



CLIMATE RESILIENCE

Congressional Action Needed to Enhance Climate Economics Information and to Limit Federal Fiscal Exposure

Report to Congressional Requesters

August 2024
GAO-24-106937
United States Government Accountability Office

Accessible Version

GAO Highlights

View [GAO-24-106937](#). For more information, contact J. Alfredo Gomez at (202) 512-3841 or gomezj@gao.gov.
Highlights of [GAO-24-106937](#), a report to congressional requesters

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Why GAO Did This Study

The effects of climate change have cost the federal government billions of dollars, and these costs will likely increase in the future, according to the National Academies of Sciences, Engineering, and Medicine and the U.S. Global Change Research Program. The federal government will face fiscal exposure from climate change no matter the outcome of domestic and international efforts to reduce emissions. This is in part because greenhouse gases already in the atmosphere will continue altering the climate system for many decades, according to the National Academies of Sciences, Engineering, and Medicine and the U.S. Global Change Research Program.

Limiting the Federal Government's Fiscal Exposure by Better Managing Climate Change Risks has been on GAO's High-Risk List since 2013. This list identifies government operations that, among other things, are in need of transformation to address economy, efficiency, or effectiveness challenges. GAO identified five areas in which government-wide action is needed to reduce federal fiscal exposure to climate change. These areas include the federal government's roles as (1) insurer of property and crops, (2) provider of disaster aid, (3) owner or operator of infrastructure, (4) leader of a strategic plan to coordinate federal efforts, and (5) provider of data and technical assistance to decision-makers.

Federal fiscal exposure to climate change can be limited by enhancing climate resilience—that is, taking actions to reduce potential future losses by planning and preparing for potential climate hazards.

What GAO Found

Climate economics is an emerging field of study. According to prior GAO work, models that estimate the economic effects of climate change are based on developing research. A small but growing number of researchers have focused their efforts on estimating the economic impacts of climate change. More recent studies have employed frameworks to compare the economic impacts across different sectors and regions within the U.S. These studies produce imprecise results due to modeling and data limitations. However, the available information provides useful insights into the economic costs and benefits estimated to be incurred by the federal government as a result of climate change.

Available estimates indicate significant projected costs to the economy and the federal government as a result of climate change. For example, in 2020, the Congressional Budget Office projected, economy-wide, that climate change will decrease average annual real U.S. gross domestic product growth by 0.03 percentage points from 2020 to 2050. In addition, economy-wide damage information is available for natural disasters in the U.S. The National Oceanic and Atmospheric Administration reported that the U.S. sustained 28 climate-related weather events and natural disasters that cost over \$1 billion in 2023, resulting in \$94.1 billion in total costs (see fig.).

Billion-Dollar Disasters in the U.S. in 2023



Sources: U.S. National Oceanic and Atmospheric Administration; GAO (icons); Map Resources (map). | GAO-24-106937

Available climate economics information also indicates that potential climate damages will be costly for the federal government. For example, according to the *Fifth National Climate Assessment*, climate change may cause tax revenues to decrease and expenditures in some areas to increase. For example, the assessment found that federal disaster response from hurricanes could lead to an increase of \$5.2 billion to \$36 billion in 2050 annual expenditures.

GAO was asked to review the economic costs of climate change to the federal government and to provide detail on how Congress might establish an organizational arrangement to prioritize federal climate resilience investments. This report examines (1) available information on the projected economic costs and benefits estimated to be incurred by the federal government as a result of climate change, (2) the extent to which the federal government has developed the capacity to acquire economic data to help understand federal climate-related financial risks, and (3) what key elements should be included in a federal organizational arrangement to prioritize climate resilience projects for federal investments.

GAO reviewed agency documents and conducted literature reviews to identify and interview 13 experts about key elements of an organizational arrangement. GAO also interviewed staff from the Executive Office of the President's (EOP) Council on Environmental Quality (CEQ), OMB, Office of Science and Technology Policy (OSTP), and the Federal Accounting Standards Advisory Board.

What GAO Recommends

GAO is making four Matters for Congressional Consideration. Specifically, GAO recommends that Congress consider:






1. establishing a federal organizational arrangement to prioritize climate resilience projects for investment. Such an organizational arrangement could be designed for success by authorizing the five key elements GAO identified in this report;
2. designating a federal entity to develop a national climate resilience strategic plan;
3. establishing and maintaining a national climate information system; and
4. designating a federal entity to develop and support agency use of information on the potential economic costs of climate change.

CEQ, OMB, and OSTP provided technical comments that GAO incorporated, as appropriate.

Through recent executive orders and Office of Management and Budget (OMB) guidance, federal agencies have been directed to report climate-related financial risks. However, federal agencies have little capacity to report their climate-related financial risks and improve their reporting about those risks. GAO found that agency financial reports from fiscal years 2022 and 2023 contain little and varied information on climate-related financial risks. However, some agencies have reported information on climate-related financial risks. For example, the U.S. Department of Defense (DOD) reported that climate change has the potential to disrupt operations, pose danger to DOD property and personnel, and necessitate additional funding to support response and recovery efforts. In 2023, DOD reported spending more than \$54 million on contingency preparedness related to climate change.

According to past GAO work and experts GAO interviewed, Congress and federal agencies can enhance climate resilience by developing an organizational arrangement with five key elements that are interdependent (see fig.). Congress and the executive branch have taken steps to develop these elements, but further congressional action is needed to implement them.

Five Key Elements of an Organizational Arrangement to Prioritize Climate Resilience Investments and to Limit Federal Fiscal Exposure to Climate Change

 National climate resilience strategic plan	Federal climate change efforts should be coordinated in a strategic plan toward common goals, such as climate resilience.
 National climate information system	The federal government should identify and update the best available climate information.
 Expanding the use of economics information	Sponsoring or conducting research on the potential economic effects of climate change could help identify significant risks.
 A consistent approach for prioritizing climate resilience investments	The federal government should periodically identify and prioritize climate resilience projects for federal investment.
 Community-driven climate migration pilot program	Assisting communities that express affirmative interest in relocation should be used as a climate resilience strategy.

Source: GAO; GAO (icons). | GAO-24-106937

Accessible Data for Five Key Elements of an Organizational Arrangement to Prioritize Climate Resilience Investments and to Limit Federal Fiscal Exposure to Climate Change

Key element	Key element information
National climate resilience strategic plan	Federal climate change efforts should be coordinated in a strategic plan toward common goals, such as climate resilience.
National climate information system	The federal government should identify and update the best available climate information.
Expanding the use of economics information	Sponsoring or conducting research on the potential economic effects of climate change could help identify significant risks.
A consistent approach for prioritizing climate resilience investments	The federal government should periodically identify and prioritize climate resilience projects for federal investment.
Community-driven climate migration pilot program	Assisting communities that express affirmative interest in relocation should be used as a climate resilience strategy.

Source: GAO. | GAO-24-106937

Over time, GAO has observed variable progress and prioritization for each element individually. GAO has made recommendations and matters related to these key elements in prior reports. Congressional action would ensure consistent and complementary policies and procedures across relevant federal funding mechanisms and engage nongovernment partners in limiting fiscal exposure. All 13 experts GAO interviewed generally agreed that congressional action is needed to establish authority or funding for an organizational arrangement to prioritize climate resilience investments and limit federal fiscal exposure. A federal organizational arrangement would be better positioned to invest in federal climate resilience projects with the highest priorities if it had all five elements working together as a system. This organizational arrangement would help limit federal fiscal exposure by prioritizing climate resilience investments toward the areas of greatest risk. Until Congress acts to establish these five key elements and the overarching organizational arrangement, climate resilience efforts may vary significantly and lack coherence to maximize impact over time.

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Abbreviations

CBO	Congressional Budget Office
CEA	Council of Economic Advisers
CEQ	Council on Environmental Quality
DOD	U.S. Department of Defense
DOI	U.S. Department of the Interior
EOP	Executive Office of the President
EPA	U.S. Environmental Protection Agency
FASAB	Federal Accounting Standards Advisory Board
FEMA	Federal Emergency Management Agency
GDP	gross domestic product
IIJA	Infrastructure Investment and Jobs Act
MD&A	Management's Discussion and Analysis
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
OMB	Office of Management and Budget
OSTP	Office of Science and Technology Policy
RCP	Representative Concentration Pathways
USDA	U.S. Department of Agriculture
USGCRP	U.S. Global Change Research Program

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441 G St. N.W.
Washington, DC 20548

August 14, 2024

The Honorable Maria Cantwell
Chair
Committee on Commerce, Science, and Transportation
United States Senate

The Honorable Susan M. Collins
Vice Chair
Committee on Appropriations
United States Senate

The effects of climate change have cost the federal government billions of dollars, and these costs will likely increase in the future, according to the National Academies of Sciences, Engineering, and Medicine and the U.S. Global Change Research Program (USGCRP).¹ According to the 2023 *Fifth National Climate Assessment*, climate change directly impacts the economy through higher temperatures, rising sea levels, and more frequent and intense extreme weather events.² For example, the assessment reported that extreme events have contributed to the displacement of individuals, which can affect U.S. economic and national security interests.

Climate change can also have indirect impacts on the public and private sectors, including areas like budgets, financial markets, jobs, and trade—creating both risks and opportunities.³ The economic consequences of climate change are likely to affect some regions, industries, and communities more than others. In addition, the federal government will face fiscal exposure from climate change no matter the outcome of domestic and international efforts to reduce emissions, in part because greenhouse gases already in the atmosphere will continue altering the earth’s climate for decades to come, according to the National Academies of Sciences, Engineering, and Medicine and USGCRP.

¹USGCRP coordinates federal research to advance the understanding of climate change across 15 federal member agencies. See USGCRP, *Fifth National Climate Assessment, Economics Chapter* (Washington, D.C.: Nov. 2023). The National Academies of Sciences, Engineering, and Medicine established a Roundtable on Macroeconomics and Climate-related Risks and Opportunities with a goal of improving understanding of how the effects of climate change relate to and affect macroeconomic performance and policy implications. In May 2024, the Roundtable on Macroeconomics and Climate-related Risks and Opportunities published proceedings of a workshop held in June 2023. See National Academies of Sciences, Engineering, and Medicine, *Incorporating Climate Change and Climate Policy into Macroeconomic Modeling: Proceedings of a Workshop* (2024) (Washington, D.C.: 2024).

²USGCRP, *Fifth National Climate Assessment*.

³Climate change could also affect individuals. For example, according to a February 2024 report from global consulting and technology services provider, ICF, the cost of climate change to a baby born in 2024 in America could be around \$500,000 over its lifetime. For additional information on the cost of climate change to individuals in the U.S., see ICF Climate Center, *Cost of Climate Change to an American Born in 2024* (Reston, VA: Feb. 2024) and M. Kotz, A. Levermann, and L. Wenz, “The economic commitment of climate change,” *Nature*, vol. 628 (2024): 551–557, <https://doi.org/10.1038/s41586-024-07219-0>.

Limiting the Federal Government's Fiscal Exposure by Better Managing Climate Change Risks has been on GAO's High-Risk List since 2013.⁴ We identified five areas in which government-wide action is needed to limit federal fiscal exposure to climate change, including the government's role as the owner and operator of federal facilities, such as military bases, and in providing disaster assistance.⁵ For example, the growing reliance on federal assistance to address the increasing number of natural disasters is a key source of federal climate-related fiscal exposure. Between fiscal years 2015 and 2024, selected appropriations for disaster assistance totaled about \$448 billion.⁶ Disaster assistance has often been provided through supplemental appropriations, which can address needs that arise after annual appropriations have been enacted.

We have recommended that the federal government invest in climate resilience to help limit its fiscal exposure to climate change impacts.⁷ Enhancing climate resilience means taking actions to reduce potential future losses by planning and preparing for potential climate hazards, such as extreme rainfall, sea level rise, and drought.⁸ Investing in climate resilience can reduce the need to take far more costly actions in the decades to come. Our 2019 *Disaster Resilience Framework* states that federal efforts can contribute to understanding the return on investment of various alternatives to address risk by developing and disseminating comprehensive approaches for estimating loss avoidance, analyzing costs and benefits of various hazard mitigation alternatives, and considering their impact on programmatic decisions and budgeting for disasters.⁹

You asked us to review the current understanding of the potential risks and economic effects of climate change to the federal government and to provide information for how Congress might establish an organizational

⁴The High-Risk List identifies federal programs and operations that are vulnerable to fraud, waste, abuse, and mismanagement, or in need of transformation. See GAO, *High-Risk Series: An Update*, [GAO-13-283](#) (Washington, D.C.: Feb. 14, 2013); and *High-Risk Series: Efforts Made to Achieve Progress Need to Be Maintained and Expanded to Fully Address All Areas*, [GAO-23-106203](#) (Washington, D.C.: Apr. 20, 2023).

⁵See [GAO-23-106203](#). Federal fiscal exposures involve responsibilities, programs, and activities that may legally commit or create the expectation for future federal spending based on current policy. See GAO, *The Nation's Fiscal Health: Road Map Needed to Address Projected Unsustainable Debt Levels*, [GAO-23-106201](#) (Washington, D.C.: May 8, 2023); and "Federal Fiscal Risks," accessed May 6, 2024.

⁶This total includes \$296 billion in selected supplemental appropriations to federal agencies for disaster assistance and approximately \$152 billion in annual appropriations to the Disaster Relief Fund for fiscal years 2015 through 2024. It does not include other annual appropriations to federal agencies for disaster assistance. Of the supplemental appropriations, \$97 billion was included in supplemental appropriations acts that were enacted primarily in response to the COVID-19 pandemic.

⁷See, for example GAO, *Climate Change: Opportunities to Reduce Federal Fiscal Exposure*, [GAO-19-625T](#) (Washington, D.C.: June 11, 2019).

⁸The National Academies of Sciences, Engineering, and Medicine defines resilience as the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events. We reported in May 2016 that two related sets of actions can enhance climate resilience by reducing risk. GAO, *Climate Change: Selected Governments Have Approached Adaptation through Laws and Long-Term Plans*, [GAO-16-454](#) (Washington, D.C.: May 12, 2016). These are climate change adaptation and pre-disaster hazard mitigation. In general, the term "adaptation" is used by climate change professionals, and "pre-disaster hazard mitigation" is employed by the emergency management community, often to speak about the same thing: becoming better prepared for climate change impacts. Adaptation is defined as adjustments to natural or human systems in response to actual or expected climate change. Pre-disaster hazard mitigation refers to actions taken to reduce the loss of life and property by lessening the impacts of adverse events and applies to all hazards, including terrorism and natural hazards, such as pandemics and weather-related disasters. In this report, we use the term "climate resilience" for consistency and to encompass both sets of actions as they relate to addressing climate risks. GAO, *Climate Resilience: A Strategic Investment Approach for High-Priority Projects Could Help Target Federal Resources*, [GAO-20-127](#) (Washington, D.C.: Oct. 23, 2019).

⁹GAO, *Disaster Resilience Framework: Principles for Analyzing Federal Efforts to Facilitate and Promote Resilience to Natural Disasters*, [GAO-20-100SP](#) (Washington, D.C.: Oct. 23, 2019).

arrangement to prioritize federal climate resilience investments.¹⁰ This report examines (1) what information is available regarding the economic costs and benefits estimated to be incurred by the federal government as a result of climate change and what limitations exist with such information, (2) the extent to which the federal government has developed the capacity to acquire economic data to help understand federal climate-related financial risks and used this information to make climate resilience investments, and (3) what key elements should be included in a federal organizational arrangement to identify and prioritize climate resilience projects for federal investments.¹¹

To examine what information is available regarding the projected economic costs and benefits estimated to be incurred by the federal government as a result of climate change and the limitations with this information, we collected background information, conducted a literature search, and reviewed published assessments of the projected economic costs and benefits estimated to be incurred by the federal government as a result of climate change. We reviewed 37 relevant sources to identify some of the quantified economic impacts of climate change on the federal government. To better understand this topic and the Executive Office of the President's (EOP) efforts to enhance climate resilience, we selected and interviewed 10 experts with expertise in estimating the economic effects of climate change in the U.S., knowledge of federal fiscal exposure to climate change, and active work on the economic effects of climate change. We also interviewed officials from the Council of Economic Advisers (CEA), an entity within the EOP.

To examine the extent to which the federal government has developed the capacity to acquire economic and financial data on federal climate-related financial risks and applied this information to climate resilience investments, we reviewed federal guidance for agencies on reporting climate-related financial risks and federal agency financial reports. We also reviewed budget requests of four agencies to identify information on the agencies' climate-related fiscal exposure. To better understand this topic and EOP's efforts, we interviewed staff from the EOP's Office of Management and Budget (OMB). We also interviewed staff from the Federal Accounting Standards Advisory Board (FASAB), which was established on October 10, 1990, and is sponsored by GAO, the U.S. Department of the Treasury, and OMB to issue federal financial accounting standards.¹²

To examine what key elements should be included in a federal organizational arrangement to identify and prioritize climate resilience projects for federal investments, we collected background materials and conducted a literature search for relevant articles, reports, and studies. We found and reviewed 27 relevant sources to identify key elements of an organizational arrangement to prioritize climate resilience investments. To better

¹⁰The economic effects of climate change to the federal government are defined as the benefits minus the costs as a result of changes in the climate, which we refer to as costs, when negative—that is, when the costs outweigh the benefits.

¹¹The sources we reviewed for this report did not quantify any net economic benefits to the federal government as a result of climate change. There are potential benefits as a result of climate change; however, the net costs are likely to outweigh these benefits over the course of this century.

¹²FASAB is comprised of a nine-member board with six nonfederal members and three members from the federal sponsors—OMB, GAO, and the Department of the Treasury—that issues financial accounting standards for federal reporting entities. FASAB supports efforts to improve federal financial reporting and the larger federal financial management community's efforts to meet their accountability responsibilities. Its mission is to be achieved through a comprehensive and independent process that encourages broad stakeholder participation and objectively considers stakeholder views. Federal reporting entities are organizations that issue a general purpose federal financial report because either there is a statutory or administrative requirement to prepare one, or they choose to prepare one. The term "reporting entity" may refer to either the government-wide reporting entity or a component reporting entity. See FASAB, *FASAB Handbook of Federal Accounting Standards and Other Pronouncements, as Amended: Appendix E, Consolidated Glossary* (Washington, D.C.: Dec. 15, 2023).

understand this topic and EOP's efforts, we selected and interviewed 13 additional experts with expertise in government-wide climate resilience planning on a national scale and experience working in the federal government on climate resilience efforts on a national scale. We also interviewed officials from the Office of Science and Technology Policy (OSTP) and USGCRP—entities within EOP—and the U.S. Environmental Protection Agency (EPA).

To assess the extent to which each element could enhance climate resilience as part of an organizational arrangement to prioritize federal climate resilience investments, we compared the elements with the current climate resilience efforts of Congress and EOP using our *Disaster Resilience Framework*.¹³ Specifically, we used the *Disaster Resilience Framework* to identify the potential positive effects achievable by implementing each element, in conjunction with existing efforts, as part of an organizational arrangement to prioritize climate resilience investments. For additional details on the scope and methodology of our review, see appendix I.

We conducted this performance audit from July 2023 to August 2024 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.

Background

This section describes (1) federal roles and responsibilities related to climate resilience planning and investment, (2) types of climate economics information for prioritizing climate resilience investments, and (3) climate resilience as a risk-management strategy to limit federal fiscal exposure.

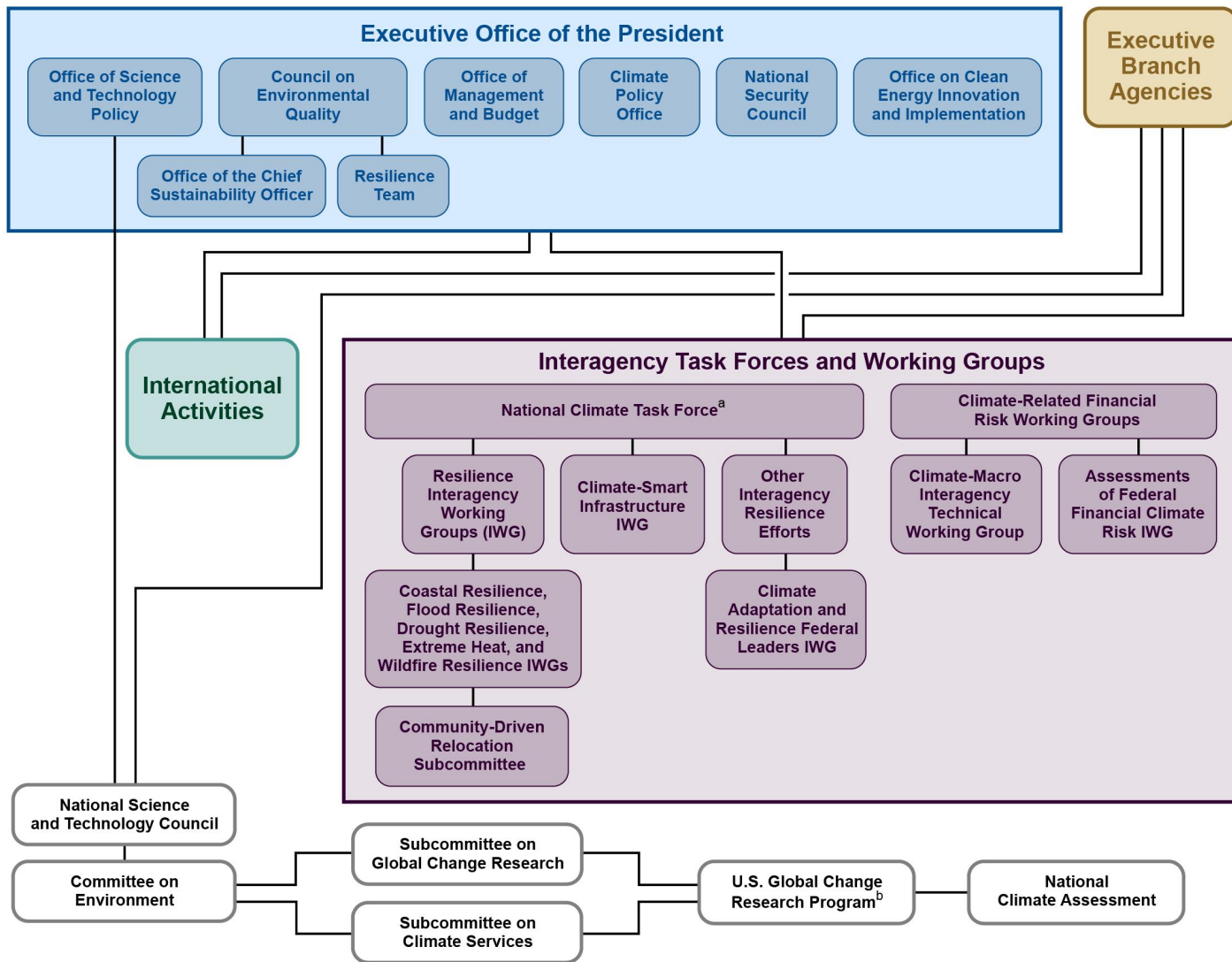
Federal Roles and Responsibilities Related to Climate Resilience Planning and Investment

Planning and investing in climate resilience is a complex, crosscutting endeavor, and the federal government has developed several mechanisms to coordinate related programs and activities. As shown in figure 1, these mechanisms include entities within EOP, including OMB, the Council on Environmental Quality (CEQ), and OSTP; committees and programs organized under OSTP; and interagency task forces and working groups that coordinate the actions of individual agencies.¹⁴

¹³GAO-20-100SP.

¹⁴CEQ advises the President and develops policies on climate change, environmental justice, federal sustainability, public lands, oceans, and wildlife conservation, among other issues. CEQ also works to ensure that environmental reviews for infrastructure projects and federal actions are efficient, thorough, and reflect the input of local communities and the public. OSTP advises the President and works with federal departments and agencies, as well as external partners, to strengthen science and technology in the U.S.

Figure 1. Selected Entities Responsible for Federal Climate Resilience Planning and Investment, as of May 2024



Source: GAO analysis of agency information. | GAO-24-106937

^aExecutive Order 14008 identifies the members of the National Climate Task Force to include the National Climate Advisor (Chair), the Secretaries for the U.S. Department of the Treasury, U.S. Department of Defense (DOD), U.S. Department of the Interior, U.S. Department of Agriculture (USDA), U.S. Department of Commerce (Commerce), U.S. Department of Energy (DOE), U.S. Department of Labor, U.S. Department of Health and Human Services (HHS), U.S. Department of Housing and Urban Development (HUD), U.S. Department of Transportation (DOT), U.S. Department of Homeland Security (DHS); Attorney General; Administrators for the U.S. General Services Administration and U.S. Environmental Protection Agency (EPA); Chair of the Council on Environmental Quality; Directors of the Office of Management and Budget and the Office of Science and Technology Policy; Assistant to the President for Domestic Policy, Assistant to the President for National Security Affairs, Assistant to the President for Homeland Security and Counterterrorism, and Assistant to the President for Economic Policy.

^bMembers of the U.S. Global Change Research Program include USDA, Commerce, DOD, DOE, HHS, DHS, U.S. Department of the Interior, U.S. Department of State, DOT, EPA, HUD, National Aeronautics and Space Administration, National Science Foundation, Smithsonian Institution, and the U.S. Agency for International Development.

Within EOP, four entities—OMB, CEQ, OSTP, and the National Security Council—have key roles and responsibilities to provide high-level policy direction for federal climate resilience planning and the

implementation of climate resilience projects executed by federal agencies.¹⁵ Other EOP entities involved in climate resilience planning and implementation include the Climate Policy Office, which coordinates the administration’s domestic climate policy agenda and the National Climate Task Force, which facilitates the organization and implementation of a government-wide approach to climate change. In addition, the Office of Clean Energy Innovation and Implementation was established to coordinate implementing the energy and infrastructure provisions of the Inflation Reduction Act of 2022 and other initiatives. Finally, the National Security Council and other intelligence agencies have completed work on climate security and disaster preparedness and response, including developing a National Intelligence Estimate on Climate Change.

Interagency entities and programs also have climate resilience roles and responsibilities. For example, various interagency working groups bring together expertise from a range of agencies, reflecting the need for a “whole of government” approach to assess and manage climate risks. In addition, USGCRP is a federal program organized under OSTP’s National Science and Technology Council and mandated by Congress to facilitate and coordinate climate change research across member agencies. USGCRP produced the *Fifth National Climate Assessment*, which provides assessment of the latest scientific information to inform agency and non-federal decisions on prioritizing climate resilience investments.¹⁶

Federal climate resilience entities also help individual agencies fulfill their responsibilities established in three key executive orders related to climate resilience. These three executive orders, issued in 2021, direct agencies to plan, implement, and report on climate resilience activities.

- **Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad***, directs federal agencies to submit climate action plans that describe steps the agency can take to bolster adaptation and increase climate resilience regarding its facilities and operations.¹⁷ The order also requires agencies to make their climate action plans public and to submit annual reports documenting the agency’s progress in implementing the plans.
- **Executive Order 14030, *Climate-Related Financial Risk***, requires agencies, as part of their climate action plans, to report information about actions they are taking to address climate-related financial risks in their procurement processes.¹⁸ It also requires OMB, in consultation with other entities, to identify primary sources of federal climate-related financial risk exposure and develop methodologies to quantify climate risks using the economic assumptions and long-term projections of the President’s budget.¹⁹ Additionally, Executive Order 14030 requires OMB to develop and publish in the President’s Budget an annual

¹⁵However, we have reported that federal agency climate resilience projects are also completed on an ad hoc basis to meet mission needs. See [GAO-20-127](#).

¹⁶USGCRP, *Fifth National Climate Assessment*.

¹⁷Exec. Order No. 14008, *Tackling the Climate Crisis at Home and Abroad*, 86 Fed. Reg. 7619, 7625 (Jan. 27, 2021).

¹⁸Exec. Order No. 14030, *Climate-Related Financial Risk*, 86 Fed. Reg. 27,967, 27,969 (May 20, 2021). This executive order also reinstated the Federal Flood Risk Management Standard, which was established by Executive Order 13690 to address current and future flood risk and ensure that projects funded with taxpayer dollars last as long as intended.

¹⁹CEA, OMB, and the Treasury lead a process to produce the economic assumptions that underlie the President’s Budget, producing 10-year projections of important economic variables, such as gross domestic product growth, interest rates, and employment. These economic assumptions play a critical role in the budget-making process, as they ensure that all agencies rely on the same macroeconomic forecast when projecting programs’ receipts and outlays over the 10-year budget window. See CEA and OMB, *White Paper: Methodologies and Considerations for Integrating the Physical and Transition Risks of Climate Change into Macroeconomic Forecasting for the President’s Budget* (Washington, D.C.: Mar. 13, 2023).

assessment of the federal government’s climate risk exposure and reduce the federal government’s climate-related financial risk exposure through formulation and execution of the budget.

- **Executive Order 14057, *Catalyzing Clean Energy Industries and Jobs through Federal Sustainability***, requires federal agencies to develop, implement, and update Climate Adaptation and Resilience Plans that build on the climate action plans required by Executive Order 14008.²⁰ Executive Order 14057 requires agencies to conduct climate adaptation analyses and planning efforts to support climate-informed financial and management decisions and program implementation. It also requires federal agencies to reform policies and funding programs that are maladaptive to climate change to decrease the vulnerability of communities, economic sectors, natural or built systems, and natural resources to climate impacts and related risks. Implementing instructions for Executive Order 14057, published in August 2022, specify that Climate Adaptation and Resilience Plans are “living documents” that require routine updates and improvements to reflect the latest climate science; provide up-to-date information about agencies’ progress toward meeting goals identified in their climate action plans; and revise agencies’ strategic priorities, if needed.²¹

Categories of Climate Economics Information

Climate economics information regarding the costs and benefits of climate change can be categorized in different ways, depending upon how the information is developed, including (1) top-down, economy-wide analysis of the impacts of climate change; (2) bottom-up sectoral analysis of the impacts of climate change; and (3) other types of climate economics information.

Top-Down, Economy-Wide Analysis of the Impacts of Climate Change

Existing federal initiatives and analyses provide information on the estimated costs from climate change at a top-down macroeconomic or economy-wide scale focusing on impacts to gross domestic product (GDP)—a measure of total economic production.²² Effects on GDP from climate change have implications for the federal government’s fiscal outlook.²³ Estimates of these effects are not broken down by sectors of the economy.

²⁰Exec. Order No. 14057, *Catalyzing Clean Energy Industries and Jobs through Federal Sustainability*, 86 Fed. Reg. 70,935, 70,939 (Dec. 8, 2021).

²¹The implementing instructions specify that agencies must submit an annual Climate Adaptation and Resilience Plan progress report to CEQ and OMB. See CEQ, [Implementing Instructions for Executive Order 14057 Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability](#) (Aug. 2022).

²²Methods to quantify GDP-level costs use integrated assessment models, which assume physical relationships between emissions and global average temperatures and these, in turn, are translated to economic effects through “damage functions” that estimate the economic impacts of climate change. Damage functions are typically represented as a percentage of GDP that is associated with different increases in global average temperatures. Some integrated assessment models can produce national-level estimates, as well as global or multinational estimates. See GAO, *Climate Change: Information on Potential Economic Effects Could Help Guide Federal Efforts to Reduce Fiscal Exposure*, [GAO-17-720](#) (Washington, D.C.: Sept. 2017).

²³We have previously reported that the federal government’s current fiscal trajectory is unsustainable over the long term as federal debt held by the public grows faster than GDP. See GAO, *The Nation’s Fiscal Health: Road Map Needed to Address Projected Unsustainable Debt Levels*, [GAO-24-106987](#) (Washington, D.C.: Feb. 15, 2024).

Federal entities that provide information on the estimated costs of climate change include (1) the Congressional Budget Office (CBO), (2) EOP, and (3) USGCRP through the *Fifth National Climate Assessment*.

- CBO produces analyses of economic and budgetary issues to support the congressional budget process, including 10-year and 30-year budget and economic projections. In 2020, CBO produced a working paper that estimated that climate change will decrease average annual real GDP growth by 0.03 percentage points from 2020 to 2050, compared with the growth that would occur under the climatic conditions that occurred at the end of the 20th century.²⁴
- The OMB *Analytical Perspectives* of the President's 2023, 2024, and 2025 budgets presented limited analyses of the federal government's fiscal exposure to climate change.²⁵ CEA and OMB have also issued a series of white papers that highlight the importance of examining the macroeconomic impacts of climate change and outline methods used in the *Analytical Perspectives* volume of the President's Budget.²⁶ According to OMB staff, the fiscal year 2025 *Analytical Perspectives* volume of the President's Budget shows that, over the long run, unmitigated climate change could significantly weigh down on U.S. GDP.²⁷
- The USGCRP *Fifth National Climate Assessment*—released in November 2023—included an economics chapter for the first time.²⁸ According to the *Fifth National Climate Assessment*, U.S. economic impacts of climate change are expected to worsen over time and will vary by location due to different hazards, regional climate change patterns, and historical climate.²⁹ For example, it is estimated that for every one-degree Fahrenheit increase of global average surface temperature, U.S. GDP growth is projected to slow approximately 0.13 percentage points, with greater effects for larger temperature changes.

²⁴The 0.03 percentage-point reduction in the GDP growth rate that CBO estimated reflected both the continuation of the recent effect of climate change on the GDP growth rate and the impact of expected increases in that effect in the future. CBO, Working Paper Series, *CBO's Projection of the Effect of Climate Change on U.S. Economic Output* (Washington, D.C.: Sept. 2020).

²⁵The *Analytical Perspectives* contain analyses that are designed to highlight specified subject areas or provide other significant presentations of budget data that place the budget in perspective, including the climate change information in the *Analytical Perspectives*. See OMB, *Analytical Perspectives: Budget of the U.S. Government Fiscal Year 2023, Chapter 21: Federal Budget Exposure to Climate Risk* (Washington, D.C.: Mar. 2022); *Analytical Perspectives: Budget of the U.S. Government Fiscal Year 2024, Chapter 10: Budget Exposure to Increased Costs and Lost Revenue Due to Climate Change* (Washington, D.C.: Mar. 2023); and *Analytical Perspectives: Budget of the U.S. Government Fiscal Year 2025, Chapter 11: Analysis of Federal Climate Financial Risk Exposure* (Washington, D.C.: Mar. 2024).

²⁶The white papers published by CEA and OMB identify future opportunities for the federal government to develop analysis to better understand climate-related financial risks, including integrating climate risks into future budget forecasts. See CEA and OMB, *White Paper: Climate-related Macroeconomic Risks and Opportunities* (Washington, D.C.: Apr. 4, 2022); and *White Paper: Methodologies and Considerations for Integrating the Physical and Transition Risks of Climate Change into Macroeconomic Forecasting for the President's Budget*.

²⁷OMB, *Analytical Perspectives: Budget of the U.S. Government Fiscal Year 2025, Chapter 3: Long-Term Budget Outlook and Chapter 11: Analysis of Federal Climate Financial Risk Exposure*.

²⁸USGCRP, *Fifth National Climate Assessment*.

²⁹The [economics chapter](#) of the *Fifth National Climate Assessment* relies on a synthesis of existing academic literature to provide an overview of the ways climate change directly impacts the economy and outlines the indirect impacts of climate change events on the economy (e.g., increasing temperatures and sea-level rise). See USGCRP, *Fifth National Climate Assessment, Economics*.

Bottom-Up Sectoral Analysis of the Impacts of Climate Change

Some studies and reports contain information on the estimated costs of climate change at a bottom-up microeconomic scale, focusing on impacts to certain sectors of the economy. Two entities that have recently reported on these impacts are EPA and EOP.

- EPA has developed methods to estimate some microeconomic impacts of climate change using its Climate Change Impacts and Risk Analysis project and Framework for Evaluating Damages and Impacts model.³⁰ The Climate Change Impacts and Risk Analysis project quantifies the physical effects and economic costs of climate change in the U.S. under different emissions scenarios, called Representative Concentration Pathways (RCP), and is used to inform the National Climate Assessments.³¹ EPA's 2017 summary study of this project included the results of modeling analyses for 25 sectors under different climate scenarios.³² For example, EPA said that adaptation actions (e.g., modifying the design of a road to increase surface density before climate change events occur), especially in the infrastructure sectors, are projected to substantially reduce climate change impacts. More specifically, across all road types and climate events, proactive adaptation to protect roads from climate change-related impacts is projected to decrease costs through 2100 by more than 75 percent under both adaptation scenarios EPA considered. In addition, when accounting for the effects of adaptation, mortality from extreme heat decreased by more than 50 percent in 2050 and 2090 under both adaptation scenarios EPA considered. In addition, the Framework for Evaluating Damages and Impacts model, which projects climate change impacts in the U.S. under various temperature or emissions pathways, draws on over 30 existing studies and models, including the Climate Change Impacts and Risk Analysis project.
- The 2023, 2024, and 2025 President's Budget *Analytical Perspectives* chapters assessed how climate change might indirectly affect federal revenues through macroeconomic channels (e.g., effects to long-term GDP growth) and microeconomic channels (e.g., federal expenditures in programs that affect individual decision-making).³³ The analyses included estimates of future expenditures for climate-related financial risk areas and provided examples of how climate change directly impacts the federal budget through both spending and revenue. We discuss these estimates later in the report.

³⁰EPA, "[Climate Change Impacts and Risk Analysis \(CIRA\)](#)," accessed May 7, 2024; and "[FrEDI Framework for Evaluating Damages and Impacts](#)," accessed May 7, 2024. According to OSTP officials, EPA also determines the social cost of greenhouse gas emissions for regulations using a bottom-up approach very similar in form to the Framework for Evaluating Damages and Impacts. These two parallel EPA bottom-up climate economics modeling approaches are constructed in very different ways and could both be used for resilience planning at a fine spatial resolution, if applied for that purpose.

³¹RCPs capture a range of potential greenhouse gas emissions pathways and associated atmospheric concentration levels through 2100. RCPs drive climate model projections under futures that have either lower or higher greenhouse gas emissions, each leading to a different level of projected global temperature change.

³²EPA, [Multi-Model Framework for Quantitative Sectoral Impacts Analysis: A Technical Report for the Fourth National Climate Assessment](#), EPA 430-R-17-001 (May 2017).

³³OMB produced the climate economics materials in the *Analytical Perspectives* in Chapter 3, *Long-term Budget Outlook*, and Chapter 11, *Analysis of Federal Climate Financial Risk Exposure*.

Other Types of Climate Economics Information

This section describes other types of economics information that are intended for purposes other than prioritizing climate resilience investments to limit fiscal exposure: (1) the social cost of greenhouse gases, (2) the costs of individual climate-related weather events and natural disasters, and (3) climate change funding.

Social Cost of Greenhouse Gases

When assessing the costs and benefits of proposed environmental regulations, federal agencies use estimates of the “social cost of greenhouse gases”—an estimate of the economic costs from increases in greenhouse gas emissions.³⁴ The social cost of greenhouse gases represents the long-term net economic costs—the costs minus any benefits—associated with an incremental increase in carbon dioxide or other greenhouse gas emissions in a given year (typically measured in dollars per metric ton of carbon dioxide equivalent). In general, the social cost of greenhouse gases is used in regulatory impact analyses and is not a tool for prioritizing climate resilience investments, the focus of this report. Given that the social cost of greenhouse gases relies on a variety of assumptions, there exists a range of values for the costs based on different assumptions.

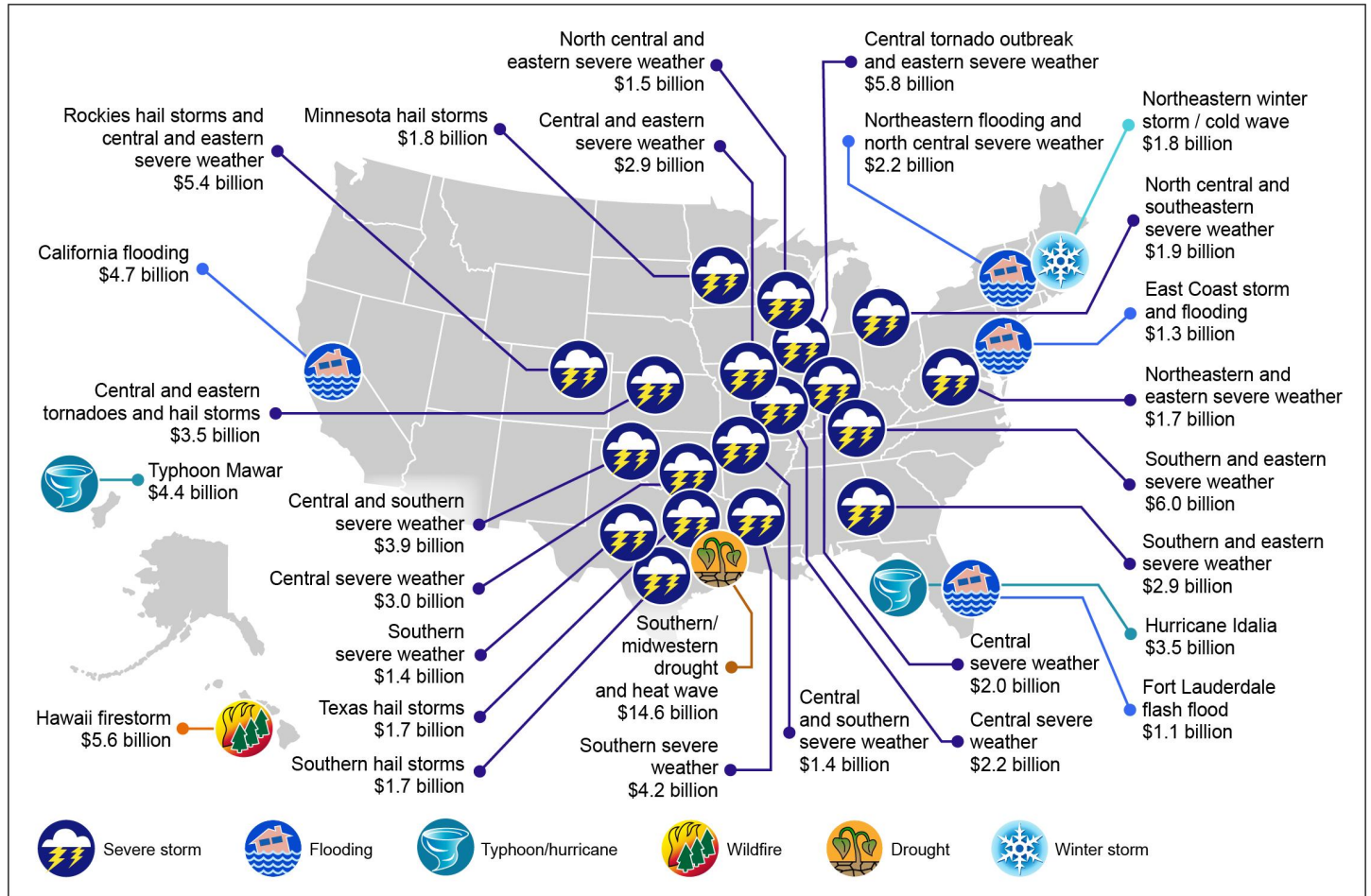
Costs of Individual Climate-Related Weather Events and Natural Disasters

Economy-wide damage information is available for the costs related to specific climate-related natural disasters in the U.S. For example, the U.S. Department of Commerce’s National Oceanic and Atmospheric Administration (NOAA) reported that, in 2023, the U.S. experienced 28 climate-related weather events and natural disasters which caused over \$1 billion in damage each (see fig. 2). Combined, the 28 events resulted in \$94.1 billion of total costs and 492 deaths.³⁵ The U.S. experienced different types of costly events, including 19 severe storm events and two tropical cyclone events that had damages of at least \$1 billion, with differential impacts felt across geographical regions.

³⁴Agencies also refer to the “social cost of greenhouse gases” as the “social cost of carbon.” See GAO, *Social Cost of Carbon: Identifying a Federal Entity to Address the National Academies’ Recommendations Could Strengthen Regulatory Analysis*, [GAO-20-254](#) (Washington, D.C.: June 23, 2020).

³⁵The extent to which the costs from these disasters and events are directly attributable to climate change versus natural weather variability is uncertain. See NOAA’s National Centers for Environmental Information, [“U.S. Billion-Dollar Weather and Climate Disasters \(2023\),”](#) accessed May 20, 2024.

Figure 2: Individual Climate-Related Weather Events and Natural Disasters Causing at Least \$1 Billion in Damages in the U.S. in 2023



Sources: U.S. National Oceanic and Atmospheric Administration (NOAA) and GAO analysis of NOAA data; GAO (icons); Map Resources (map). | GAO-24-106937

Accessible Data for Figure 2: Individual Climate-Related Weather Events and Natural Disasters Causing at Least \$1 Billion in Damages in the U.S. in 2023

Name	Disaster Type	Total CPI-Adjusted Cost (billions of Dollars)
Northeastern winter storm / cold wave	Winter Storm	1.8
Southern and eastern severe weather	Severe Storm	6.0
California flooding	Flooding	4.7
Southern and eastern severe weather	Severe Storm	2.9
Central tornado outbreak and eastern severe weather	Severe Storm	5.8
Central and eastern severe weather	Severe Storm	2.9
Fort Lauderdale flash flood	Flooding	1.1
Central and southern severe weather	Severe Storm	1.4

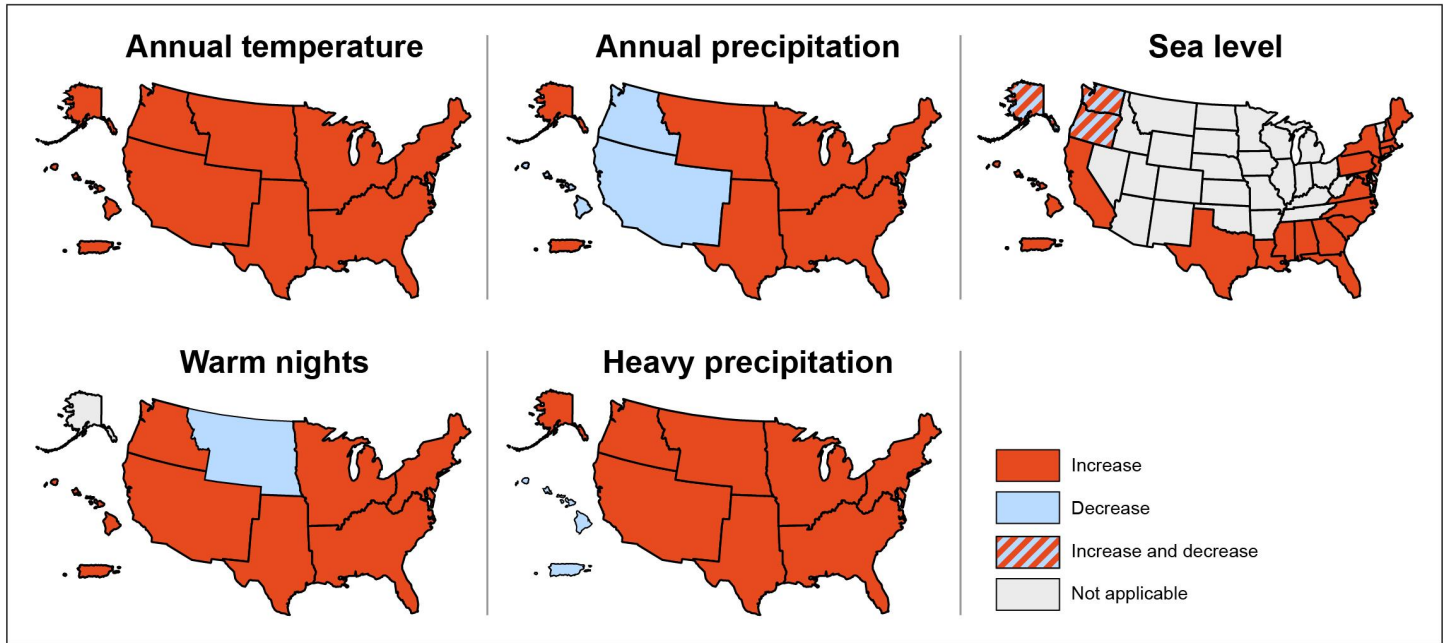
Name	Disaster Type	Total CPI-Adjusted Cost (billions of Dollars)
Central severe weather	Severe Storm	3.0
Southern severe weather	Severe Storm	1.4
Central severe weather	Severe Storm	2.2
Central and eastern tornadoes and hail storms	Severe Storm	3.5
Texas hail storms	Severe Storm	1.7
Typhoon Mawar	Typhoon/hurricane	4.4
Southern severe weather	Severe Storm	4.2
Central and southern severe weather	Severe Storm	3.9
Rockies hail storms and central and eastern severe weather	Severe Storm	5.4
Central severe weather	Severe Storm	2.0
Northeastern flooding and north central severe weather	Flooding	2.2
North central and southeastern severe weather	Severe Storm	1.9
North central and eastern severe weather	Severe Storm	1.5
Hawaii firestorm	Wildfire	5.6
Northeastern and eastern severe weather	Severe Storm	1.7
Minnesota hail storms	Severe Storm	1.8
Hurricane Idalia	Typhoon/hurricane	3.5
Southern hail storms	Severe Storm	1.7
Southern/midwestern drought and heat wave	Drought	14.6
East Coast storm and flooding	Flooding	1.3

Sources: U.S. National Oceanic and Atmospheric Administration (NOAA) and GAO analysis of NOAA data; GAO (icons); Map Resources (map). | GAO-24-106937

The *Fifth National Climate Assessment* also highlights that climate change impacts vary across the U.S. (see fig. 3).³⁶ For example, the Northeast faces increasing extreme weather, such as precipitation—causing flooding—and heat waves, while the Southwest faces higher temperatures, increasing the risks of drought.

³⁶USGCRP, *Fifth National Climate Assessment*.

Figure 3. Regional Impacts of Climate Change Across the U.S.



Sources: U.S. Global Change Research Program, *Fifth National Climate Assessment*; Map Resources (maps). | GAO-24-106937

Accessible Data for Figure 3. Regional Impacts of Climate Change Across the U.S.

Region	Annual Temperature	Warm Nights	Annual Precipitation	Heavy Precipitation
Alaska	Increase	N/A	Increase	Increase
Northwest	Increase	Increase	Decrease	Increase
Southwest	Increase	Increase	Decrease	Increase
Northern Great Plains	Increase	Decrease	Increase	Increase
Southern Great Plains	Increase	Increase	Increase	Increase
Midwest	Increase	Increase	Increase	Increase
Northeast	Increase	Increase	Increase	Increase
Southeast	Increase	Increase	Increase	Increase
U.S. Caribbean	Increase	Increase	Increase	Decrease
Hawaii and U.S.-Affiliated Pacific Islands	Increase	Increase	Decrease	Decrease

Sea Level:

- **Sea level increase:** Hawaii, Caribbean, California, Texas, Louisiana, Mississippi, Alabama, Georgia, Florida, South Carolina, North Carolina, Virginia, Maryland, New Jersey, Pennsylvania, New York, Connecticut, Massachusetts, Rhode Island, New Hampshire, Maine
- **Sea level increase and decrease:** Alaska, Oregon, Washington
- **Sea level not applicable:** Remaining states

Sources: U.S. Global Change Research Program, *Fifth National Climate Assessment*~ Map Resources (maps). | GAO-24-106937

Note: For annual temperature, warm nights, annual precipitation, and heavy precipitation, the U.S. is divided by the 10 regions of the *Fifth National Climate Assessment*.

The five maps present observed changes for five temperature, precipitation, and sea level rise metrics: (1) warming is apparent in every region (based on changes in annual average temperature in 2002–2021 compared to the 1901–1960 average for the contiguous U.S., Hawaii, and Puerto Rico and to 1925–1960 for Alaska); (2) the number of warm nights per year (days with minimum temperatures at or above 70°F in 2002–2021 compared to 1901–1960) is increasing everywhere except the Northern Great Plains, where they have decreased, and in Alaska, where nights above 70°F are not common; (3) average annual precipitation is increasing in most regions, except in the Northwest, Southwest, and Hawaii, where precipitation has decreased (same time periods as annual average temperature); (4) heavy precipitation events are increasing everywhere except Hawaii and the U.S. Caribbean, where there has been a decrease (trends over the period 1958–2021); and (5) relative sea levels are increasing along much of the US coast except in Oregon, Washington, and Alaska, where there is a mix of both increases and decreases (trends over 1990–2020).

Additional federal efforts are focused on quantifying future economic costs resulting from hazards and natural disasters. For example, in November 2023, CBO provided economic damage information, as well as future cost projections resulting from specific climate disasters, such as flooding and hurricanes.³⁷ Specifically, CBO estimated flood damage to homes with federally backed mortgages and found that costs are concentrated in coastal areas that have large populations, high housing values, and moderate-to-high flood risks.³⁸

Climate Change Funding

Federal spending on climate change generally occurs through the annual appropriations process, disaster response and relief in supplemental appropriations, and tax expenditures (such as tax deductions, exclusions, and tax credits that can reduce how much a taxpayer owes).³⁹ In 2018, we reviewed OMB's reporting on climate change funding, which was previously required by law.⁴⁰ As requested by Congress, the report provided information on budget authority enacted for climate change related activities.

OMB discusses federal fiscal exposure to climate change in the *Analytical Perspectives* volume of the President's Budget, which is separate from its most recent climate change funding reports. More complete information on fiscal exposures and the long-term effects of decisions would help policymakers make trade-offs between investments with long-term and short-term benefits. We recommended that, concurrent with any future funding reports to Congress, OMB should provide funding information about federal programs with fiscal exposure to climate change.⁴¹ According to OMB staff, the data used in our 2018 report were based on annual

³⁷See, for example, CBO, *Flood Damage and Federally Backed Mortgages in a Changing Climate* (Washington D.C.: Nov. 2023) and *Expected Costs of Damage From Hurricane Winds and Storm-Related Flooding* (Washington D.C.: Apr. 2019). In addition, CBO developed an estimate of the potential damage avoided from spending by governments and homeowners on property-level flood risk adaptations. See CBO, *Flood Damage Avoided by Potential Spending on Property-Level Adaptations* (Washington, D.C.: May 2024).

³⁸CBO, *Flood Damage and Federally Backed Mortgages in a Changing Climate*.

³⁹Tax expenditures have the same net effect on the federal budget as spending programs. See GAO, "Tax Expenditures," accessed May 9, 2024.

⁴⁰OMB's reporting accounted for requested and enacted budget authority. See GAO, *Climate Change: Analysis of Reported Federal Funding*, GAO-18-223 (Washington, D.C.: Apr. 30, 2018).

⁴¹See GAO-18-223. We closed this recommendation as implemented. According to OMB staff, funding for climate-related activities (i.e., enacted budget authority from appropriations) is different from fiscal exposure to climate change (i.e., liability that is not appropriated). Programs that fund climate activities are not the same set of programs that have fiscal exposure to climate change. While there might be some overlap, these are fundamentally different program attributes.

expenditures reports that OMB is no longer required to submit to Congress. OMB discussed the fiscal risks of climate change as part of the President's fiscal year 2025 budget.⁴²

The Infrastructure Investment and Jobs Act (IIJA) and the Inflation Reduction Act of 2022 established federal grant programs and provided funding to support climate resilience.⁴³ For example, the IIJA provided funding and established new programs for building climate resilience in the transportation sector. Specifically, the IIJA established the Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation Program, which provides \$8.7 billion in state funding and other grants over 5 years.⁴⁴ Further, the Inflation Reduction Act of 2022 provided \$2.6 billion to support NOAA's efforts to improve the climate resilience of coastal communities.⁴⁵ The Inflation Reduction Act of 2022 also created a range of tax credits and other commitments that will result in less tax revenue collected—referred to as tax expenditures because it has the same net effect on the budget as spending.⁴⁶

Climate Resilience as a Risk-Management Strategy to Limit Federal Fiscal Exposure

In 2013, we placed *Limiting the Federal Government's Fiscal Exposure by Better Managing Climate Change Risks* on our High-Risk List of federal programs and operations vulnerable to waste, fraud, abuse, or mismanagement, or in need of transformation.⁴⁷ We have reported that action is needed to limit federal fiscal exposure to climate change based on the federal government's roles and responsibilities, including (1) providing property and crop insurance; (2) providing disaster assistance; (3) owning and operating infrastructure; (4) developing a national strategic plan to coordinate federal climate resilience efforts; and (5)

⁴²OMB, *Analytical Perspectives: Budget of the U.S. Government Fiscal Year 2025, Chapter 11: Analysis of Federal Climate Financial Risk Exposure*. According to OMB staff, this chapter is intended to provide a demonstration of the various approaches currently being employed to assess physical climate risk to agency programs, facilities, and services, including two analyses that provide detailed projections of quantified financial risks to agency programs. The two detailed analyses focus on climate financial risk to USDA's Livestock Forage Disaster Program and the Forest Service and the U.S. Department of the Interior's wildland fire suppression programs.

⁴³According to CEQ officials, aggregate funding to address climate resilience and adaptation across the IIJA and the Inflation Reduction Act of 2022 exceeds \$50 billion. See Pub. L. No. 117-58, 135 Stat. 429 (2021) and Pub. L. No. 117-169, 136 Stat. 1818 (2022).

⁴⁴This program aims to make surface transportation more resilient to natural hazards, including climate change, sea level rise, flooding, extreme weather events, and other natural disasters. It does so by supporting planning activities, resilience improvements, community resilience and evacuation routes, as well as at-risk coastal infrastructure. See U.S. Department of Transportation, Federal Highway Administration, "Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Program," accessed May 7, 2024.

⁴⁵NOAA plans to use the Inflation Reduction Act of 2022 funding to support its Climate-Ready Coasts and Communities initiatives by engaging with Tribes, state, local, nongovernmental organizations, and private sector entities in coastal and Great Lakes communities. The initiatives aim to develop and support local capacity to adapt to climate change impacts, while protecting fisheries, addressing environmental justice, growing economies, and developing a climate-ready workforce. NOAA, "Inflation Reduction Act: Climate-Ready Coasts and Communities" (Washington, D.C.: Aug. 29, 2023), accessed May 7, 2024. The \$2.6 billion appropriation is available until September 30, 2026, to provide funding through direct expenditures, contracts, grants, cooperative agreements, and technical assistance to coastal states and other eligible entities. Inflation Reduction Act of 2022, Pub. L. No. 117-169, § 40001, 136 Stat. 1818, 2028.

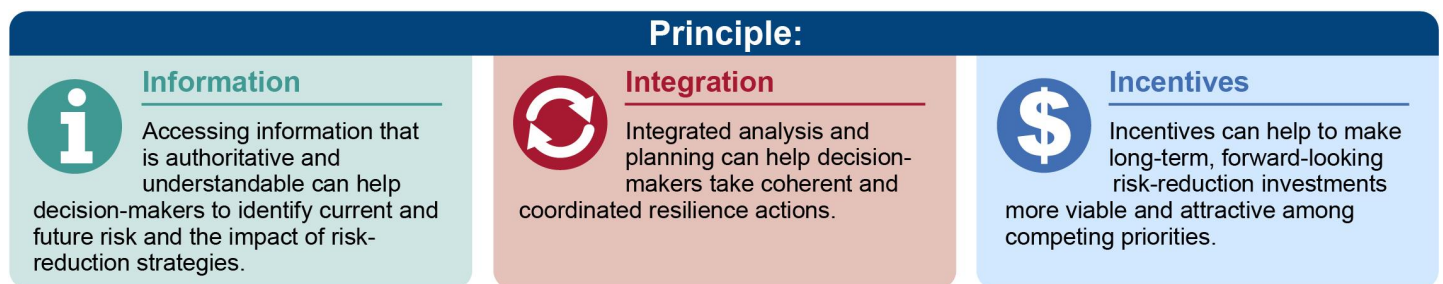
⁴⁶Tax policy includes consideration of tax system design and tax rates, as well as tax expenditures (such as tax deductions, exclusions, and tax credits). While tax expenditures can help achieve social and economic goals, they also limit the amount of tax revenue the federal government collects. In addition, it is not always clear how successfully tax expenditures achieve their intended policy goals. See [GAO-24-106987](#).

⁴⁷We most recently updated our High-Risk List in April 2023. See [GAO-23-106203](#).

providing data and technical assistance to help federal, tribal, state, territorial, local, and private decision-makers address climate change.

According to GAO's *Disaster Resilience Framework*, investments in disaster resilience provide a promising means to address federal fiscal exposure because such investments can help limit the overall impacts of disasters.⁴⁸ GAO's framework has three guiding principles—information, integration, and incentives—and lists a series of questions that can help identify opportunities to enhance federal efforts to promote disaster resilience (see fig. 4).

Figure 4: GAO's *Disaster Resilience Framework* Principles



Source: GAO; GAO (icons). | GAO-24-106937

Accessible Data for Figure 4: GAO's Disaster Resilience Framework Principles

- **Information** : Accessing information that is authoritative and understandable can help decision-makers to identify current and future risk and the impact of risk-reduction strategies.
- **Integration**: Integrated analysis and planning can help decision-makers take coherent and coordinated resilience actions.
- **Incentives**: Incentives can help to make long-term, forward-looking risk-reduction investments more viable and attractive among competing priorities.

Source: GAO; GAO (icons). | GAO-24-106937

These principles can apply to any federal effort to help agency officials and policymakers consider what kinds of actions to take to promote and facilitate disaster risk reduction. Users of the *Disaster Resilience Framework* can apply its principles and use its questions to assess almost any federal effort. Because not all elements of the framework will be relevant to every effort, users can adapt the principles for their specific needs. For example, under the information principle, we have reported that natural and climate disaster risk information that is accurate, comprehensive, and produced or endorsed by an authoritative source can help decision-makers better assess their risk. Federal agencies produce valuable information and can act as a trusted clearinghouse and integrator of federal and nonfederal information in a way that enhances its reach and value. Further, under the integration principle, we have reported that the integration of strategic resilience goals across relevant national strategies can help decision-makers in multiple federal agencies work toward a common vision and help ensure focus on a wide variety of opportunities to reduce disaster risk.

⁴⁸[GAO-20-100SP](#).

Limited Information Exists on the Economic Costs and Benefits Estimated to Be Incurred by the Federal Government as a Result of Climate Change

Estimates of the economic costs and benefits to be incurred by the federal government as a result of climate change are limited in five key ways, including that climate economics is an emerging field. However, available estimates—including those developed by the *Fifth National Climate Assessment* and OMB—indicate the federal government is likely to incur significant costs as a result of climate change. Additional information about these costs could help the federal government prioritize climate resilience investments and reduce future costs.

Estimates of the Economic Costs and Benefits to Be Incurred by the Federal Government as a Result of Climate Change Are Limited

Based on our review of prior GAO work and interviews with experts and agencies, estimates of the economic costs and benefits to be incurred by the federal government as a result of climate change are limited, including in five key ways: (1) climate economics is an emerging field of study, (2) limitations associated with the types of models used to estimate climate change impacts, (3) inherent uncertainty associated with the estimates produced by climate models, (4) available climate economics information is not focused on the federal government, and (5) some costs and benefits of climate change are difficult to quantify.⁴⁹

Climate Economics Is an Emerging Field of Study

We have reported that models estimating the economic effects of climate change are based on developing research.⁵⁰ Our previous work also states that a small but growing number of researchers focus their efforts on estimating the economic impacts of climate change. Methods to understand these impacts were first developed in the 1990s and advanced during the early 2000s. Newer methods have been used primarily to quantify the economic impacts on certain sectors, such as agriculture and energy, yet modeling efforts are expanding to other sectors, such as infrastructure. More recent studies have employed frameworks to compare the economic impacts across different sectors and regions within the U.S. According to the 2024 *Analytical Perspectives* volume of the President's Budget, many federal agencies have developed quantitative measures to address climate vulnerabilities but have not monetized estimates of financial risks and this is a new area of research.⁵¹

Limitations Associated with Climate Models

According to our review of prior GAO work and interviews with experts and agencies, models used to approximate the economic costs and benefits of climate change have limitations. These models are complex

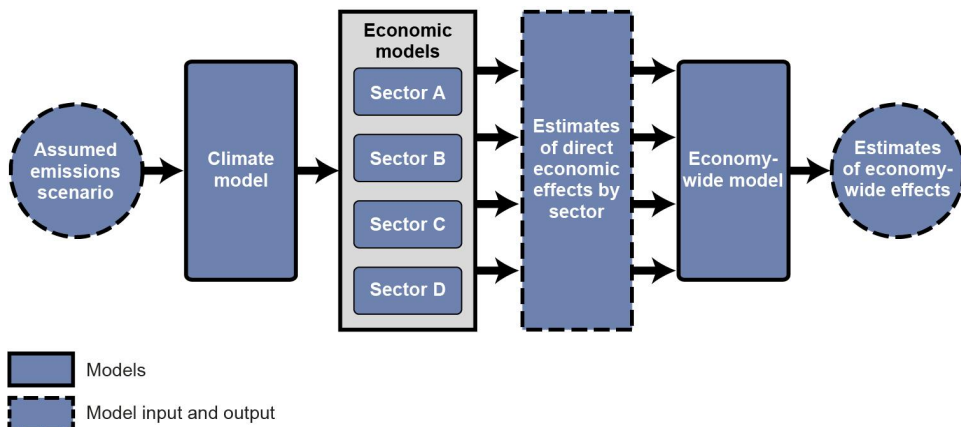
⁴⁹Some of these limitations are inherent in all types of modeling, including climate modeling. For example, all models depend on assumptions and contain some degree of uncertainty.

⁵⁰GAO-17-720.

⁵¹OMB, *Analytical Perspectives: Budget of the U.S. Government Fiscal Year 2024, Chapter 10: Budget Exposure to Increased Costs and Lost Revenue Due to Climate Change*.

because they link different types of complicated climate and economic models to assess how projected changes in the climate could affect different economic sectors and geographic regions or aspects of the federal government. Climate models, sector-specific economic models, and economy-wide models are linked together sequentially in a framework to estimate the economic impacts of climate change (see fig. 5).⁵²

Figure 5: Example of Linked Models Used to Estimate Economic Effects of Climate Change



Source: GAO analysis. | GAO-24-106937

To estimate the economic effects of climate change, a range of potential future emissions scenarios are fed into climate models. These are then linked to sector-specific economic models to create estimates of the direct economic effects of climate change on individual economic sectors. These sector-specific estimates can then be linked to economy-wide models to approximate economy-wide impacts of climate change or parsed out to estimate impacts on specific aspects of the federal government. However, the models used to estimate the economic effects of climate change have several limitations. For example, in a 2023 white paper, CEA and OMB stated that most estimates of climate change costs take economic growth as exogenous, effectively assuming there will be no substantive macroeconomic feedback from climate change.⁵³ In addition, CEA and OMB note that due to modeling complexities, it is difficult to accurately estimate U.S. macroeconomic climate risks.

Uncertainty of Climate Economics Model Estimates

We have previously reported that the limitations with climate modeling and available data make estimates of the economic effects of climate change inherently uncertain.⁵⁴ For example, researchers may not have the data they need to model the relationships between climate and society that require assumptions—typically based on historical observations—about responses to future climate change impacts. However, over the long periods that climate change is expected to occur, institutions, including government entities, may develop new approaches to build climate resilience, lessening its economic effects. For example, the 2024 *Analytical Perspectives* volume of the President’s Budget stated that modeling tools’ limitations prevent accurate or

⁵²GAO-17-720.

⁵³CEA and OMB, *White Paper: Methodologies and Considerations for Integrating the Physical and Transition Risks of Climate Change into Macroeconomic Forecasting for the President’s Budget*.

⁵⁴GAO-17-720.

robust projections of fiscal exposures and noted that their quantified fiscal impacts of climate change are illustrative and not suitable for decision-making.⁵⁵

Little Information Is Available About Federal Fiscal Exposure

According to the information we reviewed and experts we interviewed, little information is available on the costs and benefits to be incurred by the federal government resulting from climate change. Few entities are focused on parsing out costs specific to the federal government instead of costs to the entire economy. For example, the 2024 *Analytical Perspectives* volume of the President's Budget noted that the literature on federal fiscal exposure to climate change is limited and that while more economy-wide information is available, only selected programs will have proportional economic losses to a particular sector.⁵⁶ In addition, some experts and CEA officials said the *Analytical Perspectives* volume of the President's Budget did not include sectors of the economy that may face fiscal exposure as a result of climate change. Some experts recommended that OMB conduct more sector-specific, agency-specific, or region-specific analyses. The 2024 *Analytical Perspectives* volume of the President's Budget noted that the sectors highlighted were illustrative examples, and OMB staff said they intend to expand this analysis to add additional sectors.

Some Costs and Benefits of Climate Change Are Difficult to Quantify

Additionally, climate economics modeling is limited by what can be quantified. Specifically, climate economics modeling accounts for only the most easily identified and quantified damages and may miss potentially significant ways in which the costs of climate change could grow and multiply. These would be important for understanding the macroeconomic effects of climate change. According to experts we interviewed, climate economics information is, therefore, limited in its usefulness to help prioritize federal climate resilience investments. For example, most experts said economic assessments are not the only sources of information necessary to prioritize federal climate resilience investments. One expert said it is important to be cautious when monetary methods for calculating benefits and costs are applied to nonmonetary items, such as health and wellbeing.⁵⁷ Some experts said that equity can be difficult to quantify. Additionally, most experts said agency-specific analyses and state and local information are useful to prioritize these investments.

⁵⁵OMB, *Analytical Perspectives: Budget of the U.S. Government Fiscal Year 2024, Chapter 10: Budget Exposure to Increased Costs and Lost Revenue Due to Climate Change*.

⁵⁶OMB, *Analytical Perspectives: Budget of the U.S. Government Fiscal Year 2024, Chapter 10: Budget Exposure to Increased Costs and Lost Revenue Due to Climate Change*.

⁵⁷OSTP officials said that they agreed that caution is warranted in valuation and taking stances on equity. However, OMB provides specific guidance to federal agencies on valuation and assessing the costs and benefits of equity in their regulatory analysis and reporting. See OMB, *Circular No. A-4* (Washington, D.C.: Nov. 9, 2023).

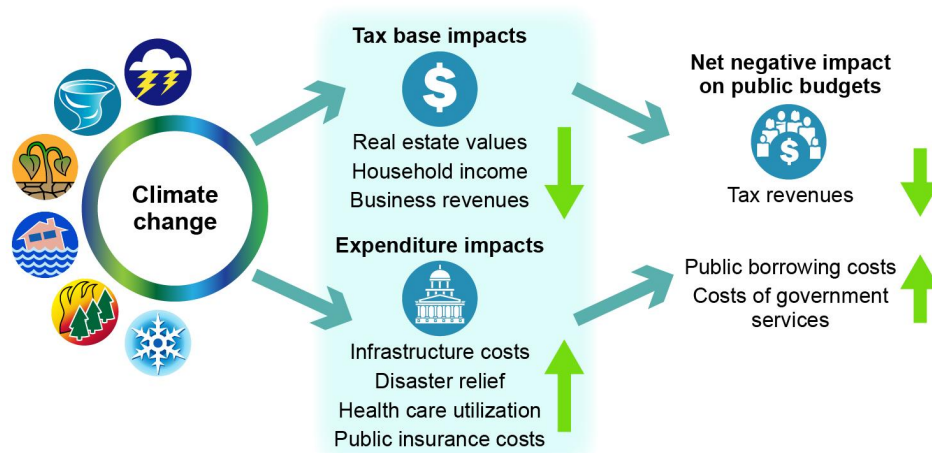
Existing Assessments of the Economic Costs Estimated to Be Incurred by the Federal Government as a Result of Climate Change Show That Costs Are Significant

The *Fifth National Climate Assessment* and the OMB *Analytical Perspectives* volume of the President’s Budget indicate that the estimated economic costs expected to be incurred by the federal government as a result of climate change are significant.⁵⁸

Fifth National Climate Assessment Economics Chapter

The *Fifth National Climate Assessment* reported that climate change can have direct impacts on the economy and indirect impacts on the federal budget in different ways.⁵⁹ Specifically, tax revenues may fall due to decreased real estate values, household income, and business revenues. Expenditures on infrastructure, disaster relief, health care, and public insurance are expected to increase. For example, extreme climate change events or hazards, such as sea level rise, wildfires, and hurricanes, are projected to decrease household incomes, which, in turn, will reduce government tax revenues (see fig. 6).

Figure 6: Fiscal Risks of Climate Change



Sources: Modified from the U.S. Global Change Research Program, *Fifth National Climate Assessment*; GAO (icons). | GAO-24-106937

The economics chapter of the *Fifth National Climate Assessment* synthesized available literature regarding federal fiscal exposure from climate change in selected sectors and found that the economic costs and benefits of climate change vary depending on the sector of interest and the climate hazard.⁶⁰ Specifically, to estimate certain costs of climate change on the federal government, the literature discussed in this chapter examined crop insurance payouts and social safety net transfers (see table 1).

⁵⁸The sources we reviewed for this report did not quantify any net economic benefits to the federal government as a result of climate change. There are potential benefits as a result of climate change; however, the net costs are likely to outweigh these benefits over the course of this century.

⁵⁹U.S. Global Change Research Program, *Fifth National Climate Assessment, Economics*.

⁶⁰U.S. Global Change Research Program, *Fifth National Climate Assessment, Economics*.

Table 1. Sample Current Impact Estimates of Climate Hazards on U.S. Economic Outcomes for the Federal Government

Impact type	Climate hazard	Economic estimate
Crop insurance payouts	Temperature increases	+19% of federally subsidized payouts
Social safety net transfers	Hurricane	+\$975–\$1,440 per capita

Source: GAO presentation of information in table 19.1 a, U.S. Global Change Research Program, *Fifth National Climate Assessment*. | GAO-24-106937

Note: Table 1 displays information from [table 19.1 a](#) in the economics chapter of the *Fifth National Climate Assessment* that is specific to the federal government. This table shows observed impacts of a sample of climate events and changes to economic outcomes in the U.S., as they are estimated in the context of a particular study. Each study examined a subset of climate drivers, and estimates are illustrative, not comprehensive. All economic impacts are provided in 2022 dollars.

The literature discussed in the economics chapter also identified future federal fiscal exposure from climate change and cited specific areas of exposure, including federal payouts for disaster relief, national flood insurance, and public services (see table 2).

Table 2. Sample Future Impact Estimates of Projected Climate Hazards on U.S. Economic Outcomes for the Federal Government

Impact type	Climate hazard	Economic estimate
Federal disaster response	Hurricanes	<ul style="list-style-type: none"> • +\$5.2 billion* (2050 annual expenditures) • +\$36 billion** (2050 annual expenditures)
National Flood Insurance Program	Flooding	<ul style="list-style-type: none"> • +\$3.9 billion annual losses (2050)* • +\$5.1 billion annual losses (2100)*
Public services	Temperature increases	+1.45% costs (2050)**

Legend: * = an intermediate scenario (e.g., Representative Concentration Pathway (RCP) 4.5).

** = a very high scenario (e.g., RCP 8.5). RCPs portray possible future greenhouse gas and aerosol emissions scenarios. RCP scenarios do not represent specific policies or economic futures but rather are defined by emissions scenarios up to 2100.

Source: GAO presentation of information in table 19.1 b, U.S. Global Change Research Program, *Fifth National Climate Assessment*. | GAO-24-106937

Note: Table 2 displays information from [table 19.1 b](#) in the economics chapter of the *Fifth National Climate Assessment* that is specific to the federal government. This table shows projected future impacts of a sample of climate events and changes on economic outcomes in the U.S., as they are estimated in the context of a particular study. Each study examines a subset of climate drivers and estimates are illustrative, not comprehensive. All impacts are provided in 2022 dollars.

OMB’s Analytical Perspectives Volume of the President’s Budget

For fiscal years 2023 and 2024, the *Analytical Perspectives* volume of the President’s Budget reported climate-related financial risks to the federal government in six sectors—coastal disaster relief, crop insurance, flood insurance, flood risk at federal facilities, health care expenditures, and wildland fire suppression—and included a few illustrative examples of additional sectors.⁶¹ According to the fiscal year 2024 *Analytical Perspectives* volume of the President’s Budget, the federal government could spend between an additional \$26 billion to \$134 billion annually (in 2021 dollars) through the late century due to costs from four of these sectors with climate-related financial risks—crop insurance, coastal disaster relief, health care expenditures, and wildland fire suppression spending—and considering only a limited scope of total potential costs to those programs (see table 3).⁶²

⁶¹See OMB, *Analytical Perspectives: Budget of the U.S. Government Fiscal Year 2023, Chapter 21: Federal Budget Exposure to Climate Risk*; and *Analytical Perspectives: Budget of the U.S. Government Fiscal Year 2024, Chapter 10: Budget Exposure to Increased Costs and Lost Revenue Due to Climate Change*.

⁶²All dollar estimates provided in the fiscal year 2023 *Analytical Perspectives* (published in March 2022) are presented in 2020 dollars. All dollar estimates provided in the fiscal year 2024 *Analytical Perspectives* (published in March 2023) are presented in 2021 dollars.

Table 3. Summary of Quantified Federal Climate-Related Risk Exposure Projected Change in Annual Expenditures

Dollars in billions of 2021

na	Midcentury ^a projected change in annual expenditure	Midcentury ^a projected change in annual expenditure	Late-century projected change in annual expenditure	Late-century projected change in annual expenditure
Assessment topic	Central measure ^b	Range: Low-high ^c	Central measure	Range: Low-high
Crop insurance ^d	N/A	N/A	1.3	0.3 – 2.2
Coastal disasters	15.3	4.6 – 34.0	51.8	22.9 – 98.5
Health care	1.0	0.2 – 1.9	11.9	0.9 – 22.9
Wildland fire suppression	1.7	0.9 – 2.4	3.9	1.6 – 10.0
Total for assessments	18.0	5.7 – 38.3	68.8	25.7 – 133.6

Legend: N/A = Not Available.

Source: GAO presentation of the Office of Management and Budget, *Analytical Perspectives: Budget of the U.S. Government Fiscal Year 2024*. | GAO-24-106937

Multiple sectors and areas of climate-related financial risk for the federal government are not included due to the nascent ability to quantify future fiscal exposures in this field.

^aMidcentury (2050 period) estimates may capture less than half of the full cost increase due to unmitigated climate change, while late-century (2100 period) estimates likely capture the vast majority of the increase.

^bThe median of all wildland fire suppression simulations is used in the “Central measure” column, so outliers in the “higher” scenario are not overemphasized in the results. All other topics use the mean as the central measure.

^c“Lower” estimates are largely based on assessments assuming Representative Concentration Pathway (RCP) 4.5, which the Fourth National Climate Assessment framed in 2018 as a “lower” scenario with less warming—generally associated with lower population growth, more technological innovation, and lower carbon intensity. “Higher” estimates are largely based on assessments assuming RCP 8.5, which the Fourth National Climate Assessment frames as a “higher” scenario—generally associated with higher population growth, less technological innovation, and higher carbon intensity.

^dThe crop insurance analysis was only conducted for late century.

The fiscal year 2023 *Analytical Perspectives* volume of the President’s Budget included information on federal costs from two of these sectors with climate-related financial risks—losses to the National Flood Insurance Program (NFIP) and the flood risks to federal facilities.⁶³ For the NFIP, the baseline scenario of \$3.3 billion (in 2020 dollars) could be subject to increased average annual losses as a result of climate change.⁶⁴ Specifically, under a lower climate scenario, this average annual loss increases to \$3.5 billion by 2050 and \$4.6 billion by 2100 (in 2020 dollars). Under a higher climate scenario, the average annual loss is projected to be \$3.7 billion by 2050 and \$6.1 billion by 2100 (in 2020 dollars). Additionally, the 2023 *Analytical Perspectives* volume of the President’s Budget reported that by 2100, under a higher climate scenario, losses of \$16.9 billion (in 2020 dollars) could be realized by a 5 percent annual chance event, and \$26.5 billion could be realized by a 2 percent annual chance event.

⁶³When examining the NFIP, OMB used a baseline scenario, a lower climate scenario, and a higher climate scenario. The baseline scenario is a simulated expected loss in today’s environment. The lower climate scenario assumes an RCP of 4.5, and the higher climate scenario assumes an RCP of 8.5. RCP scenarios do not represent specific policies or economic futures but rather are defined by emissions scenarios up to 2100. The lower and higher scenarios were both projected for 2050 and 2100. See OMB, *White Paper: Climate Risk Exposure: An Assessment of the Federal Government’s Financial Risks to Climate Change* (Washington, D.C.: Apr. 2022).

⁶⁴The NFIP ran simulations to determine typical losses, or average annual loss, as well as 1-in-20 annual loss levels and 1-in-50 annual loss levels. The 1-in-20 and 1-in-50 annual loss levels are annual loss levels at which the yearly losses are larger than precisely 95 percent and 98 percent of loss years. See OMB, *Analytical Perspectives: Budget of the U.S. Government Fiscal Year 2023, Chapter 21: Federal Budget Exposure to Climate Risk*.

The fiscal year 2023 *Analytical Perspectives* volume of the President’s Budget estimated that over 40,000 individual federal buildings and structures are in a current 100-year floodplain (i.e., an area that has an annual 1 percent chance of flooding). The estimated cost to replace these buildings and structures would be \$81 billion (in 2020 dollars). The 2023 *Analytical Perspectives* volume of the President’s Budget also found that about 160,000 individual federal buildings and structures are in a current 500-year floodplain (i.e., an area that has an annual 0.2 percent chance of flooding) and identified the total replacement costs of those structures to be about \$493 billion (in 2020 dollars). The fiscal year 2024 *Analytical Perspectives* volume of the President’s Budget provided additional projections of the replacement costs of 40 percent of federal buildings in floodplains (see table 4).

Table 4. Projected Annual Replacement Value Affected by Flooding

Dollars in millions of 2021

na	100-Year flood event (1% annual chance)	100-Year flood event (1% annual chance)	100-Year flood event (1% annual chance)	500-Year flood event (0.2% annual chance)	500-Year flood event (0.2% annual chance)	500-Year flood event (0.2% annual chance)
Category	Year 2022	Year 2052	Change: 2022 to 2052 ^a	Year 2022	Year 2052	Change: 2022 to 2052
Low	\$84	\$94	\$10	\$23	\$24	\$2
Midpoint	\$171	\$195	\$25	\$46	\$49	\$3
High	\$258	\$297	\$39	\$70	\$74	\$5

Source: GAO presentation of the Office of Management and Budget, *Analytical Perspectives*, Budget of the U.S. Government Fiscal Year 2024. | GAO-24-106937

Note: This analysis provides illustrative examples rather than providing official government estimates. Estimates are explanatory and should not be used for decision-making purposes.

^aDue to rounding, the change from 2022 to 2052 does not equate to the exact difference displayed in the table between year 2022 and year 2052.

The fiscal year 2024 *Analytical Perspectives* volume of the President’s Budget also included test cases for additional areas of climate-related financial risk, including the federal single-family housing portfolio, heating and cooling assistance, and the replacement cost of federal facilities impacted by sea level rise. For example, the 2024 *Analytical Perspectives* volume of the President’s Budget reported that the annual replacement value for federal facilities affected by sea level rise is projected to cost between \$72 million and \$127 million each year for midcentury and between \$449 million and \$1,786 million each year by the end of the century (see table 5).⁶⁵

⁶⁵Data limitations included that the data were not intended to identify site-specific risks and do not consider the value of services provided. The cost illustration also does not count transition costs, which are the costs associated with transitioning to a low-carbon economy.

Table 5. Annual Projected Replacement Value Affected by Sea Level Rise

Dollars in millions of 2021

Scenario	Year	Projected estimated replacement value
Intermediate	2050	\$72
Intermediate	2100	\$449
Intermediate-high	2050	\$127
Intermediate-high	2100	\$1,786

Source: GAO presentation of the Office of Management and Budget, *Analytical Perspectives*, Budget of the U.S. Government Fiscal Year 2024. | GAO-24-106937

Note: The analysis displayed in table 5 provides illustrative examples rather than official government estimates. The estimates have immense uncertainty due to limitations of the climate financial risk models—hence the projections are explanatory and not for decision-making. They are a gross underestimate of the costs. Estimated replacement values affected by sea level rise do not constitute a financial loss to the federal government.

Intermediate and intermediate-high scenarios project sea level rise by the end of the century—depending on future emissions and other factors—to be between 3.3 feet (intermediate) and 4.9 feet (intermediate-high) of sea level rise by 2100. However, sea levels may exceed these ranges, according to recent research about how potential Antarctic ice melt might contribute to sea level rise.

The fiscal year 2025 *Analytical Perspectives* volume of the President’s Budget included assessments of climate-related financial risks to certain agency programs related to livestock foraging and wildland fire suppression. The *Analytical Perspectives* volume of the President’s Budget also provided information about forthcoming analyses and agency efforts to address federal fiscal exposure to climate risks. For example, the 2025 *Analytical Perspectives* volume of the President’s Budget included an analysis of wildland fire suppression that showed the annual costs will increase substantially by mid and late century. Specifically, the U.S. Department of Agriculture’s (USDA) Forest Service projected that combined federal spending for fire suppression efforts by the Forest Service and the U.S. Department of the Interior will increase from a historical average of \$3.35 billion annually to \$4.69 billion per year (in 2021 dollars) by the midcentury and \$5.9 billion per year by late century.⁶⁶

Economics Information Provides Useful Insights for Federal Climate Resilience Decision-Makers

As we reported in 2017, existing information on the potential economic effects of climate change has inherent uncertainties but provides a first step toward effective climate risk management at the federal level.⁶⁷ This conclusion still holds. Along with other available information about current and future climate risks, available economic information could help inform federal decision-makers about climate risks in different sectors and identify areas of high fiscal exposure for future climate resilience investment.

In December 2023, CEA, OMB, and the Department of the Treasury highlighted the importance of improving climate economics information, given the potential effects on the national budget.⁶⁸ For example, the memorandum identified opportunities to improve existing tools, such as modifying those tools to better support near-term policymaking and help establish climate-related economic priorities over the coming decades. In

⁶⁶OMB, *Analytical Perspectives: Budget of the U.S. Government Fiscal Year 2025, Chapter 11: Analysis of Federal Climate Financial Risk Exposure*.

⁶⁷GAO-17-720.

⁶⁸CEA, OMB, U.S. Department of the Treasury, *Memorandum, Tools to support the management of near-term macroeconomic and financial risks* (Washington, D.C.: Dec. 22, 2023).

addition, all experts and CEA officials agreed that information on the economic costs and benefits of climate change to the federal government could help determine where the federal government should spend money on climate resilience. While some experts and CEA officials said assessments using economy-wide or GDP-level information on the effects of climate change are useful for determining how the federal government should invest in climate resilience, some of these experts also said more specific information would be useful. For example, one expert said researchers need to sharpen the scale of their modeling to assess more specialized or specific impacts, including local or state-level information, to prioritize climate resilience investments.

The fiscal year 2024 *Analytical Perspectives* volume of the President's Budget reported that it is critical to establish a consistent framework for evaluating climate-related financial risks.⁶⁹ This includes economics information to effectively determine the costs and benefits incurred by the federal government resulting from climate change, a common structure, and a similar set of assumptions that must be applied over time and across sectors. Specifically, in future years, the federal government will need a consistent and repeatable methodology to enable year-over-year comparisons, inform action to reduce climate-related financial risk to the federal budget, and improve understanding of the effect of actions agencies are taking to reduce these risks. Additionally, the fiscal year 2025 *Analytical Perspectives* volume of the President's Budget outlined new analytical capabilities across the federal government to help identify and manage climate risks.⁷⁰ For example, new analytical tools were published along with the *Fifth National Climate Assessment*—specifically, the NCA Interactive Atlas and new updates to the Climate Mapping for Resilience and Adaptation portal.⁷¹

⁶⁹OMB, *Analytical Perspectives: Budget of the U.S. Government Fiscal Year 2024, Chapter 10: Budget Exposure to Increased Costs and Lost Revenue Due to Climate Change*.

⁷⁰OMB, *Analytical Perspectives: Budget of the U.S. Government Fiscal Year 2025, Chapter 11: Analysis of Federal Climate Financial Risk Exposure*.

⁷¹See *Fifth National Climate Assessment*, "NCA Interactive Atlas," accessed June 14, 2024 and USGCRP, "Climate Mapping for Resilience and Adaptation portal," accessed June 14, 2024.

The Federal Government Has Little Current Capacity to Acquire Economic Data on Federal Climate-Related Financial Risks to Inform Climate Resilience Investments

As already noted, limited information exists on the economic costs and benefits estimated to be incurred by the federal government as a result of climate change. Nevertheless, federal agencies are directed to report on climate-related financial risks in executive orders and other guidance.⁷² Agencies are just beginning to implement these directives and report limited and inconsistent information. However, the federal government has little current capacity to address these limitations and meet their needs to acquire economic data to inform climate resilience investments.⁷³

Federal Agencies Are Directed to Annually Report on Climate-Related Financial Risks

Federal agencies have been directed by executive orders to consider, plan for, implement, and report climate resilience activities; develop agency adaptation plans; and report on climate-related financial risks. For example, the May 2021 Executive Order, 14030, *Climate-Related Financial Risk*, directs federal agencies to report their climate-related financial risks related to their procurement processes as part of their climate action plans required by the January 2021 Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad*. Executive Order 14030 also directed OMB to identify primary sources of federal climate-related financial risk exposure and develop methodologies to quantify and assess climate risk within the economic assumptions and long-term budget projections of the President's annual budget. Executive Order 14030 directs OMB to consult with federal agencies to conduct annual assessments of climate risk exposure. OMB staff said they also build capacity within the government to design and conduct assessments of federal climate-related fiscal exposure.

Executive branch agencies are also required to publish audited financial statements annually.⁷⁴ According to OMB staff, these statements are included in agency financial reports or performance and accountability reports. OMB guidance, Circular A-136, *Financial Reporting Requirements*, covers the form and content of agency financial reports, consistent with federal accounting standards and applicable law.⁷⁵ Agency financial statements are produced in accordance with generally accepted accounting principles. FASAB is responsible for issuing financial accounting standards for federal reporting entities.

In response to Executive Order 14030, in August 2021, OMB Circular A-136 encouraged, but did not require, entities to provide a summary of actions taken or planned in order to assess, measure, and mitigate risks related to climate change for fiscal year 2021 in the unaudited Management's Discussion and Analyst (MD&A)

⁷²Executive Order 14030 stated that climate-related financial risk, including both physical and transition risks, are risks to the financial stability of the federal government and the stability of the U.S. financial system. GAO uses similar terminology—climate-related fiscal exposures—to mean responsibilities, programs, and activities that may legally commit or create the expectation for future federal spending based on current policy. See [GAO-16-454](#).

⁷³GAO defines capacity as skilled staff, adequate funding, internal controls, technology, and management and organization infrastructure. See [GAO-23-106203](#).

⁷⁴31 U.S.C. § 3515(a).

⁷⁵OMB, [Circular A-136 Revised](#) (Washington, D.C.: May 30, 2024).

section of the annual financial reports.⁷⁶ Beginning with the June 2022 update, Circular A-136 requires certain reporting entities to summarize, in their unaudited MD&A section, any efforts taken or planned to assess, measure, and mitigate any significant climate-related risks that could affect the entity's performance, financial position, or financial condition.⁷⁷ The risks include risks to assets (such as property, plants, and equipment and loan portfolios), liabilities (including loan guarantee liabilities), contingent liabilities, and program costs. Climate-related information in the MD&A should be consistent with any other climate-related information reported by the entity. Since fiscal year 2022, OMB Circular A-136 also requires certain reporting entities to include, in the unaudited other information (or MD&A beginning in fiscal year 2023) sections, hyperlinks to their annual progress reports on climate adaptation activities and other similar reports.

As a part of certain agencies' unaudited other information or MD&A, since fiscal year 2022, OMB Circular A-136 encourages (i.e., optional at management's discretion) such agencies to report budget-related authority or outlays, and the following four types of information regarding the entity's assessment and management of any significant climate-related risk: (1) summarize the agency's governance around climate-related risk, (2) summarize the actual and potential impacts of climate-related risk on agency operations and strategy, (3) describe how the entity is identifying and assessing climate-related risks and monitoring and managing climate-related risks; and (4) describe the metrics and targets used to assess and manage relevant climate-related risks.

Following research, in August 2021, FASAB placed a two-phased Climate-Related Financial Reporting Project on its technical agenda. In May 2022, phase one was completed, resulting in the issuance of a staff paper that catalogs existing statements of federal financial accounting standards that may be relevant to climate-related financial reporting.⁷⁸ In June 2022, FASAB began work on phase two of the project to develop a climate-related financial reporting framework.

Federal Agencies Report Little and Varied Information on Climate-Related Financial Risks

Federal agencies are directed by Executive Order 14030 and OMB Circular A-136 to report on climate-related financial risk. However, we found that federal agencies report little and varied information on climate-related financial risk. As we discussed above, this is in part because there is limited information available on climate-related financial risks to the federal government for agencies to use in their reporting. Existing assessments, including the *Analytical Perspectives* volume of the President's Budget, contain some government-wide information on climate-related financial risk to inform the federal budget process at a high level.

In addition, some agency-specific information on climate-related financial risk is included in annual financial reports. For example, we reviewed federal agency financial reports from fiscal year 2022 to determine what information agencies reported based on optional and required climate-related reporting described in OMB

⁷⁶OMB, [Circular A-136](#) (Washington D.C.: Aug. 10, 2021).

⁷⁷OMB, [Circular A-136 Revised](#) (Washington D.C.: June 3, 2022). Such MD&A reporting was encouraged for FY 2021.

⁷⁸This staff paper is not an authoritative pronouncement and does not change or modify current FASAB guidance. See FASAB, "[Climate-Related Financial Reporting](#)," accessed May 28, 2024.

Circular A-136. We found that climate-related financial information varied across agencies and was limited.⁷⁹ We found similar results when reviewing fiscal year 2023 agency financial reports.

We found that agencies reported little and varied information on areas of climate-related financial risk and potential federal spending needed to address these exposures in their financial reports (see table 6).

Table 6: Examples of Agency Climate-Related Financial Risk in Fiscal Year 2023 Financial Statements

Agency	Areas of climate-related financial risk	Climate-related risk reduction spending
U.S. Department of Defense (DOD)	Climate change has the potential to disrupt operations, pose danger to DOD property and personnel, and necessitate additional funding to support response and recovery efforts.	Climate-related risk reduction spending at DOD includes <ul style="list-style-type: none"> • \$3.7 billion investment for installation resiliency and adaptation focused on military facilities, • \$1.3 billion in science and technology investments, • \$106.2 million in operational energy and buying power, and • \$54.6 million in contingency preparedness.
U.S. Department of Housing and Urban Development (HUD)	Climate change impacts, including the risk of costly new disasters, continue to increase because land use policy is failing to prevent high-risk development in areas such as those with growing flood risk or in the urban-wildland interface. Disasters have shown their potential to reshape housing and employment markets.	Climate-related risk reduction spending at HUD includes over \$837 million in reducing greenhouse gas emissions, improving energy and water efficiency, generating clean energy, and strengthening climate resilience of HUD-assisted properties.
U.S. Department of State	Climate change risks include immediate and long-term impacts of severe weather, worsening air quality, sea level rise and coastal flooding, drought, and other hazards on State supply chains, facilities, and personnel.	Climate-related risk reduction spending at State includes \$36.3 million to reduce exposure to climate-related financial risks in 2022.
U.S. Department of Transportation (DOT)	Climate change affects DOT's infrastructure due to temperature increase, precipitation change, extreme storms, sea level rise, change in snowmelt, ecosystem degradation, and land change.	Climate-related risk reduction spending at DOT includes <ul style="list-style-type: none"> • \$149 thousand for improvements in energy efficiency and the capability of future climate-related risks and • \$70 thousand for tools used to assess exposure to future climate risks.

Source: GAO analysis of agency fiscal year 2023 financial statements. | GAO-24-106937

Note: This table provides illustrative examples, not an all-inclusive list, of agency climate-related financial risk in fiscal year 2023 financial statements.

⁷⁹As discussed above, while OMB Circular A-136 contains certain requirements, the other information discussed in Circular A-136 related to reporting significant climate-related risk in the financial report is optional.

Agencies also reported information on forward-looking climate risks.⁸⁰ Most agencies included a discussion about forward-looking climate-related financial risks in their annual financial reports.⁸¹ For example, the U.S. Department of Veterans Affairs identified specific climate change vulnerabilities, including threats to facilities and infrastructure and adverse financial impacts from interruption of mission-critical supply chains.⁸² The agency also identified adaptation actions (i.e., implementing changes to building design and climate resilience standards and updating sustainable building requirements) to reduce its climate change vulnerability. In addition, the U.S. Social Security Administration identified priority areas of adaptation to prepare for increased flooding in coastal and noncoastal allocations, and disruptions and damage to transportation infrastructure.⁸³

We also reviewed fiscal year 2024 budget requests from the U.S. Department of Commerce, DOD, U.S. Department of Homeland Security, and U.S. Department of Transportation for information on federal fiscal exposure from climate change. These four agencies published information on their budgetary needs for mission-related climate activities but minimal information on budgetary needs to address climate-related financial risks to their agency. For example, DOD reported that it needed \$5.1 billion to enhance combat capability and mitigate climate risk by investing in solutions that are mission essential and provide climate benefits, such as increasing efficiencies to mitigate logistics risk in contested environments, hardening critical infrastructure, and deploying new technologies that strengthen capability.

Similarly, we reported on climate change and extreme weather challenges that DOD faces related to its facilities. For example, in 2020, an Air Force official estimated that rebuilding Tyndall Air Force Base in Florida would cost about \$3.6 billion after the impacts of Hurricane Michael in 2018 (see fig. 7).⁸⁴

⁸⁰We recently reported that selected agencies we reviewed have incorporated climate vulnerabilities as one factor, among many, into their existing processes for managing real property assets. The agencies typically ranked potential investments in real property assets based on these factors. See GAO, *Federal Real Property: Efforts to Incorporate Climate Vulnerabilities and Environmental Justice into Asset Management*, [GAO-24-106420](#) (Washington, D.C.: June 26, 2024).

⁸¹To characterize the number of annual financial statements with the information identified, we defined following modifiers: “most” represents 13 to 24 agencies, and “some” represents two to 12 agencies.

⁸²U.S. Department of Veteran’s Affairs, *Fiscal Year 2023 Agency Financial Report* (Washington, D.C.: Nov. 15, 2023).

⁸³U.S. Social Security Administration, *Agency Financial Report Fiscal Year 2023* (Washington, D.C.: Nov. 14, 2023).

⁸⁴See GAO, *National Security Snapshot: Climate Change Risks to National Security*, [GAO-22-105830](#) (Washington, D.C.: Sept. 13, 2022).

Figure 7: Hurricane Michael Damage at Tyndall Air Force Base in 2018



Source: U.S. Department of Defense/U.S. Air Force Staff Sgt. R. Conroy (photo). | GAO-24-106937

Agencies Report That the Federal Government Has Little Current Capacity to Improve Its Reporting of Climate-Related Financial Risks

We have reported that consistent climate economics information could help the federal government prioritize climate resilience investments. However, the federal government has little current capacity to use economic data to improve its reporting of climate-related financial risks.⁸⁵ In December 2023, CEA, OMB, and Treasury published a memorandum in which they stated that federal, state, and local capacity to mitigate climate risks is limited by agencies' inability to quantify climate-related financial risks.⁸⁶ The memorandum stated that existing modeling tools were not designed to support near-term decisions on adaptation policy or to support climate-related economic and social priorities in the coming decades.

CEA officials we interviewed said there is little current capacity and coordination between existing federal entities to develop economic assessments of the costs and benefits of climate change to the federal government. CEA officials also said the U.S. needs additional data and tools to assess the economic cost of climate change and to prioritize climate resilience investments. One expert we interviewed said that federal agencies are doing the heavy lifting on modeling their exposure to climate change, but they do not have additional funding or time to conduct such modeling or prioritize it over other activities. For example, EPA officials said the U.S. is missing a set of consistent, ongoing methods for evaluating the economic costs and benefits of adaptation efforts. In addition, OMB staff said they do not have capacity—in terms of extra staff—to help develop guidance for agencies to report their climate-related financial risks.

An Effective Organizational Arrangement to Prioritize Climate Resilience Investments Requires Five Key Elements Implemented Together and Congressional Action

According to past GAO work and experts we interviewed, Congress and federal agencies can enhance climate resilience by developing an organizational arrangement with five key elements to periodically identify and prioritize climate resilience projects for federal investment.⁸⁷ These elements include (1) a national climate resilience strategic plan, (2) a national climate information system, (3) expanding the use of climate economics information, (4) a consistent approach for prioritizing federal climate resilience investments, and (5) a community-driven climate migration pilot program.⁸⁸ The five key elements are interdependent and would be

⁸⁵See GAO, *Climate Change: Summary of GAO's Work on Federal Climate Resilience Projects*, [GAO-23-106362](#) (Washington, D.C.: June 20, 2023). The fiscal year 2025 *Analytical Perspectives* included examples of investments to grow the government's capacity to assess climate risks and project their fiscal impacts. See OMB, *Analytical Perspectives: Budget of the U.S. Government Fiscal Year 2025, Chapter 11: Analysis of Federal Climate Financial Risk Exposure*.

⁸⁶See CEA, OMB, *Treasury, Memorandum, Tools to Support the Management of Near-term Macroeconomic and Financial Risks*.

⁸⁷To characterize the number of experts, we defined the following modifiers: "all" represents all 13 experts, "most" represents seven to 12 experts, and "some" represents two to six experts.

⁸⁸According to OSTP officials, the need for climate information is not limited to informing decisions related to climate resilience. They said a comprehensive, integrated climate information system is needed to inform all decisions (including resilience) across the Nation.

most effective if implemented together in an organizational arrangement with direction from Congress, according to experts we interviewed.⁸⁹

⁸⁹We asked experts if any other elements should be included as part of an organizational arrangement to prioritize climate resilience investments. Experts identified potential refinements to the elements we identified but did not identify any new elements. OSTP officials said that a national climate information system would be necessary to enable any of the four other elements of an organizational arrangement for climate resilience.

An Organizational Arrangement to Prioritize Climate Resilience Investments Would Be Most Effective with the Five Key Elements Implemented Together with Congressional Direction

Congress has an opportunity to develop an effective organizational arrangement to prioritize climate resilience investments with the five key elements identified in GAO's work and validated by our interviews with experts. Over time, we have observed variable progress and prioritization of each element individually, and collectively, as an organizational arrangement. EOP and individual agencies periodically make progress on recommendations summarized in our *Limiting the Federal Government's Fiscal Exposure by Better Managing Climate Change Risks* high-risk area, but then priorities change, and progress is halted or reversed.

In the past few years, EOP has acted to better plan for climate resilience projects, but current policies and existing programs are generally designed for purposes other than climate resilience.⁹⁰

When discussing implementation challenges for the five elements of an organizational arrangement to prioritize climate resilience investments, some experts said actions and priorities to increase national climate resilience have not been consistent across administrations. For example, one expert we interviewed said the federal government works in 4-year cycles based on the presidential administration, and an administration might not have time to both create and implement a climate resilience plan. Another expert said that legal frameworks needed to implement these elements do not currently exist, and without a clear directive from Congress, climate resilience investments and efforts will continue to be fragmented.

Agencies also identified implementation challenges. For example, OSTP officials said that a major challenge is that a federal climate resilience plan would not truly be a national plan. Specifically, they said that while federal agencies provide key leadership, funding, information, and support for climate resilience action, others often implement these actions, which requires tailoring for local decision-makers and working with other organizations. In addition, OSTP officials and OMB staff said they lack capacity in terms of available staff to work on developing information and guidance on climate-related fiscal exposure.

Congressional action could ensure consistent and complementary policies and procedures across relevant federal funding mechanisms and engage nongovernment partners in limiting fiscal exposure, as called for in the integration principle of our *Disaster Resilience Framework*.⁹¹ Specifically, bringing together the disparate missions and resources of federal agencies can help to build national climate resilience. A coherent federal organizational arrangement could facilitate coordination across programs and the combination of federal funding streams.

All 13 experts generally agreed that congressional action is needed to establish authority or funding for an organizational arrangement to prioritize federal climate resilience investments and limit federal fiscal exposure. Most experts agreed that an organizational arrangement to prioritize climate resilience investments would be most effective if all five elements are implemented together. For example, one expert said all five elements need to be developed to create a durable approach for prioritizing climate resilient investments. In addition,

⁹⁰[GAO-23-106203](#).

⁹¹[GAO-20-100SP](#).

another expert said all five elements must work together in an organizational arrangement and there should be a central hub for these efforts, rather than the efforts existing separately across the federal government. Finally, one expert said that while each element requires different types of information, the elements must work together ultimately to be effective. For example, the expert said that the federal government may be able to develop a community-driven pilot program without the other elements, but this program would need to follow criteria set by a national climate resilience strategic plan to be implemented.

EOP officials were generally supportive of the concept of a larger organizational arrangement to prioritize climate resilience investments. For example, OMB staff said that designating a federal entity to develop and support agency use of climate economics information would be a helpful new capability within the federal government. USGCRP officials expressed an interest in the establishment of a comprehensive national climate information system.

A federal organizational arrangement would be better positioned to invest in federal climate resilience projects with the highest priorities if it had all five elements working together as a system. Such an organizational arrangement would help limit federal fiscal exposure by prioritizing and directing climate resilience investments toward the areas of greatest risk. Until Congress acts to establish these five key elements and the overarching organizational arrangement, climate resilience efforts may vary significantly and lack coherence to maximize impact over time.

Conclusions

Limiting the federal government's fiscal exposure to climate change risks will present a challenge no matter the outcome of domestic and international efforts to reduce greenhouse gas emissions. This is in part because greenhouse gases already in the atmosphere will continue altering the climate system for many decades, according to the National Academies of Sciences, Engineering, and Medicine and USGCRP. Current economics information, although somewhat limited, indicates that the federal government is likely to incur significant costs from the effects of changes in the climate. The federal government is currently not well-organized to manage this reality.

We identified five key elements of an organizational arrangement to prioritize federal climate resilience investments to reduce potential costs to the federal government from the effects of climate change. These key elements are (1) a national climate resilience strategic plan, (2) a national climate information system, (3) expanding the use of climate economics information, (4) a consistent approach for prioritizing climate resilience investments, and (5) a community-driven climate migration pilot program. We have made recommendations and matters related to these key elements in prior reports. In addition, these elements are interdependent and will require congressional action to authorize and implement.

Matters for Congressional Consideration

We are making the following four Matters for Congressional Consideration:

Congress should consider establishing a federal organizational arrangement to prioritize climate resilience projects for investment. Such an organizational arrangement could be designed for success by authorizing the key elements we identified in this report as a system, including (1) a national climate resilience strategic plan,

(2) a national climate information system, (3) expanding the use of climate economics information, (4) a consistent approach for climate resilience investments, and (5) a community-driven climate migration pilot program. (Matter 1)

Congress should consider designating a federal entity to develop a national climate resilience strategic plan that will guide the nation's efforts to adapt to a changing climate. The plan should, among other things, (1) define federal priorities related to adaptation and climate resilience; (2) clarify roles, responsibilities, and working relationships among federal, tribal, state, territorial, and local governments; (3) identify mechanisms to increase the capacity of federal, tribal, state, territorial, and local agencies to incorporate information about current and potential climate change impacts into government decision-making; (4) address how resources will be made available to implement the plan; and (5) build on and integrate ongoing federal planning efforts related to adaptation and climate resilience. (Matter 2)

Congress should consider establishing and maintaining a national climate information system that is periodically updated to help federal, tribal, state, territorial, local, and private sector decision-makers access and use the best available climate information. (Matter 3)

Congress should consider designating a federal entity to develop and support agency use of information on the potential economic costs of climate change to the federal government and craft appropriate responses. (Matter 4)

Agency Comments

We provided a draft of this report to CEQ, OMB, and OSTP for review and comment. CEQ, OMB, and OSTP provided technical comments, which we incorporated as appropriate.

As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies to appropriate congressional committees, the Chair of the Council on Environmental Quality, the Director of the Office of Management and Budget, the Director of the Office of Science and Technology Policy, and other interested parties. In addition, the report will be available at no charge on the GAO website at <https://www.gao.gov>.

If you or your staff members have any questions about this report, 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 report. GAO staff members who made major contributions to this report are listed in appendix II.

A handwritten signature in black ink that reads "Alfredo Gómez". The signature is written in a cursive style with a large, stylized initial "A" and "G".

J. Alfredo Gómez
Director, Natural Resources and Environment

Appendix I: Objectives, Scope, and Methodology

This report examines (1) what information is available regarding the projected economic costs and benefits estimated to be incurred by the federal government as a result of climate change and what limitations exist with such information, (2) to what extent has the federal government developed the capacity to acquire economic data to help understand federal climate-related financial risks and applied this information to climate resilience investments, and (3) what key elements should be included in a federal organizational arrangement to identify and prioritize climate resilience projects for federal investments.

Describing Information on Projected Federal Economic Effects from Climate Change

To examine available information on the projected economic costs and benefits estimated to be incurred by the federal government as a result of climate change and determine any existing limitations, we conducted a preliminary background search and a literature search and review, identified experts, and interviewed experts and agency officials.

Review preliminary background research and relevant literature. First, to conduct a preliminary background search, we searched the Congressional Research Service’s report database, the Congressional Budget Office’s website, GAO’s product page, and more general internet searches using relevant key words. We also reviewed materials from two workshops held by the National Academies of Sciences, Engineering, and Medicine cross-disciplinary Roundtable on Macroeconomics and Climate-related Risks and Opportunities in 2023. To conduct the literature search, we searched ProQuest and Elsevier’s Scopus databases for sources including peer-reviewed articles, government reports, and nonprofit and think tank publications published in the past 5 years. We searched for the key words “climate change” or “climate resilience” and “federal government” or “federal agency” in close proximity to key words including “fiscal exposure,” “cost and benefit,” and “economic impacts.” The search resulted in about 60 sources, and we identified 37 of those as relevant for our review. We identified sources published since 2017 that met our criteria for relevancy and methodological rigor, including whether the study modeled and quantified the economic impacts of climate change to the federal government. We reviewed these sources to identify quantified impacts of climate change to the federal government and summarized our findings. Additionally, as a part of our background research, we conducted scoping interviews with six knowledgeable stakeholders.

Identify and select experts. Second, we interviewed 10 experts to examine available information on the projected economic costs and benefits of climate change and any existing limitations.¹ To identify potential experts, we compiled an initial list from authors of relevant sources identified in our literature review, those with experience working on climate-related financial risks, experts interviewed in prior GAO work, and

¹We interviewed the following experts for this objective: Gary Yohe (Wesleyan University), Jeremy Martinich (U.S. Environmental Protection Agency), Marcus Sarofim (U.S. Environmental Protection Agency), Zachary Liscow (Yale Law School), James Neumann (Industrial Economics, Incorporated), Frances C. Moore (University of California, Davis), Ed Kearns (First Street), Wendy Edelberg (Brookings Institution), Sarah Kapnick (National Oceanic and Atmospheric Administration), and Solomon Hsiang (Stanford University).

recommendations from experts we interviewed.² We identified 134 potential experts. We selected experts from this list of experts based on three criteria: (1) expertise (e.g., conducting research or holding a professional position) in estimating the economy-wide effects of climate change at a national scale, meaning across U.S. sectors and regions; (2) experience or knowledge of the federal government’s actions related to climate change and climate information, including federal fiscal exposure; and (3) active participation in work on the economic effects of climate change. Based on these criteria, we selected 12 experts, but two declined interviews or did not respond.

Interview experts and agency officials. Third, we conducted semi-structured interviews with these 10 experts using a pretested instrument. We asked experts and agency officials from the Council of Economic Advisers (CEA) about their perspectives on sources of climate-related federal fiscal exposure and the usefulness of information to prioritize climate resilience investments, among other things. These 10 experts are prominent researchers or practitioners in the topic, but their views do not represent the views of all experts on the available information on the projected economic costs and benefits of climate change.

Content analysis and reporting of expert and agency views. Finally, to describe expert views on what information is available regarding the projected economic costs and benefits estimated to be incurred by the federal government as a result of climate change and what limitations exist, we conducted a content analysis. For this content analysis, we synthesized information from the semi-structured interviews with 10 experts and one agency and grouped individual expert insights into overall themes. Multiple analysts reviewed the determination of overall themes. We reported a range of themes mentioned by experts to provide illustrative examples of expert statements, but not every theme was identified. In this section of the report, we use modifiers to characterize the views of the 10 experts, as follows:

- “Some experts” represents two to four experts.
- “Most experts” represents five to nine experts.
- “All experts” represents 10 experts.

Describing the Extent to Which the Federal Government Has Developed Capacity to Acquire and Use Data on Climate-Related Risks

To examine to what extent the federal government has developed capacity to acquire economic data to help understand federal climate-related financial risks and applied this information to climate resilience investments, we reviewed presidential orders, agency guidance, and annual documents. First, we reviewed executive orders and guidance for agencies on reporting climate-related financial risks, including Executive Order 14030 and the Executive Office of the President’s (EOP) Office of Management and Budget (OMB) Circular A-136. We then analyzed how agencies applied optional components of OMB’s guidance to their annual financial reports for

²We considered experts who were presenters at the National Academies of Sciences, Engineering, and Medicine’s Roundtable on Macroeconomics and Climate-related Risks and Opportunities, authors of the economics chapter of the *Fifth National Climate Assessment*, and staff from organizations that collect or publish data on climate-related financial risks identified in internet searches. We also considered experts interviewed in GAO, *Climate Change: Information on Potential Economic Effects Could Help Guide Federal Efforts to Reduce Fiscal Exposure*, [GAO-17-720](#) (Washington, D.C.: Sept. 2017).

fiscal years 2022 and 2023.³ Second, we reviewed four agency budget requests from fiscal year 2024 to identify any available information on climate-related federal fiscal exposure. The team members used judgment to identify agencies likely to include relevant information in their budget requests.⁴ Finally, to better understand this topic and EOP's efforts, we interviewed OMB staff. We also interviewed Federal Accounting Standards Advisory Board staff.

Describing Key Elements of an Organizational Arrangement to Prioritize Climate Resilience Investments

To examine key elements that should be included in a federal organizational arrangement to identify and prioritize climate resilience projects for federal investments, we conducted a preliminary background search and a literature review, identified experts, and interviewed experts and agency officials.

Review preliminary background research and relevant literature. First, to conduct a preliminary background search, we searched the Congressional Research Service's report database, the Congressional Budget Office's website, GAO's product page, and more general internet searches, using relevant key words. To conduct the literature search, we searched ProQuest and Elsevier's Scopus databases for sources including peer-reviewed articles, government reports, and nonprofit and think tank publications published in the past 5 years. We searched for the key words, including "climate impacts" or "government-wide" in close proximity to key words, including "federal organizational arrangement" or "resilience investments." The search resulted in about 65 sources, and we identified 27 of those as relevant for our review. We reviewed these sources to identify experts to interview. Additionally, as a part of our background research, we conducted scoping interviews with five knowledgeable stakeholders.

Identify and select experts. Second, we interviewed 13 experts to examine what key elements should be included in a federal organizational arrangement to identify and prioritize climate resilience projects for federal investments.⁵ To identify potential experts, we compiled an initial list from authors of relevant sources identified in our literature review, those with experience working on climate resilience, and recommendations from experts we interviewed.⁶ We identified 152 potential experts. We applied two criteria to select experts: (1)

³We reviewed annual financial reports for the U.S. Agency for International Development, U.S. Department of Agriculture, U.S. Department of Commerce, U.S. Department of Defense, U.S. Department of Education, U.S. Department of Energy, U.S. Department of Health and Human Services, U.S. Department of Homeland Security, U.S. Department of Housing and Urban Development, U.S. Department of the Interior, U.S. Department of Justice, U.S. Department of Labor, U.S. Department of State, U.S. Department of Transportation, U.S. Department of the Treasury, U.S. Department of Veterans Affairs, U.S. Environmental Protection Agency, U.S. General Services Administration, National Aeronautics and Space Administration, National Science Foundation, U.S. Nuclear Regulatory Commission, U.S. Office of Personnel Management, U.S. Small Business Administration, and the U.S. Social Security Administration.

⁴We reviewed fiscal year 2024 budget request documents for the U.S. Department of Commerce, U.S. Department of Defense, U.S. Department of Homeland Security, and U.S. Department of Transportation.

⁵We interviewed the following experts for this objective: Tom Armstrong (Neptune and Company Inc.), Emily Wasley (Lead Author for the Adaptation and Resilience Chapter of the *Fifth National Climate Assessment*), Christy Goldfuss (Natural Resources Defense Council), Peter Schultz (ICF), Rosina Bierbaum (University of Michigan and University of Maryland), David Hayes (Stanford Law School), Richard Moss (Princeton University), Kathy Jacobs (University of Arizona), Benjamin Preston (RAND Corporation), Kevin Bush (Cadmus Group), Josh Sawislak (Deloitte Consulting LLP), Eric Letvin (Federal Emergency Management Agency), and Samantha Medlock (Federal Emergency Management Agency).

⁶We considered experts who had experience working on climate resilience based on internet searches.

expertise in government-wide climate resilience planning climate investments or projects at the national scale and (2) experience working in federal government on climate resilience at a national scale. From these criteria, we selected 17 experts, but four declined interviews or did not respond.

Interview experts and agency officials. Third, we conducted semi-structured interviews with these 13 experts using a pretested instrument. We asked experts and agency officials from the U.S. Environmental Protection Agency, the Office of Science and Technology Policy, and the U.S. Global Change Research Program about the usefulness and importance of key elements—identified in prior GAO work—in an organizational arrangement to prioritize federal climate resilience investments, among other things. The key elements include (1) a national climate resilience strategic plan, (2) a national climate information system, (3) expanding the use of economics information, (4) a consistent approach for climate resilience investments, and (5) a community-driven climate migration pilot program. These 13 experts are prominent researchers or practitioners on the topic, but their views do not represent the views of all experts on the key elements that should be included in a federal organizational arrangement to identify and prioritize climate resilience projects for federal investments.

Content analysis and reporting of expert and agency views. Finally, to describe expert views on what key elements should be included in a federal organizational arrangement to identify and prioritize climate resilience projects for federal investments, we conducted a content analysis. In this content analysis, we synthesized information from the semi-structured interviews with 13 experts and three agencies and grouped individual expert insights into overall themes. Multiple analysts reviewed the determination of overall themes. We reported a range of themes mentioned by experts to provide illustrative examples of expert statements, but not every theme was identified. In this section of the report, we use modifiers to characterize the views of the 13 experts, as follows:

- “Some experts” represents two to six experts.
- “Most experts” represents seven to 12 experts.
- “All experts” represents 13 experts.

Identifying opportunities using the *Disaster Resilience Framework*. To assess the extent to which each of these elements is important within an organizational arrangement to prioritize climate resilience investments, we compared the five elements with Congress’ and EOP’s efforts using our *Disaster Resilience Framework*.⁷ For each element, EOP effort, and principle and subprinciple included in our analysis, an analyst made a determination about whether each element could enhance climate resilience as part of an organizational arrangement to prioritize climate resilience investments, applying framework questions. A second analyst then reviewed the first analyst’s work to confirm the conclusions drawn. We followed this same procedure to determine whether the elements could together enhance climate resilience as part of an organizational arrangement to prioritize climate resilience investments.

We conducted this performance audit from July 2023 to August 2024 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

⁷GAO, *Disaster Resilience Framework: Principles for Analyzing Federal Efforts to Facilitate and Promote Resilience to Natural Disasters*, [GAO-20-100SP](#) (Washington, D.C.: Oct. 23, 2019).

audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: GAO Contact and Staff Acknowledgments

GAO Contact

J. Alfredo Gómez at (202) 512-3841 or gomezj@gao.gov.

Staff Acknowledgments

In addition to the contact named above, Joseph Thompson (Assistant Director), Zoe Need (Analyst in Charge), Margaret Adams, Jeff Arkin, Claudia Becker, Dominique Belanger, Carolyn Blocker, Colleen Candrl, Lilia Chaidez, John Delicath, Andrew Edkins, Cindy Gilbert, Emily Gupta, Holly Halifax, John Hocker, Adriane Kline, Courtney LaFountain, Micah McMillian, Dan C. Royer, Holly Sasso, Michael Smith, Evonne Tang, and Linda Tsang made key contributions to this report.

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