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BUDGET ISSUES

Opportunities to Reduce Federal Fiscal Exposures Through Greater Resilience to Climate Change and Extreme Weather

Statement of Alfredo Gomez, Director
Natural Resources and Environment

July 29, 2014

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GAO Highlights

Highlights of GAO-14-504T, a testimony before the Committee on the Budget, U.S. Senate

Why GAO Did This Study

Certain types of extreme weather events have become more frequent or intense according to the United States Global Change Research Program, including prolonged periods of heat, heavy downpours, and, in some regions, floods and droughts. While it is not possible to link any individual weather event to climate change, the impacts of these events affect many sectors of our economy, including the budgets of federal, state, and local governments.

GAO focuses particular attention on government operations it identifies as posing a "high risk" to the American taxpayer and, in February 2013, added to its High Risk List the area *Limiting the Federal Government's Fiscal Exposure by Better Managing Climate Change Risks*. GAO's past work has identified a variety of fiscal exposures—responsibilities, programs, and activities that may explicitly or implicitly expose the federal government to future spending.

This testimony is based on reports GAO issued from August 2007 to May 2014, and discusses (1) federal fiscal exposures resulting from climate-related and extreme weather impacts on critical infrastructure and federal lands, and (2) how improved federal technical assistance to all levels of government can help reduce climate-related fiscal exposures.

GAO is not making new recommendations but has made numerous recommendations in prior reports on this topic, which are in varying states of implementation by the Executive Office of the President and federal agencies.

View GAO-14-504T. For more information, contact Alfredo Gomez at (202) 512-3841 or gomezj@gao.gov.

What GAO Found

Climate change and related extreme weather impacts on infrastructure and federal lands increase fiscal exposures that the federal budget does not fully reflect. Investing in resilience—actions to reduce potential future losses rather than waiting for an event to occur and paying for recovery afterward—can reduce the potential impacts of climate-related events. Implementing resilience measures creates additional up-front costs but could also confer benefits, such as a reduction in future damages from climate-related events. Key examples of vulnerable infrastructure and federal lands GAO has identified include:

- **Department of Defense (DOD) facilities.** DOD manages a global real-estate portfolio that includes over 555,000 facilities and 28 million acres of land with a replacement value DOD estimates at close to $850 billion. This infrastructure is vulnerable to the potential impacts of climate change and related extreme weather events. For example, in May 2014, GAO reported that a military base in the desert Southwest experienced a rain event in August 2013 in which about 1 year's worth of rain fell in 80 minutes. The flooding caused by the storm damaged more than 160 facilities, 8 roads, 1 bridge, and 11,000 linear feet of fencing, resulting in an estimated $64 million in damages.

- **Other large federal facilities.** The federal government owns and operates hundreds of thousands of other facilities that a changing climate could affect. For example, the National Aeronautics and Space Administration (NASA) manages more than 5,000 buildings and other structures. GAO reported in April 2013 that, in total, these NASA assets—many of which are in coastal areas vulnerable to storm surge and sea level rise—represent more than $32 billion in current replacement value.

- **Federal lands.** The federal government manages nearly 30 percent of the land in the United States—about 650 million acres of land—including 401 national park units and 155 national forests. GAO reported in May 2013 that these resources are vulnerable to changes in the climate, including the possibility of more frequent and severe droughts and wildfires. Appropriations for federal wildland fire management activities have tripled since 1999, averaging over $3 billion annually in recent years.

GAO has reported that improved climate-related technical assistance to all levels of government can help limit federal fiscal exposures. The federal government invests tens of billions of dollars annually in infrastructure projects that state and local governments prioritize, such as roads and bridges. Total public spending on transportation and water infrastructure exceeds $300 billion annually, with about 25 percent coming from the federal government and the rest from state and local governments. GAO's April 2013 report on infrastructure adaptation concluded that the federal government could help state and local efforts to increase their resilience by (1) improving access to and use of available climate-related information, (2) providing officials with improved access to technical assistance, and (3) helping officials consider climate change in their planning processes.

Chairman Murray, Ranking Member Sessions, and Members of the Committee:

I am pleased to be here today to discuss our work on reducing federal fiscal exposures posed by climate change and extreme weather events.[1] Climate change affects the American people in far-reaching ways, according to the National Research Council (NRC) and the United States Global Change Research Program's (USGCRP) May 2014 National Climate Assessment.[2] Certain types of extreme weather events with links to climate change have become more frequent or intense according to NRC and USGCRP, including prolonged periods of heat; heavy downpours; and, in some regions, floods and droughts. In addition, according to NRC and USGCRP, warming causes sea level to rise, sea ice to melt, and oceans to become more acidic as they absorb carbon dioxide. While it is not possible to link any individual weather event to climate change, these and other observed impacts of such events disrupt people's lives and affect many sectors of our economy, including the budgets of federal, state, and local governments.

Extreme weather events have cost the nation tens of billions of dollars in damages over the past decade. In 2012, for example, Superstorm Sandy alone caused tens of billions of dollars in damages to buildings, utilities, transportation systems, and other infrastructure. Heavy rainfall and snowfall events (which increase the risk of flooding) and heatwaves are generally becoming more frequent, consistent with theoretical expectations for a warmer and moister atmosphere due to changes in the climate, according to a February 2014 joint report by the U.S. National

[1]Our past work identified a variety of fiscal exposures—responsibilities, programs, and activities that explicitly or implicitly expose the federal government to future spending. Fiscal exposures vary widely as to source, extent of the government's legal commitment, and magnitude. Further, some of these factors may change over time. For example, the government's response to an event or series of events can strengthen expectations that the government will respond in the same way to similar events in the future. For additional information, see *Fiscal Exposures: Improving Cost Recognition in the Federal Budget*, GAO-14-28 (Washington, D.C.: Oct. 29, 2013).

[2]Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program (Washington D.C.: May 2014). Click here for more information about USGCRP. NRC is the principal operating agency of the National Academy of Sciences and the National Academy of Engineering. For more information about NRC, click here.

Academy of Sciences and the Royal Society in the United Kingdom.[3] The federal budget, however, generally does not account for disaster assistance provided in cases such as Superstorm Sandy—for which Congress provided about $60 billion in budget authority for such assistance—or the long-term impacts of climate change on existing federal infrastructure and programs.[4] Because of these significant financial risks and the nation's fiscal condition, in February 2013, we added *Limiting the Federal Government's Fiscal Exposure by Better Managing Climate Change Risks* to our list of high-risk areas.[5]

One way to reduce the potential impacts of climate change is to invest in enhancing resilience. The National Academies define resilience as the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events.[6] As we reported in April 2013, enhanced resilience results from actions to reduce potential future losses, rather than waiting for an event to occur and paying for recovery afterward.[7] Enhancing resilience has begun to receive more attention because greenhouse gases that are in the atmosphere could continue altering the climate system into the future, regardless of efforts to control emissions.

[3]U.S. National Academy of Sciences and The Royal Society, *Climate Change: Evidence and Causes (Washington, D.C.: Feb 27, 2014)*. Click here to access the report and here for more information about the Royal Society, the national academy of science in the United Kingdom.

[4]Congress temporarily increased the borrowing authority for the National Flood Insurance Program by $9.7 billion and provided about $50 billion in appropriated funds for expenses related to the consequences of Superstorm Sandy.

[5]GAO, *High-Risk Series: An Update,* GAO-13-283, February 2013. Every 2 years at the start of a new Congress, GAO calls attention to agencies and program areas that are high-risk due to their vulnerabilities to fraud, waste, abuse, and mismanagement, or are most in need of transformation. Click here to access the *Limiting the Federal Government's Fiscal Exposure by Better Managing Climate Change Risks* content. The focus of this high-risk area may evolve over time to the extent that federal climate change programs and policies change.

[6]The National Academies, Committee on Increasing National Resilience to Hazards and Disasters; Committee on Science, Engineering, and Public Policy; *Disaster Resilience: A National Imperative* (Washington, D.C., 2012).

[7]GAO, *Climate Change: Future Federal Adaptation Efforts Could Better Support Local Infrastructure Decision Makers*, GAO-13-242 (Washington, D.C.: Apr 12, 2013).

Implementing resilience measures creates additional up-front costs but could also confer benefits, such as a reduction in future damages from climate-related events. Federal efforts have begun to focus on enhancing resilience and providing information to state and local decision makers so they can make more informed decisions about fiscal exposure to potential climate-related events.[8] Decisions to adapt infrastructure to climate change can also depend on many other factors, such as the availability of substitutes or the remaining useful life of existing infrastructure.

My testimony today discusses (1) federal fiscal exposures resulting from climate-related and extreme weather impacts on critical infrastructure and federal lands, and (2) how improved federal technical assistance to all levels of government can help reduce climate-related fiscal exposures. My testimony is based on reports we issued from August 2007 to May 2014. Detailed information on our scope and methodology for our prior work can be found in those reports. The work this testimony is based on was conducted in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Climate-Related and Extreme Weather Impacts on Infrastructure and Federal Lands Increase Federal Fiscal Exposures

As our past work has found, climate-related and extreme weather impacts on physical infrastructure such as buildings, roads, and bridges, as well as on federal lands, increase federal fiscal exposures. Infrastructure is typically designed to withstand and operate within historical climate patterns. However, according to NRC, as the climate changes, historical patterns do not provide reliable predictions of the future, in particular, those related to extreme weather events.[9] Thus, infrastructure designs may underestimate potential climate-related impacts over their design life, which can range up to 50 to 100 years. Federal agencies responsible for the long-term management of federal lands face similar impacts. Climate-

[8]For example, click here to access the Climate Change Resilience website maintained by the Council on Environmental Quality (CEQ) within the Executive Office of the President.

[9]See, for example, NRC, Panel on Strategies and Methods for Climate-Related Decision Support, Committee on the Human Dimensions of Global Change, *Informing Decisions in a Changing Climate* (Washington, D.C.: 2009).

related impacts can increase the operating and maintenance costs of infrastructure and federal lands or decrease the infrastructure's life span, leading to increased fiscal exposures for the federal government that are not fully reflected in the budget. Key examples from our recent work include (1) Department of Defense (DOD) facilities, (2) other large federal facilities such as National Aeronautics and Space Administration (NASA) centers, and (3) federal lands such as National Parks.

DOD Facilities

DOD manages a global real-estate portfolio that includes over 555,000 facilities and 28 million acres of land with a replacement value that DOD estimates at close to $850 billion. Within the United States, the department's extensive infrastructure of bases and training ranges—critical to maintaining military readiness—extends across the country, including Alaska and Hawaii. DOD incurs substantial costs for infrastructure, with a base budget for military construction and family housing totaling more than $9.8 billion in fiscal year 2014. As we reported in May 2014, this infrastructure is vulnerable to the potential impacts of climate change, including increased drought and more frequent and severe extreme weather events in certain locations.[10]

In its 2014 Quadrennial Defense Review, DOD stated that the impacts of climate change may increase the frequency, scale, and complexity of future missions, while undermining the capacity of domestic installations to support training activities. For example, in our May 2014 report on DOD infrastructure adaptation, we found that drought contributed to wildfires at an Army installation in Alaska that delayed certain units' training (see fig. 1).[11] Further, the fire limited the use of certain weapons systems in training and decreased the realism of the training.

[10]GAO, *Climate Change Adaptation: DOD Can Improve Infrastructure Planning and Processes to Better Account for Potential Impacts*, GAO-14-446 (Washington, D.C.: May 30, 2014).

[11]GAO-14-446. Adaptation is defined as adjustments to natural or human systems in response to actual or expected climate change.

Figure 1: Wildfire on a DOD Training Range in Alaska

Source: Alaska Fire Service. | GAO-14-504T

Note: Drought conditions contributed to a 2013 fire that limited the use of certain weapons systems and training activities.

Our May 2014 report also found that more frequent and more severe extreme weather events may result in increased fiscal exposure for DOD. Extreme precipitation events may lead to potential vulnerabilities such as increased maintenance costs for roads, utilities, and runways and increased flood-control measures. For example, we reported that in August 2013, a military base in the desert Southwest experienced an extreme rain event in which approximately 1 year's worth of rain fell in 80 minutes. According to Army officials and documents, the flooding caused by the storm damaged more than 160 facilities, 8 roads, 1 bridge, and 11,000 linear feet of fencing and resulted in an estimated $64 million in damage. Figure 2 shows flood damage to guard towers from this event.

Figure 2: Army Training Area in Southwestern United States

Source: U.S. Army. | GAO-14-504T

Note: Guard towers at an Army training area in the Southwestern United States (left); The same type of guard tower, toppled and severely damaged by flash flooding from an extreme precipitation event at this training area (right).

Other Large Federal Facilities

The federal government owns and operates hundreds of thousands of non-defense buildings and facilities that a changing climate could affect. For example, NASA's real property holdings include more than 5,000 buildings and other structures such as wind tunnels, laboratories, launch pads, and test stands. In total, these NASA assets—many of which are located in vulnerable coastal areas—represent more than $32 billion in current replacement value. Our April 2013 report on infrastructure adaptation showed the vulnerability of Johnson Space Center and its mission control center, often referred to as the nerve center for America's human space program.[12] As shown in figure 3, the center is located in Houston, Texas, near Galveston Bay and the Gulf of Mexico. Johnson Space Center's facilities—conservatively valued at $2.3 billion—are vulnerable to storm surge and sea level rise because of their location on the Gulf Coast.

[12]GAO-13-242.

Figure 3: Location of Johnson Space Center

Source: NASA. | GAO-14-504T

Federal Lands

The federal government manages nearly 30 percent of the land in the United States for a variety of purposes, such as recreation, grazing, timber, and habitat for fish and wildlife. Specifically, federal agencies manage natural resources on about 650 million acres of land, including 401 national park units and 155 national forests. As we reported in May 2013, these resources are vulnerable to changes in the climate, including

increases in air and water temperatures, wildfires, and drought; forests stressed by drought becoming more vulnerable to insect infestations; rising sea levels; and reduced snow cover and retreating glaciers.[13] In addition, various species are expected to be at risk of becoming extinct due to the loss of habitat critical to their survival. Many of these changes have already been observed on federally managed lands and waters and are expected to continue, and one of the areas where the federal government's fiscal exposure is expected to increase is in its role as the manager of large amounts of land and other natural resources. According to USGCRP's May 2014 National Climate Assessment, hotter and drier weather and earlier snowmelt mean that wildfires in the West start earlier in the spring, last later into the fall, and burn more acres.[14] Appropriations for the federal government's wildland fire management activities have tripled, averaging over $3 billion annually in recent years, up from about $1 billion in fiscal year 1999.[15]

Improved Climate-Related Technical Assistance to All Levels of Government Can Help Limit Federal Fiscal Exposures

As we have previously reported, improved climate-related technical assistance to all levels of government can help limit federal fiscal exposures. Existing federal efforts encourage a decentralized approach to such assistance, with federal agencies incorporating climate-related information into their planning, operations, policies, and programs and establishing their own methods for collecting, storing, and disseminating climate-related data. Reflecting this approach, technical assistance from the federal government to state and local governments also exists in an uncoordinated confederation of networks and institutions. As we reported in our February 2013 high-risk update, the challenge is to develop a cohesive approach at the federal level that also informs action at the state and local levels.[16]

[13]GAO, *Climate Change: Various Adaptation Efforts Are Under Way at Key Natural Resource Management Agencies*, GAO-13-253 (Washington, D.C.: May 31, 2013).

[14]Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program (Washington D.C.: May 2014).

[15]Click here to access a summary of wildland fire management issues and related reports on GAO's Key Issues website. See also Congressional Research Service, *Wildfire Management: Federal Funding and Related Statistics,* R43077 (March 5, 2014).

[16]GAO-13-283.

Federal Decision Makers

The Executive Office of the President and federal agencies have many efforts underway to increase the resilience of federal infrastructure and programs. For example, executive orders issued in 2009 and 2013 directed agencies to create climate change adaptation plans which integrate consideration of climate change into their operations and overall mission objectives, including the costs and benefits of improving climate adaptation and resilience with real-property investments and construction of new facilities.[17]

Recognizing these and many other emerging efforts, our prior work shows that federal decision makers still need help understanding how to build resilience into their infrastructure and planning processes. For example, in our May 2014 report, we found that DOD requires selected infrastructure planning efforts for existing and future infrastructure to account for climate change impacts, but its planners did not have key information necessary to make decisions that account for climate and related risks.[18] We recommended that DOD provide further information to installation planners and clarify actions that account for climate change in planning documents. DOD concurred with our recommendations.

Previously, in 2007, we concluded that federal resource management agencies had not made climate change a high priority and did not have specific guidance in place advising their managers on addressing the effects of climate change in their resource management.[19] As a result, we recommended that that the Secretaries of Agriculture, Commerce, and the Interior develop guidance for their resource managers that explains how they expect to address the effects of climate change, and the three departments generally agreed with this recommendation. However, as we found in our May 2013 report, resource managers still struggled to incorporate climate-related information into their day-to-day activities,

[17]Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* (Oct. 5, 2009). Executive Order 13653, *Preparing the United States for the Impacts of Climate Change* (Nov. 1, 2013). Click here for more information on these executive orders.

[18]GAO-14-446.

[19]GAO, *Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources*, GAO-07-863 (Washington, D.C.: Aug. 7, 2007).

even with the creation of strategic policy documents and high-level agency guidance.[20]

State and Local Decision Makers

The federal government invests tens of billions of dollars annually in infrastructure projects prioritized and supervised by state and local governments. In total, the United States has about 4 million miles of roads and 30,000 wastewater treatment and collection facilities. According to a 2010 Congressional Budget Office report, total public spending on transportation and water infrastructure exceeds $300 billion annually, with roughly 25 percent of this amount coming from the federal government and the rest coming from state and local governments.[21] However, the federal government plays a limited role in project-level planning for transportation and wastewater infrastructure, and state and local efforts to consider climate change in infrastructure planning have occurred primarily on a limited, ad hoc basis. The federal government has a key interest in helping state and local decision makers increase their resilience to climate change and extreme weather events because uninsured losses may increase the federal government's fiscal exposure through federal disaster assistance programs.

Louisiana State Highway 1 is an example of infrastructure of national importance that is managed by state and local governments. Our April 2013 report on infrastructure adaptation found that according to National Oceanic and Atmospheric Administration estimates, within 15 years, segments of Louisiana State Highway 1 will be inundated by tides an average of 30 times annually due to relative sea level rise.[22] Louisiana Highway 1 is the only road access to Port Fourchon, which services virtually all deep-sea oil operations in the Gulf of Mexico, or about 18 percent of the nation's oil supply. Flooding of this road effectively closes this port. Because of Port Fourchon's significance to the oil industry at the national, state, and local levels, the U.S. Department of Homeland Security, in July 2011, estimated that a closure of 90 days could reduce

[20]GAO-13-253.

[21]Congressional Budget Office, *Public Spending on Transportation and Water Infrastructure*, Pub. No. 4088 (Washington, D.C.: November 2010).

[22]GAO-13-242.

the national gross domestic product by about $7.8 billion.[23] Figure 4 shows Louisiana State Highway 1 leading to Port Fourchon.

Figure 4: Louisiana State Highway 1 Leading to Port Fourchon

Source: NOAA. | GAO-14-504T

We found in April 2013, that infrastructure decision makers have not systematically incorporated potential climate change impacts in planning for roads, bridges, and wastewater management systems because, among other factors, they face challenges identifying and obtaining available climate change information best suited for their projects.[24] Even when good scientific information is available, it may not be in the actionable, practical form needed for decision makers to use in planning and designing infrastructure. Such decision makers work with traditional

[23]Department of Homeland Security, National Infrastructure Simulation and Analysis Center, Risk Development and Modeling Branch, Homeland Infrastructure Threat and Risk Analysis Center, Office of Infrastructure Protection, in collaboration with the National Incident Management Systems and Advanced Technologies Institute at the University of Louisiana at Lafayette, *Louisiana Highway 1/Port Fourchon Study* (July 15, 2011).

[24]GAO-13-242.

engineering processes, which often require very specific and discrete information. Moreover, local decision makers—who, in this case, specialize in infrastructure planning, not climate science—need assistance from experts who can help them translate available climate change information into something that is locally relevant. In our site visits to several locations where decision makers overcame these challenges—including Louisiana State Highway 1—state and local officials emphasized the role that the federal government could play in helping to increase local resilience.

Any effective adaptation strategy must recognize that state and local governments are on the front lines in both responding to immediate weather-related disasters and in preparing for the potential longer-term impacts associated with climate change. We reported in October 2009, that insufficient site-specific data—such as local temperature and precipitation projections—complicate state and local decisions to justify the current costs of adaptation efforts for potentially less certain future benefits.[25] We recommended that the appropriate entities within the Executive Office of the President develop a strategic plan for adaptation that, among other things, identifies mechanisms to increase the capacity of federal, state, and local agencies to incorporate information about current and potential climate change impacts into government decision making. USGCRP's April 2012 strategic plan for climate change science recognizes this need, by identifying enhanced information management and sharing as a key objective.[26] According to this plan, USGCRP is pursuing the development of a global change information system to leverage existing climate-related tools, services, and portals from federal agencies.

In our April 2013 report, we concluded that the federal government could help state and local efforts to increase their resilience by (1) improving access to and use of available climate-related information, (2) providing officials with improved access to technical assistance, and (3) helping officials consider climate change in their planning processes.[27] As a

[25]GAO, *Climate Change Adaptation: Strategic Federal Planning Could Help Government Officials Make More Informed Decisions*, GAO-10-113 (Washington, D.C.: Oct. 7, 2009).

[26]USGCRP, National Global Change Research Plan 2012-2021: *A Strategic Plan for the U.S. Global Change Research Program* (Washington D.C.: April 2012).

[27]GAO-13-242.

result, we recommended, among other things, that the Executive Director of USGCRP or other federal entity designated by the Executive Office of the President work with relevant agencies to identify for decision makers the "best available" climate-related information for infrastructure planning and update this information over time, and to clarify sources of local assistance for incorporating climate-related information and analysis into infrastructure planning, and communicate how such assistance will be provided over time.

These entities have not directly responded to our recommendations, but the President's June 2013 Climate Action Plan and November 2013 Executive Order 13653 drew attention to the need for improved technical assistance.[28] For example, the Executive Order directs numerous federal agencies, supported by USGCRP, to work together to develop and provide authoritative, easily accessible, usable, and timely data, information, and decision-support tools on climate preparedness and resilience. In addition, on July 16, 2014, the President announced a series of actions to help state, local, and tribal leaders prepare their communities for the impacts of climate change by developing more resilient infrastructure and rebuilding existing infrastructure stronger and smarter.[29]

We have work under way assessing the strengths and limitations of governmentwide options to meet the climate-related information needs of federal, state, local, and private sector decision makers. We also have work under way exploring, among other things, the risks extreme weather events and climate change pose to public health, agriculture, public transit systems, and federal insurance programs. This work may help identify other steps the federal government could take to limit its fiscal exposure and make our communities more resilient to extreme weather events.

Chairman Murray, Ranking Member Sessions, and Members of the Committee, this concludes my prepared statement. I would be pleased to answer any questions you have at this time.

[28]More information on the June 2013 Climate Action Plan and Executive Order 13653 can be found here.

[29]Click here for more information on the resilience efforts announced on July 16, 2014.

GAO Contact and Staff Acknowledgments

If you or your staff members have any questions about this testimony, please contact me at (202) 512-3841 or gomezj@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement. Alfredo Gomez, Director; Michael Hix, Assistant Director; Jeanette Soares; Kiki Theodoropoulos; and Joseph Dean Thompson made key contributions to this testimony.