

U.S. GLOBAL CHANGE RESEARCH PROGRAM (USGCRP)

U.S. Global Change Research Program Funding¹

(Dollars in Millions)

	FY 2022 Actual	Disaster		FY 2023 Estimate Total	FY 2024 Request REVISED
		FY 2023 Estimate Base	Relief Supplemental Base		
BIO	\$162.01	\$211.71	-	\$211.71	\$225.07
CISE	-	-	30.00	30.00	30.00
ENG	-	-	-	-	50.00
GEO Programs	337.60	345.60	10.00	355.60	479.46
GEO: OPP	236.00	197.26		197.26	197.26
MPS	13.44	12.00	-	12.00	14.63
SBE	19.92	20.00	-	20.00	25.14
OISE	11.99	7.50	8.00	15.50	12.50
IA	-	-	2.00	2.00	1.00
Total	\$780.96	\$794.07	\$50.00	\$844.07	\$1,035.06

¹ Funding displayed may have overlap with other topics and programs.

Overview

As indicated in the Fourth National Climate Assessment¹, communities across the country and the world are experiencing the effects of a changing climate, including more frequent and severe flooding, more destructive wildfires, heavier rainfall, and more extreme heat waves. These and other climate changes are increasing the risk of infrastructure failure; disruption to vital public services; threats to ecosystems and species that provide benefits to people; and heat-related illness and death and other health impacts. In the U.S. and worldwide, we have experienced severe disruption to essential systems—including food, water, health, energy, transportation, and natural and managed ecosystems—that help keep people safe and healthy. People who are already vulnerable due to socioeconomic inequality and past and current marginalization are disproportionately harmed by the impacts of climate change and have lower capacity to adapt.^{2,3}

The research needed to inform responses and solutions to these challenges require better understanding of climate and global change risks affecting interconnected natural and human systems, how the behavior of those systems affects risks to society, and the social context and consequences of measures to reduce risks. Enhancing the integration of social and natural sciences in all stages of research, and the use of transdisciplinary approaches to collaborative research, are critical to advancing knowledge and the ability to inform decisions. In addition, it is paramount that participation in global change research be more inclusive and engage with populations, communities, and organizations that face higher risks from climate and global change. USGCRP has fully recognized

¹ <https://nca2018.globalchange.gov/>

² www.ipcc.ch/report/ar6/wg2/

³ <https://nap.nationalacademies.org/catalog/26435/communities-climate-change-and-health-equity-proceedings-of-a-workshop>

this need and has developed a framework in its new Strategic Plan (2022-2031)⁴ to better equip the Nation and the world to respond to change and manage critical risks.

Goals

1. **Advancing Science:** Advance scientific knowledge of interconnected natural and human systems and risks to society from global change;
2. **Engaging the Nation:** Enhance the Nation's ability to understand and respond to global change by expanding participation in the Federal research enterprise;
3. **Informing Decisions:** Provide accessible, usable information to inform decisions on mitigation, adaptation, and resilience; and
4. **Collaborating Internationally:** Build global capacity to respond to global change through international cooperation and collaboration.

NSF investments in global change research span climate science, impacts, adaptation and mitigation strategies, and solutions. As part of NSF's holistic approach to addressing global change, NSF's investments aligned with USGCRP are complemented by investments in research to advance America's clean energy future—from foundational and use-inspired knowledge in physics, chemistry, biology, materials science, and computing to large-scale systems engineering, computation, and advanced cyberinfrastructure. More information on these complementary investments can be found in the Clean Energy Technology narrative in this chapter.

NSF addresses climate and global change issues through investments that advance frontiers of knowledge, provide state-of-the-art instrumentation and facilities, develop new analytical methods, and enable cross-disciplinary collaborations while also cultivating a diverse, highly trained workforce with access to educational resources to develop the next generation of global change researchers. NSF's climate and global change-related programs support the research and related activities to advance fundamental understanding of physical, chemical, biological, and human systems, and the interactions among them. Programs encourage interdisciplinary and integrated approaches to studying Earth system processes and the consequences of change, including how humans respond to changing environments and the impacts on ecosystems and the essential services they provide.

NSF invests in the fundamental research at the heart of global change issues. Long-term, continuous, and consistent observational records are essential for testing hypotheses quantitatively and are thus a cornerstone of global change research. NSF supports a variety of research observing and sensing networks that complement, and are dependent on, the climate monitoring systems maintained by its federal partners. The results of NSF investments have helped communities address challenges associated with resilience, mitigation, adaptation, and other responses to a changing environment.

NSF invests in broadening participation activities including capacity building, research centers, partnerships, and alliances. These investments seek to foster a just, equitable and inclusive research community that reflects the diversity of the U.S, develop a workforce with the skills required to understand how the Earth system can continue to sustain society, and engage with populations, communities, and organizations that are directly affected by global change.

⁴ www.globalchange.gov/browse/reports/us-global-change-research-program-2022%E2%80%932031-strategic-plan

NSF invests in international partnerships to meet global change challenges by supporting research collaborations that foster team science, community-engaged research, and use knowledge-to-action frameworks. These convergent, interdisciplinary research collaborations bring together studies of any number of topics (such as greenhouse gas emissions, atmospheric and oceanic circulation drivers, impacts of natural and built environments, human behavior, and policy constraints) coupled with innovative artificial intelligence and computational and data science solutions, to help assess or mitigate community impacts and/or lead to technology developments.

Past investments have helped inform the National Climate Assessment and several other technical reports mandated by the Global Change Research Act of 1990. Investments have also aided U.S. communities to develop mitigation and adaptation strategies to address both challenges and opportunities derived from a changing environment. The fundamental knowledge gained through NSF disciplinary and cross-cutting programs focusing on the coupled natural-human-built system are critical in developing effective solutions to these challenges and capitalizing on opportunities.

FY 2024 USGCRP Funding

Several investments of note are planned in FY 2024. NSF will expand its activities related to risk and resilience, including new effort to build a comprehensive National Resilience Network which will focus on four key areas:

- improving climate hazard and disaster resilience in communities;
- developing technologies needed to advance resilience research;
- implementing a climate innovation challenge to determine the effectiveness, impact, and unintended consequences on proposed and already initiated climate interventions; and
- supporting research on the human health implications of climate change.

NSF will also initiate activities for new approaches for design in extreme environments to meet the challenges of the changing climate spanning rural and urban communities and natural and built environments, such as:

- sustainable, smart and resilient civil infrastructure and materials for extreme natural hazards and/or needs;
- robotics for extraordinary settings or human-robot interactions;
- agriculture and manufacturing for extreme sustainability; and
- semiconductors, microelectronics, and communications that meet extreme performance requirements.

NSF will continue to explore ways to identify and address barriers to equity and participation in the study of the Earth system. Efforts include enhancing the support of early-career researchers from a variety of institutions as well as ensuring support for postdoctoral fellows from groups underrepresented in global change fields of study. In FY 2024, NSF will start a special initiative to support Climate Equity Fellows. This program will train students and researchers in science important for addressing climate change and to be knowledgeable about the disparate impacts of climate change on disadvantaged or underserved communities and to integrate these perspectives into the design of their research projects.

Investments by Program Component Area (PCA)

USGCRP Funding by Program Component Area

(Dollars in Millions)

	FY 2022 Actual	Disaster Relief		FY 2023 Estimate Total	FY 2024 Request REVISED
		FY 2023 Estimate Base	Supplemental Base		
Multidisciplinary Earth and Human System Understanding	\$405.22	\$438.77	\$28.00	\$466.77	\$576.08
Integrated Observations	281.86	271.97	4.00	275.97	282.07
Integrated Modeling	78.99	71.33	12.00	83.33	116.71
Science of Adaptation and Science to Inform Adaptation Decisions	14.89	12.00	6.00	18.00	45.20
Communication and Education	-	-	-	-	\$15.00
TOTAL	\$780.96	\$794.07	\$50.00	\$844.07	\$1,035.06

Multidisciplinary Earth and Human System Understanding:

NSF investments improve knowledge of the Earth’s past and present climate variability through activities to document and understand climate cycles across the globe, as well as to better understand the natural variability of climate and the processes responsible for global changes using a range of paleoclimate, instrumental data, and modeling approaches. NSF also supports activities that advance our understanding of the complex interactions between, within and among the components of integrated socio-environmental systems, such as improving our understanding of the frequency and intensity of extreme climate events and the impacts of these events on natural and human systems.

Integrated Observations:

NSF supports advanced capabilities to observe the physical, chemical, biological, and human components of the Earth system over multiple space and time scales. Facilities such as the Academic Research Fleet, Ocean Observatories Initiative, and the National Ecological Observatory Network assist the Nation in gaining a fundamental scientific understanding of the Earth and monitor important variations, trends, and feedback processes between natural and human systems.

Integrated Modeling:

NSF will continue to devote significant resources to advancing climate and integrated modeling capabilities. Since there is increasingly deep interplay among observations and modeling at multiple spatial and temporal scales, a high priority will be given to developing more complete representations—models of coupled interactive atmospheric chemistry and processes, ecosystems, biogeochemical cycling, and integrated socio-environmental systems with predictive capabilities at regional and local scales. This will include continued investment in the National Discovery Cloud for Climate.

Science of Adaptation and Science to Inform Adaptation Decisions:

A key focus of the USGCRP is developing better means of assessing and responding to the impacts of global change as well as the vulnerability and resilience of both human and natural systems to those changes, particularly in highly sensitive regions in the Arctic and Antarctic. In addition to supporting research that will inform mitigation and adaptation decisions and extreme design in the age of climate change, NSF will support fundamental research regarding the science of adaptation, defined as the adjustment in natural and/or human systems to a new or changing environment that exploits beneficial opportunities or moderates negative effects.

Communication and Education:

In FY 2024, NSF will initiate a new effort to support Climate Equity Fellows. This program will train students and researchers in science important for addressing climate change and to be knowledgeable about the disparate impacts of climate change on disadvantaged or underserved communities and to integrate these perspectives into the design of their research projects.

