

Long-Term Ecological Research (LTER)

Renewal

PROGRAM SOLICITATION

NSF 22-543

REPLACES DOCUMENT(S):

NSF 19-593



National Science Foundation

Directorate for Biological Sciences
Division of Environmental Biology

Directorate for Geosciences
Division of Ocean Sciences
Office of Polar Programs

Directorate for Social, Behavioral and Economic Sciences

Full Proposal Deadline(s) (due by 5 p.m. submitter's local time):

March 23, 2022

March 02, 2023

First Thursday in March, Annually Thereafter

IMPORTANT INFORMATION AND REVISION NOTES

Revision Notes

This solicitation includes revised review criteria and proposal guidelines for LTER renewal proposals. Please read the appropriate sections, below, carefully.

The budget maxima have been increased.

The Data Management section has been updated.

The section on budgeting for ship time and logistical support has been updated.

Biosketches now follow PAPPG guidelines; they are no longer limited to one page.

PIs of proposals from sites currently on probation must contact the cognizant Program Officer for budget instructions.

Important Information

Innovating and migrating proposal preparation and submission capabilities from FastLane to Research.gov is part of the ongoing NSF information technology modernization efforts, as described in [Important Notice No. 147](#). In support of these efforts, proposals submitted in response to this program solicitation must be prepared and submitted via Research.gov or via Grants.gov and may not be prepared or submitted via FastLane.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) ([NSF 22-1](#)), which is effective for proposals submitted, or due, on or after October 4, 2021.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Long-Term Ecological Research (LTER)
Renewal

Synopsis of Program:

To address ecological questions that cannot be resolved with short-term observations or experiments, NSF established the Long-Term Ecological Research Program (LTER) in 1980. Two components differentiate LTER research from projects supported by other NSF programs: 1) the research is located at specific sites chosen to represent major ecosystem types or natural biomes, and 2) it emphasizes the study of ecological phenomena over long periods of time based on data collected in five core areas. Long-term studies are critical to achieve an integrated understanding of how components of ecosystems interact as well as to test ecological theory. Ongoing research at LTER sites is expected to contribute to the development and testing of fundamental ecological theories and significantly advance understanding of the long-term dynamics of populations, communities and ecosystems. It often integrates multiple disciplines and, through cross-site interactions may examine patterns or processes over broad spatial scales. Recognizing that the value of long-term data extends beyond use at any individual site, NSF requires that data collected by all LTER sites be made publicly accessible.

NSF currently supports 28 LTER sites. The program is on-going and proposals are periodically invited when a need is identified to balance the LTER portfolio or when funding opportunities arise to support new LTERs. These opportunities are announced through separate solicitations. This solicitation governs submission of renewal proposals for active LTER site awards.

Cognizant Program Officer(s):

Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.

- Roberto Delgado, telephone: (703) 292-2397, email: robdelga@nsf.gov
- Karla Heidelberg, telephone: (703) 292-2586, email: kheidlb@nsf.gov
- Doug Levey, Division of Environmental Biology, telephone: (703) 292-5196, email: dlevey@nsf.gov
- Peter H. McCartney, telephone: (703) 292-8470, email: pmccartn@nsf.gov
- Kendra Mclauchlan, telephone: (703) 292-2217, email: kmclauch@nsf.gov
- Francisco (Paco) B. Moore, telephone: (703) 292-5376, email: fbmoore@nsf.gov
- Cynthia L. Suchman, telephone: (703) 292-2092, email: csuchman@nsf.gov
- Daniel Thornhill, Division of Ocean Sciences, telephone: (703) 292-8143, email: dthornhi@nsf.gov
- Maria Vernet, telephone: (703) 292-8030, email: mvernet@nsf.gov
- John E. Yellen, Division of Behavioral and Cognitive Sciences, telephone: (703) 292-8759, email: [jyellen@nsf.gov](mailto: jyellen@nsf.gov)
- Hana Busse, telephone: (703) 292-7596, email: hbusse@nsf.gov

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.050 --- Geosciences
- 47.074 --- Biological Sciences
- 47.075 --- Social Behavioral and Economic Sciences

Award Information

Anticipated Type of Award: Continuing Grant

Estimated Number of Awards: 1 to 12

Each year, between 1 and 12 sites are scheduled for renewal.

Approximately 1/3 of sites are eligible for renewal in each even-numbered year but due to probationary sites only being renewed for 2 years, occasional site retirement and sites being pushed off-cycle for various reasons, substantial variation may occur. Renewal proposals may be considered in odd-numbered years.

All awards are subject to the availability of funds.

Anticipated Funding Amount: \$15,300,000

Funding amounts are tied to the number of proposals submitted during a given cycle and the maximum allowed budget (currently \$1,275,000). The anticipated funding amount (\$15,300,000) assumes 12 proposals, all with 6-year budgets at the maximum allowed amount.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- The LTER program is currently accepting only renewal proposals. Only the organization or institution that holds the current award is eligible to apply for a renewal. Collaborative proposals must be submitted using the "single proposal" method as described in NSF Proposal and Award Policies and Procedures Guide. Separately submitted collaborative proposals will be returned without review.

Who May Serve as PI:

The lead PI on a renewal proposal must be the lead PI on the current award or one of the co-PIs listed on the current award.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or co-PI:

An individual is not allowed to be lead PI on more than a single renewal proposal.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not required
- **Preliminary Proposal Submission:** Not required
- **Full Proposals:**
 - Full Proposals submitted via Research.gov: *NSF Proposal and Award Policies and Procedures Guide* (PAPPG) guidelines apply. The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.
 - Full Proposals submitted via Grants.gov: *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov* guidelines apply (Note: The *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide).

B. Budgetary Information

- **Cost Sharing Requirements:**

Inclusion of voluntary committed cost sharing is prohibited.
- **Indirect Cost (F&A) Limitations:**

Not Applicable
- **Other Budgetary Limitations:**

Other budgetary limitations apply. Please see the full text of this solicitation for further information.

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):
 - March 23, 2022
 - March 02, 2023
 - First Thursday in March, Annually Thereafter

Proposal Review Information Criteria

Merit Review Criteria:

National Science Board approved criteria. Additional merit review criteria apply. Please see the full text of this solicitation for further information.

Award Administration Information

Award Conditions:

Additional award conditions apply. Please see the full text of this solicitation for further information.

Reporting Requirements:

Standard NSF reporting requirements apply.

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I. INTRODUCTION

All ecological populations, communities, and ecosystems face long-term change. Identifying the nature of these changes and the mechanisms driving them requires the collection, analysis, and interpretation of data over long periods of time. To address questions that cannot be resolved with short-term observations or experiments, NSF established the Long-Term Ecological Research Program (LTER). Two components characterize LTER research: 1) it is located at specific sites chosen to represent major biomes or ecosystem types, and 2) it emphasizes the study of phenomena over long periods of time based on data collected in five core areas. Ongoing research at LTER sites provides a unique opportunity for researchers to obtain an integrated, holistic understanding of populations, communities, and ecosystems that is not possible through individual, short-term awards.

Over thirty-five years of LTER research have produced unique and valuable knowledge about ecological change in response to natural and human influences. The disciplinary breadth of LTER research includes population and community ecology, ecosystem science, evolutionary biology, urban ecology, oceanography, and, in some cases, social and economic sciences. LTER research has advanced the fields of Ecology and the Earth Sciences and helped to provide the empirical data needed to forecast change. It has also advanced understanding of regional and continental-scale processes, through cross-site analyses of ecological change. Urban LTER sites have also contributed to the development of social-ecological theory as a principle objective.

As the LTER Program progresses through its fourth decade, new challenges and opportunities arise that demand long-term research. New frontiers have grown out of the recognition that important ecological processes are context-dependent and non-linear, that ecological and evolutionary processes interact continually through feedbacks, and that the effects of environmental change on ecosystem structure and function are poorly understood. The LTER program will continue to provide the basic scientific understanding required to explore these new frontiers.

II. PROGRAM DESCRIPTION

The proposed research must be organized around a suite of compelling questions that deepen understanding of ecological processes and require uninterrupted, long-term collection, analysis, and interpretation of environmental data. LTER research should be developed around a conceptual framework that motivates questions requiring experiments and observations over long time frames. The conceptual framework should explicitly justify the long-term question(s) posed by the research, and it should identify how data in LTER core areas and any experimental work contributes to an understanding of the question(s) while testing major ecological theories or concepts. The framework should provide the justification for all studies outlined in the proposal and should be informed by ongoing analyses of long-term data. Proposed research should have the goals of achieving a mechanistic understanding of biological responses to past and present environmental change at multiple scales and of using this understanding to predict ecological responses at population, community, and ecosystem levels, and - if appropriate - evolutionary responses and social responses to ongoing or future environmental change.

NSF has invested in coordination across the 28 active sites through cross-site or network-level activities, recognizing the value of addressing questions across broader spatial scales within the LTER network and of collaborations with broader research communities. Renewal proposals may include comparative research with other LTER or non-LTER projects. These broader-scale activities should extend the conceptual framework proposed for innovative site-based research. Research must thoroughly justify the need for long-term support to understand ecological systems and processes.

Core data collection at LTER sites will continue to center on the five areas of 1) primary production, 2) population dynamics and trophic structure, 3) organic matter accumulation, 4) inorganic inputs and movements of nutrients through the ecosystem, and 5) patterns and frequency of disturbances. Analyses of these data provide the foundation for testing major theories and for identifying new questions that demand long-term study. These five areas focus and integrate LTER research within and among sites.

In addition to the core data collected for all sites, Urban LTER sites must also relate the human impact on land use and land-cover change in urban environments to ecosystem dynamics, examine the effects of human-environmental interactions in urban ecosystems, and develop integrated approaches to linking human and natural dynamics. More generally, NSF recognizes that human decisions, behavior, and actions may contribute to LTER research at non-urban sites to the extent that they influence long-term ecological and ecosystem processes. LTER renewal projects may elect to integrate social sciences in support of ecological research, if necessary to answer key, conceptually-motivated ecological questions.

The scientific goals of the proposed research will be evaluated based on the following principles:

1. Formulation of a conceptual framework that motivates new research questions of broad interest to ecologists and other environmental biologists.
2. Identification of important, general ecological questions that a) derive from and extend major ecological theories, b) are motivated by the analysis of long-term data, and c) require collection of additional, long-term data (including data in the 5 core areas) to be answered.
3. Conceptually-based predictions that link processes and observations across levels of organization (population, community, and ecosystem) or across temporal or spatial scales. Where appropriate, collaborations within or outside of the LTER network of sites may be included.

4. Development, refinement, and testing of quantitative models that provide a mechanistic understanding of ecological processes fundamental to the conceptual framework and inform future work.
5. In addition, for the urban sites, integrated approaches to examine effects of human-environment interactions on urban ecosystem dynamics.

Please read carefully the program-specific review criteria described below.

Publicly accessible data are a critical outcome of NSF's investment in LTER sites. Renewal proposals must articulate milestones and deliverables for information consistent with guidance provided below in Section V: Supplementary Documents: 2. Data Management Plan. Renewal proposals will be evaluated in part based on the availability of data collected using LTER funds, particularly data for the five core areas, with the expectation that all data collected since the inception of a site will be publicly available.

III. AWARD INFORMATION

At the end of each up to 6-year award, active LTER sites in good standing are eligible for renewal. Projects may request up to \$1,275,000 per year. This amount includes \$18,000 per year to support research experiences for two undergraduates and \$27,000 per year for Schoolyard activities. PIs of sites on probation must contact the cognizant Program Officer for budget instructions. Budgets must be thoroughly justified.

All awards are subject to the availability of funds.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

- The LTER program is currently accepting only renewal proposals. Only the organization or institution that holds the current award is eligible to apply for a renewal. Collaborative proposals must be submitted using the "single proposal" method as described in NSF Proposal and Award Policies and Procedures Guide. Separately submitted collaborative proposals will be returned without review.

Who May Serve as PI:

The lead PI on a renewal proposal must be the lead PI on the current award or one of the co-PIs listed on the current award.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or co-PI:

An individual is not allowed to be lead PI on more than a single renewal proposal.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via Research.gov or Grants.gov.

- Full Proposals submitted via Research.gov: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal and Award Policies and Procedures Guide* (PAPPG). The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg. Paper copies of the PAPPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from nsfpubs@nsf.gov. The Prepare New Proposal setup will prompt you for the program solicitation number.
- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov*. The complete text of the *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: (https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from nsfpubs@nsf.gov.

See PAPPG Chapter II.C.2 for guidance on the required sections of a full research proposal submitted to NSF. Please note that the proposal preparation instructions provided in this program solicitation may deviate from the PAPPG instructions.

The following instructions supplement the PAPPG and NSF Grants.gov Application Guide guidelines:

Proposal Format

The page limits contained in this solicitation take precedence over those given in the NSF PAPPG. Each project must be managed by a single organization with other organizations involved via sub-awards. Proposals will be subjected to initial screening for the requirements in the PAPPG and this solicitation. Those that do not meet specific requirements may be returned without review.

Cover Sheet: The title must start with the acronym, "LTER:" followed by the substantive title.

Project Description: The Project Description cannot exceed 32 pages. The 32 pages can include up to 25 pages of text and up to 7 pages of figures – no substitution of text for figures will be accepted. Text and figures can be intermixed as long as none of the limits are exceeded.

The following sections must be included (in any order):

Results from Prior Support: Describe results of prior LTER support. To provide a context for the current renewal, it may be useful to summarize, in a few sentences, the major foci of previous LTER proposals. This section should also include:

The 10 most significant publications resulting from the last 6 years of funding.

A report on data availability, summarizing briefly the table of datasets included as a supplementary document (see below).

Results of Broader Impacts

Results of any supplemental support

Response to Previous Reviews: Include in this section a description, in appropriate detail, of how the proposal incorporates major recommendations and/or addresses substantive issues identified during the recent mid-term review. If a site is currently on probationary status, changes made in response to the prior proposal review should also be summarized in this section.

Proposed Research: Essential to this section is a clear articulation of a conceptual framework that motivates questions requiring experiments and observations over long time frames. The conceptual framework should explicitly justify the long-term question(s) posited by the research and it should identify how data in LTER core areas and any experimental work contributes to an understanding of the question(s) while testing major ecological theories or concepts. The framework should provide the justification for all studies outlined in the proposal and should be informed by ongoing analyses of long-term data. Proposed research should have the goals of achieving a mechanistic understanding of biological responses to past and present environmental change at multiple scales and of using this understanding to predict ecological responses at population, community, and ecosystem levels, and - if appropriate - evolutionary responses and social responses to future environmental change.

Authors should describe in appropriate detail the experiments and observations that will be carried out and explain how these fit into the proposed conceptual framework. Methods and data analyses must be described in enough detail so that reviewers can critically evaluate the quality of those efforts. Quantitative modeling, appropriate to the maturity of the site and the problems addressed, should be a component of the research effort. Proposed models or model development must be presented in sufficient detail to allow evaluation, including of the model structure. New activities should be conceptually integrated with ongoing, longer-term studies. If cross-site or other collaborative efforts are proposed, they should fit intellectually within the overarching research plan, and authors should describe how such efforts will advance understanding of site-specific dynamics or how they relate to communities or ecosystems at different spatial scales. This section of the proposal should conclude with a synthesis that ties together the proposed research activities and shows how the project will significantly advance understanding of ecological dynamics at different spatial and temporal scales.

Details on sampling methods and design for the collection of data in the five core areas, and for new activities, are important. In some cases, less detail may be needed for ongoing projects, particularly when methods have been published in peer-reviewed journals. **Reference to established methods through links to websites is no longer allowed.**

Related Research Projects: Many LTER projects leverage funds from NSF and non-NSF sources to obtain additional research support. Please use this section to report other research efforts that are **essential** to address the questions posed in this renewal, and describe how the research efforts contribute to answering these questions.

Broader Impacts: Broader impacts that complement the proposed research activities should be presented, including new educational activities planned through Schoolyard LTER programs, public outreach, media interactions, and applications of your research to policy and management. If well justified, support will be provided for 2 REU students. Plans for their involvement in research and for their mentoring must be included. Funds for REU activities must be requested as Participant Support and described separately in the budget justification, as explained in more detail below. Support will also be provided for LTER Schoolyard activities, as described above.

References Cited: References must follow PAPPG format

Biographical Sketches: Provide a biographical sketch for the PI, co-PIs and any other senior personnel listed in the proposal. The format of the Bio Sketch must follow instructions in the PAPPG.

Budget and Budget Justification Projects may request up to \$1,275,000 per year for each of up to 6 years, as detailed above. Please contact the Program Director managing your current award for clarification or with questions about your budget.

All awards are subject to the availability of funds. Thorough justification of items requested in the budget is required. Explain why you need the funds requested to carry out specific aspects of the proposed research. Justification for general purpose equipment such as boats and other field vehicles must describe its primary or exclusive use for the proposed research.

Funds for REU students must appear as Participant Support Costs. They should be justified and accompanied by a table that includes requests for stipends, travel, and other expenses.

Budgets should include all costs charged to the project for necessary platforms and facilities supporting the research except for those facilities separately supported by NSF (e.g., UNOLS research vessels, research aircraft, or field equipment). For research involving UNOLS vessels, a UNOLS ship time request should be appended to proposals as a Supplementary Document. Likewise, research involving polar regions should follow established guidelines for requesting logistical assets, as discussed in the relevant proposal solicitations (for Antarctic Sciences, see NSF 21-567 section entitled 'Additional instructions for Proposals Involving Fieldwork'; for Arctic Sciences, see NSF 21-526 section entitled 'Proposals involving Arctic Field Work or Ship Time'). Principal Investigators are responsible for filing the appropriate requests for major research platforms, if applicable; a copy of the request must be attached as a Supplementary Document.

Current and Pending Support: Provide this information for PI, co-PI and any other senior personnel, as specified in the PAPPG. The renewal proposal is considered a pending support activity.

Facilities, Equipment and Other Resources: Describe other sources of funding, how LTER funds are leveraged at your site, and what other in-kind services are provided, and by whom. **The description should be included in the *Facilities, Equipment and Other Resources* section of the proposal, should be narrative in nature, and should not include any quantifiable financial information.** For further information please see the PAPPG.

Supplementary Documents must include the following (order is not important). Please note that Research.gov currently can only accept one file for Other Supplementary Documents. If submitting via Research.gov, please combine all documents designated as Other Supplementary Documents into one PDF.

1. A table that lists all datasets from the site that have been deposited into the Environmental Data Initiative or other public data repository (see 2. Data Management Plan below). Provide the creator name, year of publication, dataset title, a Digital Object Identifier (DOI) or a Data Package Identifier issued by the repository, and indicate which datasets are associated with the five core areas. Datasets associated with the 10 most significant publications listed in *Results from Prior Research* should also be highlighted.
2. Data Management Plan (DMP) (maximum of 5 pages): Since this document exceeds the NSF limit of two pages, it must be submitted as a separate supplemental document. A separate document must also be uploaded into the DMP module that states 'As instructed in the solicitation, this information is being submitted as Other Supplementary Documentation'.

It is expected that data derived from LTER funding will be made freely and publicly available within a maximum of two years of collection, and that LTER data and data products used in published manuscripts will also be publicly available. The DMP should describe how data management is involved in experimental design, data collection, processing, validation, documentation, curation, access, analysis, and publication of data generated by, or integral to, LTER-funded research. The DMP should document policies and procedures for meeting the site's obligation for dissemination of data and related products. It should specify clearly what datasets will be produced and where and when they will be made public. Policies regarding prioritization, delay, or limits on access must be justified. In the event of an award, annual reports should include a report on progress on the collection and publication of these datasets. Note that renewal proposals for Arctic or Antarctic sites must meet additional data management and data reporting requirements as outlined in [NSF 21-526](#) (Arctic Research Opportunities) or [NSF 21-567](#) (Antarctic Research Opportunities).

Submitters are advised to consult the following sources for best practices and policies that apply to the LTER network as a whole or to the particular NSF division under which their project is to be funded:

- o The LTER Network's Information Management Policy (<https://lternet.edu/policies/data-access>)
- o NSF Proposal & Award Policies & Procedures Guide (PAPPG): (https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg)
- o BIO Directorate's Guidance on Data Management Plans: https://www.nsf.gov/bio/pubs/BIODMP_Guidance.pdf. Antarctic Data Management language (DCL 16-055): https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf16055:
- o Division of Ocean Sciences (OCE) Sample and Data Policy (NSF 17-037): https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf17037.

The LTER program expects data to be deposited a national, public data repository capable of assigning Digital Object Identifiers (DOI) and searchable via community accepted portals such as DataONE (<https://www.dataone.org/>). A number of such repositories are available to the LTER community and PIs are encouraged to use them in accordance with the applicable policies for their site. For an expanded list of data repositories that may be appropriate, see the DataONE list of member nodes (<https://www.dataone.org/network>)

- o Environmental Data Initiative (<https://portal.edirepository.org/nis/home.jsp>)
- o The Biological and Chemical Oceanography Data Management Office (<http://www.bco-dmo.org/>)
- o The Arctic Data Center (<https://arcticdata.io/>)
- o Knowledge Network for Biocomplexity (<https://knbn.ecoinformatics.org/>)

These documents, vetted by the LTER Network governance, identify standards that members of the LTER community have agreed to meet and be reviewed against. They cover policies regarding the timely publication of data, requirements for accessing LTER data, and terms of appropriate use of LTER data. They also provide community standards for data management, assessment metrics and procedures, technological recommendations, and network collaboration.

3. Project Management Plan (maximum of 3 pages): This section should include a cohesive management plan that is adequate for a project of the size and complexity proposed. The plan should describe how decisions related to funding, research, and personnel will be made and implemented. The Project Management Plan also must address continuity of leadership and succession planning, including descriptions of efforts to recruit new scientists to the project, and efforts to increase diversity among site participants. New participants bring new ideas and fresh perspectives, which are likely to enrich the development of research at the site. Explain any major changes anticipated or proposed, including a change in the project's lead PI since the most recent award.
4. Postdoctoral Mentoring Plan (maximum 1 page): A single postdoctoral mentoring plan must be included if salaries for post-doctoral researchers are included on the postdoctoral scholars line in the proposal budget or any subaward budgets.
5. Ship time - Proposals may require the scheduling of ship time. Support for ship time for sites managed by the Division of Ocean Sciences (OCE) is generally provided by the University-National Oceanography Laboratory System (UNOLS). For OCE-managed sites, support for any non-UNOLS platforms would need to be included in the LTER site proposal budgets.
6. Logistical Support for Antarctic and Arctic LTER sites: Five current LTER sites rely on research support and logistics provided through GEO/Office of Polar Programs (OPP). The Arctic Research Support and Logistics (ARSL) Program supports the field component of research projects funded through science programs in the Arctic Sciences part of OPP and through other programs at NSF. Third party logistics providers currently include [Battelle Arctic Research Operations](#), which manages support at many Arctic sites; and UIC (Ukpeagvik Iñupiat Corporation) to support work on Alaska's North Slope; and the Toolik Field Station, which is operated by the Institute of Arctic Biology at the University of Alaska Fairbanks. The Antarctic Sciences Section, as part of the U.S. Antarctic Program (USAP), supports scientific research in Antarctica and the Southern Ocean with logistics provided by OPP's Antarctic Infrastructure and Logistics Section (AIL). **Proposals involving Antarctic fieldwork must include the statement, "This proposal requires fieldwork in the Antarctic" as the last line of the Project Summary.** In addition, **investigators proposing fieldwork must follow specific instructions found in Section V.A. "Additional Instructions" section of the NSF 21-567 Antarctic Research Program solicitation.** Projects requiring research vessel support must submit a [UNOLS ship request form](#) as a Supplementary Document. For further information for Polar sites, investigators may contact their cognizant Program Director or the Research Support or Ocean Projects Managers in the Office of Polar Programs and as listed in [NSF 21-526](#) (Arctic Research Opportunities) or [of NSF 21-567](#) (Antarctic Research Opportunities).

Single Copy Documents

Collaborators & Other Affiliations (COA) information specified in the PAPPG should be submitted using the instructions and spreadsheet template found at

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Other Budgetary Limitations:

Federal agency scientists and scientists based in other countries may participate contingent on funding from other federal agency or foreign agency partners, but not via NSF funding.

Projects may request up to \$1,275,000 per year. This amount includes \$18,000 per year to support research experiences for two undergraduates and \$27,000 per year for Schoolyard activities. Budgets must be thoroughly justified.

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

March 23, 2022

March 02, 2023

First Thursday in March, Annually Thereafter

D. Research.gov/Grants.gov Requirements

For Proposals Submitted Via Research.gov:

To prepare and submit a proposal via Research.gov, see detailed technical instructions available at: https://www.research.gov/research-portal/appmanager/base/desktop?_nfpb=true&_pageLabel=research_node_display&_nodePath=/researchGov/Service/Desktop/ProposalPreparationandSubmission.html. For Research.gov user support, call the Research.gov Help Desk at 1-800-673-6188 or e-mail rgov@nsf.gov. The Research.gov Help Desk answers general technical questions related to the use of the Research.gov system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

For Proposals Submitted Via Grants.gov:

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: <https://www.grants.gov/web/grants/applicants.html>. In addition, the NSF Grants.gov Application Guide (see link in Section V.A) provides instructions regarding the technical preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

Submitting the Proposal: Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed application will be transferred to the NSF FastLane system for further processing.

Proposers that submitted via Research.gov may use Research.gov to verify the status of their submission to NSF. For proposers that submitted via Grants.gov, until an application has been received and validated by NSF, the Authorized Organizational Representative may check the status of an application on Grants.gov. After proposers have received an e-mail notification from NSF, Research.gov should be used to check the status of an application.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal and award process (and associated timeline) is included in PAPPG Exhibit III-1.

A comprehensive description of the Foundation's merit review process is available on the NSF website at: https://www.nsf.gov/bfa/dias/policy/merit_review/.

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Building the Future: Investing in Discovery and Innovation - NSF Strategic Plan for Fiscal Years (FY) 2018 – 2022*. These strategies are integrated in the program planning and implementation

process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the strategic objectives in support of NSF's mission is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions must recruit, train, and prepare a diverse STEM workforce to advance the frontiers of science and participate in the U.S. technology-based economy. NSF's contribution to the national innovation ecosystem is to provide cutting-edge research under the guidance of the Nation's most creative scientists and engineers. NSF also supports development of a strong science, technology, engineering, and mathematics (STEM) workforce by investing in building the knowledge that informs improvements in STEM teaching and learning.

NSF's mission calls for the broadening of opportunities and expanding participation of groups, institutions, and geographic regions that are underrepresented in STEM disciplines, which is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

A. Merit Review Principles and Criteria

The National Science Foundation strives to invest in a robust and diverse portfolio of projects that creates new knowledge and enables breakthroughs in understanding across all areas of science and engineering research and education. To identify which projects to support, NSF relies on a merit review process that incorporates consideration of both the technical aspects of a proposed project and its potential to contribute more broadly to advancing NSF's mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." NSF makes every effort to conduct a fair, competitive, transparent merit review process for the selection of projects.

1. Merit Review Principles

These principles are to be given due diligence by PIs and organizations when preparing proposals and managing projects, by reviewers when reading and evaluating proposals, and by NSF program staff when determining whether or not to recommend proposals for funding and while overseeing awards. Given that NSF is the primary federal agency charged with nurturing and supporting excellence in basic research and education, the following three principles apply:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These "Broader Impacts" may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities.

These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

2. Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two merit review criteria are listed below. **Both** criteria are to be given **full consideration** during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. (PAPPG Chapter II.C.2.d(i). contains additional information for use by proposers in development of the Project Description section of the proposal). Reviewers are strongly encouraged to review the criteria, including PAPPG Chapter II.C.2.d(i), prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to
 - a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
 - b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to

achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and other underrepresented groups in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

Proposers are reminded that reviewers will also be asked to review the Data Management Plan and the Postdoctoral Researcher Mentoring Plan, as appropriate.

Additional Solicitation Specific Review Criteria

Assessment of Intellectual Merit will be based on the five principles described previously (II. Program Description). Proposals involving fieldwork in the polar regions will also be evaluated for operational feasibility, which includes resource availability, environmental protection and waste management provisions, safety and health measures, and safeguards of radioactive materials.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Panel Review.

Reviewers will be asked to evaluate proposals using two National Science Board approved merit review criteria and, if applicable, additional program specific criteria. A summary rating and accompanying narrative will generally be completed and submitted by each reviewer and/or panel. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF strives to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. Large or particularly complex proposals or proposals from new awardees may require additional review and processing time. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director acts upon the Program Officer's recommendation.

After programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications. After an administrative review has occurred, Grants and Agreements Officers perform the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

Once an award or declination decision has been made, Principal Investigators are provided feedback about their proposals. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers or any reviewer-identifying information, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award notice, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award notice; (4) the applicable award conditions, such as Grant General Conditions (GC-1)*; or Research Terms and Conditions* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award notice. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at https://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from nsfpubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the NSF *Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.

Special Award Conditions:

Mid-Term Reviews: Awardees will be required to participate in site visit reviews at a mutually agreed upon time during the award period, normally around the mid-term of the award.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer no later than 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). No later than 120 days following expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

Failure to provide the required annual or final project reports, or the project outcomes report, will delay NSF review and processing of any future funding increments as well as any pending proposals for all identified PIs and co-PIs on a given award. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through Research.gov, for preparation and submission of annual and final project reports. Such reports provide information on accomplishments, project participants (individual and organizational), publications, and other specific products and impacts of the project. Submission of the report via Research.gov constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report also must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

More comprehensive information on NSF Reporting Requirements and other important information on the administration of NSF awards is contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.

VIII. AGENCY CONTACTS

Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.

General inquiries regarding this program should be made to:

- Roberto Delgado, telephone: (703) 292-2397, email: robdelga@nsf.gov
- Karla Heidelberg, telephone: (703) 292-2586, email: kheidelb@nsf.gov
- Doug Levey, Division of Environmental Biology, telephone: (703) 292-5196, email: dlevey@nsf.gov
- Peter H. McCartney, telephone: (703) 292-8470, email: pmccartn@nsf.gov
- Kendra Mclauchlan, telephone: (703) 292-2217, email: kmclauch@nsf.gov
- Francisco (Paco) B. Moore, telephone: (703) 292-5376, email: fbmoore@nsf.gov
- Cynthia L. Suchman, telephone: (703) 292-2092, email: csuchman@nsf.gov
- Daniel Thornhill, Division of Ocean Sciences, telephone: (703) 292-8143, email: dthornhi@nsf.gov
- Maria Vernet, telephone: (703) 292-8030, email: mvernet@nsf.gov
- John E. Yellen, Division of Behavioral and Cognitive Sciences, telephone: (703) 292-8759, email: [jyellen@nsf.gov](mailto: jyellen@nsf.gov)
- Hana Busse, telephone: (703) 292-7596, email: hbusse@nsf.gov

For questions related to the use of FastLane or Research.gov, contact:

- FastLane and Research.gov Help Desk: 1-800-673-6188
- FastLane Help Desk e-mail: fastlane@nsf.gov.
- Research.gov Help Desk e-mail: rgov@nsf.gov

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail: support@grants.gov.

IX. OTHER INFORMATION

The NSF website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this website by potential proposers is strongly encouraged. In addition, "NSF Update" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF [Grants Conferences](#). Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on [NSF's website](#).

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed

via this mechanism. Further information on Grants.gov may be obtained at <https://www.grants.gov>.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic research.

NSF receives approximately 55,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Arctic and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

Facilitation Awards for Scientists and Engineers with Disabilities (FASSED) provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See the *NSF Proposal & Award Policies & Procedures Guide* Chapter II.E.6 for instructions regarding preparation of these types of proposals.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at <https://www.nsf.gov>

- **Location:** 2415 Eisenhower Avenue, Alexandria, VA 22314
- **For General Information** (NSF Information Center): (703) 292-5111
- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**
 - Send an e-mail to: nsfpubs@nsf.gov
 - or telephone: (703) 292-8134
- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See [System of Record Notices](#), NSF-50, "Principal Investigator/Proposal File and Associated Records," and NSF-51, "Reviewer/Proposal File and Associated Records." Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding the burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to:

Suzanne H. Plimpton
Reports Clearance Officer
Policy Office, Division of Institution and Award Support
Office of Budget, Finance, and Award Management
National Science Foundation
Alexandria, VA 22314

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National Science Foundation, 2415 Eisenhower Avenue, Alexandria, Virginia 22314, USA
Tel: (703) 292-5111, FIRS: (800) 877-8339 | TDD: (703) 292-5090 or (800) 281-8749

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