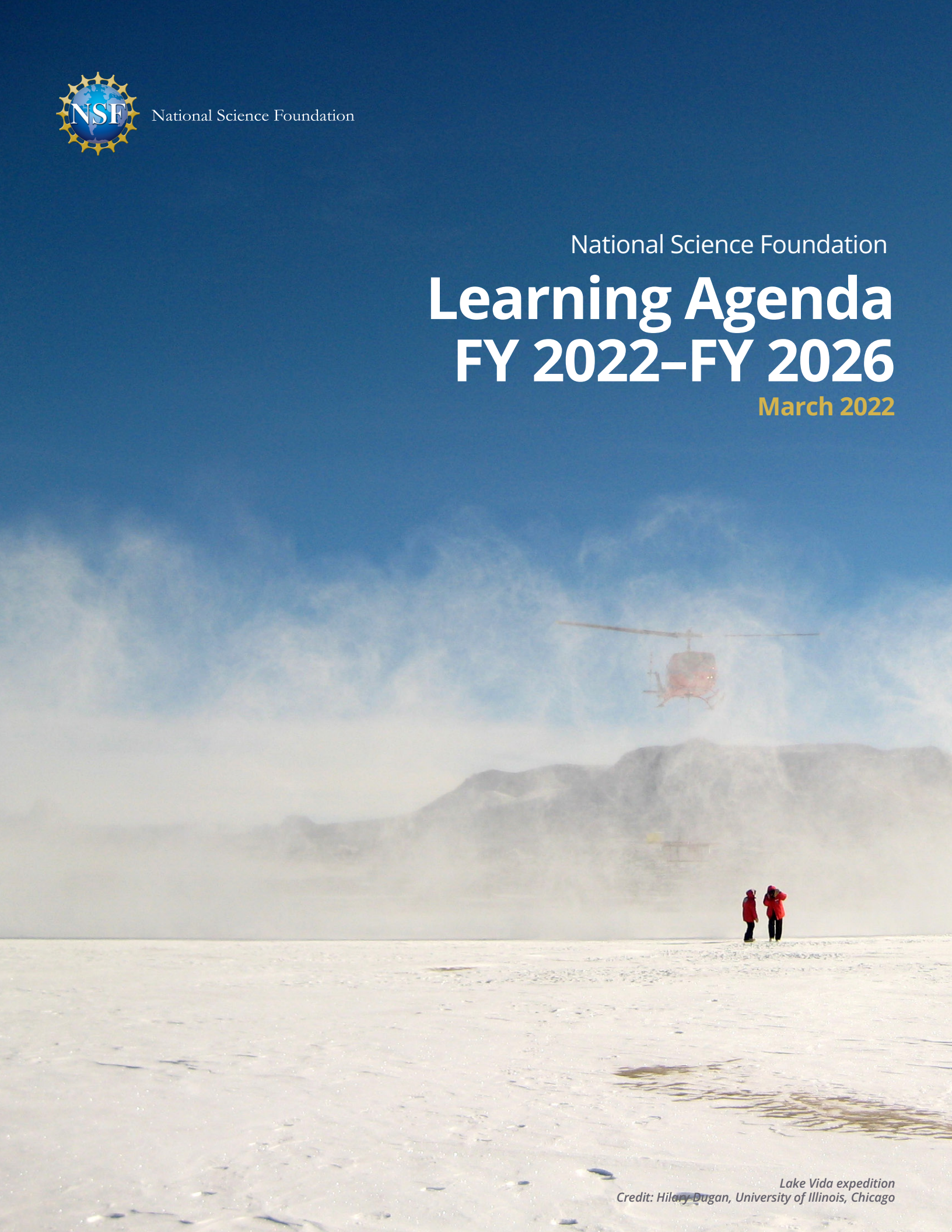
National Science Foundation

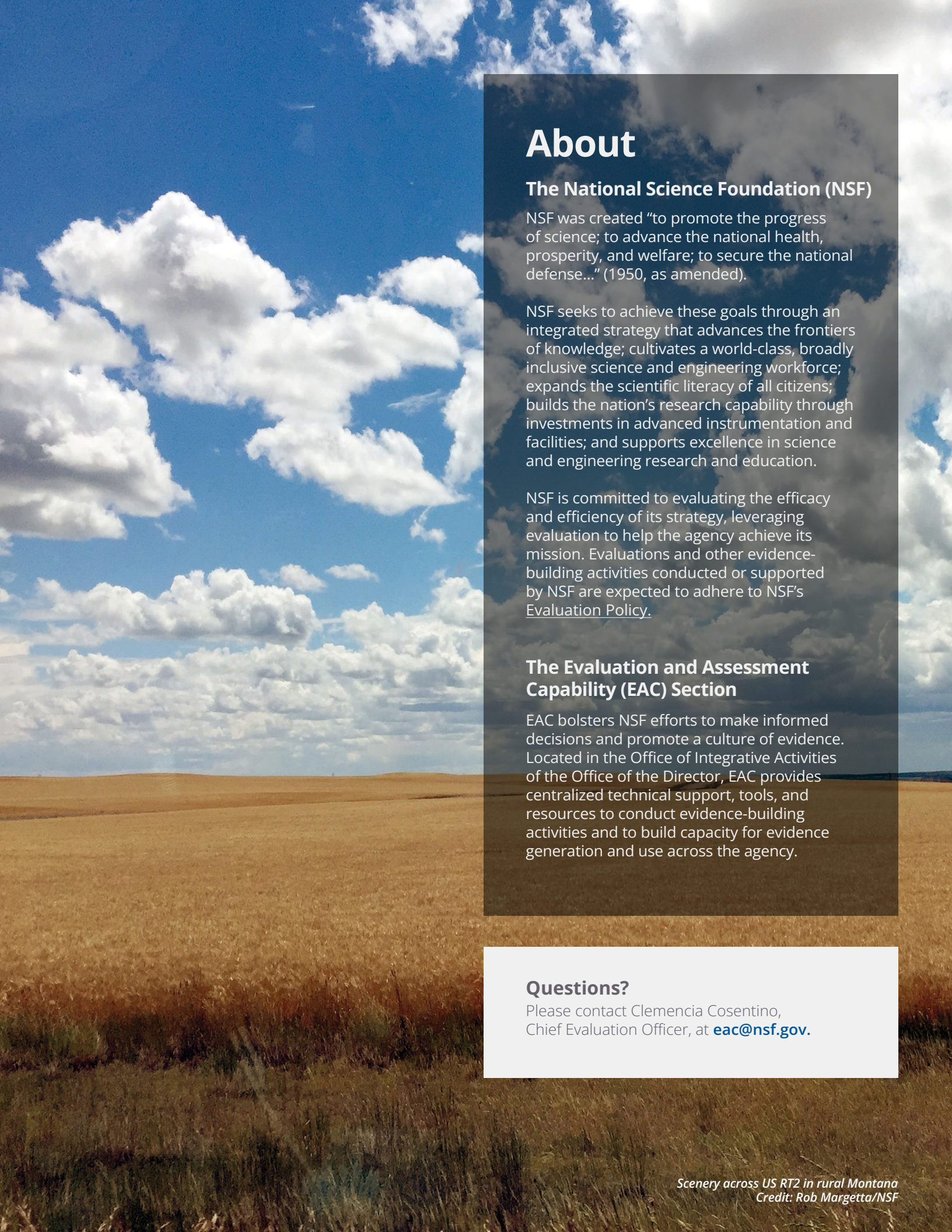
National Science Foundation

Learning Agenda FY 2022–FY 2026

March 2022



Lake Vida expedition
Credit: Hilary Dugan, University of Illinois, Chicago



About

The National Science Foundation (NSF)

NSF was created "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense…" (1950, as amended).

NSF seeks to achieve these goals through an integrated strategy that advances the frontiers of knowledge; cultivates a world-class, broadly inclusive science and engineering workforce; expands the scientific literacy of all citizens; builds the nation's research capability through investments in advanced instrumentation and facilities; and supports excellence in science and engineering research and education.

NSF is committed to evaluating the efficacy and efficiency of its strategy, leveraging evaluation to help the agency achieve its mission. Evaluations and other evidence-building activities conducted or supported by NSF are expected to adhere to NSF's Evaluation Policy.

The Evaluation and Assessment Capability (EAC) Section

EAC bolsters NSF efforts to make informed decisions and promote a culture of evidence. Located in the Office of Integrative Activities of the Office of the Director, EAC provides centralized technical support, tools, and resources to conduct evidence-building activities and to build capacity for evidence generation and use across the agency.

Questions?

Please contact Clemencia Cosentino, Chief Evaluation Officer, at **eac@nsf.gov.**

Scenery across US RT2 in rural Montana
Credit: Rob Margetta/NSF

Canyon along U.S. Route 87 in rural Montana
Credit: Rob Margetta/NSF

Acknowledgments

NSF gratefully acknowledges the contributions of a wide range of stakeholders who were consulted or otherwise participated in the preparation of the agency's Learning Agenda, which also serves as the foundation for NSF's Annual Evaluation Plans.

NSF Leadership and Staff

Leadership and staff from all NSF Directorates and Offices joined brainstorming sessions, helped prioritize learning questions, and drafted/reviewed the plans to answer those questions.

Federal Government Agencies

NSF consulted with other government agencies with similar investment portfolios to assess the merits of the questions, formulate technical approaches to answer the questions, and determine the questions' potential for generating evidence that is useful for other agencies.

Other Stakeholders

NSF consulted with evaluators and researchers across multiple sectors—in academia, private and philanthropic organizations, and state and local government—and solicited input from the public through a request for information published in the Federal Register.

Introduction

The Foundations for Evidence-Based Policymaking Act of 2018, Public Law No. 115-435 (Evidence Act), gave impetus to ongoing federal efforts to use evidence in decision-making. This legislation created an opportunity to focus attention on promoting government effectiveness and efficiency by building and using evidence in the most impactful way. This document presents NSF's Learning Agenda or Evidence-Building Plan for FY 2022–FY 2026 and was developed following guidance provided by the Office of Management and Budget (OMB M-21-27, OMB M-19-23, OMB M-20-12, and OMB Circular No. A-11).

Tutakoke River's edge
Credit: Ryan Choi, Utah State University

Torres del Paine National Park, Chile
Credit: Carlye Calvin: ©University Corporation for Atmospheric Research

Section 1

Overview: Guiding and Priority Questions

NSF expects to pursue several evidence-building efforts over the four years of the next Strategic Plan, FY 2022–FY 2026. These may take many forms—evaluations, performance monitoring, landscaping studies, literature reviews, and so on—and may be conducted or supported by different organizations within the agency.

Guiding Questions

To ensure that evidence-building efforts pursued across the Foundation contribute to agency learning priorities, NSF developed four high-level guiding questions aligned with the four goals in its Strategic Plan. Presented in Section 3, these guiding questions will serve as a North Star for evidence-building activities. They will help ensure that all specific questions (described below) prioritized across NSF Directorates and Offices meet ultimate agency learning goals and, in four years, contribute information needed to develop the next NSF Strategic Plan.

Priority Questions

NSF developed a set of specific questions to answer through studies supported by NSF over the next few years. Some of these questions were included in NSF's Interim Learning Agenda. Agency staff engaged in discussions to develop NSF's Strategic Plan or participated in exercises designed to surface additional useful questions. The priority questions align with Administration priorities, including equity, climate change, and pandemic recovery.

Iceberg in Rosita Harbor, South Georgia Island
Credit: Kelton W. McMahon, Graduate School of Oceanography, University of Rhode Island

Section 2

Selection Criteria

The following are five criteria used to select questions for NSF's Learning Agenda:

(1) fill a knowledge gap—the information sought is not available from existing sources, such as scholarly literature and evaluations supported by other agencies implementing similar efforts

(2) have leadership support—to prioritize the staff time and commit the resources that the work demands

(3) have potential to support upcoming decisions—are likely to yield actionable and useful evidence in a timely fashion

(4) have potential for broad impacts—will likely result in findings that are useful for a broad set of stakeholders, programs, or organizations

(5) are prioritized by NSF leadership—respond to evolving requirements, Congressional mandates, and national and long-term strategic priorities

During NSF's initial phase of Evidence Act implementation, these criteria were assessed as follows:

- Individually, criteria 1-3 are necessary but not sufficient conditions
- Questions meeting criteria 1-4 are likely to be prioritized, absent resource constraints
- Criterion 5 is a sufficient condition to identify a question as significant

These criteria, and their use, may be revised as implementation of the Evidence Act and related legislation matures and as NSF responds to changing priorities and external events, such as those observed in recent years (COVID-19, government shutdowns, and delays in appropriations).

Section 3

Questions at a Glance: FY 2022–FY 2026

This section includes (1) guiding questions that align with each goal in NSF's Strategic Plan, (2) more specific questions prioritized for NSF's Learning Agenda because they contribute information in support of NSF's Strategic Plan goals and objectives, and (3) a mapping of the priority questions to NSF's Strategic Plan and the Administration priorities.

Antarctic Peninsula Paleontology Project
Credit: Joseph Sertich, Denver Museum of Nature and Science

NSF's Strategic Plan provides the foundation for NSF's Learning Agenda

Strategic Goals	Guiding Questions
1 Engage: Empower STEM talent to fully participate in science and engineering	How can NSF help grow STEM talent and opportunities for all Americans most equitably?
2 Discover: Create knowledge about our universe, our world, and ourselves	How can NSF fuel transformative discoveries most effectively?
3 Impact: Benefit society by translating knowledge into solutions	How can NSF mobilize knowledge most effectively to impact society?
4 Excel: Excel at NSF operations and management	How can NSF excel in stewarding and realizing its vision?

Priority questions align with NSF's Strategic Plan

The priority questions below are organized to show how they align with a Strategic Goal's associated Guiding Question, although each priority question contributes to more than one agency goal.

How can NSF grow STEM talent and opportunities for all Americans most equitably?

FY22-1 Missing Millions
How can NSF help increase the participation of underrepresented groups in the STEM workforce?

FY22-2 COVID pandemic
In what ways did the COVID pandemic influence the participation of different groups in the NSF portfolio of programs and activities?

FY22-3 Harassment prevention
How can NSF help reduce and ultimately eliminate harassment in federally funded research settings?

FY22-4 REU-ETAP data system
How could the data system developed for the Research Experiences for Undergraduates (REU) Sites program be leveraged to improve prospective monitoring of characteristics of participants in research experiences supported by other NSF programs and study the impact of research experiences on STEM outcomes, such as educational attainment?

How can NSF fuel transformative discoveries most effectively?

FY22-5 Climate change
What are the characteristics of NSF's portfolio on climate change, and to what extent might this portfolio advance NSF's goals of equity, discovery, and impact?

FY22-6 EPSCoR
How do Established Program to Stimulate Competitive Research (EPSCoR) program funding strategies (infrastructure, co-funding, and outreach) contribute to increasing academic research competitiveness across jurisdictions?

How can NSF mobilize knowledge most effectively to impact society?

FY22-7 Partnership
What are the benefits of receiving an award from a program supported by a partnership? How do these differ from benefits associated with awards from programs not supported by a partnership? What outputs and outcomes are associated with partnership programs? To what extent can these be attributed to the partnership programs? What improvements could make partnership programs more effective or easier to implement?

FY22-8 Convergence Accelerator
8a. What can be learned from the Convergence Accelerator's innovative selection process that may inform improvements in how the agency identifies and selects projects with high potential to advance ideas from concepts to deliverables to industry and other partners?
8b. In what ways does the Convergence Accelerator Innovation Training contribute to the emergence of new capacities among participating researchers to meet pressing societal needs?

How can NSF excel in stewarding and realizing its vision?

FY22-9 Merit Review
What are the characteristics of proposals evaluated through the merit review process? Are these characteristics (of individual investigators, teams, institutions, or proposed projects) associated with different review or funding outcomes?

FY22-10 No deadlines
What outcomes are associated with the adoption of a no-deadlines proposal submission process?

Priority questions support current Administration priorities

	Federal Administration Priorities				
Learning Agenda Priority Questions	Equity	Climate Change	COVID/ Pandemic Recovery	Global Leadership/ Economic Recovery/ Innovation	Trust in Government
FY22-1 Missing Millions	●			●	●
FY22-2 COVID pandemic	●		●	●	
FY22-3 Harassment prevention	●			●	●
FY22-4 REU-ETAP data system	●			●	●
FY22-5 Climate change	●	●	●	●	●
FY22-6 EPSCoR	●			●	
FY22-7 Partnership		●	●	●	
FY22-8 Convergence Accelerator		●	●	●	
FY22-9 Merit Review	●			●	●
FY22-10 No deadlines	●			●	

Section 4
Study Plans

This section includes a brief study plan for each prioritized question. The study plans show the alignment of the questions with NSF's Strategic Plan. They also provide overviews of the background/rationale, timeline, technical approach, data sources, expected challenges and mitigating strategies, and use and dissemination plans. Plans are color coded to align with OMB's typology of evidence-building activities (OMB M-19-23).

Seismic vibration research at the red rock arches of the Colorado Plateau.
Credit: Alison Starr, University of Utah

How can NSF help increase the participation of underrepresented groups in the STEM workforce?

Strategic Goal

Engage: Empower STEM talent to fully participate in science and engineering

Strategic Objectives

Ensure accessibility and inclusivity
Unleash STEM talent for America

Guiding Question

How can NSF help grow STEM talent and opportunities for all Americans most equitably?

Background and Rationale

The National Science Board's (NSB) report, Vision 2030, notes that "women and underrepresented minorities remain inadequately represented in S&E relative to their proportions in the U.S. population." NSF awards more than $1 billion to broadening participation programs each year. These include programs focused on broadening, programs placing an emphasis on broadening participation, and programs that support research that contributes to these efforts by engaging students, post-docs, and early career faculty. Programs also vary in the strategies used to broaden participation—including scholarships, fellowships, mentorships, research experiences, and other interventions targeting individuals, teams, networks, and institutions. NSF has evaluated some of its efforts (examples include the quasi-experimental evaluations of the Louis Stokes Alliances for Minority Participation and the Graduate Research Fellowship Program) and evaluation activities will continue throughout the years of NSF's new Strategic Plan as specific research questions are developed. These questions will guide further studies that contribute useful evidence that helps NSF bolster the efficacy of its initiatives to broaden participation and reduce inequities in how it delivers programs to its communities.

Continued...

Background and Rationale *cont'd*

NSF will pursue a series of studies designed to answer specific research questions, which might include the following: What intersectional groups are extremely underrepresented in STEM, and why? How could NSF leverage tools at its disposal—policies, strategies, programs, and so on—to increase the participation of these (most extremely underrepresented intersectional) groups in the STEM enterprise? What are the characteristics and, among individuals, educational and workforce outcomes of beneficiaries of NSF workforce development programs? What are the impacts of NSF policies and programs on the diversity of the STEM workforce and the participation of the most underrepresented groups? What changes to current NSF policies and programs might further catalyze improvements in the participation of extremely underrepresented groups in the STEM enterprise? What does success look like? Answers to these questions will help NSF identify best practices and align programs and policies toward closing gaps in participation in the STEM enterprise.

Timeline

FY 2022–FY 2026

Technical Approach

Technical approaches will be developed once the results of ongoing studies are available (such as the ongoing evaluations of the ADVANCE program and the Emerging Frontiers in Innovation Research Experience and Mentoring program) and new questions are finalized. NSF might pursue foundational studies (1) to further diagnose the problem of underrepresentation in STEM (and develop targeted interventions) and (2) to understand the characteristics of beneficiaries from NSF's portfolio of investments and (3) determine the success of current NSF strategies and programs in achieving their goals equitably. More specifically, next steps may include the following: (1) an analysis that helps NSF identify extremely underrepresented groups (as characterized by intersectional characteristics, such as disabled women of color) and diagnose barriers to their participation; (2) a systematic review of broadening participation approaches used by NSF or emerging from the scholarly/policy literature to inform decisions regarding the portfolio of strategies that NSF will pursue; (3) a meta-analysis of existing evaluations related to NSF investments in broadening participation to identify the most impactful strategies leading to equitable outcomes and gaps in knowledge; and (4) additional evaluations with well-matched comparison group designs to measure the causal impacts of NSF programs and contribute useful knowledge to guide agency efforts to dismantle barriers to equitable participation in the STEM enterprise.

Continued...

Data Sources

Studies will rely on the following data sources: NSF administrative records (including annual and final reports and existing monitoring data systems to identify individuals), the National Center for Science and Engineering Statistics (for nationally representative survey data), the Integrated Postsecondary Education Data System and Carnegie Classification of post-secondary institutions (for information on the characteristics of institutions), the National Student Clearinghouse (for educational outcomes data), and individuals who participate in data collections (such as students, postdoctoral research fellows, university administrators, and principal investigators (PIs) surveyed or interviewed).

Challenges and Mitigating Strategies

NSF anticipates challenges in identifying participants and nonparticipants and obtaining data on their characteristics to conduct descriptive analyses and construct well-matched comparison groups. NSF will rely on its data systems and national data, analyze the quality of existing data, and devise approaches to fill in data gaps, such as collecting demographic and prior achievement information through collections conducted as part of the new studies.

Proposed studies will also place burden on respondents asked to participate in surveys, interviews, or focus groups. NSF will seek to collaborate with stakeholders to develop approaches that rely on existing data, leverage moments when respondents have strong incentives to provide information, and clearly communicate benefits of participation. A related challenge will be obtaining adequate response rates from participants and nonparticipants to enable robust and causal inferences. NSF will draw on its extensive experience recruiting respondents to devise appropriate strategies for each respondent group.

Use and Dissemination

Findings will help NSF describe, reduce, and address barriers to full participation by updating programs and policies, identifying best practices to consider adopting, and aligning efforts to broaden participation of groups underrepresented in STEM. As appropriate, findings will also be shared with the NSB, Committee on Equal Employment Opportunity in Science and Engineering, communities implementing NSF-funded programs (such as PIs), beneficiaries of NSF programs, and the public.

In what ways did the COVID pandemic influence the participation of different groups in the NSF portfolio of programs and activities?

Strategic Goal

Engage: Empower STEM talent to fully participate in science and engineering

Strategic Objective

Ensure accessibility and inclusivity

Guiding Question

How can NSF help grow STEM talent and opportunities for all Americans?

Background and Rationale

The COVID-19 pandemic disrupted NSF operations. In mid-March 2020, the agency transitioned to remote work and cancelled in-person activities, including panels through which thousands of proposals (more than 40,000 yearly) are peer reviewed to receive funding recommendations. NSF grantees also experienced disruptions. Some institutions reported closing laboratories or limiting field work, which affected research conducted by faculty, researchers, post-docs, and students. NSF-supported facilities were affected as well; for example, needed resources could not be deployed to some facilities due to travel restrictions. Concerns over the impacts of these COVID-driven disruptions on the scientific enterprise—and on the careers of those most at risk (such as early career and female scientists)—were voiced at NSF and beyond (Cui, Ding, and Zhu 2021; NASEM 2021; Myers et al. 2020, Morgan et al. 2021). These included warnings of grant applications delayed, papers left unwritten, and research careers stalled, particularly among groups underrepresented in science, technology, engineering, and mathematics. NSF used administrative data to monitor key indicators (such as proposals received by gender) and leveraged its deep community connections to hear from external stakeholders regarding problems encountered and strategies used to address them. What emerged was a complex picture that requires careful assessment. Disruptions seemed to have led to both negative and positive outcomes. For instance, the switch to virtual work disrupted in-person panels but also opened the door for increasing reviewer diversity through remote panels (by removing the barrier that travel may represent for some, such as scientists with caregiver responsibilities or underrepresented minorities with disabilities that make traveling difficult). Building a deeper understanding of this complexity is an important step in developing or revising interventions to (1) address any inequities that may have been exacerbated or introduced during the pandemic, (2) reinforce positive outcomes observed, and (3) prepare for future disruptions.

Timeline

FY 2022–FY 2023

Continued...

Technical Approach

This evaluation will include quantitative and qualitative components. The quantitative component will begin with a descriptive analysis of the characteristics of different groups in NSF's portfolio over time. This will include the characteristics of principal investigators (PIs) and teams submitting proposals and of reviewers participating in panels or conducting ad-hoc reviews—overall, by Directorates and Offices, and by whether proposals were awarded or declined. This exploratory work will facilitate analyses of data through a difference-in-differences approach (to measure differences in measures, such as proposals submitted by gender before and after the pandemic) and the specification of regression models as part of an interrupted time-series (ITS) design to determine changes that might be attributed to COVID—by modeling (and comparing) the expected pre-COVID and observed since-COVID trends, controlling for relevant factors. The qualitative component will rely on information gathered through semi-structured interviews with NSF program officers (POs), PIs, and reviewers. Once collected, these qualitative data will assist in the interpretation of quantitative findings, and model specification (to ensure important relationships are not overlooked) and understanding of relevant factors (positive and negative) that influenced participation in NSF's portfolio since the onset of the pandemic. If helpful for programming decisions, interview findings may be used to design a survey to be administered to a representative sample of PIs/reviewers to estimate the influence of different factors on participation in NSF's portfolio of programs.

Data Sources

This study will rely on the following data sources: NSF administrative data (on PIs, reviewers, proposals, panel reviews, and award decisions), the National Center for Science and Engineering Statistics (for nationally representative survey data on the characteristics of the scientific workforce), the Integrated Postsecondary Education Data System and Carnegie Classification of post-secondary institutions (for information on the characteristics of institutions of PIs and reviewers), and interview data (from POs, PIs, and reviewers).

Continued...

Challenges and Mitigating Strategies

This study faces at least three limitations related to existing data quality, methodological assumptions, and respondents. (1) The share of principal investigators and reviewers providing information on their demographic characteristics has been declining over time, which limits NSF's ability to produce valid and reliable estimates and tease out whether changes observed are due to changes in the composition of individuals in our data (resulting from missing data) or to changes in participation. NSF will attempt to mitigate this challenge by conducting sensitivity analyses to test the robustness of findings and use imputation techniques where possible. (2) A key assumption of the ITS design is that pre-COVID trends would have continued unchanged and that no other external factors systematically affected the groups of interest during the post-COVID period. During interviews, we will seek to determine if these assumptions are reasonable and, if not, identify relevant factors to adjust analyses accordingly. (3) Devising a sampling strategy that enables us to identify a group of POs, PIs, and reviewers to interview (to obtain the insights we are looking for) and that agree to participate in this study will be challenging. We will work closely with NSF POs and develop a sample with appropriate replacement cases.

Use and Dissemination

Findings will be shared with NSF stakeholders to inform programming and policy decisions to address inequities and promote the inclusion of underrepresented groups in STEM. As permitted, they will also be disseminated to other Federal Government Agencies that have similar programs.

How can NSF help reduce and ultimately eliminate harassment in federally funded research settings?

Strategic Goal

Engage: Empower STEM talent to fully participate in science and engineering

Strategic Objectives

Ensure accessibility and inclusivity
Unleash STEM talent for America

Guiding Question

How can NSF help grow STEM talent and opportunities for all Americans most equitably?

Background and Rationale

NSF is committed to ensuring that all individuals have access to NSF-funded research and learning environments that are free of any form of harassment. To this end, NSF has been bolstering its policies, guidelines, and communications strategies. NSF has also begun evaluating its efforts and intends to continue evaluation activities throughout the years of its next Strategic Plan, FY 2022 to FY 2026. In early FY 2023, the agency expects to complete two ongoing studies. The first is an analysis of the communication strategy for NSF's term and condition regarding sexual harassment, other forms of harassment, or sexual assault. The second is an evaluation of NSF's conference policy, which extends the reach of NSF's anti-harassment efforts to a broader range of work environments. Findings from these studies will contribute useful evidence for answering this priority question and help design next steps in its efforts to bolster the efficacy of its anti-harassment initiatives. Over the next few years, the agency will pursue a series of studies designed to answer specific research questions, which might include the following: What are the characteristics of incident reports filed, and what implications do these characteristics have for the efficacy and equity of NSF prevention efforts?, In what ways do existing institutional policies, processes, or practices (particularly those related to Title IX requirements) influence responses to NSF's T&C?, What strategies can a federal agency like NSF use effectively to prevent harassment?.

Timeline

FY 2022–FY 2026

Technical Approach

Technical approaches will be developed once the results of ongoing studies are available and new questions are finalized. Such studies may include (1) a descriptive analysis of incidents reported to understand their characteristics, assess whether underreporting may be occurring, and sharpen existing or devise new prevention strategies; (2) a systematic literature review on harassment prevention approaches to inform decisions regarding the portfolio of strategies that NSF will pursue; and

Continued...

Technical Approach *cont'd*

(3) interviews or focus groups with members of the NSF community (to include, as appropriate, faculty, institutional administrators, researchers, teachers, post-docs, and students) to understand the influence of NSF reporting requirements on institutional practices or processes, assess bias in reporting of incidents, and elicit input on (a) expectations regarding what NSF can do to prevent harassment and promote reporting of incidents and (b) effective strategies that a government agency such as NSF may pursue. NSF is interested in identifying a range of effective prevention strategies, including those that rely on positive reinforcement such as prizes for institutions creating or actively promoting safe environments effectively or prizes for individuals and teams advancing knowledge about impactful strategies to promote safe research and learning environments that foster inclusion of groups underrepresented in the STEM enterprise.

Data Sources

Studies will rely on the following data sources: NSF administrative records (for information on incidents reported and the community of grantee institutions, principal investigators (PIs), and other beneficiaries of NSF programs), the Integrated Postsecondary Education Data System and Carnegie Classification of post-secondary institutions (for information on the characteristics of institutions), and individuals who participate in data collections (such as students, post-docs, university administrators, and PIs surveyed or interviewed).

Challenges and Mitigating Strategies

We expect several challenges. The first challenge will be in constructing a complete data set for analysis of incidents reported, as reports vary in the details provided. This can be mitigated by contacting institutions, where needed, to seek clarifications. Another challenge will be in making inferences based on incidents reported without a robust way of assessing bias in reporting. We will seek to investigate bias and consult the literature and experts in the field, such as participants in the recent National Academies of Sciences Workshop on Developing Evaluating Metrics for Sexual Harassment Prevention Efforts. A third challenge will be in obtaining high response rates as we contact individuals to participate in interviews or surveys. NSF will draw on its extensive experience recruiting respondents to devise appropriate strategies for each respondent group.

Use and Dissemination

Findings will be used to consider approaches to bolster NSF's harassment prevention efforts. They will be shared internally with leadership and staff, particularly those leading NSF efforts in this space (the NSF Office of Equity and Civil Rights and the Office of the General Counsel). Findings will also be disseminated to other stakeholders across the Federal Government—such as agency equity teams or interagency working groups—to promote harassment prevention efforts throughout the Federal Government. As appropriate, findings will also be shared with the broader community of beneficiaries of NSF programs and the public.

How could the data system developed for the Research Experiences for Undergraduates (REU) Sites program be leveraged to improve prospective monitoring of characteristics of participants in research experiences supported by other NSF programs and study the impact of research experiences on STEM outcomes, such as educational attainment?

Strategic Goal

Engage: Empower STEM talent to fully participate in science and engineering

Strategic Objectives

Ensure accessibility and inclusivity
Unleash STEM talent for America

Guiding Question

How can NSF help grow STEM talent and opportunities for all Americans?

Background and Rationale

The Research Experiences for Undergraduates (REU) program was created in 1987 to strengthen the science, technology, engineering, and mathematics (STEM) workforce. The program is designed to foster student research and promote diversity, as "one of the most effective avenues for attracting students to and retaining them in science and engineering and preparing them for careers in these fields" (NSF 19-582). Implemented across NSF Directorates, the program invests at least $85 million yearly in grants. These grants mostly go to university faculty who either (1) support about 10 students per year conducting research at their REU Sites, usually during the summer; or (2) support one or more students through REU supplements. For the past few years, NSF has supported the design, development, and pilot testing of a data system needed for several purposes, including (1) responding to the America COMPETES Reauthorization Act of 2010 (Section 514[a][6] of Public Law 111-358), which requires ongoing tracking of demographic characteristics and career outcomes of participants in REU Sites; and (2) enhancing NSF efforts to monitor program implementation through a data collection system paired with data analytics capacity and visualizations that make information easily accessible to program officers. NSF also leveraged the opportunity to provide a service to principal investigators (PIs), who are mostly university faculty members, and prospective student applicants. This service creates efficiencies in program administration (PIs can use the system to administer student applications to their sites instead of devoting resources to developing and maintaining their own application systems) and lowers the barriers to entry into the program both for PIs, who can leverage the existing application system, and students, who can more easily identify and apply to research experiences around the nation through a single application. As the system is enhanced and implementation is scaled up in FY 2022–FY 2024, NSF has an opportunity to consider how to further develop the system to integrate other programs in its portfolio of workforce development efforts and facilitate use for future rigorous evaluations. These future developments would not

Continued...

Background and Rationale *cont'd*

only support NSF efforts to assess its portfolio of investments but would also support contributions to the existing literature on research experiences, which relies heavily on descriptive and correlational studies and offers limited evidence of impacts (National Academies of Sciences, Engineering, and Medicine 2017).

Timeline

FY 2022–FY 2024

Technical Approach

The pilot of the REU data system included testing of (1) a web portal to collect basic student information such as demographic characteristics and (2) a common student application. Either could enable NSF to design quasi-experimental and, with voluntary participation among PIs, experimental evaluations of the program. As the NSF Education and Training Application (ETAP) system is scaled up for further testing and implementation, NSF seeks to design and develop the functionalities needed to conduct such evaluations. This might include expanding disclosures to inform system users of planned or potential studies, specifying propensity-score matching models for quasi-experimental evaluations using data collected through the system, and documenting voluntary participation in randomized studies. NSF also seeks to consider expanding this system to enable participation of other NSF programs that serve students as a path toward building a unified data system for programs offering research experiences (in the medium term) and for other workforce development programs (in the long run). Doing this will require deep stakeholder engagement in considering advantages and disadvantages of such expansion, identifying needed system enhancements, and charting a path forward.

Data Sources

Data sources will include data system documentation, brainstorming meetings with NSF leadership (such as members of the NSF Evidence Act and Data Governance Steering Committee), interviews or focus groups with NSF POs, and webinars with PIs.

Challenges and Mitigating Strategies

Robust stakeholder engagement, ensuring that all voices are heard and considered, will present the greatest challenge to this effort, especially as it grows to include additional programs. This challenge will be addressed by seeking input from the EAC Steering Committee, which is comprised of leadership from across NSF Directorates and Offices, designing stakeholder engagement activities and allowing sufficient time in the design and testing phases of this work to not only engage stakeholders but also act on their feedback.

Use and Dissemination

This data system will be used by NSF POs and PIs to manage applications, monitor participation in the REU program, report to leadership (internally and externally), and support evaluations. Findings will be disseminated internally in real time through the system's integrated reporting capabilities and externally through the NSF website.

What are the characteristics of NSF's portfolio on climate change, and to what extent might this portfolio advance NSF's goals of equity, discovery, and impact?

Strategic Goal

Discover: Create knowledge about our universe, our world, and ourselves

Strategic Objective

Advance the frontiers of research

Guiding Question

How can NSF fuel transformative discoveries most effectively?

Background and Rationale

NSF's broad portfolio of programs supports a wide range of activities related to climate change, including efforts that advance our understanding of (1) the processes that govern climate on Earth at different spatial and temporal scales, (2) the impact that changes in climate have on ecosystems and societies, and (3) the most sustainable solutions and technologies that will enable adaptation to, and mitigation of, climate change. This wide-ranging portfolio of investments in climate change has grown over time from focused disciplinary programs within Directorates and Offices (such as Climate and Large-Scale Dynamics in the Directorate for Geosciences and Environmental Sustainability in the Directorate for Engineering) to cross-disciplinary programs across Directorates and Offices (such as Critical Aspects of Sustainability, Navigating the New Arctic, and Dynamics of Integrated Socio-Environmental Systems). In collaboration with the community, substantial research on climate science and its impacts is undertaken at NSF's largest federally funded research and development center, the National Center for Atmospheric Research. As this evolution suggests, research in climate change has moved from disciplinary to convergent approaches—that is, integrated interdisciplinary and cross-sectoral approaches to understand the causes of climate change, measure its impacts, and devise effective, sustainable, scalable, and equitable solutions. Understanding the present characteristics of NSF's portfolio of investments in climate change is critical to supporting ongoing efforts to design strategies that will help direct the research supported (how, who, and what science is supported) and the investments made (within and across Directorates) to amplify the impact of scientific advances in slowing and hopefully reversing the impacts of climate change.

Timeline

FY 2022–FY 2023

Continued...

Technical Approach

This study will document the characteristics of the climate change portfolio currently supported by NSF. These may include the Directorates and Offices supporting the activities (funding and co-funding), areas of focus (understanding of climate change processes and phenomena, impacts, or solutions), approaches (disciplinary, interdisciplinary, convergent), partnership types (by partner characteristics, such as industry versus academia, and by the presence of "co-production" or "engaged research" with communities most impacted by climate change), diversity in the scientific workforce in this space, and other dimensions relevant to consider future directions of this portfolio of work and assess equity along different dimensions. The analysis will be descriptive and correlational (not causal) and may include an assessment of solicitation guidance against the pool of proposals received (to investigate alignment with or responsiveness to NSF guidance), a comparison of awards and declines to understand the characteristics of successful and unsuccessful proposals, and an assessment of the correlates of equity through regression models (for example, are multi-stakeholder teams more likely to engage in research with an equity focus than academic teams? Are proposals that consider equity or social justice dimensions of climate change more or less likely to be awarded than other proposals?). Findings will provide insights that may (1) inform revisions to solicitations or Dear Colleague Letters; (2) increase collaboration across NSF Directorates and Offices, supporting climate change efforts (such as those seeking to support convergent or equity-focused activities); and (3) lead to revisions in guidance that NSF staff provides to reviewers, ensuring the review process is equitable and in alignment with solicitations.

Data Sources

This study will rely on semi-structured interviews with NSF program officers and existing data sources—including NSF documents (solicitations and Dear Colleague Letters), grantee documents (proposals, annual and final reports), NSF administrative data (such as demographic data on principal investigators), and existing national data (such as Integrated Postsecondary Education Data System and Carnegie Classification of post-secondary institutions)—and text searching and natural language processing tools to extract information from documents.

Challenges and Mitigating Strategies

Earlier, similar analyses suggest that the text analytic methods proposed here may lead to underestimates (false negatives) and overestimates (false positives) in different Directorates based on differences in discipline-specific language and context. To address this common problem in information retrieval through text analytic and artificial intelligence techniques—a problem often described in the literature as recall (success in identifying valid cases from a population) and precision (share of cases identified that are valid)—NSF will create a detailed data file with available information for troubleshooting to achieve an adequate balance between recall and precision.

Use and Dissemination

Findings from this study will be shared with key NSF stakeholders and used to refine NSF's strategy for investments in climate change.

How do EPSCoR program funding strategies (infrastructure, co-funding, and outreach) contribute to increasing academic research competitiveness across jurisdictions?

Strategic Goal

Discover: Create knowledge about our universe, our world, and ourselves

Strategic Objectives

Advance the frontiers of research
Enhance research capability

Guiding Question

How can NSF fuel transformative discoveries most effectively?

Background and Rationale

As its name indicates, the Established Program to Stimulate Competitive Research (EPSCoR) seeks to foster sustainable improvements in research and development (R&D) capacity in the 28 jurisdictions (states and territories) that individually received 0.75 percent or less of total NSF funding over the most recent five-year period. The EPSCoR program employs three investment strategies: (1) it supports physical, human, and cyber infrastructure in academic institutions through its Research Infrastructure Improvement funding tracks; (2) it co-funds meritorious proposals reviewed by other NSF programs that also satisfy EPSCoR programmatic criteria; and (3) it promotes interaction within the EPSCoR community and NSF through workshops and other outreach activities that help build mutual awareness and develop areas of potential strength. The program's theory of change asserts that EPSCoR jurisdictions have opportunities to use EPSCoR funds and other available resources to improve their science, technology, engineering, and mathematics (STEM) ecosystems by strengthening academic research competitiveness —that is, the research competitiveness of the academic institutions in their jurisdictions. EPSCoR seeks to expand its capacity to generate and use evidence to monitor program progress in increasing academic research competitiveness through its three funding strategies.

Timeline

FY 2023–FY 2025

Technical Approach

This outcomes evaluation will build on prior work, such as an exploratory study completed in FY 2020, to develop a design that helps NSF determine whether and how EPSCoR, through its different funding tracks, may be associated with observed project outcomes. The technical approach will be developed once background work is

Continued...

Technical Approach *cont'd*	completed and may include analyses overall and by funding track, such as (1) descriptive analyses of jurisdictional characteristics, outputs, and outcomes to determine variation in characteristics and progress in implementation and outcomes over time; (2) a regression analysis of longitudinal data on EPSCoR jurisdictions (most likely done using a lower unit of analysis, such as participating institutions) to establish associations between observed outcomes and program participation, controlling for other factors that are known or hypothesized to be associated with outcomes; and (3) case studies of former EPSCoR program jurisdictions (or those nearing graduation or improving their research competitiveness) to understand the strategies that enabled them to increase their research competitiveness.
Data Sources	This study will rely on a monitoring data system that will be developed for the EPSCoR program and will draw data from NSF administrative data systems, existing national data collections, and new collections (as needed).
Challenges and Mitigating Strategies	A prior study (released in Summer 2021) indicated that it would be challenging to detect progress toward success for EPSCoR jurisdictions when the sole outcome measure was the program's eligibility criteria. This challenge will be mitigated by relying on a rich set of output and outcome measures that can be used both to monitor institutional and jurisdictional progress and for program improvement.
Use and Dissemination	Findings from this study will be shared with EPSCoR NSF program officers, grantee universities, and jurisdiction science and technology steering committees to inform decisions that may influence the ARC of institutions and jurisdictions.

What are the benefits of receiving an award from a program supported by a partnership? How do these differ from benefits associated with awards from programs not supported by a partnership? What outputs and outcomes are associated with partnership programs? To what extent can these be attributed to the partnership programs? What improvements could make partnership programs more effective or easier to implement?

Strategic Goal

Impact: Benefit society by translating knowledge into solutions

Strategic Objectives

Deliver benefits from research
Lead globally

Guiding Question

How can NSF mobilize knowledge most effectively to impact society?

Background and Rationale

Building partnerships is a high priority for NSF, as evidenced by two consecutive agency Priority Goals (APGs for FY 2020 and FY 2021) focused on developing a partnerships strategy. The importance of partnerships is echoed in the recent National Science Board's Vision 2030 report and reflected in the new Directorate for Technology, Innovation, and Partnerships (TIP) proposed in the NSF FY 2022 budget request. Partnerships can accelerate discovery in several ways. They can expand the kinds of questions that can be addressed, enable access to expertise and infrastructure, and expand communities of researchers. NSF engages in two types of partnerships—direct and indirect. Direct partnerships are established by NSF with other federal agencies, industry, private foundations, non-governmental organizations, and foreign science agencies. Indirect or "NSF-stimulated" partnerships are required or encouraged by NSF and established by principal investigators (PIs) on NSF grants seeking collaborators with complementary expertise or resources. These types of partnerships are common in many NSF programs, such as the Established Program to Stimulate Competitive Research, and can vary greatly in their characteristics. Having acquired deep experience in building, managing, sustaining, and ending partnerships, NSF is prioritizing evaluation activities that complement other ongoing learning efforts (such as conducting a landscape study) to reap the greatest benefits from partnerships. This study will be the second of several conducted to learn about the efficacy of NSF's partnership strategy and identify ways to improve it.

Timeline

FY 2022–FY 2023

Continued...

Technical Approach

This study will rely on the design developed in FY 2021 to begin evaluating NSF partnerships by studying direct partnerships with industry through the Directorate for Computer and Information Science and Engineering (CISE). NSF selected this type of partnership for the first evaluation for several reasons. Partnerships with industry are a priority for NSF and those in CISE (1) account for a substantial share of existing partnerships (for example, six of the seven new industry partnerships in FY 2019 were in CISE), (2) have sufficient cohorts of grantees to support retrospective or prospective evaluations, and (3) may have comparable non-partnership programs that could be used in support of a more rigorous (quasi-experimental) design to evaluate measurable outputs and outcomes. This study will also rely on qualitative analyses—such as analyses of interviews with partners and grantees—to uncover the benefits of partnerships and the barriers and facilitating factors to successful implementation (from the perspective of participants). These analyses will identify opportunities for improvements and dissemination of promising practices. NSF will use findings from the quantitative analyses to select samples of partners and grantees for surveys and/or interviews to ensure that NSF is able to tease out factors that are likely associated with successful partnerships.

Data Sources

Data sources will be determined after the design is completed and are likely to include NSF administrative data and documents (such as grantee annual and final reports), data on productivity (publications, patents, funding raised, startups launched, and so on), and surveys and interviews with different stakeholders (such as partners and grantees).

Challenges and Mitigating Strategies

Two potential challenges stand out. The first is related to the complexity of creating a high-quality data file with information across programs, years, and data sources. The design phase of this project will enable NSF to devise a data strategy. The second challenge is methodological, as many factors stand in the way of effective evaluation of investments in basic science, such as long timelines to observe outcomes. In the design phase, NSF will identify opportunities to employ designs that enable causal inferences and identify cohorts for which outcomes can reasonably be expected by the time of this study.

Use and Dissemination

Findings will be shared with NSF leadership and program officers. They will be used for program improvements and to inform the design of evaluations of other types of partnerships.

What can be learned from the NSF Convergence Accelerator's innovative selection process that may inform improvements in how the agency identifies and selects projects with high potential to advance ideas from concepts to deliverables of interest to industry and other partners?

Strategic Goal

Impact: Benefit society by translating knowledge into solutions

Strategic Objectives

Deliver benefits from research
Lead globally

Guiding Question

How can NSF mobilize knowledge most effectively to impact society?

Background and Rationale

The NSF Convergence Accelerator is a unique organizational structure within NSF that was initiated in FY 2019. It seeks to (1) accelerate the transition of use-inspired convergence research into practice and (2) build team capacity to pursue exploratory, high-risk projects in topics that vary yearly. The Convergence Accelerator employs approaches that are not present in other NSF programs. These include (1) cohorts of grantees who participate in NSF trainings to prepare to transition their research ideas into investment-ready deliverables; (2) grant cycles with two distinct phases that allow for timely adjustment of resource allocations, team composition, and research direction based on progress; (3) coopetition—that is, teams are encouraged to work both in collaboration and competition as they seek opportunities to join forces across teams to transition to Phase II; (4) a novel selection process to transition from Phase I to Phase II by submitting written proposals reviewed by panelists as well as "oral pitches" before a panel of judges; and (5) an expo that provides a platform for grantees to pitch their ideas to a wider audience, including potential collaborators and investors. This study focuses on understanding how the Convergence Accelerator's two-phase selection process may influence the nature and evolution of the submitted and selected research ideas (and ultimately the translation of ideas into useful applications) and the composition of the grantees and their teams.

Timeline

FY 2022–FY 2023

Technical Approach

This descriptive study will document the trajectories of teams and ideas through the two-phase selection process used with the 2019 inaugural cohort. The first component will be a quantitative analysis of awarded and declined proposals to identify and compare the key characteristics of the teams and ideas selected and winnowed from Phase I and Phase II. The second component will build on these findings and rely

Continued...

Technical Approach *cont'd*

on a qualitative content analysis of the reviews and recommendations produced by panelists and judges during the Phase I and Phase II selection activities to further describe the characteristics the reviewers and judges found most and least compelling. This component will also include interviews with a stratified random sample of review panelists and pitch judges (representative of high and low ratings) to gather their insights from the selection process. The third component will be an analysis of expressions of interest submitted to NSF from potential partners and investors in response to the Phase I teams' presentations at the Expo 2020. These letters of interest serve as a proxy indicator of whether those teams and ideas that had traction during selection are received as intended in the venture marketplace.

Data Sources

This study will rely on the following data sources: Convergence Accelerator solicitation (2019), NSF 2019 grant proposals (100 submitted proposals of which 43 received Phase I awards), artifacts and documents submitted by 43 Phase I grants and 10 Phase II grants, expressions of interest submitted to NSF, Expo 2020 report, and interviews with and reviews prepared by panelists and judges.

Challenges and Mitigating Strategies

We anticipate difficulties in aligning reviewers' and judges' evaluations of proposals with Convergence Accelerator goals. We plan to mitigate this challenge by conducting follow-up interviews with the reviewers and judges to understand how they used evidence from proposals and pitches to inform their reviews.

Use and Dissemination

Findings from this study will be shared with NSF stakeholders and used to improve the current Convergence Accelerator selection practices.

In what ways does the Convergence Accelerator Innovation Training contribute to the emergence of new capacities among participating researchers to meet pressing societal needs?

Strategic Goal

Impact: Benefit society by translating knowledge into solutions

Strategic Objectives

Deliver benefits from research
Lead globally

Guiding Question

How can NSF mobilize knowledge most effectively to impact society?

Background and Rationale

The NSF Convergence Accelerator is a unique organizational structure within NSF that was initiated in FY 2019. The Convergence Accelerator seeks to (1) accelerate the transition of use-inspired convergence research into practice and (2) build team capacity to pursue exploratory, high-risk projects in topics that vary yearly. One of the signature approaches of the Convergence Accelerator that distinguishes it from other NSF efforts is the training the program provides to grantees to prepare them to transition their research ideas into investment-ready deliverables. This training is important for the success of the program in achieving its goals. This study seeks to determine in what ways and to what extent the curriculum developed for the program and the training provided using this curriculum helped teams acquire capabilities (attitudes and skills) that promote the Convergence Accelerator program's goals of building team capacity to transition research ideas into market-ready investments.

Timeline

FY 2022–FY 2023

Technical Approach

This study focuses on the FY 2022 cohort of Convergence Accelerator grantees and has two components to study training outcomes associated with program participation. The first component is a quantitative analysis of changes in grantees' understanding and, if possible, application of design thinking, team management, partnership development, and strategic communication concepts and practices, as these are the focus of Convergence Accelerator training. The analysis will be based on data collected through pre- and post-training surveys completed by participants. The second component will be based on a qualitative analysis of how artifacts evolved over time and may demonstrate how teams' research ideas are refined, packaged, and delivered after exposure to the Convergence Accelerator curriculum with grantee participation in trainings. This component of the study will be based on a comparison of the proposals submitted by grantees in Phase I versus Phase II and the oral pitches

Continued...

Technical Approach *cont'd*	delivered as part of the Phase II competition. To conduct this comparison, we will develop and apply a rubric that aligns elements of grantees' work with program learning objectives.
Data Sources	This study will rely on the Convergence Accelerator training material (agendas, presentations, workbooks, and other materials); grantee proposals, annual reports, and final deliverables/reports; pre- and post-training surveys of participants; and pitch videos. Convergence Accelerator instructors and coaches will be interviewed as sources for information about instrument development and testing.
Challenges and Mitigating Strategies	Two main challenges stand out for this study. The first is the potential for low survey response rates, based on early experiences. To address this challenge, NSF plans to motivate participants by increasing their understanding of the importance of responding to surveys. Convergence Accelerator staff will also seek to revise the solicitation and award letters to make participation in evaluation activities a program requirement. The second challenge is construct validity and reliability of the rubric developed to analyze proposals and pitches. To mitigate this challenge, NSF will interview coaches and instructors for additional calibration of the rubric and train the analysts for using the rubric to ensure high inter-rater reliability.
Use and Dissemination	Findings from this study will be shared with key NSF stakeholders and used to refine Convergence Accelerator's grantees' training.

What are the characteristics of proposals evaluated through the merit review process? Are these characteristics (of individual investigators, teams, institutions, or proposed projects) associated with different review or funding outcomes?

Strategic Goal

Excel: Excel at NSF operations and management

Strategic Objective

Strengthen at speed and scale

Guiding Question

How can NSF excel in stewarding and realizing its vision?

Background and Rationale

Merit review is a core process at NSF and is critical to the mission of promoting the progress of science. The merit review process guides NSF's funding decisions, and the written reviews provide valuable feedback to researchers submitting proposals. NSF receives more than 40,000 proposals every year, mostly from university faculty submitting to competitive grant programs (Merit Review Process FY 2019). Proposals are reviewed and funding decisions made through merit review, which is a multi-step process that includes peer review of proposals, program officer (PO) recommendation to award or decline proposals, and final review and concurrence by a division director (DD) of the PO recommendation, taking into consideration the balance of the program and division portfolios.[1] Through its merit review process, NSF seeks to ensure that proposals are assessed in a fair, competitive, transparent, and in-depth manner and that a program's portfolio (breadth, scope, representativeness) is considered while making final decisions for award. As such, the agency's ability to achieve its goals (empower talent, discover knowledge, mobilize that knowledge, and excel in doing so) depends on the success of this process.

Preliminary findings from descriptive analysis of NSF administrative data show that, on average, (1) the share of women and underrepresented minorities submitting proposals to NSF is lower than expected given their representation in the overall population, and (2) the funding rate of proposals submitted by principal investigators (PIs) from racial and ethnic groups underrepresented in STEM is lower than that of PIs from non-underrepresented groups. However, exploratory regression analyses suggest that these differences may be explained by other factors, such as PI experience and education. Further analysis is needed.

Studying the characteristics (and correlates) of awarded and declined proposals will help NSF better understand each stage of the merit review process and assess its influence on the evolution of the characteristics of the science and the scientists supported. Developing this deep understanding is critical to agency efforts to ensure

[1] A very small share of proposals submitted under selected mechanisms (such as proposals for Grants for Rapid Response Research or RAPIDs) are competitively reviewed by internal scientists.

Continued...

Background and Rationale *cont'd*

the efficacy and equity of decisions made daily. To this end, the priority question identified in this study plan is the first in a series of questions[2] that will guide studies to help NSF answer the following, critical question: How well does the merit review process provide the input needed by NSF to make the most effective, efficient, and equitable funding decisions?

Timeline

FY 2022–FY 2024

Technical Approach

This study will have two components. The first will be a descriptive analysis of observable proposal characteristics that may be correlated with outcomes of interest at various stages of the merit review process. These include proposal submission, proposal rating, panel review and rating, PO recommendation, and DD review and concurrence of the PO recommendation. Characteristics that may be analyzed include the following:

- Individual characteristics—such as PI demographics, experience, and research productivity (such as publications)
- Institutional characteristics—such as the research intensity, minority-serving status, sector status of the PI, collaborators, and partner institutions
- Proposed project characteristics—such as the area of science, proposed broader impacts, methodology pursued, and project size
- Proposal review characteristics—such as review outcomes (review rating, panel summary) and reviewer characteristics (demographics of reviewers and POs)

Whether any of these characteristics are associated with proposal outcomes is an empirical question. The second component of this study will focus on this question. It will seek to understand the correlates of outcomes at each stage of the review process described earlier and whether average differences observed in the descriptive analyses hold after controlling for relevant factors through appropriate regression models.

Data Sources

Studies will rely on the following data sources: NSF administrative records (including proposal, PI, and reviewer records), the Integrated Postsecondary Education Data System and Carnegie Classification of post-secondary institutions (for information on the characteristics of institutions), National Center for Science and Engineering Statistics (NCSES) Survey of Doctorate Recipients (for demographic, education, and career history information from individuals with a U.S. research doctoral degree in a science, engineering, or health field), and productivity data (publications and patents) from sources such as Web of Science, Scopus, and Dimensions.

[2] The question series will include a focus on several NSF and National Science Board priorities regarding the implementation of the merit review process, such as assessing the effectiveness of NSF's reviewer training in promoting equity and review quality.

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Challenges and Mitigating Strategies

NSF anticipates various data and methodological challenges in conducting this study. The first is missing demographic data for PIs and reviewers. For example, in FY 2020, more than 30 percent of proposals were submitted by PIs who did not report their race or ethnicity. NSF will consider ways to conduct nonresponse bias analyses with available data to develop adjustments, such as weights, and use imputation techniques for multivariate analyses (adhering to policy and legal guidance). Another challenge is linking NSF administrative data to existing national and external data, a challenge that will be addressed by collaborating with colleagues at NCSES and external data providers to identify ways to merge data while adhering to information protections and other legal regulations. Methodological challenges include the possibility of differences in outcomes resulting from unobserved factors unrelated to the NSF merit review process. An example is discrimination that leads to differential opportunities for research experience and publication, which are factors that will be included in the regression models along with demographic characteristics with which those factors may be correlated. If so, this might violate assumptions of the regression models to be specified. The exploratory phase of this study will include an assessment of these assumptions. Similarly, NSF expects proposal quality to be a strong predictor of proposal outcomes. Although there is no objective measure of proposal quality, proposal and average review ratings may be used as proxies. However, if ratings are biased, the observed association with demographic characteristics will also be biased. Whether review ratings are biased is an empirical question that will be investigated as well.

Use and Dissemination

Findings will help NSF leadership and staff consider strategies for improving the efficacy and equity of the merit review process. As appropriate, findings will also be shared with other science funding agencies that may be using similar merit review procedures, the NSB, Committee on Equal Employment Opportunity in Science and Engineering, beneficiaries of NSF programs, and the public.

What outcomes are associated with the adoption of a no-deadlines proposal submission process?

Strategic Goal

Excel: Excel at NSF operations and management

Strategic Objective

Strengthen at speed and scale

Guiding Question

How can NSF excel in stewarding and realizing its vision?

Background and Rationale

NSF receives more than 40,000 grant proposals every year, mostly from university faculty submitting to competitive grant programs (NSF by the Numbers). Between FY 2010 and FY 2019, the average funding rate for competitive proposals was 24 percent.[3] During those years, principal investigators (PIs) who received an award submitted, on average, 2.3 proposals per award received. Each proposal submitted is reviewed by both an external panel of expert reviewers and NSF program officers (POs) who manage the merit review process, which includes finding reviewers, running panels, and processing recommendations. This represents a tremendous amount of work for PIs, POs, and panelists, even though most of those proposals will ultimately be declined. NSF POs hypothesized that one operational change—namely, to eliminate proposal deadlines—might help make this process more efficient and, perhaps, even improve the quality of proposals submitted. In FY 2014, NSF began the no-deadline pilot whereby several participating programs in the Directorate for Geosciences (GEO) eliminated deadlines and target dates for proposal submission, accepting proposals any time throughout the year. Over the past few years, core programs in several other Directorates have joined the pilot. Preliminary findings suggest that the elimination of deadlines is associated with a reduction in proposal submissions. Now that the pilot has grown and been implemented for a few years, NSF is able to study several outcomes that may be associated with the shift to no deadlines across several Directorates at NSF. This is likely to be the first of several studies as the analysis transitions from its present focus on overall outcomes to more specific topics, such as how the elimination of deadlines may have affected subpopulations (say, submissions by gender or program size).

Timeline

FY 2022–FY 2023

[3] The funding rate refers to the proportion of proposals acted on in a given fiscal year that were awarded.
Source: https://www.nsf.gov/nsb/publications/pubmeritreview.jsp and https://www.nsf.gov/pubs/2020/nsf20002/

Continued...

Technical Approach

This outcomes study will seek to test several hypotheses that motivated the elimination of deadlines. Some of these hypotheses are that the elimination of deadlines may be associated with (1) a reduction in proposal volume, (2) a more even distribution of proposals submitted throughout the year (instead of concentrated around deadlines), (3) a faster review process or lower dwell time (if a reduction in proposal volume is observed), (4) higher proposal quality (if faculty submit fewer proposals when they feel they are ready for review), (5) lower burden on reviewers who are asked to participate in fewer panels or review fewer proposals, and (6) lower burden on POs (as they shepherd fewer proposals through the merit review process) or more evenly distributed burden throughout the year. NSF will test these hypotheses through descriptive (time-series and correlational) analyses using NSF retrospective administrative data. For hypotheses 3 to 5, NSF will consider interviewing or surveying key stakeholders (POs, PIs, and reviewers) who experienced the shift to a no-deadlines submission process to obtain their opinions and perceptions of the impact of removing deadlines on the merit review process. For all hypotheses, NSF will assess the possibility of identifying similar programs that did not adopt a no-deadlines process to use as a comparison group and increase methodological rigor. This is unlikely to be feasible across all of NSF but might be feasible within Directorates.

Data Sources

This study will rely on existing NSF administrative data and possibly on interviews with or surveys from POs, PIs, and reviewers.

Challenges and Mitigating Strategies

Confounding internal and external factors that affected the pilot or agency operations—such as varying approaches to implementing the no-deadlines pilot across Directorates or the lapse in appropriations and therefore operations between December 2018 and January 2019—present the greatest challenge to this study. These factors may influence the specification of the analysis or the interpretation of findings. The study team will need to develop a deep understanding of how the no-deadlines pilot was implemented in each Directorate (in what years, through what programs, and so on) and other conditions of operations that may have changed or been influenced by internal or external factors over the same time period. To this end, a working group with representation from each Directorate and Office offering research programs will provide guidance and feedback throughout this study.

Use and Dissemination

Findings from this study will be shared with key NSF stakeholders and presented to leadership to inform discussions regarding the implications of pilot findings for wider adoption of no deadlines. Key findings will be released to the public, as they should be of interest to other government agencies and private foundations that implement competitive grant programs.

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Cutler Marsh in Cache County, Utah
Credit: Matt Jensen, Utah State University