Macrosystems Biology: Research on Biological Systems at Regional to Continental Scales

PROGRAM SOLICITATION
NSF 10-555

National Science Foundation

Directorate for Biological Sciences

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

September 16, 2010

April 04, 2011

First Monday in April, Annually Thereafter

IMPORTANT INFORMATION AND REVISION NOTES

A revised version of the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), NSF 11-1, was issued on October 1, 2010 and is effective for proposals submitted, or due, on or after January 18, 2011. Please be advised that the guidelines contained in NSF 11-1 apply to proposals submitted in response to this funding opportunity. Proposers who opt to submit prior to January 18, 2011, must also follow the guidelines contained in NSF 11-1.

Cost Sharing: The PAPPG has been revised to implement the National Science Board's recommendations regarding cost sharing. Inclusion of voluntary committed cost sharing is prohibited. In order to assess the scope of the project, all organizational resources necessary for the project must be described in the Facilities, Equipment and Other Resources section of the proposal. The description should be narrative in nature and must not include any quantifiable financial information. Mandatory cost sharing will only be required when explicitly authorized by the NSF Director. See the PAPP Guide Part I: *Grant Proposal Guide (GPG)* Chapter II.C.2.g(xi) for further information about the implementation of these recommendations.

Postdoctoral Researcher Mentoring Plan: As a reminder, each proposal that requests funding to support postdoctoral researchers must include, as a supplementary document, a description of the mentoring activities that will be provided for such individuals. Please be advised that if required, FastLane will not permit submission of a proposal that is missing a Postdoctoral Researcher Mentoring Plan. See Chapter II.C.2.j of the GPG for further information about the implementation of this requirement.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Macrosystems Biology
Research on Biological Systems at Regional to Continental Scales

Synopsis of Program:

The Macrosystems Biology: Research on Biological Systems at Regional to Continental Scales will support quantitative, interdisciplinary, systems-oriented research on biosphere processes and their complex interactions with climate, land use, and invasive species at regional to continental scales as well as planning and development activities to enable groups to conduct Macrosystems Biology Research.

Cognizant Program Officer(s):

- Elizabeth R. Blood, telephone: (703) 292-8400, email: eblood@nsf.gov
- Todd A. Crowl, telephone: (703) 292-7870, email: tcrowl@nsf.gov

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

- 47.074 --- Biological Sciences

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 10 to 15

Anticipated Funding Amount: $20,000,000 pending availability of funds. Two categories of awards will be made. Category 1 Awards: Exploratory or incubation grants to develop teams, explore a high risk idea, strategy, or innovative approach, hold

workshops and develop plans to establish regional to continental scale networks of partners. These awards will be 1 to 2 years in duration. Category 2 Awards: Larger and longer grants to support full-fledged Macrosystems Biology Research or Modeling studies. These awards may be up to 5 years in duration. Budgets for each type of award should reflect the scope and complexity of the work proposed.

Eligibility Information

Organization Limit:

Proposals may only be submitted by the following:

- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.
- Other Federal Agencies and Federally Funded Research and Development Centers (FFRDCs): Contact the appropriate program before preparing a proposal for submission.

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI:

None Specified

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not Applicable
- **Preliminary Proposal Submission:** Not Applicable
- **Full Proposals:**
  - Full Proposals submitted via FastLane: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg.
  - 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: http://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:** Not Applicable

C. Due Dates

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

  September 16, 2010

  April 04, 2011

  First Monday in April, Annually Thereafter

Proposal Review Information Criteria

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

Award Administration Information

Award Conditions: Standard NSF award conditions apply.

Reporting Requirements: Standard NSF reporting requirements apply.

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I. INTRODUCTION

The biosphere has changed more in the past 50 years than during any time in human history. Many of the changes are driven by human activities such as climate and land use change, and the introduction of invasive species that collectively affect living systems by altering the fundamental relationships between life and the non-living environment that sustains it. Many of the changes challenge our understanding of how the biosphere works - how the ecological systems on which we depend will respond to changes in climate, land use, biodiversity, and a host of related environmental factors. Our current understanding of the biosphere is largely based on knowledge derived either from small plot (less than 1 hectare) research or from satellite-scale remote sensing. However, the basic scientific knowledge needed to understand the biosphere at regional to continental and annual to decadal scales, to quantify the strong and weak forces regulating the biosphere, and to predict the consequences of climate and land use change and invasive species on living systems cannot be extrapolated from studies conducted at local or global scales.

A major challenge in developing a predictive capability is that biosphere responses are often non-linear and can involve contagious spread of organisms, diseases, etc. from local to continental scales, with the most extreme impacts in zones where multiple factors converge. Large and often unpredictable changes in the biosphere can result from the interplay between fine-scale patterns and processes coupled with broad scale dynamics. These cross-scale interactions contribute to the observed non-linear dynamics and may be accompanied by abrupt threshold responses. Because many of these responses and feedbacks occur at regional to continental scales, they cannot be investigated with disconnected studies of individual ecosystems or short periods of observation.

II. PROGRAM DESCRIPTION

The National Science Foundation invites proposals from interdisciplinary teams of scientists to conduct innovative, integrated, systems-oriented "macrosystems biology" research to detect, understand and forecast the consequences of climate and land use change and invasive species on the biosphere at regional to continental scales. Proposals should address the scales where the ecological research challenges are the greatest and where research has the greatest potential to transform the field of ecology by addressing scaling issues that have long hindered development of large-scale ecology. Projects should strive to provide a mechanistic understanding of how multiple scale dynamics contribute to the structure, functioning, and change of the biosphere, and lead to the development of a more predictive understanding of ecological change. Proposals should be well grounded in theory, include novel approaches that will result in a theoretical framework for a predictive understanding of macroscale biology, and shows great promise for enhancing basic theoretical understandings.

Proposals should include quantitative research approaches such as mathematical or computational models; numerical simulations; artificial intelligence techniques; statistics; visualization; or database development. Proposals are encouraged for the development and/or integration of macrosystems models (e.g., data-assimilation, biological, ecological, environmental) that link local, regional and continental scales. These models should address key problems linking ecological and evolutionary processes over a variety of spatial and temporal scales. Projects should develop theoretical foundations that will be useful for modeling based on either existing data and/or data to be collected by existing or planned environmental observatories. Mathematical models should include appropriate estimates of uncertainty, and experiments should assess power and precision.

Non-exclusive example questions include:

- What are the structuring processes that determine the temporal dynamics and spatial structure of regional systems? Are these processes scale dependent? How do these processes vary across the continent or at continental margins?
- How does inter-annual variability of biosphere exchange respond to oscillations in general circulation patterns (e.g. El Nino Southern Oscillation, Pacific Decadal Oscillation, North Atlantic Oscillation)? How does the onset of these effects track in time and space with the teleconnections of these general circulation patterns across the continent?
- How will the biosphere respond to changes in natural- and human-induced forces such as climate, land use, and invasive species across a range of spatial and temporal scales? What is the pace and pattern of the responses? What is the effect on biosphere services at local, regional, and continental scales?
- What is the impact of "connectivity" (local patterns and processes affecting broad-scale ecological dynamics) on the global environment? What are the strong and weak forces that connect or influence regions?
- What are the causes and consequences of regional synchrony in dynamics of populations? Are there continental scale drivers that entrain regional and local patterns of population growth, dispersal, speciation, or diversification?

- How are local and regional scale process of invasion and disease transmission shaped by continental scale patterns of connectivity? How can continental scale data inform forecasts of disease outbreaks and invasions? How do invasive species or emerging diseases arrive at a new location?
- How do climate and land-use changes impact temperature and carbon cycling in lakes and streams, and what is their effect on aquatic metabolism? How do these changes alter the connectivity among regions or regional feedbacks to climate?
- How do changes in intensity, spatial distribution and frequency of extreme events affect regional systems and their attributes? How will changes in regional systems affect other regions or their connectivity (e.g. soil erosion and airborne dust, water retention, nutrient export, invasive species)?
- What are the ecological and socio-ecological consequences of local land-use changes at regional and continental scales? What are the spatial and temporal patterns in human activity within a region and their consequences to the biosphere?
- How are dust, nutrient, or biological source and deposition regions (connected through air and water vectors) related to patterns of human activity or land use, and how does the biosphere structure, function and services respond to changes in loadings resulting from changing human activity or land use?
- How does climate change affect regional temperature, hydrology, and drought severity, and what influences are predicted on species distributions and interactions, phenology, or biosphere productivity, biogeochemistry or evolution?
- How will climate-change-induced impacts on fuel accumulation, combustibility and rates of ignition impact fire regimes of landscapes, regions, or continents?

Proposals may leverage existing research networks such as Long Term Ecological Research (LTER), research sites (Critical Zone Observatories - CZO), field stations, synthesis centers, and ongoing and proposed academic and federal programs such as the National Ecological Observatory Network and the Ocean Observing Initiative. However the proposals must clearly demonstrate how the research will develop fundamentally new knowledge and enhance theory.

Proposals should contain innovative approaches to develop the capabilities of people and/or tools needed to advance these areas of research in the future, so that the next generation of researchers will learn to work in diverse teams across disciplinary and international boundaries, and use advanced sensing and monitoring, communication, and information technologies to work across many scales of time and space.

The inclusion of post-doctoral training opportunities is particularly encouraged. The proposals should offer an innovative and forward thinking plan for post-doctoral training that extends beyond the mentoring that would normally occur as part of a single research project. Training opportunities could include short-courses, workshops, or other activities (national or international). Sample topics might include leadership, large project management, application of statistical methods for integrating data across scales, isotope methods useful for macro-scale studies, or computational techniques for dealing with large, regional or continental datasets.

Regional to continental scale processes transcend international boundaries. The data, information, knowledge, and expertise to fully understand these dynamics may require international partnerships. Relevant and appropriate international partnerships are encouraged through this solicitation and other NSF solicitations to conduct collaborative research and to build collaborations (e.g. Research Coordination Networks). Funding guidelines for involving international collaborators include:

- Travel expenses for US scientists and students participating in exchange visits integral to the project.
- Project-related expenses for international partners to engage in research activities while in the United States as a project participant.
- Project-related expenses for US participants to engage in research activities while abroad as a project participant.

III. AWARD INFORMATION

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 10 to 15

Anticipated Funding Amount: $20,000,000 pending availability of funds. Two categories of awards will be made. Category 1 Awards: Exploratory or incubation grants to develop teams, explore a high risk idea, strategy, or innovative approach, hold workshops and develop plans to establish regional to continental scale networks of partners. These awards will be 1 to 2 years in duration. Category 2 Awards: Larger and longer grants to support full-fledged Macrosystems Biology Research or Modeling studies. These awards may be up to 5 years in duration. Budgets for each type of award should reflect the scope and complexity of the work proposed.

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds and quality of proposals. This program is expected to last ~ 5 years, subject to availability of funds and programmatic considerations.

IV. ELIGIBILITY INFORMATION

Organization Limit:

Proposals may only be submitted by the following:

- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.
- Other Federal Agencies and Federally Funded Research and Development Centers (FFRDCs): Contact the appropriate program before preparing a proposal for submission.

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI:

None Specified

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 Grants.gov or via the NSF FastLane system.

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF Grant Proposal Guide (GPG). The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

- 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: (http://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) 292-7827 or by e-mail from nsfpubs@nsf.gov.

In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via the NSF FastLane system. Chapter II, Section D.4 of the Grant Proposal Guide provides additional information on collaborative proposals.

The information below supplements the standard proposal preparation guidelines in the GPG and the NSF Grants.gov Application Guide. It pertains to all submissions.

Proposal Cover Sheet.

Indicate the solicitation number in the PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE block and select "Macroscale Biology" as the Program in the Unit Selection List. If your project includes international activities, you must check the box for "International Cooperative Activities Country Name" that appears under Other Information when the "remainder of cover sheet" is clicked, then select the countries involved.

NOTE: For all proposals, a starting date of March 15, 2011 or later should be requested.

Project Summary. Provide a summary description of the project, including its research or development theme and key innovative features, in a manner that will be informative to a general technical audience. If the project includes international activities, they should be included in the project summary also. Project Summaries must be written carefully to explicitly point to and detail the two NSF merit review criteria -- intellectual merit and broader impacts -- in separate paragraphs. If the project summary does not explicitly address both the intellectual merit and the broader impacts of the proposed activity, the proposal will be returned without review. At the top of this page include the title of the project, the name of the principal investigator, and the lead organization. Also list all other participating institutions/organizations, including international collaborators.

Table of Contents: The Table of Contents is system generated and cannot be edited.

Project Description.

Project Descriptions are limited to 15 pages total, including several specific required parts described below. This 15 page limit does not include pages devoted to references, the project budget, or supplementary documentation. The project description includes:

a. Results of Prior NSF Support: Proposals must include relevant results from prior NSF support.

b. Description of Research and Education Activities: The description should provide a clear statement of the research and education activities to be undertaken. It should include the empirical and theoretical foundations of the work, with reference to relevant work of the applicants and others; details of the methods to be used; and explain the significance of the outcomes. The narrative should reflect the intellectual merit of the work, its innovativeness, and responsiveness to the objectives of the solicitation. As appropriate, clear description of qualitative, quantitative, or experimental methods and procedures should be included. Projects involving international collaborations or other activities should describe them here. The broader impacts of the proposed activities should be an integral part of the narrative.

Biographical Sketches. Each proposal must include biographical sketches for all senior investigators, and also include biographical sketches for principal foreign collaborators. All biographical sketches must adhere to the format given in the GPG.

Project Budget. The budget justification (up to 3 pages) should explain and justify major cost items. For undergraduate and graduate student participants and postdoctoral associates, include a breakdown of costs by types of participants. Funds to cover the cost of attendance of the PI at an annual awardee meeting in Arlington, VA should be requested.

Proposals Involving Multiple Organizations. Proposals involving multiple organizations may be submitted in one of two ways: (1) as a single proposal with one organization serving as the lead organization and with support to other organizations provided through subawards, or (2) as a collaborative proposal, where each submitting organization must meet the eligibility criteria outlined in section IV. Please note that all collaborative proposals submitted as separate submissions from multiple organizations must be submitted via FastLane. Chapter II, Section D.4 of the GPG provides additional information on collaborative proposals.

Proposals Involving Collaborators at Foreign Organizations. Proposers are reminded they must provide biographical sketches of all

senior project personnel, including those at foreign organizations. In addition, as supplementary documentation, proposals involving foreign collaborators should provide documentation of a willingness to collaborate through letters of commitment from the international counterpart organizations. Please note that although eligibility for this competition is restricted to US organizations collaborations with foreign organizations may be considered.

Projects with international activities should include: a) details on the complementary expertise of the US and foreign partners; b) a description of the proposed contributions and division of labor among participating researchers and institutions; c) plans for involving US students and junior researchers.

Supplementary Documents

1. Data Management and Access Plan (3 pages maximum)
   All proposals must include a description of the data sets that will be collected or collated, including their sources, plans for interpretation or analysis, and for preservation, documentation, and sharing of data, samples, and physical collections and their final disposition. The data management plan should also include explicit descriptions of models, their data sources and model validation outputs. This supplementary document must be labeled "**Data Management Plan**".

2. Project Management Plan (3 pages maximum)
   Each proposal must contain a management plan, which includes 1) the specific roles of the PI, co-PIs, other senior personnel and paid consultants at all organizations involved; 2) how the project will be managed within and across organizations and disciplines; 3) identification of the specific coordination mechanisms that will enable cross-institution and/or cross-discipline scientific integration (e.g., regular meetings or teleconferencing, yearly workshops, graduate student exchange, project meetings at conferences, videoconferences, software repositories, etc.); 4) clearly delineated project milestones and deliverables; and 5) pointers to the budget line items that support these coordination and management mechanisms.

3. Postdoctoral Researcher Mentoring Plan (1 page maximum)
   Each proposal that includes funding for one or more post-docs must include a mentoring plan that explicitly states the roles of the post-doc as well as how they will interact with the other project personnel. See GPG, Chapter II.C.2.j for additional information on postdoctoral researcher mentoring plans.

Single Copy Documents:

Collaborators/Individuals with Conflicts of Interest. Provide a list, in an alphabetized table, of the full names and institutional affiliations of all persons with potential conflicts of interest as specified in NSF's Grant Proposal Guide. For each PI, Co-PI and other Senior Personnel, include all co-authors/editors and collaborators (within the past 48 months), all graduate advisors and advisees, and any other individuals or institutions with which the investigator has financial ties (please specify type). Do not include the names of people with whom you do not have conflicts as this may unnecessarily limit qualified reviewers. In addition, list all subawardees who would receive funds through the Macrosystems Biology award.

B. Budgetary Information

Cost Sharing: Inclusion of voluntary committed cost sharing is prohibited

C. Due Dates

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

  September 16, 2010

  April 04, 2011

  First Monday in April, Annually Thereafter

D. FastLane / Grants.gov Requirements

- **For Proposals Submitted Via FastLane:**

  Detailed technical instructions regarding the technical aspects of preparation and submission via FastLane are available at: https://www.fastlane.nsf.gov/a1/newstan.htm. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane 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.

  Submission of Electronically Signed Cover Sheets. The Authorized Organizational Representative (AOR) must electronically sign the proposal Cover Sheet to submit the required proposal certifications (see Chapter II, Section C of the Grant Proposal Guide for a listing of the certifications). The AOR must provide the required electronic certifications within five working days following the electronic submission of the proposal. Further instructions regarding this process are available on the FastLane Website at: https://www.fastlane.nsf.gov/fastlane.jsp.

- **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. The Grants.gov's Grant Community User Guide is a comprehensive reference document that provides technical information about Grants.gov. Proposers can download the User Guide as a Microsoft Word document or as a PDF document. The Grants.gov User Guide is available at: http://www.grants.gov/CustomerSupport. In addition, the NSF Grants.gov Application Guide provides additional technical guidance regarding 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.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program where they will be reviewed if they meet NSF proposal preparation requirements. 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 who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with the 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.

A. NSF Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board (NSB)-approved merit review criteria: intellectual merit and the broader impacts of the proposed effort. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two NSB-approved merit review criteria are listed below. The criteria include considerations that help define them. These considerations are suggestions and not all will apply to any given proposal. While proposers must address both merit review criteria, reviewers will be asked to address only those considerations that are relevant to the proposal being considered and for which the reviewer is qualified to make judgements.

What is the intellectual merit of the proposed activity?
How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative, original, or potentially transformative concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

What are the broader impacts of the proposed activity?
How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

Examples illustrating activities likely to demonstrate broader impacts are available electronically on the NSF website at: http://www.nsf.gov/pubs/gpg/broaderimpacts.pdf.

Mentoring activities provided to postdoctoral researchers supported on the project, as described in a one-page supplementary document, will be evaluated under the Broader Impacts criterion.

NSF staff also will give careful consideration to the following in making funding decisions:

Integration of Research and Education
One of the principal strategies in support of NSF's goals is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the diversity of learning perspectives.

Integrating Diversity into NSF Programs, Projects, and Activities
Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- 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.

Additional Review Criteria:

In addition to responding to the standard NSF review criteria, reviewers will be asked to place emphasis on the following:

- The extent to which the proposal is well grounded in theory, includes novel approaches that will result in a theoretical framework for a predictive understanding of macroscale biology, and shows great promise for enhancing basic theoretical understandings.
- The extent to which the proposals are highly interdisciplinary and broadly integrate across relevant biological, atmospheric, geological, social, mathematical, and engineering disciplines. The interdisciplinary research is expected to be reflected in the Principal Investigators involved in the project. Projects will be given consideration if they promote the development of collaboratory partnerships with other research platforms, observatories, research centers, or networks.
- The proposal addresses the inherent complexity and highly connected nature of the biosphere, includes multi-scale perspectives, is focused on understanding processes at regional to continental scales, and places a high priority on "scaling" and "integrating" the results from observations at one scale to better understand processes and dynamics at other scales.
- The proposal includes quantitative approaches, advanced conceptual models, data assimilation, or other modeling approaches to study the systems chosen for investigation.

In accordance with the NSF Proposal and Award Policies and Procedures Guide (NSF 10-1), all proposals submitted in response to this solicitation must explicitly address the Broader Impacts criterion. Although proposed Broader Impacts activities in any of the identified categories are acceptable, WSC investigators are especially encouraged to undertake activities that effectively address goals and challenges associated with one or more of the following key areas:

- recruitment, education and training of the future scientific, engineering, technical, and policy workforce and leadership needed to pursue basic research on regional to continental scale biology;
- include innovative and collaborative post-doctoral leadership fellows with project management, leadership, technological and collaborative training and opportunities;
- tools and infrastructure to provide government and industry policymakers with current knowledge on issues related to regional to continental scale processes affecting the biosphere and regional to continental scale biological feedbacks, so as to better inform decisions on adaptation and mitigation;
- improving public awareness and understanding of the interconnections between the biosphere, climate change and sustainability and the impacts, and technical strategies for adaptation and mitigation; and
- opportunities to engage a diverse community of learners and educators in regional to continental scale research.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review.

Reviewers will be asked to formulate a recommendation to either support or decline each proposal. 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 is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, 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.

In all cases, 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 and 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.

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 letter, 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 letter; (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 letter. 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 http://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 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 *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

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 at least 90 days before the end of the current budget period. (Some programs or awards require more frequent project reports). Within 90 days after 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 that PI. 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 FastLane, for preparation and submission of annual and final project reports. Such reports provide information on activities and findings, project participants (individual and organizational) publications; and, other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system. Submission of the report via FastLane constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report 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.

VIII. AGENCY CONTACTS

General inquiries regarding this program should be made to:

- Elizabeth R. Blood, telephone: (703) 292-8400, email: eblood@nsf.gov

- Todd A. Crowl, telephone: (703) 292-7870, email: tcrowl@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@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, National Science Foundation Update is a free e-mail subscription service 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 Regional Grants Conferences. Subscribers are informed through e-mail when new publications are issued that match their identified interests. Users can subscribe to this service by clicking the "Get NSF Updates by Email" link on the NSF web site.

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this new mechanism. Further information on Grants.gov may be obtained at http://www.grants.gov.

ABOUT THE NATIONAL SCIENCE FOUNDATION

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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 40,000 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 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 provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See Grant Proposal Guide Chapter II, Section D.2 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.

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- **For General Information** (NSF Information Center)**:** (703) 292-5111
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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 Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and NSF-51, "Reviewer/Proposal File and Associated Records, " 69 Federal Register 26410 (May 12, 2004). 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
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