

# **GLOBAL LEARNING AND OBSERVATIONS TO BENEFIT THE ENVIRONMENT (GLOBE)**

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## **1997 Announcement of Opportunity for Science/Education Teams**

### *Program Announcement and Guidelines*

Proposal Receipt Deadline: *October 15, 1997*

NATIONAL SCIENCE FOUNDATION

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

## A. Introduction

The National Science Foundation (NSF), in cooperation with the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA), invites the submission of proposals for participation in the Science and Education component of the Global Learning and Observations to Benefit the Environment (GLOBE) Program. These agencies are issuing this Announcement on behalf of the GLOBE Program, a federal interagency program in which the three agencies are participants.

Projects supported by the GLOBE Program are intended to increase:

- Scientific understanding of the Earth,
- Student achievement in science and mathematics, and
- Environmental awareness of individuals.

The GLOBE program currently supports kindergarten through twelfth grade students at over 1,500 schools who make environmental observations following established research protocols, and who report their data via the Internet/World Wide Web to the GLOBE Student Data Archive. Over 2,000 additional schools and other educational venues have also committed to follow these same protocols. Data collected through GLOBE are publicly available. GLOBE also supplies training to teachers and teacher-trainers in the implementation of this program, taking its measurements, and using its learning activities which complement the measurements. A variety of information resources are provided on-line, including visualizations of some data and GLOBEMail, a web-based mail system which allows program participants around the world to communicate with one another. Those interested in responding to this Announcement may wish to further familiarize themselves with the GLOBE Program by accessing its site on the World Wide Web at <http://www.globe.gov>.

## B. Description of the Opportunity

GLOBE is seeking proposals in five specific areas described in this Announcement. Principal Investigators, co-Principal Investigators and other senior personnel should have demonstrated ability to work in a team environment and a strong commitment and ability to collaborate with a multi-disciplinary and inter-disciplinary design group. All team members should be knowledgeable about innovations in educational reform and have the ability to incorporate reform features in the design of their approaches.

All proposals must be from scientist-educator teams with the Principal Investigator being either a scientist for proposals in the first area cited below or an educator in the case of the other four areas. GLOBE is an international program and encourages scientists and educators from outside the United States to form teams and respond to this Announcement in Areas 1 and 2, although no Federal support will be provided to non-U.S. institutions. Proposals in the other three areas must come from institutions in the U.S. NSF awards to U.S. institutions and GLOBE agreements with non-U.S. institutions will be for up to four years with an approximate starting date of May 1998. International teams should pay particular attention to the special instructions which follow, and to any special restrictions in each Section.

Under this Announcement it is anticipated that 20 to 50 proposals, including international participants on a no-exchange-of-funds basis, will be selected. Approximately 20 awards to U.S. institutions are expected to total approximately \$3.6 million per year in combined funding from the three agencies, depending on the quality of the proposals received and the availability of funds. Should affordable proposals of sufficient quality not be obtained to cover the on-going activities of the GLOBE Program, the Government reserves the option of finding cost-effective, alterna-

tive approaches to ensure continued support of this program and its objectives.

### Special Instructions for International Proposals

Teams proposed in response to this Announcement may include scientists and educators from multiple countries including partnerships of U.S. and non-U.S. individuals and institutions. The GLOBE Program intends the following meaning for "no exchange-of-funds basis":

**Proposals submitted by foreign institutions will only undergo merit review, and will not receive U.S. Government funding. If support for U.S. institution(s) is requested as part of an international proposal, a U.S. institution must submit the proposal.**

All proposals with participation from institutions outside the U.S. must be accompanied by letters of endorsement from an appropriate funding source, demonstrating a commitment to fund those elements of the investigation or activity to be conducted at non-U.S. institutions, should the proposal be selected.

International Proposals will be accepted only for Areas 1 and 2 below, and must be submitted in the English language.

A description of the on-going measurements included in GLOBE is given in Section C. Proposals are solicited for the following program areas:

## Area 1 - Scientific Involvement in GLOBE and Its Measurements

For scientific involvement in GLOBE, one must propose to:

- conduct environmental research using GLOBE student data culminating in publications in the refereed scientific literature;
- assume responsibility for one or more existing or new GLOBE measurement protocols as follows:
  - modify or establish the protocols, as needed, to assure that the resulting data will meet established standards for use in research;
  - test any new protocols or protocol changes in the field and laboratory setting and in school implementation;
  - resolve any questions pertaining to the protocols;
  - review all data submitted to GLOBE using these protocols and support overall GLOBE data quality control and assurance efforts; and
  - review and establish all instrument specifications and resolve related questions pertaining to instrumentation alternatives and materials;
- support the overall training and outreach activities of GLOBE including:
  - science team participation in selected training workshops;
  - interactions with students and teachers, answering their questions, participating in “Web Chats,” providing on-line messages and visiting GLOBE schools; and
  - some mentoring of GLOBE students, particularly in the students’ efforts to conduct and publish their own research.

Investigations will be selected to support the on-going measurement protocols listed in section C, including the protocols for use of the Global Positioning System (GPS) to locate GLOBE study and sample sites. Support for new measurements will be considered provided that:

- these measurements are appropriate for, and accessible to, all GLOBE schools except those where location precludes making the measurements;
- they are of high scientific priority in research to improve the understanding of the global environment;
- they complement the existing measurements and extend them within the on-going areas of observation (atmosphere/climate, hydrology, land cover/biology, and soil); and,

- the cost of any additional equipment required by the schools for the conduct of a new protocol or closely related group of protocols should be modest and appropriate for purchase by individual schools.

All proposals for Area 1 must clearly identify the measurement protocols for which responsibility will be assumed.

It is anticipated that 10 to 30 such proposals will be selected, including those submitted by the international community on a no-exchange-of-funds basis.

For proposals in Area 1, the scientist-educator team should be led by a scientist who will serve as Principal Investigator, with an additional scientist and one or two educators who will serve as co-Principal Investigator(s).

## Area 2 - Development of Learning Activities

Proposals for the development of learning activities in support of GLOBE measurements must include:

- development of new learning activities that complement the GLOBE measurement protocols;
- adaptation of existing learning activities to enhance the inquiry-based approach and/or, the use of the features of the GLOBE Student Data Server, such as GLOBE student data, GLOBE visualizations and GLOBEMail;
- ongoing support of learning activities through collaboration with the science and evaluation teams, materials development teams, the GLOBE Office, the systems development teams; through fine-tuning and adaptation of materials based on field testing and interaction with the above cited groups, attendance; and through presentation and modeling of the learning activities at planning and training sessions;
- classroom testing of learning activities prior to their inclusion in the GLOBE Teachers Guide;
- provision of the learning activities and associated educational materials in forms which support their dissemination in print, on the World Wide Web, and in other media as appropriate; and,
- support for the overall training and outreach activities of GLOBE including answering the questions of teachers and providing them assistance as needed in effectively using these learning activities.

Learning activities may focus on one or more of the measurement groups listed in Section C, on the *Seasons Investigation*, on a new Earth System Science investigation, or on combinations spanning more than one of these areas or groups.

To the extent permitted within available funds, GLOBE will select efforts in the development of learning activities which in the aggregate:

- cover the full range of current GLOBE Investigation areas (i.e. the measurement groups listed in Section C plus *Seasons* and Earth System Sciences, described below);

- incorporate an inquiry-based approach, including the use of questioning, planning and conducting investigations, use of tools to collect and analyze data, development of explanations about conclusions of investigations and communication of results by students;
- involve and encourage use of tools such as modeling, geographic information systems, and visualizations and use of comparisons with remote sensing data in the analysis GLOBE of data;
- take advantage of GLOBE infrastructure by encouraging use of the features of the GLOBE Student Data Server, such as GLOBE student data, GLOBE visualizations and GLOBEMail;
- support teachers in improving science, mathematics, geography, computer, social science, language, and inter-disciplinary education;
- cover the full spectrum of grade levels K - 12 (or ages 5 to 18 years) with age appropriate activities; and,
- serve as vehicles for the establishment of learning communities within schools, school districts and beyond school districts within countries and internationally.

Priority areas of design will include learning activities which focus on lower elementary students (K-3 in the U.S. and the equivalent in other countries) and high school activities which focus on disciplinary design so that they can easily be incorporated in traditional courses such as general science, biology, chemistry and physics. Development of strategies and approaches for integration of learning activities in school curricula will also be priorities.

It is anticipated that 5 to 15 such proposals will be selected, including those submitted by the international community on a no-exchange-of-funds basis.

For proposals in Area 2, the scientist-educator team should be led by an educator who will serve as Principal Investigator, with an additional educator and one or two scientists who will serve as co-Principal Investigator(s).

### **Area 3 - Design of U.S. Student Assessment Tools for Protocols and Learning Activities**

Proposals for the development of U.S. student assessment tools for use by teachers, if they so choose, in conjunction with this program should include:

- development of and on-going support for tools that can be used to assess student understanding of all aspects of GLOBE, including assessment tools for both the protocols and learning activities;
- design of assessment items which link the concepts, skills and processes in the protocols and learning activities and correlate with the formative and summative program evaluation;

- classroom testing of all assessment tools prior to their inclusion in the GLOBE Teachers Guide;
- provision of sufficient information to enable teachers to understand and use these tools for inclusion in each section of the GLOBE Teacher's Guide in forms which support their dissemination in print, on the World Wide Web, and in other media as appropriate;
- provision of tools spanning the range of learning styles including use with non-traditional learners; and
- support for the overall training and outreach activities of GLOBE including answering the questions of teachers and providing them assistance as needed in effectively using these assessment tools.

It is expected that only one award will be made for support of student assessment. For this area, proposals must be from U.S. institutions.

For proposals in Area 3, the scientist-educator team should be led by an educator who will serve as Principal Investigator, with an additional educator and a scientist who will serve as co-Principal Investigator(s).

Priority will be given to proposals with Principal Investigators who have strong backgrounds in student assessment.

Assessment tools described in this Announcement are intended for classroom use for determining understanding of concepts and in assessing student progress so as to guide instruction; it is and not intended for use in program evaluation, which is addressed in Area 4.

### **Area 4 - Evaluation**

Evaluation plans of the GLOBE Program should include:

- establishment of clear indicators, both quantitative and qualitative, by which the effectiveness of GLOBE can be measured with respect to the program goals given in Section A;
- formative and summative program evaluation strategies;
- assessment of GLOBE implementation in classrooms, schools, and communities with respect to these established metrics and with respect to the effectiveness and quality of materials for students and teachers with respect to information infrastructure, materials, and training; and,
- a timeline that allows for the production of evaluation reports at least annually with interim reports as needed by GLOBE Program management.

It is expected that only one award will be made for support of GLOBE evaluation. For this area, proposals must be from U.S. institutions.

For proposals in Area 4, the scientist-educator team should be led by an educator who will serve as Principal Investigator, with additional educators and a scientist who will serve as co-Principal Investigator(s).

Priority will be given to proposals with Principal Investigators who have strong backgrounds in evaluation. Coordination with

the other groups working on the science protocols, learning activities, and student assessment tools, as well as with GLOBE management and GLOBE computer systems teams, will be critical.

These data will be collected for statistical purposes associated with the evaluation of the effectiveness and the refinement of the GLOBE Program.

## Area 5 - Development and Integration of Educational Materials

Proposals for the development of educational materials in support of the overall GLOBE program should include:

- enhancing the current GLOBE Teacher's Guide and producing those components of the Guide and associated materials which complement the protocols and learning activities and complete and enhance the educational effectiveness of the overall set of GLOBE materials;
- overall integration of materials in and delivery of future editions of the GLOBE Teacher's Guide in print, on the World Wide Web, and in other media as appropriate, up to the point of, but not including, printing, operational dissemination, or reproduction;

- assumption of responsibility for maintaining the current GLOBE Teacher's Guide; including maintaining a digital master version, making and tracking changes as directed by GLOBE management, suggesting enhancements, providing digital or hard copy masters for the printer, liaison with the GLOBE Office and the printer; and
- support for interactions and teaming with those selected for scientific involvement and development of learning activities (items 1, 2 and 3 above) on their provision of all required inputs for the Teacher's Guide; and support for the overall training and outreach activities of GLOBE including answering the questions of teachers and providing them assistance as needed in effectively using the Teacher's Guides.

It is expected that only one award will be made for support of development and integration of educational materials. For this area, proposals must be from U.S. institutions.

For proposals in Area 5, the scientist-educator team should be led by an educator who will serve as Principal Investigator, with an additional educator and one or two scientists who will serve as co-Principal Investigator(s).

# C. GLOBE Program Description

## Current GLOBE Materials

Currently GLOBE measurements are grouped into four areas or investigations —Atmosphere/Climate, Hydrology, Land Cover/Biology, and Soil. There is also an investigation for Global Positioning System (GPS) measurements that the students are required to make at their school and at each of their measurement sites. For each of these measurement groups, additional material is provided including background information, interviews with the Principal Investigators, and a description of the context for the scientific use of the data.

Two additional sections of GLOBE materials will be composed only of learning activities: the existing *Seasons* material, and new Earth System Science investigations materials resulting from proposals responding under this Announcement. *Seasons* materials are available through the GLOBE Office. Generally, only one group will be selected to support a given set of closely interrelated protocols (e.g. total snow accumulation, daily new snow, and water equivalent of daily new snow), but there may be cases where multiple groups are selected to support the same protocol set (e.g. hydrology measurements carried out in fresh water and brackish water or land cover measurements in forests and grasslands). Proposers should clearly state the protocols which they offer to support and whose data they intend to use. GLOBE may negotiate the scope of activities to achieve the coverage desired within cost and practical constraints.

## Current GLOBE Measurements

### Atmosphere/Climate

- Cloud cover and cloud type
- Ultraviolet flux within one hour of local solar noon
- Liquid precipitation within the previous 24 hours
- Solid precipitation within the previous 24 hours and its liquid water equivalent
- Total snow accumulation
- pH of rain or melted snow
- Atmospheric temperature within one hour of local solar noon and maximum and minimum temperatures within the previous 24 hours

### Hydrology

- Surface water temperature
- pH
- Conductivity of fresh water or salinity of salt or brackish water
- Dissolved oxygen

- Nitrogen as nitrate
- Turbidity of the water column or surface water

### Land Cover/Biology

- Extent of canopy and ground cover
- Dominant and subdominant species in the canopy and the heights and circumferences of five individuals of each of these species for forest, woodland, or shrubland sites
- Dominant and subdominant species, and dry biomass of one square meter during the growing season for grassland sites
- Manual and unsupervised classifications of 15 km by 15 km GLOBE Study Sites centered on each school using Landsat Thematic Mapper data and the Modified UNESCO Classification system and accuracy assessment of these classifications
- Land cover assessment at selected sample sites

### Soil

- Characterization of each horizon in profiles of the top one meter of soil, including:

- Structure, color, consistence, texture, sand, silt, and clay content, pH, fertility (nitrogen as nitrate, phosphate, and potassium content), and bulk density, and vertical extent
- Soil moisture in the top 5 cm to one meter of soil
- Infiltration of water into the soil
- Soil temperature at depths of 5 and 10 cm

### Global Positioning System (GPS)

- GPS based location, measured directly or determined with off-sets

Detailed GLOBE Measurement Protocols are found in the GLOBE Teacher's Guide and are available at <http://www.globe.gov> on the World Wide Web.

Proposers wishing to have a current copy of the full GLOBE Teacher's Guide in printed form should contact Jean Fitch at GLOBE, Tel: +1 (202) 395-7600 or by e-mail at <[fitch@globe.gov](mailto:fitch@globe.gov)>. Expedited delivery can be arranged at your cost.

## D. Preparation and Submission of Proposals

Grant proposals for support of activities under each of the five program areas described above are invited. Applicants should identify the specific area addressed by their proposals. Institutions wishing to propose in more than one area should submit separate proposals for each area and include appropriate cross-references in each including any budget changes which would result if more than one of these proposals were accepted.

Proposals submitted in response to this Announcement will be accepted from colleges, universities, and other not-for-profit institutions. Proposals should be prepared and submitted in accordance with the guidelines provided in the NSF *Grant Proposal Guide (GPG, NSF 95-27)*. This document contains blank forms and full instructions for proposal preparation. Single copies of this brochure are available at no cost from:

Forms and Publications Unit  
Room P-15  
National Science Foundation  
4201 Wilson Boulevard  
Arlington, VA 22230

Copies of this document may also be ordered by telephone from the NSF Forms and Publications Unit at +1 (703)-306-1130 or via e-mail at <[pubs@nsf.gov](mailto:pubs@nsf.gov)>. More comprehensive information is contained in the NSF *Grant Policy Manual (NSF 95-26)*, for sale through the Superintendent of Documents, Government Printing Office, Washington, DC 20402, USA.

Proposals will be subjected to initial screening for the requirements in the *GPG* and will be returned without review or advance notification if deficiencies are found. Proposals will NOT be forwarded to other programs if found to be inappropriate for GLOBE.

Twelve (12) copies of each proposal, including one copy bearing original signatures committing the institutions involved to their responsibilities as proposed, should be mailed to:

Proposal Processing Unit, Room P-60  
Attention: GLOBE/GEO  
National Science Foundation  
4201 Wilson Boulevard  
Arlington, VA 22230

The original signed copy should be printed only on one side of each sheet. Additional copies may be printed on both sides.

### Proposal Submission Date

Proposals submitted in response to this Announcement must be received by the NSF by **October 15, 1997**. Proposals will be returned without review or comment after this date.

### Project Period

Funding of successful proposals is planned to commence in May 1998, and budgets submitted should be for up to four years,

showing annual increments. Funding will be approved in annual increments subject to satisfactory progress and the availability of funds.

## Proposal Review

Proposal review will be conducted by NSF on behalf of GLOBE and the participating agencies; thus, proposal format should follow NSF guidelines as detailed in the *GPG*. It is anticipated that proposals will be subject to both mail and panel reviews with the panels convening in early February 1998.

## Review Criteria

Proposals will be reviewed in accordance with the standard NSF external merit review process. Reviewers of the proposals will consider standard NSF evaluation criteria, and GLOBE Program specific criteria.

## NSF Review Criteria

The standard NSF criteria are as follows:

- **What is the intellectual merit and quality of the proposed activity?**

The following are typical questions that will be asked in assessing how well the proposal meets the criterion:

- What is the likelihood that this project will significantly advance the knowledge base within and across different fields?
- Does the proposal show an awareness of issues surrounding GLOBE, the requirements of a science and education program involving students from around the world, and the relevant work already done in this program?
- Will the proposal be supported by the involvement of appropriate personnel including leadership by an effective scientist-educator partnership, as well as having adequate facilities, resources, and an institutional commitment?
- Does the proposal address the areas of interest to GLOBE?
- Are the preliminary goals and objectives, and the plans and procedures for achieving the goals of the proposal well-developed, innovative, worthwhile, and realistic?
- Does the proposal take into consideration the background, preparation and capability of GLOBE students?
- Will the proposed activity contribute positively to the overall effectiveness of the GLOBE Program?
- Are the results likely to be useful?

- **What are the broader impacts of the proposed activity?**

This criterion relates to the potential of the proposed project to contribute to greater cooperation between researchers and educators, greater understanding or improvement of the quality, distribution, or effectiveness of research done by scientists, or to improvement of the GLOBE Program. Typical questions raised during the review process are:

- How well does the activity advance discovery and understanding while concurrently promoting teaching, training, and learning?
- Will it create/enhance facilities, instrumentation, information bases, networks, partnerships, and/or infrastructure?
- How well does the activity broaden the diversity of participants? Does the activity enhance scientific and technological literacy?
- Will the proposed activity promote effective cooperative arrangements between researchers and educators?
- Does the proposal effectively address the GLOBE objectives given in Section A?
- Will the proposal include any provisions to prepare students in associated learning institutions for careers in science, technology, social sciences, and policy?
- Are plans for dissemination and communication of results appropriate and adequate?

## GLOBE Review Criteria

Through the review process, priority will be given to applicants who can demonstrate (1) a commitment to and expertise in design, implementation or evaluation of student-based science activities, (2) the ability to deliver their results or products in a timely fashion with excellence, (3) a mutual, strong commitment from a scientist-educator team, (4) cost effectiveness, including institutional cost-sharing, and (5) a willingness and ability to contribute to the overall GLOBE Program.

**Criteria specific to the GLOBE Program are delineated in Section B. Please note that each of the five areas of opportunity have specific criteria.**

## Additional Guidance

Further information can be obtained from GLOBE by contacting Dr. Dixon M. Butler, Assistant Director for Science <[dbutler@globe.gov](mailto:dbutler@globe.gov)>, or Dr. Ralph K. Coppola, Assistant Director for Education <[rcoppola@globe.gov](mailto:rcoppola@globe.gov)> or by contacting Dr. Paul Filmer, NSF GLOBE Program Director, at the National Science Foundation <[globe@nsf.gov](mailto:globe@nsf.gov)>.

## Award Announcements

Awards will be made individually through written notices to the institution. Before such information is dispatched, the Foundation can give no information concerning the probability that any particular proposal will be supported or declined. **Proposers are strongly urged to refrain from making inquiries.** Decisions on awards will be announced as soon as they are made, not simultaneously. Thus, it is normal for some proposers to receive a decision earlier than others. It is expected that awards will be made during May of 1998. The number of awards will depend on the quality of the proposals received and the availability of funds for this program.

## Award Administration

Grants awarded as a result of this Announcement will be administered in accordance with the terms and conditions of *Grant General Conditions (GC-I)*, or *Federal Demonstration Partnership General Terms and Conditions (FDP-III)*, depending on the grantee organization.

Grants will be awarded to the lead U.S. institution identified in the proposal, which will be responsible for financial accountability.

International agreements will be negotiated by GLOBE with non-U.S. proposing institutions for activities selected under this Announcement.

## Privacy Act and Public Burden Statements

The National Science Foundation (NSF) provides awards for research and education in the sciences and engineering. The awardee is wholly responsible for the conduct of such research and preparation of the results for publication. The Foundation, therefore, does not assume responsibility for the research findings or their interpretation. The Foundation welcomes proposals from all qualified scientists, engineers and educators, and strongly encourages women, minorities, and persons with disabilities to compete fully in any of the research and education-related programs described here. In accordance with Federal statutes, regulations, and NSF policies, no person on grounds of race, color, age, sex, national origin, or disability shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from the National Science Foundation. Facilitation Awards for Scientists and Engineers with Disabilities (FASSED) provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF-supported projects. See the program announcement or contact the program coordinator at +1 (703) 306-1636.

The Foundation has TDD (Telephonic Device for the Deaf) capability, which enables individuals with hearing impairment to communicate with the Foundation about NSF programs, employment, or general information. To access NSF TDD, dial +1 (703) 306-0090 for FIRS +1 (800) 877-8339. Activities described in this publication are in categories 47.050, *Geosciences*, and 47.076, *Education and Human Resources*, in the Catalog of Federal Domestic Assistance (CFDA).

The information requested on proposal forms is solicited under the authority of the National Science Foundation Act of 1950, as amended. It will be used in connection with the selection of qualified proposals and may be disclosed to qualified reviewers and staff assistants as part of the review process; to applicant institutions/grantees to provide or obtain data regarding the review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers as necessary to complete assigned work; and to other government agencies in order to coordinate programs. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 60 Federal Register 4449 (January 23, 1995), and NSF-51, "Reviewer/Proposal File and Associated Records," 59 Federal Register 8031 (February 17, 1994). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of your receiving an award.

Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing the instructions. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to:

Gail A. McHenry  
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