practices to improve the resilience of their communities to climate impacts. The Federal Government has a critical role to play in supporting these efforts by ensuring that Federal policies and programs incorporate climate change, incentivize and remove barriers to community resilience, and provide the information and assistance communities need to understand and prepare for climate risks. The Federal Government also has a responsibility to protect its own investments, such as military installations and space launch facilities, and ensure that the lands and resources it holds in the public trust are managed for a changing climate.

In order to better support communities across the country as they prepare for the impacts of climate change, the Task Force proposes that the Administration advance actions across the Federal Government that align with the following overarching principles:

- Require consideration of climate-related risks and vulnerabilities in the design, revision, and implementation of all Federal policies, practices, investments, regulations, and other programs.
- Maximize opportunities to take actions that have dual-benefits of increasing community resilience and reducing greenhouse gas emissions.
- Strengthen coordination and partnerships among Federal agencies, and across Federal, state, local, tribal, and territorial jurisdictions as well as economic sectors.
- Provide actionable data and information on climate change impacts and related tools and assistance to support decision-making at all levels.
- Consult and cooperate with Tribes and indigenous communities on all aspects of Federal climate preparedness and resilience efforts, and encourage states and local communities to do the same.

The diverse challenges posed by climate change will require a wide range of actions to ensure that communities across the country, large and small, are prepared. With coordination, thoughtful planning, and decisive action, Federal, State, and local governments, Tribes, and territories can ensure a safe and prosperous future.

Summary of Recommendations

1. Building Resilient Communities: Climate change will impact communities for years to come, and long-term efforts to build resilience will help communities thrive in the 21st century and beyond. By incorporating climate change considerations into its programs, the Federal Government can support communities as they rethink traditional approaches to land use and land management, building and infrastructure siting and design, and community planning.

2. Improving Resilience in the Nation's Infrastructure: Climate change poses a significant threat to the safety and reliability of critical infrastructure systems. Whether related to energy, transportation, freshwater management, coastal protection, or ecosystems, Federal action can improve the way climate impacts and greenhouse gas emissions are incorporated into public and private infrastructure investments, policies, and practices.

3. Ensuring Resilience of Natural Resources: Climate change puts America's vital natural resources and ecosystems at risk. By helping communities better protect and conserve the Nation's natural resources, the Federal Government can improve human and community resilience in cost-effective ways.

4. Preserving Human Health & Supporting Resilient Populations: Climate change presents a significant public health threat to individuals and communities, exacerbating illness and increasing the frequency and severity of dangerous extreme weather events. The Federal Government can support State, local, tribal, and territorial efforts to address the needs of populations most vulnerable to climate impacts, protect public health, and improve disaster preparedness.

5. Supporting Climate-Smart Hazard Mitigation and Disaster Preparedness and Recovery: Climate change will increase the frequency and severity of extreme weather events, which are often devastating to communities. Through more holistic hazard mitigation planning, improved data collection and mapping, partnership development, and program modernization, the Federal Government can improve efforts to prevent and mitigate the effects of extreme weather and other climate-related hazards.

6. Understanding and Acting on the Economics of Resilience: Climate change poses significant economic risk to all sectors and communities. Advancing measures to encourage more prudent investments in long-term resilience can better ensure a vibrant economic future as the climate continues to change.

7. Building Capacity for Resilience: To successfully prepare for climate change, communities must have the capacity to recognize, understand, and assess relevant climate-related hazards, risks, and impacts. The Federal Government can help communities build this capacity by continuing to shape or reshape programs, policies, information sources, and other forms of assistance that enable state, local, tribal, and territorial jurisdictions to prepare for climate change.

Additionally, the Federal Government should establish a process for tracking and reporting on progress made in the implementation of the recommendations, as well as specific benchmarks.

Introduction: A Call to Prepare for Climate Change Impacts

"Climate change, once considered an issue for a distant future, has moved firmly into the present."
- First Key Finding of the Third National Climate Assessment[3]

Across the United States, communities—large and small, urban and rural—are on the front lines of climate change. Increased warming, drought, and insect outbreaks, caused or exacerbated by climate change, have increased wildfires and other impacts on people and ecosystems in the Southwest. Extreme rainfall events and flooding have increased in the Midwest over the last century, degrading water quality and negatively impacting transportation systems and other infrastructure, agriculture, and human health. Heat waves, more extreme rainfall, and coastal flooding due to sea level rise and storm surge are expected to increase in the Northeast and Gulf Coast regions. Thawing of permafrost in the Arctic and rising sea levels and reduced freshwater supplies in the Pacific are also expected to worsen in the future.

Snapshot of projected climate impacts

- By mid-century, the infrastructure investments needed to combat rising temperatures in the Midwest will require more than $6 billion. "Further, approximately 95% of the electrical generating infrastructure in the Midwest is susceptible to decreased efficiency due to higher temperatures."[4]
- Across the North Atlantic states, cumulative costs of sea-level rise and associated flood damage may exceed $88 billion by 2100.[5]
- As much as 40% of reef-associated fish may be lost due to massive coral disease outbreaks, associated with higher water temperatures, in the Hawaiian archipelago, impacting $385 million in associated goods and services for Hawaii alone.[6]
- For California and other states across the Southwest climate change will increase the cost of maintaining and improving drinking water infrastructure by increasing the need for wastewater treatment and water desalination to supplement water supplies; even without the costs of these preparedness measures, California's drinking water system alone will require more than $4 billion in investment per year for the next 10 years.[7]
- In Alaska, thawing and sinking of once frozen ground may cost between $3.6 and $6.1 billion (10% to 20%) above current public infrastructure maintenance over the next 20 years. In more rural parts of Alaska, such permafrost thaw is likely to disrupt community water supplies and sewage systems, posing risks to residents' health.[8]

[3] See Melillo, J.M., Richmond, T.C., and Yohe, G.W. Eds., 2014: *Highlights of Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program, pp. 148. http://nca2014.globalchange.gov

[4] See Pryor, S. C., et al. "Ch. 18: Midwest" *Climate Change Impacts in the United States: The Third National Climate Assessment,* http://nca2014.globalchange.gov/report/regions/midwest

[5] See Moser, S.C., et al. "Ch. 25: Coastal Zone Development and Ecosystems" *Climate Change Impacts in the United States: The Third National Climate Assessment*, http://nca2014.globalchange.gov/report/regions/coasts

[6] See Leong, J.-A., et al. "Ch. 23: Hawai'i and U.S. Affiliated Pacific Islands." *Climate Change Impacts in the United States: The Third National Climate Assessment*, http://nca2014.globalchange.gov/report/regions/hawaii-and-pacific-islands

[7] See Garfin, G. et al. "Ch. 20: Southwest." *Climate Change Impacts in the United States: The Third National Climate Assessment*, http://nca2014.globalchange.gov/report/regions/southwest

[8] See Chapin, F. S., III, et al. "Ch. 22: Alaska" *Climate Change Impacts in the United States: The Third National Climate Assessment*, http://nca2014.globalchange.gov/report/regions/alaska

To address the root causes of these challenges, leaders at all levels of government and in the private sector are acting to reduce greenhouse gas emissions. Significant reductions in these emissions are needed in order to slow the effects of climate change before it becomes too difficult and expensive for nations and communities to adequately prepare for anticipated climate impacts. But carbon pollution has been building in our atmosphere for decades, so even as we act to reduce the emissions of greenhouse gases that drive climate change, we must also prepare our communities for the impacts that can no longer be avoided.

Anticipating and planning for these impacts now can reduce the harm and long-term costs of climate change to communities. Decisions made today about where and how communities grow, the infrastructure they build, and the codes and standards they adopt will affect them long into the future, so decision-makers must take climate change into account as they plan. In doing so, there must also be a particular focus on helping the most vulnerable populations prepare, since they are likely to be disproportionately affected. This will require thoughtful planning and capacity building, including the development and timely delivery of science, information, analytical tools, and practical, cost-effective measures and technologies that can help deal with future climate conditions. Coordinated action by all levels of government, businesses, individual citizens, and others will be crucial.

"In April 2014, severe flooding in Alabama resulted in widespread damage throughout Baldwin County, including the Town of Perdido Beach. In our tiny town surrounded on three sides by estuarine water bodies, every street was damaged and three were impassable, cutting off an entire neighborhood until emergency work could be done to restore passage. Unable to handle the 25 inches of torrential rain that fell over a period of two days, numerous homes were flooded and extensive damage occurred to our infrastructure. Fortunately, recovery assistance came by way of State and Federal aid. While post-disaster assistance is much needed and appreciated, local leaders need support to plan for future extreme weather impacts before they occur."

- **Mayor Patsy Parker, Perdido Beach, Alabama**

Flood damage in Perdido Beach, AL.
Photo Credit: *Patsy Parker, May 2014.*

Current Actions to Prepare for Climate Change

From repeated low level flooding and extreme storms to increasing temperatures and drought, climate change hits every community differently. State, local, tribal, and territorial leaders are at the forefront of dealing with these impacts and preparing their communities for future changes. These leaders recognize the need to act now to protect their communities, and are doing so with their own authorities and resources while working with diverse partners including business, community organizations, various levels of government, and citizen groups.

Examples of innovative and forward-thinking leadership can be found in communities across the country. For example, the City of Houston has created a network of mobile solar-powered community support and disaster response stations that can operate off the electric grid and provide basic needs to the community in the aftermath of major disasters; communities from Vermont to Des Moines and Fort Collins to Fond du Lac Reservation have recovered from severe floods and storm damages by rebuilding

roads and other infrastructure with specific designs for better withstanding future hazards; four counties in Southeast Florida joined together to establish a coordinated planning effort to adapt to sea level rise; and low-lying states like Delaware and Maryland have established requirements for state-funded construction projects to be designed to accommodate future sea level rise and increased flooding.

> *"Cities are at the frontlines of climate change and must deal with its consequences through effective actions. Grand Rapids has faced the impacts of floods, heat waves, and snow blizzards in the last three years. State and Federal governments need to provide support to local governments and ensure coordinated efforts to address climate change effects."*
>
> - **Mayor George Heartwell**
> **Grand Rapids, Michigan**

The Federal Government has an essential and unique role to play in supporting these efforts. Through funds that help to build and repair critical infrastructure such as roads, bridges, and water treatment plants, regulations that ensure clean air and clean water, support for disaster recovery, and programs that promote public health and economic development, the Federal Government works with States, local governments, Tribes, and territories to ensure that communities across the country are safe and prosperous. As part of their work to achieve these diverse missions, Federal agencies can support local efforts to build climate resilience by providing vital leadership, guidance, and information, and by adjusting their programs to encourage preparedness and recognizing and removing barriers to local initiatives. Because climate impacts are felt locally but require action across political boundaries, these actions must involve partnerships with multiple jurisdictions, and the Federal Government can promote such coordination.

The Federal Government should also lead by example in its own efforts to prepare for climate change impacts. According to a 2013 Government Accountability Office (GAO) report[9], climate change increases Federal exposure to risk in several areas, including as the owner/operator of infrastructure such as defense facilities and other property, the provider of disaster recovery assistance, and the insurer of property and crops vulnerable to climate impacts. The Federal Government can address climate impacts in these areas, and on the natural, cultural, and historic resources it has statutory responsibilities to protect. Federal actions to prepare for climate change impacts on missions, programs, and operations will ensure that government services remain effective despite a changing climate. These actions will also ensure that taxpayer and other national resources endure and are invested wisely. It is critical that these efforts are coordinated with state, local, tribal, and territorial partners.

Hurricane Sandy coastal flooding in Mantoloking, NJ.
Photo Credit: *New Jersey National Guard/Scott Anema.*

[9] "High Risk Series: An Update" *U.S. Government Accountability Office*, GAO-12-283. February 2013. http://www.gao.gov/products/GAO-13-283

Task Force Recommendations

The Task Force has developed the following recommendations on key actions the Federal Government can take to better support state, local, tribal, and territorial leaders working to prepare their communities for the impacts of climate change. These recommendations focus on opportunities to remove barriers to resilient investments, modernize Federal grant and loan programs to better support and encourage local efforts, and develop the information and tools that decision makers need to understand and prepare for the impacts of climate change. Recommendations are organized across seven themes: Building resilient communities; improving resilience in the Nation's infrastructure; ensuring resilience of natural resources; preserving human health and resilient populations, supporting climate-smart hazard mitigation and disaster preparedness and recovery, understanding and acting on the economics of resilience, and building capacity for resilience.

Overarching Principles

The following overarching principles represent common threads in the Task Force discussions and recommendations, and provide high–level guidance for efforts to build National climate preparedness:

1. Require consideration of climate-related risks and vulnerabilities as part of all Federal policies, practices, investments, and regulatory and other programs.
Current Federal programs, policies, investments, and assistance mechanisms do not fully account for climate vulnerabilities and risks, resulting in Federal investments in Federal, state, local, tribal, and territorial projects that may not be appropriately designed to withstand or address potential climate-related impacts. Taxpayer dollars spent on projects that do not consider these impacts in design or execution could be wasted.

Federal programs can drive more resilient community choices by:

- Prioritizing Federal investments toward more resilient projects and disallowing Federal investments that would increase risk or vulnerability;
- Ensuring that all disaster recovery projects funded with Federal dollars are cost-effective and designed and built to avoid and withstand future climate impacts;
- Ensuring that all infrastructure and other long-lived investments made with Federal dollars are designed to be effective, accessible, and operational under future climate conditions;
- Encouraging innovative approaches that leverage private capital and existing assets; and
- Providing technical assistance to States, territories, Tribes, and communities that lack capacity to adapt to climate change.

Learning from Hurricane Sandy Resilient Rebuilding

The work of the Hurricane Sandy Rebuilding Task Force and of the many Federal agencies that provided assistance for recovery and rebuilding in the region affected by the storm demonstrate early advances in revamping Federal programming to consider resilience. For example, the Department of Housing and Urban Development (HUD) required that all of its grantees assess their vulnerabilities to current and future risks and show how they would address those risks, while the Department of Transportation (DOT) provided $3.6 billion for projects designed to increase the resilience of the transportation systems in the affected region.[10] These and other such practices can ensure responsible use of Federal dollars—a smart policy in any case, but especially important in an era of constrained resources.

[10] "Notice of Funding Availability for Resilience Projects in Response to Hurricane Sandy" *U.S. Department of Transportation,* FTA-2013-006-TPM. Federal Register, 78(248). 26 December 2013. http://www.fta.dot.gov/grants/13077_15783.html

2. Maximize opportunities to take actions that have dual-benefits of increasing community resilience and reducing greenhouse gas emissions.
Reducing greenhouse gas emissions will ultimately limit the impacts of climate change on communities. As communities develop strategies to prepare and withstand the impacts of climate change, these solutions should, where possible, utilize actions that complement or directly support efforts to reduce greenhouse gas emissions. Particular emphasis should be placed on opportunities presented by planning decisions and investments in areas including:

- The nexus between increasing demand for water for energy production and the extraordinary energy demand associated with the treatment and movement of water;
- The climate resilience and energy efficiency of transportation systems that support sustainable development and also reduce carbon emissions and related pollutants;
- Energy systems that are cleaner and more efficient, in addition to more climate-resilient; and
- The health of natural systems that provide resilience services like buffering of coastal and riverine flooding and stormwater management, while also providing mitigation benefits, including carbon sequestration and storage.

3. Strengthen coordination and partnerships among Federal agencies, and across Federal, state, local, and tribal jurisdictions and economic sectors.
The challenges posed by a changing climate cross the traditional boundaries of government agencies, economic sectors, politics, and geography. So-called "silos" among and within Federal agencies must be removed to ensure alignment of policies, practices, and resources for climate resilient planning and projects, and local voices should be at the table during development of locally relevant initiatives to ensure they have the intended effect. The Federal Government can also play an important role in promoting cooperation across jurisdictions, regions, and at multiple levels of government in order to ensure an integrated approach. As governments cannot solve these problems alone, private sector and other stakeholder involvement should be encouraged.

4. Provide actionable data and information on climate change impacts and related tools and assistance to support decision-making.
To make climate-smart planning and investment decisions at a regional, state, tribal, territorial, and local level, decision-makers need access to the best available information about climate impacts in a user-friendly and accessible format. Building on successful efforts like the National Oceanic and Atmospheric Administration's (NOAA) Regional and Integrated Sciences and Assessments program, more can be done to provide authoritative, consistent, and relevant information and tools to help inform planning and decision making at all levels.

Western Water Assessment
Salt Lake City, Utah

The Western Water Assessment (WWA)[11], based at the University of Colorado Boulder, is a program of NOAA serving Colorado, Utah, and Wyoming with climate data and research partnerships. In 2009, WWA placed a liaison in Salt Lake City, and has since partnered with Salt Lake City Municipal and universities in Utah and Wyoming to develop climate models and conduct vulnerability assessments to help the City identify climate change scenarios on a much needed local and community scale. The work is made available, through synthesis and real-time climate information interfaces, to other communities as well, allowing for dissemination of decision-relevant information.

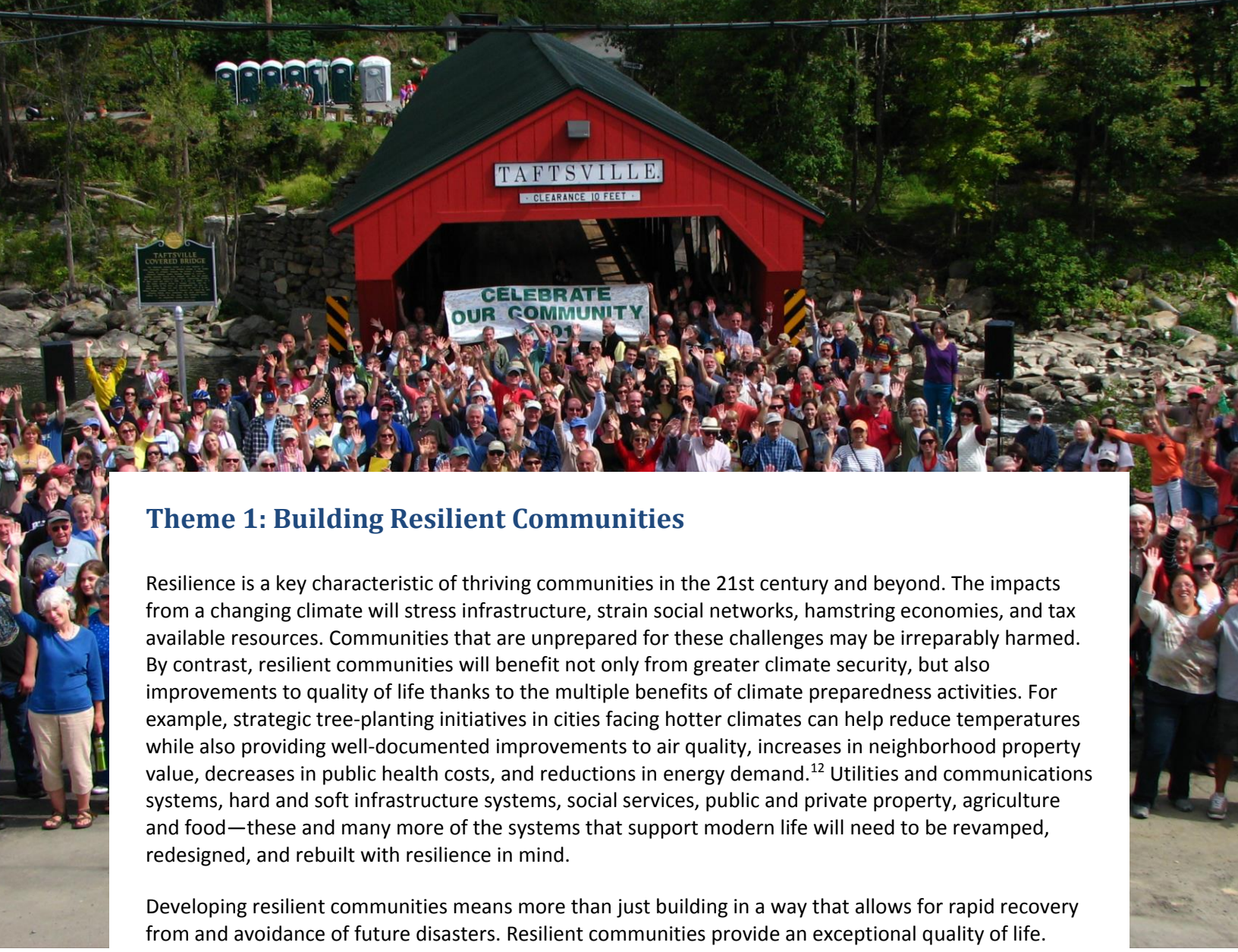
[11] See http://wwa.colorado.edu/

5. Consult and cooperate with Tribes and indigenous communities on all aspects of Federal climate preparedness and resilience efforts, and encourage States and local communities to do the same. Through targeted and widespread engagement with Tribal, Alaska Native, and Pacific Island indigenous communities by Task Force members and Federal agency partners, consensus emerged around recommendations to support tribal and indigenous communities in preparing for the unique impacts they face as a result of climate change. The Federal Government must fully incorporate its government-to-government relationship with Tribes and Alaska Native communities into existing programs and activities that relate to climate change by enhancing self-governance capacity, promoting engagement of State and local governments with tribal communities, and recognizing the role of traditional ecological knowledge in understanding the changing climate.

"Responding to climate change must be a shared responsibility that shouldn't be constrained by our respective political boundaries, geographical locations or cultures. Minnesota experienced torrential rains and heavy flooding in 2012, and the Fond du Lac Reservation was heavily impacted. The Tribe learned the hard way that the many jurisdictions involved had not sufficiently coordinated their emergency planning. As roads were damaged and neighborhoods were isolated, we had to figure out on our own how to evacuate and house displaced residents. We have since learned that our response could have been faster and more efficient with the assistance that other agencies could have provided. Similarly, we learned that the Tribe's emergency response assets would have been helpful to others. We know now that we need to work harder to engage in multi-jurisdictional planning to best serve all our citizens."

- **Karen Diver, Chairwoman, Fond Du Lac Band of Lake Superior Chippewa**

Informed by the overarching principles above, the Task Force offers the following specific recommendations across seven themes.



Theme 1: Building Resilient Communities

Resilience is a key characteristic of thriving communities in the 21st century and beyond. The impacts from a changing climate will stress infrastructure, strain social networks, hamstring economies, and tax available resources. Communities that are unprepared for these challenges may be irreparably harmed. By contrast, resilient communities will benefit not only from greater climate security, but also improvements to quality of life thanks to the multiple benefits of climate preparedness activities. For example, strategic tree-planting initiatives in cities facing hotter climates can help reduce temperatures while also providing well-documented improvements to air quality, increases in neighborhood property value, decreases in public health costs, and reductions in energy demand.[12] Utilities and communications systems, hard and soft infrastructure systems, social services, public and private property, agriculture and food—these and many more of the systems that support modern life will need to be revamped, redesigned, and rebuilt with resilience in mind.

Developing resilient communities means more than just building in a way that allows for rapid recovery from and avoidance of future disasters. Resilient communities provide an exceptional quality of life. Characteristics of these communities include clean and abundant water supplies protected for future generations, and energy systems powered by fuels that do not exacerbate climate change or damage public health and are reliable even when disaster strikes. In addition, resilient communities enable more efficient forms of transportation like walking or bus and rail transit, yielding public health benefits.

Forward-looking and informed planning is also a critical component of ensuring that communities are prepared for climate impacts. Siting and designing buildings and infrastructure for long-term climate resilience can improve cost-effectiveness by helping ensure continuity of operations and minimizing recovery costs after a disaster. Federal agencies are already playing a pivotal role in incentivizing and helping to share model approaches to holistic, resilience-focused planning. The following recommendations offer ways the Federal Government can continue to facilitate more systemic infrastructure planning and project design and construction, address climate-related hazards, and help State and local governments, Tribes, and territories build more resilient communities.

Vermonters celebrate the re-building of a historic covered bridge washed away by Tropical Storm Irene (2011).
Photo Credit: *Bill Caswell, President, National Society for the Preservation of Covered Bridges.*

[12] See documentation of these and other benefits at:
http://depts.washington.edu/hhwb/Top_References.html#Local%20Economics and
http://www.houstonregionalforest.org/Report/

1.1 Accelerate the development of models and disseminate best practices for community resilience.

Federal agencies are already playing a pivotal role in sharing and incentivizing model approaches to sustainability across the country with programs like the interagency Partnership for Sustainable Communities led by HUD, DOT, and the Environmental Protection Agency (EPA). These efforts should be broadened to demonstrate how communities can integrate sustainability and climate resilience, and encourage replication of successful models.

Actions to advance this recommendation include:

1.1.1 Expand the Partnership for Sustainable Communities and other place-based programs to explicitly incorporate and encourage climate resilience by supporting the development of local laboratories where approaches to sustainable and resilient energy, infrastructure, transportation, flood proofing, natural infrastructure, etc. can be tested and disseminated more broadly.[13]

1.1.2 Collaborate across Federal agencies to provide services and promote channels for sharing climate resilience best practices and lessons learned, including peer-to-peer learning among States, local communities and Tribes, and workshops, training, and interactive web resources.

"In the planning and rebuilding process after the May 2007 tornado, Greensburg citizens met at community meetings to plan the future. This process allowed us to address systematic problems that could be corrected in the rebuild. Sustainability and rebuilding 'green' were the focus of being a resilient community."

- **Mayor Bob Dixson, Greensburg, Kansas**

Vermont and Colorado Peer Exchange

In September 2013, Colorado experienced an unprecedented eight-day rain resulting in devastating flooding and destruction. The event affected about 1,500 square miles leaving more than six thousand people evacuated, thousands of homes and businesses destroyed or damaged, dozens of bridges destroyed, and approximately 200 miles of roads impassable. Through a relationship between their Governors, Vermont officials came to advise Colorado officials on transportation system recovery and how to work through the Federal Highways Administration (FHWA) and Federal Emergency Management Agency (FEMA) recovery processes. This policy exchange is credited with speeding Colorado's recovery; all roads were rebuilt and opened to a temporary functioning before December 2013.

1.2 Develop and encourage adoption of resilience standards in the siting and design of buildings and infrastructure.

The Federal Government should play a leading role in developing and encouraging the use of resilience guidelines and standards across sectors and throughout the built environment.[14] Federal participation in the establishment of such standards for climate resilience would encourage adoption by the private sector, other levels of government, and nongovernmental organizations, ultimately accelerating integration of climate resilience measures across sectors and communities.

[13] See for example, the Climate Action Champions Competition, launched in October 2014. The competition builds on the momentum of ongoing place-based initiatives to recognize innovation and leadership by local and tribal governments in reducing carbon pollution and preparing for the impacts of climate change. http://www.whitehouse.gov/blog/2014/10/01/recognizing-american-communities-climate-action-champions

[14] The Federal Government has contributed to the widespread adoption of standards, such as Leadership in Energy & Environmental Design (LEED), by adopting such standards for its own operations.

Actions to advance this recommendation include:

1.2.1 Establish guidance and, where appropriate, minimum standards, to help achieve consistency in the consideration and treatment of climate resilience as part of project planning, design, and construction. Federal incentives can be used to encourage State and local governments, Tribes, and territories to adopt resilience standards, and to use higher standards when rebuilding in the wake of disasters.

1.2.2 Federal agencies should adjust their practices in and around floodplains to ensure that Federal assets will be resilient to the effects of climate change, including sea level rise, more frequent and severe storms, and increasing river flood risks, as called for in the President's Climate Action Plan. Projects that receive Federal funding should be sited and designed with the best-available climate data and include margins of safety, such as freeboard and setbacks, to account for uncertainties and reduce costs and disruption from future hazards.

High tide flooding in Broward County, Florida. Photo Credit: *Paul Krashefski.*

1.3 Encourage and reward climate-smart land use management and development practices.

Federal policies and programs should provide incentives and technical assistance to support climate-smart land use and development that actively assesses and manages climate-related risks. State and local governments, Tribes, and territories that employ such practices should receive preferential consideration, a greater Federal cost share and/or more favorable financing terms from Federal programs that fund infrastructure, community, and housing development. Cost shares or interest rates could be more favorable, for example, for those communities that adopt freeboard, strong building codes, or floodplain and coastal setbacks; join the National Flood Insurance Program (NFIP) Community Rating System; or prohibit new critical facilities and other high-consequence activities in the 500-year floodplain. As much as possible, the incentives should be similar across Federal programs so that recipients are consistently rewarded for similar actions.

Actions to advance this recommendation include:

1.3.1 Federal agencies should consider strategies within existing grant programs to facilitate and explicitly encourage integrated hazard mitigation approaches that incorporate climate-change-related risks, land use, and capital improvement planning.[15]

1.3.2 Use strategies for pooling resources across agencies and simplifying planning and other programmatic requirements, which often over-burden communities, to help build state, local, tribal, and territorial capacity and encourage climate-smart land use policies while optimizing efficiencies.

[15] Incentives could be added to FEMA's Hazard Mitigation Grant Program, HUD's Community Development Block Grant program, the Department of Commerce's Economic Development Administration grants, EPA's State Revolving Loan Funds, US Department of Agriculture's (USDA) Rural Development grants, and US Army Corps of Engineers (USACE) programs, among others.

1.3.3 In order to support climate-smart land use in smaller and more rural communities, the NFIP Community Rating System should include application and reporting processes that are designed for communities that may lack the capacity to meet the current program's administrative requirements.

1.4 Lead by example: The Federal Government should serve as a model for climate resilience in its investments, operations, and programs.

Federal Government facilities and operations should serve as models for climate resilience by ensuring that climate impacts are taken into account in all stages of facility planning, design, construction, and management. Water, energy, and other resource demands associated with Federal activities should also be evaluated and planned for in light of projected changes in climate and in cooperation with local and regional managers and community officials. This process would protect the Federal Government's investments in its facilities and the economic benefits they provide to regions. It would also help protect the water resources and ecological health of regions in the face of a changing climate, and promote sustainable land use planning.

Actions to advance this recommendation include:

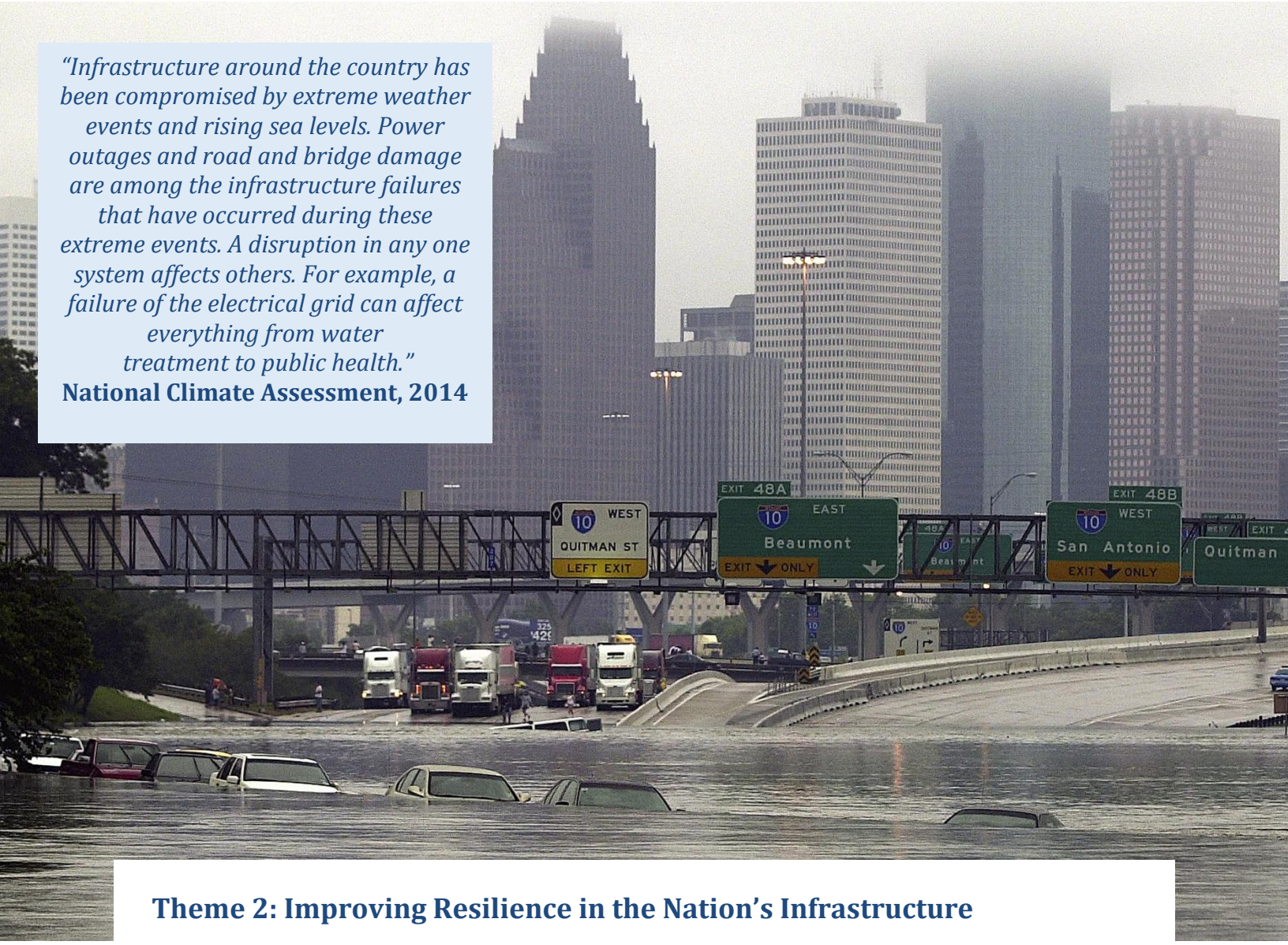
1.4.1 Commit to the incorporation of resilient design standards in the building, retrofit or repair of Federal facilities and projects and investments on Federally-owned property.

1.4.2 Maximize the use of natural infrastructure designs in all Federally-funded capital projects.

1.4.3 Employ resilient distributed energy generation for Federal facilities, where feasible, as part of the President's 20% by 2020 renewable energy goal.

> *"One of the first sustainability resolutions in the nation was adopted in Franklin County, Ohio in 2006. Citing the mutual compatibility of economic development and environmental protection, the policy is embedded in all county budgeting, leading to LEED Gold construction of several community institutions, reducing cost by saving energy and extending building lifetime. Similar approaches should be taken to integrate climate preparedness measures throughout local planning."*
>
> - **Commissioner Paula Brooks, Franklin County, Ohio**

"Infrastructure around the country has been compromised by extreme weather events and rising sea levels. Power outages and road and bridge damage are among the infrastructure failures that have occurred during these extreme events. A disruption in any one system affects others. For example, a failure of the electrical grid can affect everything from water treatment to public health."
National Climate Assessment, 2014



Theme 2: Improving Resilience in the Nation's Infrastructure

Climate change threatens the safety and reliability of the infrastructure systems that local economies and community security depend upon. Climate change impacts water delivery and wastewater treatment systems; flood risk management infrastructure; rail, road, and port infrastructure; natural infrastructure; energy production and distribution systems; and critical facilities, highlighting the interdependence of these systems and affecting social and economic activity in public and private sectors. Federal investments, activities, and policies must seek to reduce vulnerability of public and private infrastructure to sea level rise, recurrent flooding, storm surge events, coastal erosion, and other climate change related impacts through incorporation of such risks into siting, design, repair, and management of critical infrastructure.

The following recommendations offer ways that the Federal Government can align investments, policies, and practices to reduce the vulnerability of public and private infrastructure to climate impacts, including through better planning and siting, and improving the resilience of infrastructure that cannot be relocated from vulnerable areas.

Overflow from White Oak Bayou spilled onto Interstate 45 near Quitman Street after remnants of Tropical Storm Allison inundated Houston, Texas. Photo Credit: *Smiley N. Pool/Houston Chronicle.*

2.1 Support climate resilience as part of coastal infrastructure planning and investments.
A significant portion of the Nation's population, economic activity, and infrastructure is located near the coast, in floodplains, or in other areas vulnerable to sea level rise, more intense storms, tides, and coastal erosion. Remote communities, including small islands and some Alaska-Native villages, are especially vulnerable. Federal programs must better take into account both the importance and vulnerabilities of these areas when providing guidance or resources. For example, in July 2014, NOAA announced new program guidance[16] for state coastal management programs to ensure greater consideration of how climate change may exacerbate challenges in the management of coastal areas. Building off of this important step, additional actions to help advance this goal include:

2.1.1 The USACE should conduct coastal climate vulnerability assessments of all of its districts and disseminate this information to communities to enable cross-jurisdictional resilience planning.
2.1.2 Support efforts by facility managers for ports, harbors, inland navigation waterways, and coastal highways, to identify and address climate vulnerabilities. Make resilience planning a requirement for Federal support for ports, harbors, and inland waterways used for navigation, and for coastal highways, including congressionally authorized channel and navigation improvement projects.
2.1.3 Increase Federal support for local sea level rise and coastal erosion research and planning, and implement strategies that address both current and future impacts of climate change on coastal and Great Lakes ecosystems and communities. This should include improved agency coordination and transparency in the planning, review, and permitting of shoreline projects.
2.1.4 Provide technical assistance to assist coastal and island communities as they develop response plans and strategies for sea level rise, increased storm surge, and other climate change related risks.
2.1.5 Expand the use of the USACE's regional sediment management programs, where appropriate, to address coastal erosion threats in a comprehensive and cost-effective manner.

Coast Smart Communities Program
State of Maryland

Maryland's shorelines extend over 3,000 miles along the diverse landscapes of the Chesapeake Bay, the Coastal Bays, and the Atlantic Ocean. These landscapes are highly susceptible to coastal storms, flooding, and hurricanes, and are vulnerable to the long-term effects of a changing climate. Supported by NOAA's Coastal Zone Management program, the CoastSmart Communities[17] program connects local planners to information, tools, people, grants, and trainings to assist local communities in addressing short- and long-term coastal hazards, such as coastal flooding, storm surge, and sea level rise. To date, CoastSmart has funded more than twenty local government projects, all aimed at increasing overall resilience to coastal hazards in Maryland.

2.2 Promote and prioritize the use of green and natural infrastructure.
Natural systems are important features within the built environment, providing buffers against flood impacts and storm surge, storing water and recharging aquifers, helping to manage stormwater and moderate local temperatures, and providing vital habitat for native and migratory wildlife. Green infrastructure, also called natural infrastructure or natural defenses, for example wetlands, healthy reefs, living shorelines, dunes, floodplains, and forests, can mitigate risks to life and property while providing other social, economic, and environmental benefits, including carbon sequestration. Utilizing

[16] See "NOAA Coastal Zone Management Act," http://coastalmanagement.noaa.gov/backmatter/media/guidancefy14309.pdf
[17] See "Maryland Department of Natural Resources: CoastSmart Communities," http://dnr.maryland.gov/coastsmart/

green infrastructure alongside traditional infrastructure can help communities, public agencies, and private industry prepare for and respond to climate change in a cost-effective manner, and enhance natural and social systems. The Federal Government should facilitate planning and financial support for the protection, creation, and restoration of natural infrastructure to enhance environmental benefits and mitigate future risks from a variety of climate hazards.

Coastal ecosystem restoration project, New York City. Photo Credit: *NCA, Department of City Planning.*

Actions to advance this recommendation include:

2.2.1 Require that project scoping for federally funded transportation, water, energy, and other infrastructure investments include evaluation of natural infrastructure, alone or in combination with engineered or "gray" measures, to address issues such as coastal protection, stormwater runoff, and flood storage.

2.2.2 Provide tools, resources, best practices, case studies, engineering guidelines and incentives to help jurisdictions consider and utilize green infrastructure as a strategy for managing climate change impacts that maximizes environmental, social, and economic benefits, and protects natural systems.

2.2.3 Federal policies and programs should seek to identify, protect, and maintain ecological features such as forests and wetlands that may serve to buffer Federally funded infrastructure projects from climate impacts, remove regulatory and administrative barriers to restoration and maintenance of natural systems that help increase or maintain community resilience, and promote the use of traditional ecological knowledge and management features in resilience strategies.

2.2.4 Adjust Federal project funding and grant programs to ensure that the use of natural infrastructure to wholly or partially buffer facilities and infrastructure from climate impacts is an eligible activity, and encourage this practice as appropriate.

2.2.5 Encourage States, local governments, Tribes, and territories to fully implement the 20% set-aside for green infrastructure projects under the EPA State Revolving Fund programs, including through updated and enhanced guidance. The EPA should also consider increasing the percent set-aside allowable for green infrastructure.

2.2.6 Revise the new policy allowing "waterway channelization and erosion projects" to be funded under FEMA's mitigation funding programs in order to clarify that floodplain restoration projects to reduce erosion are fundable under this policy, and to add a requirement that project applicants investigate non-structural, green infrastructure approaches to flood risk management and utilize them to the greatest extent practicable before resorting to structural solutions.

Natural infrastructure from coast to coast

Across the country, states with coastal exposure are taking steps to utilize natural infrastructure to protect coastlines and enhance resilience. For example:

- In Florida, examples of natural infrastructure solutions include wave-breaking coral reefs, wave-absorbing beaches and dunes, and flood attenuating coastal wetlands, as well as natural/engineered hybrid features generally called living shorelines.
- In 2008, the Maryland legislature enacted the Living Shoreline Protection Act. The Act requires riparian property owners to rely upon "living shorelines" (defined as nonstructural shoreline stabilization measures such as marsh creation), whenever feasible, to protect shorelines from erosion while also providing critical wildlife habitat. A variety of State agencies in Maryland are involved in implementing the program and related efforts.
- In March 2014, the Washington State Department of Ecology released its "Soft Shoreline Stabilization" guidance,[18] which assists local government staff in planning and implementing shoreline stabilization provisions within Shoreline Master Programs. This guidance provides an introduction to common shoreline stabilization impacts and applicable regulations, describes the underlying intent of soft stabilization management policies, and identifies key considerations for soft shoreline planning and permitting, including project challenges.

2.3 Support and incentivize climate resilient water resource planning and management.[19]

The water sector is vulnerable to climate change through more intense droughts, extreme storm events, shifting precipitation, loss of mountain snowpack, Great Lakes water level decline, sea level rise, ecosystem changes, degradation of supply, storage, and delivery infrastructure, temperature rise, and other impacts. The Federal Government must support and incentivize climate-smart water resource planning and management, in all regions and at all levels of government.

2.3.1 Expand Federal agency collaborations with State and local governments, Tribes, territories, and regional entities to evaluate the long-term risks of climate change on water resource availability and in the development of sustainable water resource plans and management strategies. Activities could include sharing of data, costs, personnel, and resources, using models such as the Silver Jackets Program led by USACE or the Service First partnership between the U.S. Forest Service and Department of Interior (DOI). Applicable agencies include EPA, DOI (including the Bureau of Reclamation), and USACE.

[18] See "Washington Department of Ecology: Shoreline Master Program Planning and Implementation Guidance," https://fortress.wa.gov/ecy/publications/publications/1406009.pdf

[19] See related recommendations on protecting water quality and quantity (3.5) and Promoting green and natural infrastructure (2.2).

2.3.2 Provide technical support and guidance on how to conduct assessments of the vulnerability of water infrastructure to climate change impacts and incorporate climate change resilience into water resource planning and project design and related economic development planning.

2.3.3 Assign a higher priority to climate resilient programs and projects when administering Federal grant programs relating to water supply, wastewater, and water resources projects, including EPA's Clean Water and Drinking Water State and Tribal Revolving Funds, as allowable under applicable statutory frameworks.

Recycled water is used to irrigate landscaping in Pittsburg, CA. Photo Credit: *Florence Low, California Department of Water Resources.*

Climate-Smart Water Use in Los Angeles, California

Los Angeles is preparing to construct the world's largest advanced groundwater treatment plant in order to recoup the significant loss of its groundwater resources due to contamination, to enable the City to augment its local groundwater supplies through efforts to dramatically increase storm water and recycled water recharge, and to ensure a reliable and adequate local supply during dry years and in the event of an earthquake. Los Angeles is leveraging public and private resources to capture, infiltrate, and reuse stormwater by building multi-benefit green projects that also meet runoff water quality standards and provide greening to communities and better quality of life.

Illinois Clean Water Initiative

In July 2014, Governor Quinn signed into law an expansion to Illinois' Clean Water Initiative, which for the first time in Illinois history allows units of local government to obtain low-interest financing through the Initiative to move forward on capital projects that will remove pollutants from stormwater runoff and other non-point sources. The expansion of eligibility will assist municipalities, sewer districts and stormwater management agencies in Illinois to address capacity and capability of water infrastructure under future climate projections. Further, the $2 billion Clean Water Initiative is greatly expanding the number of affordable loans for communities across the State to invest in resilient water infrastructure.

2.4 Assist transportation officials in better understanding the vulnerabilities and risks to transportation networks and facilities and integrate climate resilience planning and preparedness criteria throughout existing Federal transportation funding programs.

Investments in resilience can reduce costs over the life-cycle of assets in vulnerable locations and also help build sustainable transportation options that reduce greenhouse gas emissions from the transportation sector. However, it can be difficult to justify transportation and infrastructure investments that accommodate future climate impacts when limited resources make it a challenge just to meet present-day demands like keeping the current transportation system in good repair, reducing congestion, and keeping facilities safe. Existing Federal programs can be modified or expanded to encourage inclusion of climate change preparedness and resilience when implemented at the state, regional, territorial, tribal, and local levels:

2.4.1 Develop and disseminate information, analyses, and tools for improving engineering design standards and decision making, so that new and existing transportation networks and facilities can be adapted and made resilient to climate change using the best available science.

2.4.2 Review DOT grants and programs to ensure that State and local governments, Tribes, and territories can access funding for transportation system vulnerability assessments. This includes continuing and expanding the successful Federal Highway Administration (FHWA) Climate Vulnerability Pilot Program.

2.4.3 Amend criteria for DOT's discretionary grant programs to require that recipients address potential climate impacts to any proposed projects. This would include utilizing best available climate data, any available climate vulnerability assessments, applicable local and state climate change plans as they pertain to transportation projects, vulnerability scores, and existing climate adaptation plans or strategies.

2.4.4 Transportation project funds should allow maximum flexibility in the eligibility of climate preparedness and resilience elements so that decision-makers can allocate funds most efficiently to improve public safety and reduce risk balanced against other project factors.

2.4.5 The FHWA should maximize the use of Emergency Relief Program funding to build climate resilience (betterments) into storm-damaged infrastructure, in consultation with state, tribal, territorial, and local jurisdictions and communities.

2.4.6 Building on parameters laid out for the 2014 Transportation Investment Generating Economic Recovery (TIGER) program, specifically and consistently adjust grant criteria and guidelines for TIGER and other DOT grant programs to favor transportation projects that will improve climate resilience.[20]

[20] "Notice of Funding Availability for the Department of Transportation's National Infrastructure Investments under the Consolidated Appropriations Act, 2014" *U.S. Department of Transportation*, DOT-OST-2014-XXXX. Federal Register, 79(41). 25 February 2014. http://www.dot.gov/sites/dot.gov/files/docs/TIGER%202014%20NOFA_FINAL.pdf

Climate and Transportation Planning in Philadelphia

The Federal Transit Administration's (FTA) Climate Change Adaptation Assessment Pilot Program funded seven projects across the country to advance the state of practice for adapting transit systems to the impacts of climate change.[21] In Philadelphia, several partners came together to conduct a vulnerability and risk assessment of the Southeastern Pennsylvania Transportation Authority's (SEPTA) Manayunk/Norristown regional rail line. This line closely parallels the Schuylkill River, which has experienced 10 of its highest 18 crests in recorded history since 2003, resulting in numerous delays and damage. The Pilot Program built capacity and facilitated the beginning of SEPTA's climate planning work, ultimately positioning SEPTA for a competitive award of $86 million in subsequent Federal funding through FTA's Emergency Relief Program. SEPTA will use the funds to improve disaster preparedness by building an alternate system control center, stabilizing embankments over commuter railroads, and improving flood protection of tracks.

2.5 Support Property Assessed Clean Energy programs.

Building community resilience on regional and national scales will require significant investment in the retrofit of public and private infrastructure. Residential and commercial properties will require improved weatherization to increase energy efficiency and address the potential impacts of extreme weather events. As heating and cooling costs soar in response to changing temperature extremes, energy efficiency retrofits and investments in renewable energy will help reduce energy bills, increase diversification of power sources, and advance distributed energy distribution infrastructure, adding redundancy to power systems. These benefits advance community resilience by freeing-up funds for additional investments and decreasing community vulnerability to economic and public health risks that accompany power loss in the face of natural hazards. Barriers to wide-scale retrofit of existing private properties include limited access to and incentives for long-term financing to cover project costs. Property Assessed Clean Energy (PACE) provides a means of financing energy efficiency upgrades, renewable energy installations, and weatherization improvements on residential and commercial properties through a voluntary property assessment. PACE also offers co-benefits such as spurring local investment and expanding economic opportunities in the green energy sector.

Actions to advance this recommendation include:

2.5.1 Reform policies preventing Freddie Mac and Fannie Mae from purchasing mortgages for properties with PACE loans.

2.5.2 Support the development of PACE programs that address locally relevant energy efficiency programs, renewable energy installations, and weatherization improvements.

2.6 Support development of a clean and resilient energy grid.

The country's energy grid is vulnerable to extreme weather that can cause prolonged and widespread power outages. Such extremes are likely to increase as global temperatures continue to rise. Higher temperatures also decrease power plant efficiencies during periods when electricity demand is the highest, placing additional stresses on the electricity system. In order to develop more robust, resilient energy infrastructure that is prepared for climate impacts, there is a need for policy and regulatory certainty that encourages upgrading electric infrastructure to enhance its resilience. These upgrades include not only hardening existing transmission and distribution systems, but also expanding them to include currently disconnected communities and incorporating efficient, renewable and low-carbon

[21] See "Announcements of Project Selections: Transit Climate Change Adaptation Assessment Pilots," http://www.fta.dot.gov/sitemap_14228.html

technology, resilient microgrids that can function as back-up systems, and distributed generation. Improving the resilience of electricity distribution and transmission line networks can reduce the number and length of outages and the cost to local and state economies.

Electrical grid failure. Photo Credit: *NCA, Iwan Baan/Getty Images.*

Actions to advance this recommendation include:

2.6.1 Incentivize investments in resilient, distributed microgrids and renewable energy microgrids through the Commerce Department's Comprehensive Economic Development Strategies and other Federal programs as appropriate.

2.6.2 Encourage the deployment of a microgrid framework to develop robust distributed generation systems using a variety of networked clean energy technologies that can also provide backup power as needed. Providing and promoting technical assistance for developing microgrids with combined heat and power can help ensure that the energy demands of a community or facility are met.[22]

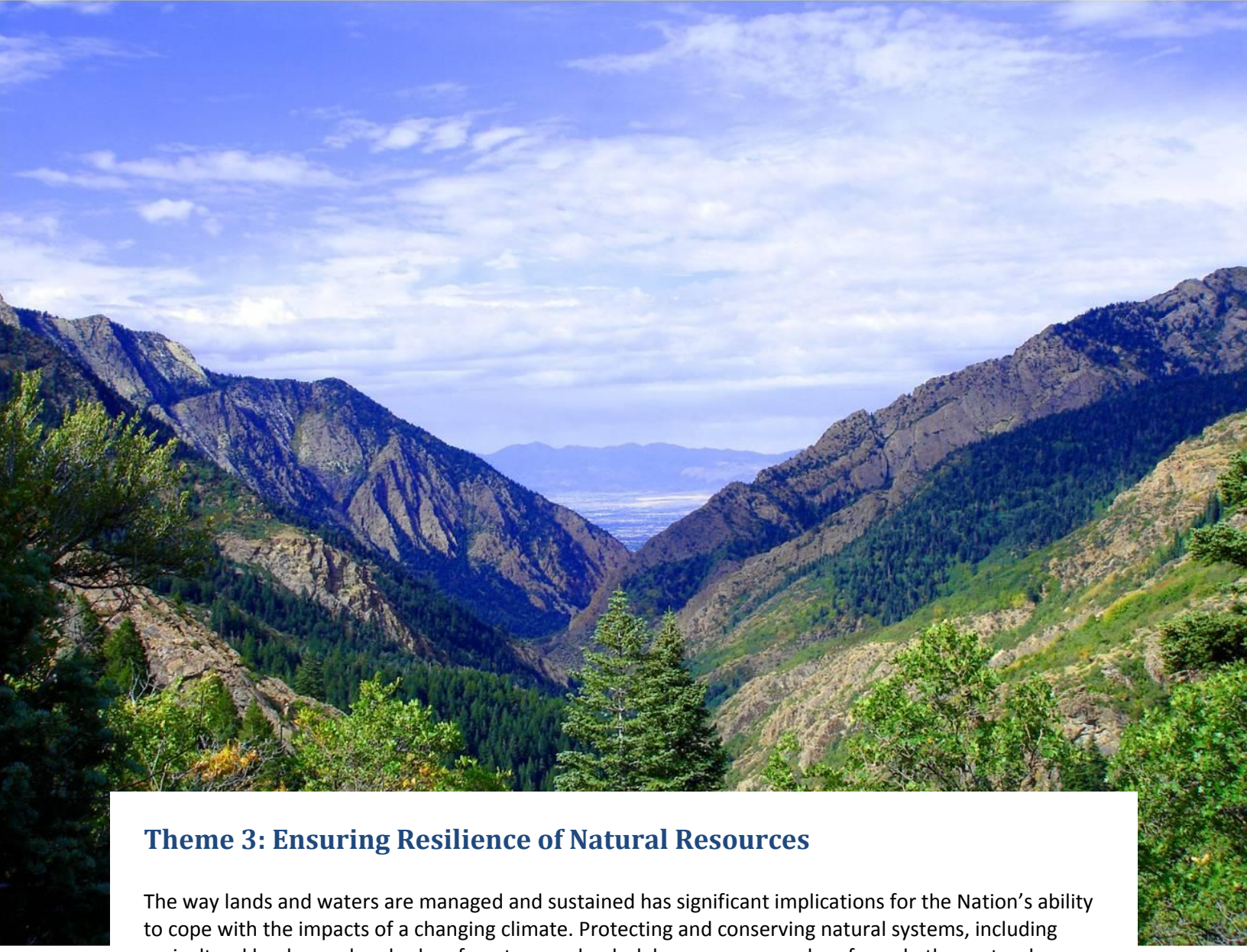
2.6.3 Promote resilient microgrid development by providing technical assistance through the Department of Energy (DOE) to states and electric distribution utilities that seek to make utility hardening improvements; by encouraging the Federal Energy Regulatory Commission (FERC) to open a docket designed to incentivize and reduce barriers to resilient microgrid development; and by providing loan guarantees for resilient microgrid deployment through the DOE Loan Programs Office.

2.6.4 Expand energy partnerships with Tribes to include incentives for siting on or near tribal lands and Federal promotion of grid accessibility for Tribes. Such partnerships should include opportunities for revenue sharing and/or ownership where appropriate.

2.7 Finalize guidelines for consideration of climate impacts and greenhouse gas emissions in National Environmental Policy Act evaluations of proposed Federal actions.

In accordance with the National Environmental Policy Act (NEPA), Federal agencies are responsible for analyzing the environmental effects of proposed Federal actions. In 2010, the CEQ released draft guidance to Federal agencies on consideration of effects of climate change and greenhouse gas emissions in their evaluation of proposals. The guidance affirms that greenhouse gas emissions and climate change impacts should be considered in developing NEPA reviews, and asked for comment on whether and how to address those effects for land management proposals. This guidance has yet to be finalized. Meanwhile, projects and investments are being advanced without adequate and coordinated consideration of the project design or alternatives relative to climate impacts and greenhouse gas emissions, a direction that generates unacceptable public health, safety, and financial risks for communities. The Administration should finalize guidance for considering climate impacts and greenhouse gas emissions in NEPA evaluations of proposed Federal actions.

[22] Executive Order 13624 on Accelerating Investment in Industrial Energy Efficiency may offer a vehicle for advancing this action. See http://www.whitehouse.gov/the-press-office/2012/08/30/executive-order-accelerating-investment-industrial-energy-efficiency.



Theme 3: Ensuring Resilience of Natural Resources

The way lands and waters are managed and sustained has significant implications for the Nation's ability to cope with the impacts of a changing climate. Protecting and conserving natural systems, including agricultural lands, rural and urban forests, grasslands, lakes, oceans, coral reefs, and other natural habitats, can help protect critical livelihoods, reduce human vulnerabilities and enhance community resilience in a cost-effective manner.

The Administration's Climate and Natural Resources Priority Agenda[23] (Agenda), released in October 2014, identified a suite of actions the Federal Government will take to enhance the resilience of the Nation's natural resources to the impacts of climate change. The Agenda reflects a Federal commitment to ensure the resilience of natural resources on which communities across the country depend by advancing climate-smart conservation practices and optimizing carbon storage and sequestration in land and water resource management. The recommendations below highlight opportunities to build on this commitment to ensure the resilience of the Nation's natural resources.

Big Cottonwood Canyon in the Central Wasatch Mountain Watershed, Utah. The watershed is a critical water supply to the Salt Lake Valley. Photo Credit: *Patrick Nelson.*

[23] See "Priority Agenda: Enhancing the Climate Resilience of America's Natural Resources," by the Council on Climate Preparedness and Resilience. http://www.whitehouse.gov/sites/default/files/docs/enhancing_climate_resilience_of_americas_natural_resources.pdf

3.1 Restore and conserve ecosystems and lands to build resilience in a changing climate.
Conservation of natural and working lands can help communities mitigate and prepare for climate change by supplying clean water, local food supplies, and other critical services; serving as buffers against flood impacts and storm surge; storing water and recharging aquifers; helping to moderate local temperatures; and providing vital habitat for native and migratory wildlife. These benefits—and community resilience—can be better realized with investments in ecosystem conservation and restoration.

Actions to advance this recommendation include:

3.1.1 Target lands for conservation that provide climate resilience benefits. The goals, guidance, and funding criteria of Federal conservation and land acquisition programs should incentivize the restoration and protection of land that contributes to long-term climate resilience and the provision of important ecosystem services.[24] Federal policy should also incentivize private conservation and reduced conversion of working lands to urban lands. Federally-funded land acquisitions in hazard-prone areas should be maintained as open space or other non-conflicting use (such as recreational areas), and not reoccupied.

3.1.2 Federal agencies including DOI, USDA, EPA, USACE, and NOAA should foster landscape-scale and regional conservation by identifying and developing landscape-level and regional partnerships to support resilience. Resources should be coordinated and leveraged on an interagency basis—for example, USDA Climate Hubs, DOI Climate Science Centers, Landscape Conservation Cooperatives, and other Federal climate science efforts—to advance collaborative research and conservation on a scale more effective for supporting resilience.

3.1.3 USDA and DOI should require climate resilience planning for natural resources. State and regional planning processes such as State Wildlife Action Plans and State Forest Action Plans should be required to consider impacts of climate change and address resilience priorities.

3.1.4 USDA, DOI, FEMA, and other agencies can reduce human and ecosystem vulnerability to wildfires by prioritizing pre-fire forest fuel thinning and post-fire forest restoration to address forest health needs, especially in the most vulnerable watersheds. Wildfire risks to adjacent communities can be reduced by providing resources and assistance for fire-safe homes and communities.

A home destroyed by wildfire in Okanogan County, Washington. Photo credit: *Washington Governor's Office.*

[24] Opportunities for implementation include the Land and Water Conservation Fund (i.e. Forest Legacy), Natural Resources Conservation Service Programs (e.g. Agricultural Conservation Easement Program, Wildlife Habitat Incentive Program, Environmental Quality Incentives Program), Cooperative Forestry Assistance programs and grants, NOAA's Coastal and Estuarine Land Conservation Program, and other programs that seek to protect working and natural lands through fee acquisition, easements, grants, land-owner agreements, and contracts.

3.1.5 Minimize the decline of marine life, wildlife, pollinators, and plants vulnerable to climate change by supporting full and robust implementation of the National Fish, Wildlife and Plants Adaptation Strategy and enhanced interagency coordination.[25]

Knoxville's "Urban Wilderness"

Over the last four years, the City of Knoxville, Tennessee has worked with local partners to establish an outdoor recreation destination on more than 1,000 acres of forested land along Knoxville's downtown river-front. This "urban wilderness" includes ten parks, more than forty miles of recreational trails, a nature education center, a wildlife management area, four Civil War sites, incredible views, and unparalleled natural features. In addition to providing recreation and aesthetic assets to the community, Knoxville's conservation efforts also protect the ecosystem services provided by forests and natural open spaces, such as clean water, water retention, wildlife habitat, soil stabilization, and urban cooling. Given East Tennessee's Appalachian topography, these natural resources help increase local resilience to strong rainfall and heat events, which are expected to become more intense and frequent as the climate changes.

"Knoxville's efforts to conserve natural open space in its urban core achieve a variety of recreation and conservation benefits. Federal support for communities to conserve and restore local ecosystems will boost resilience while also improving quality of life for residents."

- **Mayor Madeline Rogero, City of Knoxville, Tennessee**

3.2 Combat the spread of invasive species, pests, and diseases.

A changing climate can create conditions that benefit invasive pests, animals, plants, pathogens, and diseases that degrade agricultural, forest, and fishery productivity and quality; accelerate the decline of native plants and animals; weaken ecosystem resilience; and adversely impact human health and the economy. The Federal Government should work closely with State and local governments, Tribes, and territorial jurisdictions to strengthen biosecurity and improve control of invasive species, pests, and disease as a means to prepare for and adapt to climate change by improving coordination; providing tools and funding for prevention, early detection and rapid response, control and eradication; and demonstrating leadership in enforcement of related laws and quarantines.[26]

Actions to advance this recommendation include:

3.2.1 Assess the need for stricter regulations, inspection, and enforcement for importation of plants and animals to prevent new introductions of invasive species.

3.2.2 Integrate climate resilience and adaptation planning into invasive species programs and partnerships, including the National Invasive Species Council, the Invasive Species Advisory Council, the Great Lakes Restoration Initiative, and similar regional efforts, and integrated pest management programs.

3.2.3 Increase regional monitoring of the spread of invasive species, analysis of pests and potential threats, eradication methods and control methods (such as biocontrol technology) through enhanced research, identification, interagency coordination, and education efforts.

[25] See "National Fish Wildlife, Plants Climate Adaptation Strategy," http://www.wildlifeadaptationstrategy.gov/pdf/NFWPCAS-Final.pdf

[26] See the *Climate and Natural Resources Priority Agenda* for more information on Federal commitments that correlate with this recommendation. http://www.whitehouse.gov/sites/default/files/docs/enhancing_climate_resilience_of_americas_natural_resources.pdf

Hawaii's Interagency Invasive Species Council

"The council works to break down silos within government for an integrated, cross-sector approach to align shared priorities and identify opportunities for collaboration. HISC appreciates Federal agency participation in the council and strongly supports State-Federal joint inspection facilities at ports as an effective biosecurity partnership. The National Invasive Species Council has been a key partner with ongoing communication and coordination between local, State, regional and Federal governments."

- **Governor Neil Abercrombie, State of Hawaii**

3.3 Support resilience planning for ocean and coastal ecosystems.[27]

Ocean acidification, changes in salinity, and increasing water temperatures along coasts and within estuarine systems are growing concerns among fisheries and resource managers. Climate-related ocean acidification and hypoxia (a lack of oxygen in the water) are also serious threats to ocean health, especially for corals and coral reefs and the communities that depend on ocean and coastal resources. Of particular concern to remote communities, especially islands and Alaska Natives villages, is the ongoing impact of coastal erosion and thawing of permafrost that may be caused or made worse by climate change. Federal resources to proactively address erosion and permafrost issues are very limited, yet are critically important to local communities and island nations. As the extent and severity of ocean and coastal climate change impacts increases, solutions must include collaboration and commitment from all levels of government, nongovernmental organizations, and citizens to protect resources and the populations that call these areas home. Federal agencies should work more closely with coastal, island, and Great Lakes States, territories, Tribes and other jurisdictions to research, model, and monitor impacts of ocean acidification, sea level rise, and increasing water temperatures on coastal and marine ecosystems, including migratory bird and fish habitats. In doing so, State and local governments, Tribes, and territories, along with university and international partners, should coordinate to advance solutions that strategically target available resources and assistance to advance adaptation and resilience.

Bleaching of coral colonies in Pago Bay, Guam. Photo Credit: *D. Burdick/ University of Guam Marine Lab.*

[27] See related recommendations on coastal infrastructure (2.1).

3.4 Promote integrated watershed management and planning to protect water quality and quantity. [28]
Longer periods of more intense drought, increased evaporation due to higher temperatures, degradation of forests and landscapes, variable precipitation patterns, and changes in mountain snowpack may impact the quality and quantity of water for drinking and for agricultural and ecological needs. Increases in extreme precipitation events also create serious concerns for water quality, as much of the Nation's infrastructure is not designed to accommodate short-duration, high-intensity rain events. Federal policies and programs should encourage and incentivize integrated, multi-jurisdictional, watershed-based approaches to manage stormwater, reduce flood risk, and protect water quality and quantity. Such policies and programs should leverage resources to realize the multiple benefits of helping communities become more sustainable and resilient.

Actions to advance this recommendation include:

3.4.1 Federal agencies including EPA, NOAA, and DOI, should work with State and local governments, Tribes, and territories to support the development of comprehensive regional data-provisioning and modeling initiatives to provide decision-makers with adequate information to plan for and adapt to climate change impacts on water quality and quantity.

3.4.2 EPA and other Federal agencies should improve stormwater and water quality BMPs, including green infrastructure practices, to reflect enhanced understanding of climate impacts on water quality, and help institutionalize them into stormwater and water quality management programs at all levels of government.

3.4.3 Federal agencies including EPA, USACE, DOI, and USDA should work together to develop a national, integrated water strategy that focuses on interagency support for watershed restoration, groundwater partnerships, water (storm and waste) reclamation and reuse, and water conservation. Establish regional interagency water security partnerships that include state, local, and tribal representatives.

Hawaii's Watershed Partnerships construct fences in critical natural areas to protect natural resources and ecosystem services from the impacts of invasive animals. Photo Credit: *Emma Yuen, Hawaii Department of Land and Natural Resources.*

[28] See related recommendations on green and natural infrastructure (2.2).

"The plan will provide water and habitat managers with the tools they need to cope with the anticipated detrimental effects of climate change on snowpack and streamflows. Basin stakeholders… chose to set aside their personal interests and work together to formulate a comprehensive set of solutions that benefit the basin as a whole."

- **Governor Jay Inslee, State of Washington**

Yakima River Basin Integrated Water Resource Management Plan, Washington State

The Yakima Basin Integrated Plan is a collaborative plan to build resilience for the river basin as climate change strains the water resources on which its farms, families and fish all depend. Having faced water challenges for decades—including five drought years in the last twenty—and with mountain snowpack expected to decline significantly, the people of the basin face grave threats to their livelihoods. Recognizing this, local, county, and tribal governments, the conservation community, irrigation districts and others joined together with State and Federal agencies on a comprehensive plan to protect and enhance habitat and improve water supply for irrigation, municipal and domestic uses.

3.5 Enhance the scientific understanding of climate impacts on natural resources and provide technical assistance to help communities reduce adverse climate impacts.

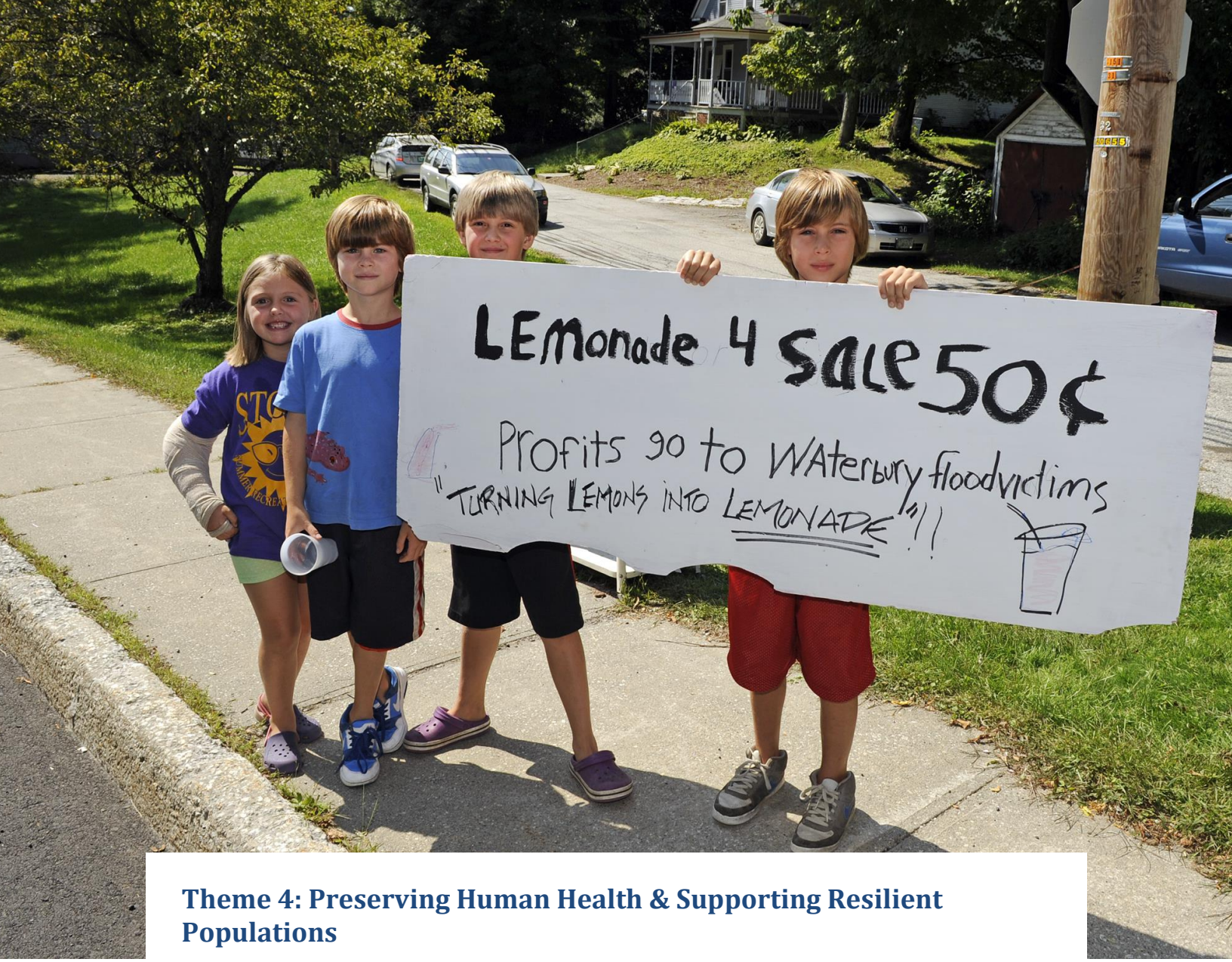
Accurate, up-to-date information is needed to manage forest, fishery, and working land health, ensure long-term carbon benefits, assess the conditions and trends of forest carbon stocks, address climate-driven stressors on forests, fisheries and agriculture, and fully understand the interactions with other natural cycles and systems. Existing inventory efforts, research, and applied science partnerships to understand and address threats such as fire, invasive outbreaks, and climate change should be supported and developed in ways that provide landowners, natural resource managers, and policy makers with the information they need to make sound decisions.

Actions to advance this recommendation include:

3.5.1 USDA and other Federal land managers should support research programs that monitor how climate is affecting agricultural and natural resources in the near- and long- term.

3.5.2 Federal conservation programs should test, disseminate, and incentivize the use of BMPs for managing climate impacts and for promoting ecosystem resilience of agricultural, forest and rangeland, and freshwater, and marine systems. Federal, state, local, tribal, and territorial resource managers should seek opportunities to collaborate on research and management strategies, especially where land and other resources are managed within the same watersheds.

3.5.3 USDA's Forest Service programs, such as the National Forest System and the State and Private Forestry Program, should develop BMPs for use in developing state forest adaptation goals and strategies in Forest Action Plans and consider ways to enhance urban forest canopies.



Theme 4: Preserving Human Health & Supporting Resilient Populations

A comprehensive approach to climate preparedness and resilience must consider more than adaptation strategies for the built and natural environments; it fundamentally must account for the resilience of people and communities. Communities must have the capabilities and capacity to recognize the impacts of climate change on public health, social networks, and the needs of vulnerable populations—which will bear disproportionate burdens under a changing climate—prepare for those impacts, and develop mechanisms to enhance resilience among residents. The Federal Government has an important role to play in safeguarding critical health needs and removing institutional barriers to climate preparedness. The following recommendations offer ways the Federal Government can support state, local, tribal, and territorial efforts to preserve and enhance the health and social resilience of communities in the face of a changing climate.

Young Vermonters join outpouring of support for Irene flood survivors (2011). Photo Credit: *Gordon Miller.*

4.1 Address the needs of vulnerable populations.
Certain populations, especially those that already face economic or health-related challenges, are likely to be disproportionately burdened by climate impacts. These populations may include tribal, Alaska-Native, and island communities, as well as low-income citizens or those with existing health conditions or vulnerabilities (small children, the elderly, those with chronic medical conditions, and individuals with medical disabilities). Vulnerabilities may be heightened by physical location, limits to financial or other resources, lack of access to emergency services, support, health care, or other limitations. To increase the resilience of these populations, decision makers and private sector partners need locally-specific information, tools, and resources to understand and assess climate risks, identify the populations most vulnerable, and develop effective preparedness and resilience strategies.

Actions to advance this recommendation include:

4.1.1 Develop guidance and tools that consider geographic, economic, and social contexts to help identify disproportionately vulnerable populations and those most at risk to the effects of climate change. In addition to Census data, tools should build on existing Federal programs that track public health data, provide information to support the planning and siting of public housing, and provide mapping tools and imagery products that inform environmental and health considerations regarding vulnerable populations.

4.1.2 Federal programs that serve vulnerable populations (e.g. flood insurance, disaster recovery, public health, occupational health, energy assistance, water utility assistance, supplemental nutrition, economic development, senior assistance programs, and housing programs) should evaluate how climate change will impact needs and service delivery and integrate consideration of these impacts in strategic planning and funding allocation.

4.2 Improve capacity to protect public health.
Climate change will exacerbate existing public health risks and contribute to new threats, including shifts in the emergence and distribution of some diseases. The public health community needs support to prepare for worsening and emerging risks to public health from the impacts of climate change. Specific actions to advance this recommendation include:

4.2.1 Expand and build on the Centers for Disease Control and Prevention (CDC) Climate-Ready States and Cities Initiative, which currently provides tools and guidance to 16 states and two large cities' health departments through the Building Resilience Against Climate Effects (BRACE) program. BRACE provides a pathway for health departments to build capacity and incorporate climate resilience planning into their programs. Mechanisms for grantees to share their experiences, best practices and model programs with non-grantees, including all local governments, should be strengthened.

4.2.2 Encourage recipients of CDC's Public Health Emergency Preparedness (PHEP) cooperative agreement funding to consider climate change impacts when developing their PHEP-required hazard and vulnerability assessments and develop mitigation strategies, as appropriate.

4.2.3 Support the development and enhancement of climate-sensitive health tracking and surveillance tools, including mechanisms to track disease vectors, and support research into low-toxicity pesticides to limit risks from these vectors and other strategies to limit disease spread caused or exacerbated by climate change.

4.2.4 Improve awareness of mental health needs and services in preparedness planning and disaster response and recovery, including extreme weather events training for mental health professionals relating to climate-related risk factors and stressors. All-hazard emergency preparedness and response funding should explicitly address stress, anxiety, depression or other potential behavioral health impacts associated with climate-related disasters and other long-term impacts of climate change.

4.3 Assist communities in building food system security.
Climate-related food shortages and associated changes in food production patterns can result in price spikes, reduced food quality, and decreased supply due to impacts on production, transportation, and storage. This is especially important in remote and subsistence communities, but also in urban "food deserts."[29] Risks to the agricultural sector directly impact farm worker communities, which has a ripple effect on local, state, tribal, and Federal assistance programs and community cohesiveness. The Federal Government should assist communities in building food system security by protecting and conserving natural resources and helping farmers, fishermen, and other stakeholders understand climate impacts and preparedness strategies, while providing resources and incentives to support climate-smart local, small-scale, and healthy food production and distribution in rural and urban areas.

Actions to advance this recommendation include:

4.3.1 USDA and other relevant agencies, such as NOAA, the Department of Health and Human Services (HHS), EPA, and DOI/Bureau of Indian Affairs, should support research to build increased understanding of climate change-related risks to both public and private sector aspects of food supply chains, including subsistence-based food systems and agricultural workers and communities. This should include encouraging regional marine and terrestrial food-shed and water resource vulnerability maps to visualize food sources and pathways to market in a particular area.

4.3.2 USDA should conduct a comprehensive risk assessment of the direct and indirect impacts of climate change on supplemental food and nutrition programs and develop strategic climate preparedness and resilience plans for these programs.

4.3.3 Support subsistence activities central to the economic and food security of tribal, Alaska-Native, territorial, indigenous island, and other communities. These communities and their representative jurisdictions must be fully integrated into resource governance decisions that affect their food sources, including the Federal Subsistence Board, fishery management councils, and co-management organizations.

4.4 Improve disaster preparedness for communities most at-risk.
Every community located in a hazardous area—whether on a low-lying coast or on a fire-prone hillside—should prepare for potential disasters, including those that may be new or getting worse under a changing climate. This includes disaster preparedness, response, and recovery planning. The Federal Government should provide support to these communities and regions to create integrated risk management plans for evacuation, sheltering, and meeting medical, nutrition, and other humanitarian needs during a disaster.

Decentralized Supply Distribution Centers Houston, Texas

With support from DOE, the City of Houston has created a network of mobile community support and disaster response energy stations that can operate off the grid and provide basic needs to the community. The solar generators/mobile offices, with battery back-up, are designed for emergency relief efforts after hurricanes or cooling centers during times of extreme heat. Support provided by these units includes water and food, charging stations for phones and medical equipment, and case work assistance. When not being used in an emergency, they are used year-round for services, outdoor classrooms or to educate the public and bring awareness to solar projects.

[29] Food deserts are urban neighborhoods and rural towns without ready access to fresh, healthy, and affordable food. See http://apps.ams.usda.gov/fooddeserts/foodDeserts.aspx

Actions to advance this recommendation include:

4.4.1 Provide or enhance access to pre-disaster training on Federal response and recovery programs for elected officials, community and tribal leaders, agency staff, and first responders in high-risk areas, in order to help communities mobilize for recovery efficiently and effectively.

4.4.2 Build capacity for sheltering and basic supply distribution with guidance and technical support to help communities prepare for widespread distribution of food and other basic supplies, and identify and prepare shelters that can be used during and after extreme weather events without interfering with key community services.

4.4.3 Remove regulatory and technical barriers in order to help communities deploy back up and grid-tied renewable distributed energy generation. Back up energy generation should include solar/battery storage, wind, combined heat and power, and/or extend the life and stability of fuel-based generators, and should prioritize key facilities for first responders and evacuation to ensure basic load priorities (e.g., fueling of emergency vehicles, lighting, heating and cooling, phone charging, and refrigeration of medicine).

4.4.4 Federal agencies should develop health-sensitive extreme weather event warning systems that are sensitive to changes in climate and enhance response activities for at-risk populations.

4.5 Explore Federal role in addressing climate change-related displacement, needs of affected communities, and institutional barriers to community relocation.

Urgent and long-term climate change impacts, including drought, sea level rise, coastal erosion, and water degradation are already affecting and will continue to affect the habitability of places where people live and work. As a result, displacement and migration of populations can be expected in every region of the country and in U.S. affiliated jurisdictions.

The Federal Government has an opportunity to provide international leadership by establishing an institutional framework for responding to the complex challenges associated with climate-related displacement. This framework will help Federal agencies and partners provide coordinated, critical support to affected communities across the United States. State, local, tribal, and territorial entities should be consulted and involved in the development of the framework.

> *"In Alaska, the communities of Shishmaref, Newtok and Kivalina have decided that the relocation of their entire community offers the only viable long-term strategy to protect their communities and residents. Accelerating rates of erosion, caused by the combination of repeated extreme weather events, thawing permafrost and decreased arctic sea ice, are causing the land that makes up these communities to permanently disappear. Each community has worked for more than a decade to facilitate relocation. Institutional barriers and the lack of a designated coordinating Federal agency has hampered the local efforts to move their communities to a safe location. Federal and state agencies need to work together with local residents to overcome the barriers and relocate the residents to safety."*
>
> - **Mayor Reggie Joule, Northwest Arctic Borough**

Theme 5: Supporting Climate-Smart Hazard Mitigation and Disaster Preparedness and Recovery

Scientific findings and recent experience alike demonstrate that certain types of extreme events will become more frequent or severe in a changing climate, with potential impacts to the economy and communities including high recovery costs for repairing and rebuilding infrastructure and buildings. The following recommendations offer ways the Federal Government can further support regional, state, local, tribal, and territorial efforts to prepare for disasters, recover in a way that enhances future resilience, and prevent and mitigate hazards wherever possible.

Erosion of Guam's coast, Talofofo Bay, Guam. Photo Credit: *D. Burdick/Bureau of Statistics and Plans.*

Fort Collins' Path to Resilience

Fort Collins experienced a devastating flood in 1997 that caused loss of life and property. Following that incident, the City implemented a variety of management strategies to mitigate the impacts of floods on life, health, and property in floodplain areas, including floodplain regulations, open space preservation, acquisition of at-risk structures, stormwater capital projects, public education, and flood early warning systems. The Fort Collins Floodplain Management Program is now ranked as one of the top programs nationwide under the FEMA Community Rating System. In September, 2013 another catastrophic flooding event occurred in northern Colorado, causing millions of dollars in property and infrastructure damage. As a result of investments in resilience and mitigation planning, Fort Collins experienced minimal impact, and instead was able to assist neighboring communities in their recovery efforts.

"Community investments in resilience pay off in protecting human life, minimizing loss and lowering recovery costs. Federal agencies should incentivize local policy implementation and investments in hazard-prone areas to protect life and property."

- **Mayor Karen Weitkunat, Fort Collins, Colorado**

5.1 Build a stronger culture of partnership and service to communities impacted by disaster.

In the wake of a disaster, leaders in state and local government, tribes, and territories often find themselves needing to master the differing rules and procedures of myriad Federal funding programs while working rapidly to establish effective, coordinated response across multiple levels of government, special districts, and private sector and other nongovernmental organizations. Federal officials can support swift, resilient recovery by coordinating Federal resources and facilitating effective and efficient access to those resources, reflected through clear and consistent guidance, sustained technical support, and effective partnership efforts.

Actions to advance this recommendation include:

5.1.1 FEMA should convene and manage multi-agency Federal teams to work with and provide more coordinated assistance to state, local, tribal, and territorial leaders in implementing a comprehensive approach to recovery and utilizing a full range of funding sources from across Federal agencies and programs. FEMA's Federal Coordinating Officers and recovery field staff should be trained in the range of applicable Federal programs as well as in effective team building, problem solving and management so that they can coordinate broad and effective Federal recovery partnerships. These teams should include state, local, and tribal participants to incorporate local knowledge and leverage existing partnerships.

5.1.2 Minimize staff transitions in Federal field teams deployed to disaster-stricken areas and ensure information transfer to minimize disruption and inconsistent practices when staff transitions occur. Utilize a clear and consistent set of guidelines and criteria for making and communicating decisions on funding eligibility and requirements.

"In my time as Mayor, Des Moines has experienced an unprecedented number of 100 and 500 year flood events. Our responsibility as a City is to ensure the safety of all our citizens and their property. Sometimes that process requires strategic buyouts of properties that fall within the floodplain. For this to work effectively, local, state, and federal partners must work closely together and interagency coordination must be a priority in order to avoid conflicting direction from multiple authorities that negatively impact residents."

- ***Mayor Frank Cownie, Des Moines, Iowa***

5.1.3 Foster productive and efficient recovery partnerships by providing joint pre-disaster training on rebuilding with resilience for Federal staff, state agencies, and tribal, territorial, and local leaders in vulnerable areas, including on resources, requirements, and opportunities. Create and publicize web resources providing consolidated information from multiple agencies about funding, technical resources, and best practices.

5.1.4 Improve FEMA's Disaster Assistance Programs by providing clear and consistent thresholds for eligibility and procedures for applicants, procedures for damage assessments, and alignment with other Federal disaster relief programs.

Residents creating sandbags in Des Moines, Iowa, 2010.
Photo Credit: *The City of Des Moines' Public Works Department.*

5.2 Remove barriers to rebuilding for future climate resilience.

Rebuilding damaged areas and infrastructure after a disaster is an investment that should be informed by the best available science on climate risks. Federal recovery programs should consistently support repair and rebuilding projects that also mitigate future climate hazards. Administrative obstacles to funding in this way should be eliminated. Federal studies have demonstrated that every dollar invested in mitigating future disaster risks avoids more than four dollars in future recovery costs,[30] demonstrating the economic value of investing Federal recovery dollars in climate-smart projects.

Actions to advance this recommendation include:

5.2.1 Modify disaster recovery programs to encourage and prioritize projects that are sized and designed to withstand future climate impacts and that are located outside areas vulnerable under current or foreseeable conditions.[31]

5.2.2 Coordinate eligibility and grant documentation requirements for similar types of projects across different agencies' recovery funding programs to reduce red tape, speed project implementation, and lessen administrative costs. Additionally, help communities finance resilient recovery investments with higher upfront costs by allowing jurisdictions to combine funds from different Federal programs administered by different agencies.

5.2.3 Support small, remote, and rural communities, as well as tribal areas, territories, and island communities, that lack the capacity to identify and execute resilient recovery investments by providing enhanced technical assistance, removing barriers to hiring grant specialists and project coordinators, and lowering or removing grant match requirements where they present a significant barrier.

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[30] Rose, Adam, et al. "Benefit-Cost Analysis of FEMA Hazard Mitigation Grants." *Natural Hazards Review* 8.4 (2007): 97-111. University of Southern California, 1 Nov. 2007. http://research.create.usc.edu/cgi/viewcontent.cgi?article=1014&context=published_papers

[31] Relevant programs include FEMA's Individual Assistance, Public Assistance, and Hazard Mitigation Assistance, HUD Community Development Block Grant – Disaster Recovery, and Small Business Administration (SBA) disaster assistance programs.

Rebuilding a Stronger Vermont after Hurricane Irene

"Vermont was committed to building back stronger after Irene ravaged our State in 2011 – destroying over 500 miles of roadway, and flooding thousands of homes, businesses and farms. We built partnerships with FEMA and FHWA focused on removing the barriers to resilient rebuilding plans. We insisted on relocating our state hospital out of a flood plain, purchasing properties to remove homes and businesses from future harm, and rebuilding larger culverts and bridges to protect our communities from future storms. Federal agencies must build stronger partnerships through recovery and work together to find common sense solutions that enable communities to build for the future."

- **Governor Peter Shumlin, State of Vermont**

Vermont learned from Irene and other floods that erosion damage from river flooding puts communities, infrastructure, and the economy at risk. Vermont has developed a science-based methodology for mapping erosion hazard zones adjacent to rivers that is helping to identify vulnerabilities to future flooding. The State is improving management of river corridors and floodplains and is working with communities to assess risks and take action to reduce future hazards.[32]

5.3 Incentivize and fund Community Resilience Plans with a holistic approach to preparedness and recovery.

After major disasters, communities dealing with extensive damage have a rare opportunity to significantly enhance their readiness for future climate-related risks. The Federal Government should encourage and fund a comprehensive approach to planning and implementing forward-looking investments that can significantly reduce future risk. This is especially important in urban areas, where recovery programs are designed to fund a series of individual projects that may not address more systemic risks facing entire neighborhoods or commercial areas (such as inadequate stormwater management or lack of natural infrastructure for buffering storms).

Actions to advance this recommendation include:

5.3.1 Federal recovery programs should permit funding for projects outside of the immediately damaged area if those investments would have significant and demonstrable benefits for risk reduction under present or anticipated conditions.

5.3.2 Coordinate across Federal agencies to accelerate the pre-disaster planning and post-disaster execution of buyouts in areas prone to coastal or riverine flooding or wildfire under current or anticipated conditions.

"After Superstorm Sandy, the City of Hoboken began developing plans to make the city more resilient to flooding. Representatives from FEMA explained that the City could receive funding to flood-protect fire stations, a community center, and other municipal facilities, but not for measures that would provide protection to the entire city. During future flood events, this approach would result in having "islands of protection." Even if a firehouse were protected from flooding, it would be inaccessible and unusable. Funding policies should be structured to allow for mitigation measures that can protect larger areas, including entire communities."

- **Mayor Dawn Zimmer, Hoboken, New Jersey**

[32] See http://accd.vermont.gov/strong_communities/opportunities/planning/resiliency/VERI and http://floodready.vermont.gov/

5.3.3 Identify, evaluate, and pilot innovative financing strategies—such as special districts focused on financing resilience measures, bonds, and public-private partnerships—that could leverage reductions in post-project insurance premiums or other private sector funding to raise capital for investments to increase resilience

5.4 Modernize data collection, analysis, and mapping based on current and predicted climate impacts to help improve local capacity for effective hazard mitigation planning.

Many communities have not yet calculated and evaluated risks associated with climate change for infrastructure, public health and safety, or built and natural environments. Insufficient or inaccurate data stymie hazard evaluation and sound mitigation plan development. In particular, out-of-date or inaccurate flood hazard maps impede the efforts of communities to understand and assess vulnerability to sea level rise, coastal storm surge, and riverine flooding and to develop policies and projects to reduce risk. Erosion hazards, which are likely to worsen in many parts of the country due to predicted increases in extreme precipitation events, remain largely unmapped. Communities also lack information about changing wildfire risk, drought and other climate-influenced hazards. In response to these challenges, initiatives at all levels of government are underway to leverage private and other nonfederal sources of data, to build partnerships to generate and analyze mapping data, and to promote the use of the best-available science in land use decisions. These innovations and partnerships should be supported by Federal agencies. Additionally, Federal investments in mapping and data need to be prioritized to deliver mapping products and other tools that support nonfederal efforts to manage risks in addition to flood, including wildfire, landslide, erosion, and drought.

Actions to advance this recommendation include:

5.4.1 Federal agencies such as FEMA, NOAA and United States Geological Survey (USGS) should collaborate with State and local governments, Tribes, territories, universities, private sector, and other nongovernmental organizations to accelerate the development of hazard maps that integrate climate change, ocean acidification and sea level rise projections. Federal, state, tribal, territorial, and local mapping projects should coordinate and share data to avoid redundancy, leverage resources, and prioritize funding.

5.4.2 Provide adequate funding to update NFIP Flood Insurance Rate Maps to reflect expected sea level rise, changes in storm frequency and intensity, shoreline change, and changes in river and localized flooding in order to inform planning, regulate development, and target cost-effective investments for minimizing future flood damage.[33]

A home is left standing among debris from Hurricane Ike (2008) in Galveston County, Texas. Floodwaters from Hurricane Ike were as high as eight feet in some areas causing widespread damage across the coast of Texas. Photo Credit: *David J. Phillip-Pool/Getty Images.*

[33] The Association of State Floodplain Managers estimated the cost for providing flood maps nationwide at $4.5 to $7.5 billion, a good investment given that the *annual* cost of flood damages in the United States from 2000-2009 was $10 billion. For more information, see: "Flood Mapping for the Nation: A Cost Analysis for the Nation's Flood Map Inventory," *Association of State Floodplain Managers (ASFPM). 1 March 2013.* http://www.floods.org/ace-files/documentlibrary/2012_NFIP_Reform/Flood_Mapping_for_the_Nation_ASFPM_Report_3-1-2013.pdf

"Guam is in the most active area for typhoons in the world and is in the only basin that can have a hurricane or typhoon any month of the year. Our community has endured super typhoons; lived without power, water, and gas for weeks; recovered from hundreds of millions of dollars in damaged infrastructure; and revitalized our tourism industry. Guam's story demonstrates a community's size is not always a good measure of the vulnerability and risk it faces."

- ***Governor Eddie Calvo, Island of Guam***

5.4.3 FEMA's Risk Mapping, Assessment, and Planning program should map current and projected 500-year floodplains throughout the U.S. in order to reduce risk to critical facilities under the requirements of Executive Order 11988.[34]

5.4.4 Help State and local governments, Tribes, and territories manage disaster risks by building their capacity to monitor and assess hazard risks and providing technical assistance on interpreting hazard maps and using them wisely to support land use management, emergency response, economic recovery efforts, natural resource management, and disaster recovery planning. Scale up community-based training disaster preparedness and planning.

5.4.5 The work of the Technical Mapping Advisory Council should include consideration of strategies for making informed land-use decisions that promote public resilience and safety where detailed maps and information on climate impacts are not yet available.

5.5 Modernize and elevate the importance of hazard mitigation programs.

The Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation Grant Program have been critical sources of hazard mitigation funding. Improvements in program administration would increase their flexibility and breadth for addressing varying mitigation needs across urban, suburban, Tribal, and rural areas. Reducing the average project approval time is an essential step towards a more effective program, as is lengthening performance timeframes beyond two years**.** To avoid time-consuming and costly Federal reviews of every proposed project, the Administration should consider making the hazard mitigation programs more like a block grant program, similar to HUD's Community Development Block Grants. Pilot programs authorized under the Sandy Recovery Improvement Act have helped states and municipalities and should be made permanent. The newly-announced Mitigation Integration Task Force, intended to identify and invest in projects that will increase resilience, is an important starting point toward a more effective program.

Actions to advance this recommendation include:

5.5.1 Adjust eligibility criteria for Federal programs, including FEMA hazard mitigation programs as well as other Federal disaster recovery programs at HUD, DOT, USACE, EPA, and SBA, to avoid funding activities that may encourage or perpetuate occupation of hazardous or vulnerable areas, such as floodplains, storm-surge zones, and wildland-urban interfaces that are vulnerable to wildfire.

5.5.2 Federal agencies should work together to consolidate requirements for hazard mitigation and encourage integration with land use plans, and streamline plan approval so that urgent mitigation actions are not delayed post-disaster. Grants and technical assistance should also be provided to support risk communication targeting at-risk property owners.

[34] See "Executive Order 11988: Floodplain Management," http://www.archives.gov/federal-register/codification/executive-order/11988.html

5.5.3 Make ecosystem restoration and preservation eligible for the HMGP, the Pre-Disaster Mitigation Program, and the Flood Mitigation Assistance Program, particularly in flood- and drought- prone areas where such natural infrastructure projects can minimize future loss of life and property.

5.5.4 Review eligibility criteria for receipt of hazard mitigation funding and eliminate barriers that prevent tribal and rural communities from accessing this funding.[35]

5.5.5 Adjust eligibility for Federal disaster recovery programs and the FEMA Hazard Mitigation Programs to improve eligibility for measures that address erosion, mudslide, and landslide hazards and that are often not associated with a disaster or not eligible disaster recovery activities.

5.6 Strengthen the National Flood Insurance Program to avoid development that increases exposure and losses to flooding, and eliminate inequities for urban and rural locations.

The National Flood Insurance Program (NFIP) has helped many property owners get back on their feet after losing homes and businesses by providing more direct, rapid, and complete support for disaster recovery, repair, and rebuilding. The minimum standards local governments must adopt to participate in the program should be strengthened to prevent the continued degradation of critical floodplains, wetlands, coastal marshes and dune areas that naturally buffer the impacts of storms and rising sea levels. In low- to mid-risk flood prone areas, insurance rates should be reduced for property owners who rebuild to meet more robust standards and codes. NFIP policies should also be better designed to provide equitable coverage across all types of development and housing in rural, suburban, and urban areas.

Actions to advance this recommendation include:

5.6.1 To address the fact that NFIP insurance policies are not well designed for densely populated urban areas, FEMA should conduct a study to identify solutions to address challenges in NFIP administration in urban areas including addressing properties with basements, differentiating among occupants in multi-family and high-rise housing based on their elevation, addressing common areas of condominiums, and reviewing thresholds for substantial damage determinations.

5.6.2 Develop stronger minimum standard requirements for local governments participating in the NFIP, especially for new development proposed in undeveloped areas where floodplains or coastal shores provide valuable functions for slowing and storing floodwaters and mitigating the risk of flood damage. For example, the NFIP minimum standards for these areas could be founded on an approach that minimizes risks for existing development, avoids adverse impacts for floodplains and coastal shores, and discourages development that worsens flood and erosion risks or produces other adverse impacts upstream, downstream, or on adjacent properties.[36]

5.6.3 Revise FEMA's Community Rating System to award more points when communities adopt comprehensive, community-wide approaches to increase climate resilience and manage risk to reduce the costs of climate impacts and disasters (e.g. with strong building codes).

5.6.4 Provide technical assistance to help communities participate in the NFIP and develop a less administratively burdensome Community Rating System option for smaller communities.

[35] "Alaska Native Villages: Limited Progress Has Been Made on Relocating Villages Threatened by Flooding and Erosion" *U.S. Government Accountability Office*, GAO-09-551. June 2009. http://www.gao.gov/new.items/d09551.pdf

[36] Sometimes known as "avoidance" or a "no adverse impact" approach.

Theme 6: Understanding and Acting on the Economics of Resilience

Climate change poses significant economic risk to all sectors and communities across the United States.[37] In the face of increasingly frequent and severe storms, flooding, heat waves, and other climate-related disruptions, investments in resilience can reduce future risk and help to protect against severe economic losses and threats to public health and safety. To prepare for these changes, all facets of public, private, and civil society will need to engage in developing new partnerships and strategies to make the best investment decisions possible and reduce the costs of climate impacts that cannot be avoided. The following recommendations offer ways the Federal Government can advance sensible measures to foster more prudent investments in long-term resilience and ensure a vibrant economic future in the face of climate change.

Governor Inslee visits shellfish processing center in Shelton, WA. Ocean acidification has already begun to impact the shellfish industry, an important economic driver in the region. Photo credit: *Washington Governor's Office.*

[37] See for example "Risky Business: The Economic Risks of Climate Change in the United States," June 2014. http://riskybusiness.org/uploads/files/RiskyBusiness_Report_WEB_09_08_14.pdf

6.1 Promote private sector and workforce resilience to reduce economic disruptions associated with the impacts of climate change.

The private sector is responsible for much of the infrastructure of physical plants, supply chains, and retail, commercial, and industrial facilities that local and regional economies rely upon. Federal programs should support regional, state, tribal, territorial, and local efforts to engage the private sector in community resilience and hazard mitigation planning and related projects, including Chambers of Commerce and major employers, as well as architects, engineers, and other designers and the professional organizations that represent them.

Actions to advance this recommendation include:

6.1.1 Federal efforts to identify community resilience indicators should include metrics of economic resilience, including considerations of supply chains, the work force, and other measures of climate impacts to commercial activity.

6.1.2 Federal policies and programs should encourage participation of business and labor leaders, and representatives from professional organizations and other stakeholders when developing and implementing various regional, state, tribal, territorial, and local community climate-related plans, including Hazard Mitigation Plans, Disaster Recovery Plans, and Climate Adaptation Plans, among others.

"Like our Central Coast neighbors and the rest of California, Santa Barbara County is in the middle of a severe drought with our major fresh water lake at only 30% capacity and dropping. Extreme heat events and lack of rainfall have also increased our risk for wildland fires, of which we have had five major incidences over the past decade. In addition, the drought threatens our top industries: agriculture and tourism. A commitment to preparing for a future with climate change will ensure our communities remain secure, stable, and resilient in a future of uncertainty. "

- **Salud Carbajal, Supervisor, Santa Barbara County, California**

6.2 Reward resilient investments and consider the benefits of ecosystem services in cost-benefit analysis.

Adapting to climate impacts will require long-term investments, the benefits of which might not be seen in the short term. There is a longstanding debate among experts and academics on what the appropriate discount rate is for use in projects that have long-term benefits; evidence that discount rates that are lower than conventional rates may be important to consider in order to address difficult economic and ethical questions that arise with long-term investments.[38] Government decision-making processes, particularly related to cost-benefit analyses, can favor short time frames, leading to underinvestment in projects with long-term benefits. These same decision-making processes can fail to adequately consider the long-term and accrued economic, environmental, and societal benefits of climate-resilient investments, resulting in decisions that undervalue or overlook long-term resilience opportunities and lead to greater costs in the long-run. The accounting practices and evaluation criteria used by the Federal government have a significant impact on state, local, and tribal government decision-making, particularly given the large role Federal contributions often play in infrastructure projects. The Federal Government should use this influence to incentivize decision making that accounts for climate related risks and vulnerabilities, and results in longer-term climate resilient strategies and investments.

[38] See for example Portney, P.R., and Weyent, J.P. (Eds.) "Discounting and Intergenerational Equity" RFF Press, 1999.

The following adjustments to policy and practice can further advance this recommendation:

6.2.1 Adjust cost-benefit methodologies across Federal programs to fully value the benefits of front-end investments in resilient planning and design, including in ecosystem services, green infrastructure, and post-disaster rebuilding of damaged buildings and infrastructure with new design standards to consider the future avoided costs associated with responding to climate-related events, such as lost economic productivity, or rebuilding after a disaster. These cost-benefit methodologies should be as uniform as possible across Federal programs.

6.2.2 Allow for flexibility when evaluating projects with benefits that accrue over especially long timeframes, such as those that increase resilience to projected climate impacts. This could include using sensitivity analyses that incorporate lower discount rates, where appropriate, to allow decision makers to make use of that information to more accurately value the return on climate smart investments.

6.2.3 Develop guidance and technical assistance for State and local governments, Tribes, and territories interested in incorporating these practices into their own decision making. Federal agencies might also require the use of some or all of these practices as a condition for receiving Federal grant funds, where appropriate, so long as the cost of applying these requirements are not transferred to tribal and vulnerable communities (creating a barrier to funding self-determined projects or the integration of the guidance into their decision-making).

6.2.4 The Administration should collaborate across Federal missions and programs and with the private sector to develop innovative funding platforms to support resilience investments in retrofits to the built environment that reduce the up-front cost of the retrofit and support long term payback of the investment through on bill financing or other mechanism.

6.3 Safeguard places of national, economic, and historical significance.

Disaster and climate preparedness must become a priority for facilities and infrastructure critical to the smooth functioning of National, regional, state, tribal, territorial, and local economies—whether those are major airports, ports, transportation systems or water and energy production and distribution facilities. A lack of disaster or climate preparedness for these facilities and installations could be catastrophic not only in the immediate community, but also for whole industries or regions served by their operations.

Actions to advance this recommendation include:

6.3.1 Expand funding and technical assistance available to those managing facilities and infrastructure critical to regional economic resilience to help them develop forward-thinking climate and preparedness plans, decision-making tools for rebuilding, strengthening or relocation actions, and develop state-of-the-art tools to enhance preparedness capabilities applicable to their specific climate risks. Plans should be developed with input from and in collaboration among State and local governments, Tribes, and territorial agencies; incorporating local knowledge and priorities; and integrating with existing and evolving climate preparedness planning efforts. Technical assistance should be integrated across Federal agencies to ensure that plans leverage multidisciplinary expertise and accommodate interdependencies at all levels.

6.3.2 Provide guidelines to inform state, territory, tribal and local governmental climate adaptation planning that includes historic and cultural properties and buildings to protect their contribution to tourism, acknowledge and respect their cultural significance, and ensure that quality of life in communities across the country is maintained.

Preparing Facilities with National Economic Significance
Los Angeles and Houston

The Ports of Los Angeles and Houston are two of the largest and most active ports in the world. Together these two ports are responsible for generating over 2.2 million jobs.[39] Wide-spread damage to these ports would result in significant economic loss for the Los Angeles and Houston-Galveston regions, and negatively affect the global supply chain resulting in product shortages and increased costs for consumers and manufacturers. Responsibility for protecting these crucial pieces of national infrastructure should not fall to local governments alone. Measures to increase resilience at these ports, such as micro-grids for electrical power and infrastructure to protect against sea level rise, must be a National priority.

6.4 Collaborate with the insurance industry.

Federal agencies should continue efforts called for in the President's Climate Action Plan to partner with the insurance industry and jointly explore opportunities to:

6.4.1 Adjust pricing structures to incentivize building that anticipates climate trends.

6.4.2 Create incentives through favorable ratings for insurance and bonds for communities that adopt robust resilience standards and practices, including stronger building codes.

6.4.3 Develop policies that require early notification of climate-related natural hazards prior to property transactions.

Representatives of State and local governments, Tribes, and territories should be included in dialogue with the insurance industry to represent the on-the-ground perspective and experience with a diversity of climate risks.

"In Carmel, the first priority is to do what is best for the people. We have made environmental stewardship a top priority, creating jobs and improving the quality of life in our community. It's clear that the poles are warming and we need to be prepared to deal with increases in severe storms, flooding, and extreme heat events we are likely to see in Indiana under a changed climate. Sensible Federal policies and programs will help cities and communities like Carmel become more resilient to these impacts."

- **Mayor Jim Brainard, Carmel, Indiana**

[39] See http://www.portofla.org/about/facts.asp and http://www.portofhouston.com/about-us/economic-impact/

Theme 7: Building Capacity for Resilience

In order to adequately plan for climate impacts and make smart investments in resilience, communities must first have the capacity to recognize, understand, and assess relevant climate-related risks, and the impact of those threats to local economies, infrastructure, property, agriculture, natural resources, and human populations. Often, the greatest need is not for the creation of new data or information, but tools and assistance to navigate the wide array of products and resources already available.

In addition, coordination among and within Federal agencies to ensure delivery of these resources, as well as alignment of policies and practice in support of climate resilient planning and projects by State and local governments, Tribes, and territories, is vital. As the challenge of recovery from climate-related disasters increases, communities will need well-coordinated, well-managed, and collaborative assistance from Federal agencies that leverages and supports existing regional, state, tribal, territorial, and local knowledge networks.

The following recommendations offer ways the Federal Government can shape programs, policies, investments, information sources, and other forms of assistance to ensure that all State and local governments, Tribes, and territories have the capacity to evaluate their particular climate vulnerabilities and act to build resilience.

Children in Philadelphia enhance local green stormwater infrastructure with spring plantings. Photo Credit: *Philadelphia Water Department.*

7.1 Provide data, tools, and guidance at a scale sufficient to guide decision-making and investments. Decision makers at the state, local, tribal, and territorial levels need consistent, geographically specific, and accessible information and tools to identify climate risks and support resilience planning in their communities. The Federal Government should ensure that these efforts are supported by the best-available science through continued research and development of policies, guidance, and a centralized toolkit with resources to help jurisdictions identify climate risks and vulnerable populations, and take steps to increase climate resilience and preparedness. Building on www.climate.data.gov and the Climate Resilience Toolkit currently under development, all climate information should be delivered through a single portal, and uniform standards for climate data should be used to ensure consistency and compatibility across Federal agencies.

Actions to advance this recommendation include:

7.1.1 Develop consistent and regionally- and locally-appropriate sea level rise, storm surge, and Great Lakes water level projections. All Federal agencies should adopt a consistent method for projecting relative sea level rise and Great Lakes water levels and use standardized scenarios across all agencies that accurately represent the range of projected changes, taking into account regionally- and locally-specific conditions.

7.1.2 Create a central Federal repository of hazard maps at the State level. Currently USGS, FEMA, and other agencies maintain maps separately.

7.1.3 Support the delivery of downscaled climate data and the development of regional and sub-regional impact projections and mapping to ensure the availability of data and information at a resolution that is relevant to local decision makers.

7.1.4 Provide guidance for choosing and using existing climate change scenarios and climate impact projections for decision-making, including vulnerability and risk assessments or evaluations.

Cal-Adapt
California

Cal-Adapt[40] is a web-based tool that provides reliable and easy access to the wealth of climate data and information available, through interactive visualizations, to support efforts to prepare for climate impacts in the State of California. Cal-Adapt allows the public to identify potential climate change risks in specific geographic areas throughout the State. Users can query by location or click on an interactive map to explore what climate impacts are likely to occur in their area of interest. Cal-Adapt synthesizes volumes of existing climate change scenarios and climate impact research and presents it in an easy-to-understand graphical format at a scale that allows local governments throughout the state to use Cal-Adapt to inform local planning efforts and policy development.

7.2 Foster and support cross-jurisdictional and regional cooperation. The experiences of communities affected by acute and long-term climate change impacts offer good lessons for how to build secure and sustainable food, water, energy supply, transportation, and natural resource management systems. Regional organizations such as county associations, metropolitan planning organizations, councils of governments, coordinating councils, regional infrastructure exchanges, and climate collaboratives have developed partnerships and programs that cater to unique regional attributes, natural systems, policy frameworks, governance structures and political realities. For this reason, the Federal Government should work more actively within these existing and emerging frameworks to support resilience and preparedness efforts, while supporting the development of regional frameworks in parts of the country that may not currently have such structures in place. Federal agencies should increase participation with regional organizations and partners and help build capacity to develop best practices and programs tailored to the unique regional impacts of climate change.

[40] See http://cal-adapt.org/

Actions to advance this recommendation include:

7.2.1 Increase support for and incentivize efforts that bring together groups of States, territories, counties, localities, and Tribes to leverage Federal resources more efficiently and collaborate across jurisdictional lines to develop regional indicators, projections, planning tools, and response options, and to implement joint climate preparedness and resilience strategies. Examples include establishing partnerships (like the Western Watershed Alliance) or using Federal programs to fund voluntary collaborations across jurisdictions.

7.2.2 Provide clearer pathways and remove barriers to Federal funding for regional and cross-jurisdictional and/or multi-agency collaborations, integrating climate resilience and preparedness strategies, to maximize efficiencies associated with successful on-going collaboration. Actions could include developing criteria for incorporating these collaborations as an allowable entity for Federal grants and funding programs.

7.2.3 Identify resources, research, training, and technical assistance that could be provided or leveraged by relevant regional Federal facilities (e.g. DOE National Laboratories, Department of Defense (DOD) installations and facilities, etc.) to help regions build climate preparedness through research, capacity building, partnerships, engagement in regional collaboratives or other efforts to assess vulnerabilities and improve regional resilience.

Southeast Florida Regional Climate Compact

"Even though our Regional Climate Action Plan[41] leaves it up the individual county or city to implement the plan's 110 recommendations in ways which works best for each, we have found it makes fiscal and practical sense to work together. It is this spirit of cooperation, the ability to share, trust, and learn from each other, which has led to accelerated action throughout our region—a region so large it accounts for roughly one third of Florida's population. And while all of this gives us great reason to celebrate success, the truth is, we could not have done it without the expertise of our Federal partners."

- **Kristin Jacobs, County Commissioner, Broward County, Florida**

7.3 Create a Climate Resilience Corps to boost community capacity.
Local jurisdictions could greatly benefit from focused climate resilience and preparedness expertise provided by programs such as those established by The Corporation for National and Community Service. A Climate Resilience Corps should be established to provide technical assistance, guidance, and on-the-ground support to help communities advance climate preparedness. This program should leverage existing programs such as Citizen Corps, FEMA Corps, and other national service programs. The Climate

Power Corps members help install and maintain green stormwater infrastructure in Philadelphia. Power Corps supports youth workforce development and environmental stewardship and resilience.
Photo Credit: *Philadelphia Water Department.*

[41] See "Southeast Florida Regional Climate Change Compact Counties: Regional Climate Action Plan," http://www.southeastfloridaclimatecompact.org/wp-content/uploads/2014/09/regional-climate-action-plan-final-ada-compliant.pdf

Resilience Corps should provide technical support to build community capacity; support climate preparedness and resilience planning; support community action and engagement on climate change; train and engage a new generation of youth and educators to lead on climate resilience; promote community education and training on climate resilience; and spur and support citizen-centric preparedness and training. The Climate Resilience Corps should focus on assisting those communities that lack capacity to address the planning and implementation efforts necessary for a community to become more resilient to the impacts of climate change.

7.4 Increase climate literacy and public awareness.

A major barrier to increasing community resilience and reducing the risks of climate change is a lack of public awareness and understanding of the public health and other effects of climate change. An educated and engaged populace is essential to obtain the public support necessary for effective actions to occur and be sustained. Education and training is needed to make clearer the link between how the climate is changing and what the impacts are on the lives of citizens. The Federal Government should develop and make available communications and educational tools and resources that can be adapted to local needs. A cooperative and conscientious strategy is needed to advance climate education and literacy, weave climate impact messages across Federal programs, and utilize high-level and diverse messengers to communicate about the risks of climate change and the benefits of taking steps to reduce these risks.

Actions to advance this recommendation include:

7.4.1 Develop resources for educators based on the National Climate Assessment and other sources of best-available and locally-relevant science, including incorporation of local and traditional knowledge where appropriate.

7.4.2 Coordinate Federal activities on climate communications to develop clear, consistent, and unified messages on climate risks, including the impacts to human health. Provide resources to State and local governments, Tribes, and territories to access these messaging tools.

7.4.3 Senior Federal health officials (e.g., the U.S. Surgeon General, the Director of the CDC, and others) should highlight the public health impacts of climate change and public health announcements should include information about relevant links between climate change and the personal behavior or health threat being considered.

MADE CLEAR
Maryland and Delaware

The Maryland and Delaware Climate Change Education, Assessment and Research (MADE-CLEAR) program is supported by the National Science Foundation as a member of the Climate Change Education Partnership, through a grant awarded to the University System of Maryland. MADE-CLEAR addresses Maryland and Delaware's shared regional climate change concerns and aligns with the States' STEM education emphasis. Its primary goal is to build partnerships among state universities, public schools, informal science education institutions, Federal agencies, and the private sector to support climate education. Currently, MADE-CLEAR is advancing climate science as a part of the curriculum in K-12 classrooms, informal science education programs, and university courses; developing new pathways for teacher training and development in climate science education; engaging in research on how students learn climate content; and enhancing public outreach on climate policy and science.

Conclusion

Task Force members share a commitment to continue collaborating with the Administration as these recommendations are implemented. The Administration has already made progress by acting upon good ideas that have emerged through this process over the past year. For example, at the Task Force meeting in Washington DC on July 16, 2014, President Obama announced a series of new actions[42] responding to the Task Force's input. There is considerable work ahead that will require deliberate coordination across all levels of government and with community leaders. Moving forward, the Administration should develop a transparent and structured process for implementing the recommendations of this Task Force and should continue to engage State and local governments, Tribes, and territories in dialogue throughout the development of responsive polices and initiatives. Additionally, the Administration should:

- **Designate a senior Administration official to coordinate across Federal agencies on the implementation of the Task Force's recommendations.**

- **Establish implementation benchmarks and a process for reporting on progress.** The Administration's implementation strategy should include mechanisms to track actions and establish accountability going forward. Task Force members stand ready to support these activities and should continue to receive regular report-outs on implementation actions. Opportunities to provide feedback on progress through a convening meeting or other information-sharing forum should also be created within one year's time.

[42] See "Fact Sheet: Taking Action to Support State, Local, and Tribal leaders as They Prepare Communities for the Impacts of Climate Change," http://www.whitehouse.gov/the-press-office/2014/07/16/fact-sheet-taking-action-support-state-local-and-tribal-leaders-they-pre

Appendix A: Definitions

Adaptation means adjustment in natural or human systems in anticipation of or response to a changing environment in a way that effectively uses beneficial opportunities or reduces negative effects.[43]

Preparedness means actions taken to plan, organize, equip, train, and exercise to build, apply, and sustain the capabilities necessary to prevent, protect against, ameliorate the effects of, respond to, and recover from climate change related damages to life, health, property, livelihoods, ecosystems, and national security.[44]

Resilience means the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions. [45]

Risk means a combination of the magnitude of the potential consequence(s) of climate change impact(s) and the likelihood that the consequence(s) will occur.[46]

Vulnerability means 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.

[43] Executive Order No. 13653, 3 C.F.R. 7 (2013). Print.
[44] Ibid.
[45] Ibid.
[46] Bierbaum, R., et. al "Ch. 28: Adaptation." *Climate Change Impacts in the United States: The Third National Climate Assessment*, http://nca2014.globalchange.gov/report/response-strategies/adaptation

Appendix B: Abbreviations

BMP – Best Management Practices

BRACE – Building Resilience Against Climate Effects

CDC – Centers for Disease Control

CEQ – Council on Environmental Quality

DOD – Department of Defense

DOE – Department of Energy

DOI – Department of the Interior

DOT – Department of Transportation

EOP – Executive Office of the President

EPA – Environmental Protection Agency

FTA – Federal Transit Authority

FEMA – Federal Emergency Management Agency

FERC – Federal Energy Regulatory Commission

FHWA – Federal Highway Administration

GAO – Government Accountability Office

HMGP – Hazard Mitigation Grant Program

HUD – Department of Housing and Urban Development

IGA – Intergovernmental Affairs

NEPA – National Environmental Policy Act

NFIP – National Flood Insurance Program

NOAA – National Oceanic and Atmospheric Administration

PACE – Property Assessed Clean Energy

PHEP – Public Health Emergency Preparedness

SBA – Small Business Administration

TIGER – Transportation Investment Generating Economic Recovery

USACE – U.S. Army Corps of Engineers

USDA – U.S. Department of Agriculture

USGCRP – U.S. Global Change Research Program

USGS – U.S. Geological Survey

Appendix C: Acknowledgements

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