

**Program Announcement
To DOE National Laboratories
LAB 04-23**

***Program for Ecosystem Research:
Scaling Across Levels of Biological Organization in Ecological
Systems***

SUMMARY: The Office of Biological and Environmental Research (BER) of the Office of Science (SC), U.S. Department of Energy (DOE), hereby announces its interest in receiving proposals for the Scaling Across Levels of Biological Organization in Ecological Systems Initiative, a component of the BER Program for Ecosystem Research (PER). Proposals should describe experimental research and/or numerical modeling projects to develop a more mechanistic understanding of effects of environmental change on the structure (i.e., physical state) and functioning (e.g., cycling of elements and energy) of terrestrial ecosystems, including identification of the underlying causal mechanisms and pathways and how they are linked. The focus of all projects should be on understanding linkages between levels of biological organization, with the levels of organization ranging from a genome or proteome up to, and including, a whole ecosystem. Experimental research should involve the construction and study of model terrestrial ecosystems (non-aquatic microcosms and/or mesocosms) containing simplified but hierarchical communities including autotrophs, consumers, and decomposers. Environmental variables of primary interest are temperature, hydrology, carbon dioxide concentration, and/or ozone concentration. Proposed experiments that involve controlled manipulation of one or more of these environmental variables and the measurement of proteomic responses of individual species and the whole ecosystem are strongly encouraged. Any changes in the proteome should then be related to changes in ecosystem structure and functioning. Numerical modeling projects are encouraged that focus on development and evaluation of advanced biologically based computational algorithms and/or approaches to ecosystem modeling that could be used to establish a theoretical basis for whether and how proteomic changes in single species, communities, or whole ecosystems might affect the structure and functioning of an ecosystem.

All proposals submitted in response to this Program Announcement must explicitly state how the proposed research will support accomplishment of the BER Long Term Measure of Scientific Advancement to "deliver improved climate data and models for policy makers to determine safe levels of greenhouse gases for the Earth system."

DATES: Researchers are encouraged (but not required) to submit a one-page preproposal for programmatic review by August 31, 2004.

Formal proposals submitted in response to this Program Announcement must be received by 4:30 p.m., Eastern Time, October 21, 2004, to permit timely consideration for award in Fiscal Year 2005.

ADDRESSES: Preproposals referencing Program Announcement LAB 04-23 should be sent to Dr. Jeffrey S. Amthor via e-mail to jeff.amthor@science.doe.gov. Please include "Preproposal Program Announcement LAB 04-23" in the e-mail subject field.

Formal proposals in response to Program Announcement LAB 04-23 are to be submitted as two paper copies of the full proposal and one MS-Windows compatible CD containing the proposal in a *single* PDF file.

If submitting by U.S. Postal Service First Class Mail or Priority Mail, the two copies of the proposal and the CD should be sent to: Climate Change Research Division, Program Announcement LAB 04-23, SC-74/Germantown Building, U.S. Department of Energy, 1000 Independence Avenue, SW, Washington, DC 20585-1290.

If submitting by U.S. Postal Service Express Mail, any commercial mail delivery service, or when hand carried by the applicant, the following address should be used: Climate Change Research Division, Program Announcement LAB 04-23, SC-74, Office of Biological and Environmental Research, Office of Science, U.S. Department of Energy, 19901 Germantown Road, Germantown, MD 20874-1290.

FOR FURTHER INFORMATION CONTACT: Dr. Jeffrey S. Amthor, phone: (301) 903-2507; e-mail: jeff.amthor@science.doe.gov. Program information is available at the following URL: <http://www.science.doe.gov/ober/CCRD/per.html>.

SUPPLEMENTARY INFORMATION: The PER mission is to measurably improve the scientific basis for predicting or detecting effects of environmental changes associated with energy production (i.e., global and regional changes in atmospheric composition and related climatic changes) on terrestrial ecosystems and their component organisms and processes. Terrestrial ecosystems, their functions, and their components most valued by society are of highest priority to the PER. The PER mission supports the DOE Energy Strategic Goal "to protect our national and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy" by contributing to the science base needed to judge environmental implications of various energy supply options.

The PER is intended to contribute specifically to the long-term BER program goal of delivering data and models needed to determine safe levels of greenhouse gases in the atmosphere. The PER's contribution to this goal is carried out by quantifying cause-and-effect relationships between environmental changes associated with energy production (i.e., increased concentrations of greenhouse gases in the atmosphere and related environmental changes) and the structure and functioning of important terrestrial ecosystems. Understanding of such relationships is important to a determination of safe (or acceptable) levels of greenhouse gases.

Objectives of the PER are to improve scientific understanding of how and why (or if) terrestrial ecosystems, their component organisms, and critical biological and/or ecological processes are affected (or controlled) by, and respond to, multiple environmental changes. To meet these objectives, the PER supports experimental research and modeling at both universities and government laboratories. The research and modeling supported by the PER considers direct and

indirect effects of environmental changes on terrestrial ecosystems, their components, their processes, and their structures. Experimental research based on underlying theory, and modeling that considers ecological hierarchies (i.e., multi-level or mechanistic modeling), are foci of the PER. An ecological hierarchy appropriate to the PER might begin with macromolecules (e.g., DNA or proteins) and proceed through ever more complex levels of organization, such as organelles, cells, tissues, organs, organisms, populations, and communities, arriving finally at ecosystems. In FY 2004, the PER began its Scaling Across Levels of Biological Organization in Ecological Systems Initiative to consider information flow and controls exerted within such hierarchies in terrestrial ecosystems.

Ecosystem responses to environmental changes of particular interest to the PER include: (1) adjustments at the ecosystem scale, such as changes in the organized hierarchy of ecosystem processes, structures, biological diversity, and/or succession; and (2) adjustments at the organismal scale *that are manifested at the ecosystem scale*, including physiological, biochemical, and/or genetic changes that may facilitate (or hinder) ecosystem functioning and stability.

Environmental changes of most interest to the PER are: (1) warming and changes in diurnal, seasonal, and interannual temperature cycles; (2) changes in precipitation and evapotranspiration (e.g., intensification of the hydrologic cycle); and (3) increasing atmospheric carbon dioxide and (tropospheric) ozone concentrations.

Request for Proposals

This Program Announcement requests proposals for activities aimed at developing a more mechanistic understanding of effects of environmental change on the structure and functioning of terrestrial ecosystems, including identification of the underlying causal mechanisms and pathways and how they are linked. Specifically, research is sought in two areas:

Area 1: Experimental studies focused on understanding linkages among levels of biological organization in model terrestrial ecosystems (i.e., experimental, non-aquatic microcosms and/or mesocosms) containing simplified but hierarchical communities, including autotrophs (higher, and possibly lower, plants), consumers (primary, and possibly secondary, tertiary, etc., consumers), and decomposers. When applicable, appropriate symbionts should be included in the communities. Projects will include construction and maintenance of microcosms and/or mesocosms, including their proper statistical replication. Experiments are encouraged that manipulate temperature, soil moisture, atmospheric carbon dioxide concentration, and/or atmospheric ozone concentration in controlled ways. Studies might obtain new genomic, proteomic, and/or metabolomic data and use that data and, if appropriate, hierarchical theory of biological and ecological systems to: (a) explain observed effects of experimental environmental manipulation(s) on ecosystem-scale states and processes (i.e., ecosystem structure and functioning); and/or (b) make predictions based on theoretical models about changes in ecosystem structure and/or functioning that can and will be tested with observations and data at multiple scales within the range from the genome of individual species to the entire ecosystem (i.e., the experimental microcosm or mesocosm).

Area 2: Theoretical and/or numerical modeling studies of the bases for scaling information across multiple levels of biological organization in ecological systems. Proposals are encouraged that concentrate on developing new theoretical models or approaches to biological and ecological modeling, and might focus on development and evaluation of advanced biologically based computational algorithms and/or approaches to ecosystem modeling that could be used to establish whether and how proteomic changes in single species, communities, or whole ecosystems might affect the structure and functioning of an ecosystem. The emphasis must be on scaling information (processes, mechanisms, controls) across multiple levels of biological organization in terrestrial ecosystems. The aim of the Scaling Initiative is to bridge levels of organization from genomes (or proteomes or metabolomes) to whole terrestrial ecosystems, but individual theoretical/modeling studies might focus on a subset of levels of organization (proposals should be clear and specific about which levels of organization will be studied or modeled). Projects might incorporate genomic, proteomic, and/or metabolomic data, along with information on the associated biochemical and physiological mechanisms and pathways that control and influence biological and ecological processes, into hierarchical (multi-level) ecosystem models. The new models or modeling approaches should enhance a capability to explain and predict effects of environmental changes associated with energy production on ecosystem structure and functioning. The use of existing biological or ecological models to study or simulate biological or ecological effects of environmental change, without clearly articulated plans to first improve the theoretical bases of scaling across multiple levels of biological organization within such models, will not be considered for support. Theoretical and modeling studies might, but need not, be linked to the microcosm and/or mesocosm studies developed under area (1) above. In those cases, results of the microcosm and/or mesocosm experiments would be used to evaluate the model(s) or modeling approach(es).

The focus of all proposals -- experimental and theoretical/modeling -- should be on the advancement of the theoretical and empirical bases for scaling information and data from the genomic, proteomic, or metabolomic levels of component species and communities up through higher levels of biological organization within ecosystems to discover causal mechanisms and pathways that determine whether and how effects of energy-related environmental changes are manifested on the structure and functioning of a whole ecosystem.

Proposals aimed primarily at plant, soil, or ecosystem carbon exchange or carbon balance, or directed at carbon sequestration in terrestrial ecosystems, are inappropriate for PER. Such proposals should be directed to the DOE BER Terrestrial Carbon Processes (TCP) program.

To enhance integration of activities throughout the PER, all projects funded by the PER will participate in annual Investigator Meetings. Costs for such meetings should be included in each proposal budget, and should be based on one trip of 5 days each year to Washington, DC, for all key personnel of each project.

Program Funding

It is anticipated that about \$4,800,000 will be available for awards in Fiscal Year 2005, contingent on the availability of appropriated funds. Proposals may request project support for up to 3 years, with out-year support contingent on availability of funds (expected to be about

\$2,400,000 per year for this program in Fiscal Year 2006 and beyond), progress of the research, and programmatic needs. Annual budgets for experimental (microcosm and/or mesocosm) studies are expected to range from \$300,000 to \$1,000,000 total costs, with larger budgets possibly needed in FY 2005 to construct microcosms and/or mesocosms, unless there is prior approval from the Program Manager. Annual budgets for theoretical/modeling projects are expected to range from \$100,000 to \$300,000 total costs, unless there is prior approval from the Program Manager. DOE may encourage collaboration among prospective investigators to promote joint proposals by using information obtained in the preproposal or other forms of communication. DOE is under no obligation to pay for any costs associated with preparation or submission of proposals.

Preproposals

An electronic preproposal is strongly encouraged (but not required) prior to submission of a formal proposal. The preproposal, to fit entirely on a single page, should include the title of the project; Principal Investigator's name, institution, telephone number, and e-mail address; names of proposed co-investigators; and a concise narrative describing the research project. A response to each preproposal, discussing the potential program relevance of a formal proposal, generally will be communicated within 15 days of receipt. Please note that notification of a successful preproposal is not an indication that an award will be made in response to any formal proposal.

Merit Review

Proposals will be subjected to formal merit review (peer review) and will be evaluated against the following criteria, which are listed in descending order of importance:

- Scientific merit of the project
- Appropriateness of the proposed method or approach
- Competency of the personnel and adequacy of the proposed resources
- Reasonableness and appropriateness of the proposed budget

Proposals will also be evaluated with respect to program policy factors such as the relevance of the proposed research to the terms of this announcement.

Submission Information

All submissions and inquiries about this program announcement should reference Program Announcement LAB 04-23.

OFFICE OF SCIENCE GUIDE FOR PREPARATION OF SCIENTIFIC/TECHNICAL PROPOSALS TO BE SUBMITTED BY NATIONAL LABORATORIES

Proposals from National Laboratories submitted to the Office of Science (SC) in response to this program announcement should adhere to the following guidelines for content and format. Please

follow the guidelines carefully, as deviations could be cause for declination of a proposal without merit review.

1. Summary of Proposal Contents

Field Work Proposal (FWP) Format (Reference DOE Order 5700.7C) (DOE ONLY)

Proposal Cover Page

Table of Contents

Abstract (one page)

Narrative (main technical portion of the proposal, including background/introduction and any preliminary studies, proposed research and methods, timetable of activities, and responsibilities of key project personnel)

Literature Cited

Budget and Budget Explanation

Other Support of Investigator(s)

Biographical Sketch(es)

Description of Facilities and Resources

Appendix (optional)

2. Number of Copies to Submit

Formal proposals in response to this Program Announcement are to be submitted as two paper copies of the proposal and one MS-Windows compatible CD containing the proposal in a single PDF file. The paper copies and CD should be sent directly to the SC Program office listed above.

A copy of the proposal should also be provided to the appropriate DOE operations office.

3. Detailed Contents of the Proposal

Proposals must conform to the following two requirements: the height of the letters must be no smaller than 10 point with at least 2 points of spacing between lines (leading); the margins must be at least one-half inch on all sides. Figures, charts, tables, figure legends, etc., may contain smaller type as long as it is legible.

3.1 Field Work Proposal Format (Reference DOE Order 5700.7C) (DOE ONLY)

The Field Work Proposal (FWP) is to be prepared and submitted consistent with policies of the investigator's laboratory.

3.2 Proposal Cover Page

The following proposal cover page information may be placed on plain paper (no form is required).

Title of proposed project

SC Program Announcement number and title

Name of laboratory
Name of principal investigator (PI)
Position title of PI
Mailing address of PI
Telephone number of PI
Fax number of PI
E-mail address of PI
Name of official signing for laboratory*
Title of official
Telephone number of official
Fax number of official
E-mail address of official
Requested funding for each fiscal year; total request
Use of human subjects in proposed project:
 If activities involving human subjects are not planned at any time during the proposed project period, state "No"; otherwise state "Yes" and provide the IRB Approval date and Assurance of Compliance Number and include all necessary information with the proposal concerning use of human subjects.
Use of vertebrate animals in proposed project:
 If activities involving vertebrate animals are not planned at any time during this project, state "No"; otherwise state "Yes" and provide the IACUC Approval date and Animal Welfare Assurance number from NIH and include all necessary information with the proposal concerning use of vertebrate animals.
Signature of PI, date of signature
Signature of official*, date of signature

*The signature certifies that personnel and facilities are available as stated in the proposal, if the project is funded.

3.3 Table of Contents

Provide the initial page number for each of the sections of the proposal. Number pages consecutively at the bottom of each page throughout the proposal. Start each major section at the top of a new page. Do not use unnumbered pages and do not use suffixes with page numbers, such as 5a, 5b.

3.4 Abstract

Provide an abstract of no more than 400 words. Give the project objectives, the approach to be used, and what the research is intended to accomplish. State the hypotheses to be tested (if any).

3.5 Narrative

The narrative comprises the research plan for the project and is limited to 20 pages. It should contain enough background material, including review of the relevant literature, to demonstrate sufficient knowledge of the state of the science. The major part of the narrative should be

devoted to a description and justification of the proposed project, including details of the methods to be used. It should also include a timeline for the major activities of the proposed project, and should indicate which project personnel will be responsible for which activities.

If any preliminary studies have been conducted that are relevant to this program announcement, they should be described in the narrative.

If any portion of the project is to be done in collaboration with another institution (or institutions), provide information on the institution(s) and what part of the project it will carry out. Further information on any such arrangements is to be given in the sections "Budget and Budget Explanation", "Biographical Sketches", and "Description of Facilities and Resources".

3.6 Literature Cited

Give full bibliographic entries for each publication cited in the narrative.

3.7 Budget and Budget Explanation

A detailed budget is required for the entire project period, which normally will be three years, and for each fiscal year. DOE's budget page, Form 4620.1 (available at <http://www.science.doe.gov/production/grants/Forms-E.html>), should be used to provide budget information. Modifications of categories are permissible to comply with institutional practices, for example with regard to overhead costs.

A written justification of each budget item is to follow the budget pages. For personnel this should take the form of a one-sentence statement of the role of the person in the project. Provide a detailed justification of the need for each item of equipment. Explain each of the other direct costs in sufficient detail for reviewers to be able to judge the appropriateness of the amount requested.

Further instructions regarding the budget and budget justification are given below in section 4.

3.8 Other Support of Investigators

Other support is defined as all financial resources, whether Federal, non-Federal, commercial, or institutional, available in direct support of an individual's research endeavors. Information on active and pending other support is required for all senior personnel, including investigators at collaborating institutions to be funded by a subcontract. For each item of other support, give the organization or agency, inclusive dates of the project or proposed project, annual funding, and level of effort (months per year or percentage of the year) devoted to the project.

3.9 Biographical Sketches

This information is required for senior personnel at the laboratory submitting the proposal and at all subcontracting institutions. The biographical sketch is limited to a maximum of two pages for each investigator.

To assist in the identification of potential conflicts of interest or bias in the selection of reviewers, the following information must be provided in each biographical sketch.

Collaborators and Co-editors: A list of all persons in alphabetical order (including their current organizational affiliations) who are currently, or who have been collaborators or co- authors with the investigator on a research project, book or book article, report, abstract, or paper during the 48 months preceding the submission of the proposal in response to this Program Announcement. Also include those individuals who are currently or have been co-editors of a special issue of a journal, compendium, or conference proceedings during the 24 months preceding the submission of the proposal. If there are no collaborators or co-editors to report, this should be so indicated.

Graduate and Postdoctoral Advisors and Advisees: A list of the names of the individual's own graduate advisor(s) and principal postdoctoral sponsor(s), and their current organizational affiliations. A list of the names of the individual's graduate students and postdoctoral associates during the past 5 years, and their current organizational affiliations.

3.10 Description of Facilities and Resources

Facilities to be used for the conduct of the proposed research should be briefly described. Indicate the pertinent capabilities of the national laboratory, including support facilities (such as machine shops), that will be used during the project. List the most important equipment items already available for the project and their pertinent capabilities. Include this information for each subcontracting institution, if any.

3.11 Appendix (optional)

Information not easily accessible to a reviewer may be included in an appendix, but do not use the appendix to circumvent the page limitations of the proposal. Reviewers are not required to consider information in an appendix, only that in the body of the proposal, and reviewers may not have time to read extensive appendix materials with the same care they would use with the proposal proper.

The appendix may contain the following items: up to five publications, manuscripts accepted for publication, abstracts, patents, or other printed materials directly relevant to this project, but not generally available to the scientific community; and letters from investigators at other institutions stating their agreement to participate in the project (do not include letters of endorsement of the project).

4. Detailed Instructions for the Budget

DOE Form 4620.1 "Budget Page", available at <http://www.science.doe.gov/production/grants/Forms-E.html>, should be used to report budget items and totals.

4.1 Salaries and Wages

List the names of the principal investigator and other key personnel and the estimated number of person-months for which DOE funding is requested. Proposers should list the number of postdoctoral associates and other professional positions included in the proposal and indicate the number of full-time-equivalent (FTE) person-months and rate of pay (hourly, monthly or annually). For graduate and undergraduate students and all other personnel categories such as secretarial, clerical, technical, etc., show the total number of people needed in each job title and total salaries needed. Salaries requested must be consistent with the institution's regular practices. The budget explanation should define concisely the role of each position in the overall project.

4.2 Equipment

Items of needed equipment should be individually listed by description and estimated cost, including tax, and adequately justified. Allowable items ordinarily will be limited to scientific equipment that is not already available for the conduct of the work. General purpose office equipment normally will not be considered eligible for support.

4.3 Domestic Travel

The type and extent of travel and its relation to the research should be specified. Funds may be requested for attendance at meetings and conferences, other travel associated with the work and subsistence. In order to qualify for support, attendance at meetings or conferences must enhance the investigator's capability to perform the research, plan extensions of it, or disseminate its results. Consultant's travel costs also may be requested.

4.4 Foreign Travel

Foreign travel is any travel outside Canada and the United States and its territories and possessions. Foreign travel may be approved only if it is directly related to project objectives.

4.5 Other Direct Costs

The budget should itemize other anticipated direct costs not included under the headings above, including materials and supplies, publication costs, computer services, and consultant services (which are discussed below). Other examples are: aircraft rental, space rental at research establishments away from the institution, minor building alterations required for the conduct of the research, service charges, and fabrication of equipment or systems not available off-the-shelf. Reference books and periodicals may be charged to the project only if they are specifically related to the research.

a. Materials and Supplies

The budget should indicate in general terms the type of required expendable materials and supplies with their estimated costs. The breakdown should be more detailed when the cost is substantial.

b. Publication Costs/Page Charges

The budget may request funds for the costs of preparing and publishing the results of the research, including costs of reports, reprints page charges, or other journal costs (except costs for prior or early publication), and necessary illustrations.

c. Consultant Services

Anticipated consultant services should be justified and information furnished on each individual's expertise, primary organizational affiliation, daily compensation rate, and number of days expected service. Consultant's travel costs should be listed separately under travel in the budget.

d. Computer Services

The cost of computer services may be requested. A justification based on the established computer service rates should be included.

e. Subcontracts

Subcontracts should be listed so that they can be properly evaluated. There should be an anticipated cost and an explanation of that cost for each subcontract. The total amount of each subcontract should also appear as a budget item. For large subcontracts, separate budget pages (DOE Form 4620.1) can be used to provide details of the subcontract.

4.6 Indirect Costs

Explain the basis for each overhead and indirect cost. Include the current rates.