



REQUEST FOR INFORMATION (RFI)

Science and Education Use Scenarios to Inform the Final Design of the National Ecological Observatory Network (NEON)

IMPORTANT INFORMATION

ISSUER(S)

National Ecological Observatory Network, Inc.
NEON Project Office, & American Institute of Biological Sciences

CONTACTS

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NATIONAL TELECONFERENCE

NEON, Inc. will host a RFI Q&A Session in Washington, D.C. on Wednesday November 1st from 1pm - 4pm EDT. The event will be held at the American Society of Association Executives (ASAE) Eye Street Conference Center (1575 Eye St, NW, Washington DC 20005) in the "East Room". This Q&A Session will enable those who are interested in submitting a response to the RFI to seek clarifications about the requirements. If you are unable to attend in person, you may participate in a live webcast of the event with a call-in line for questions. The session will also be recorded for playback later. Please check the NEON, Inc. website for updates on details.

DEADLINE FOR RESPONSES

5 January 2007, 5 pm PST

This Request for Information is NOT soliciting research proposals for funding. The goal of this RFI is to obtain information from the environmental science community to further refine the design and specifications of NEON. This information is needed to prepare the Project Execution Plan, a document required for the Preliminary Design Review, which is the second of three reviews that must occur prior to requesting funds from NSF to construct NEON.

The summary page of all responses to this RFI will be publicly available on the NEON, Inc. website.

Respondents to this RFI should thoroughly acquaint themselves with the NEON Integrated Science and Education Plan and Network and Informatics Baseline Design before preparing a response. These documents are available at <http://www.neoninc.org/documents>.

It is STRONGLY recommended that anyone considering responding to this RFI register at http://surveys.aibs.org/opinio/s?s=rfi_registration in order to receive any updates, as they arise. However, registration is NOT required for submitting a response to this RFI.

Overview

The National Ecological Observatory Network (NEON) is a continental-scale research platform for discovering and understanding the fundamental ecological principles that govern the dynamics of the large-scale biosphere (including responses to land-use and climate change) and feedbacks between the biosphere and the geosphere, hydrosphere, and atmosphere. NEON is designed to address two major Science Challenges:

- How will ecosystems and their components respond to changes in natural- and human-induced forcings such as climate, land use and invasive species across a range of spatial and temporal scales? And, what is the pace and pattern of the responses?
- How do the internal responses and feedbacks of biogeochemistry, biodiversity, hydroecology and biotic structure and function interact with changes in climate land use and invasive species? And, how do these feedbacks vary with ecological context and spatial and temporal scales?

The NEON Project Office, in cooperation with NSF's Division of Biological Infrastructure, is seeking assistance from interested investigators and/or consortia of researchers in refining the design of NEON. Following a two year community planning process, the current continental infrastructure design was chosen to enable scientific research that cannot be done using traditional research sites or even regional approaches using current field facilities, centers, or research networks. However, to finalize the NEON design, additional information is needed on the scientific questions the research community plans to address using NEON, the measurements required to address the questions, what NEON infrastructure they will use to address those questions, how they will use that infrastructure, where the infrastructure should be geographically located, and what, if any, experimental infrastructure is needed to supplement NEON observational infrastructure to address those questions. In addition, recommendations for the core sites that will comprise the NEON continental infrastructure backbone are sought.

This Request for Information (RFI) seeks information in two areas:

1. **Research Designs:** Identification of (1) national / multi-regional scale scientific questions that require NEON's observational research and cyber infrastructure, and (2) national/multi-regional scale questions that cannot be answered through observational data alone but also require continental-scale manipulative experiments. The questions must fall under the purview of one of the two fundamental NEON Science Challenges (see above and in the Integrated Science and Education Plan [ISEP]). Recommendations must not only identify the question but describe what NEON components would be used in the research, how they would be used and where they should be located. For recommendations involving manipulative experiments, respondents must include information on what infrastructure/resources are needed in addition to the current NEON suite of infrastructure.
2. **Core Wildland Site Locations:** Identification of a specific location within each of the designated 20 NEON climate domains where NEON core "wildland" sites should be established. When networked, these 20 sites will become the NEON continental infrastructure backbone.

Respondents may choose to address one or both areas. For Research Designs, respondents must clearly demonstrate the relationship between the science question, the measurements that need to be taken, and the sensors or manual sampling that are needed to acquire the measurements.

Introduction

Ecological science is transforming the way we understand and study the biosphere. Theory predicts that climate and land use change are driving variation in the biosphere at regional to continental scales. The fundamental mechanisms underlying the processes, phenomena, interactions and feedbacks at these scales are poorly understood and limit the ability of scientists to make reliable forecasts of ecological change.

During the past decade ecological research has become increasingly multidisciplinary and interdisciplinary as researchers have formed collaborations, networks, and centers to tackle these complex questions. Models and a few case studies provide some support for these theories, but there is no research platform to comprehensively test these theories or study ecological aspects of regional to continental scale dynamics. Many independent regional research campaigns provide tantalizing, but incomplete insights. A persistent continental scale presence is needed to provide the temporal context necessary to quantify the complex and often non-linear responses of biological systems.

Through a series of workshops, conferences, panels and open comment periods, the scientific community worked to design NEON as a research platform for testing and refining the theory needed to explain how large-scale ecosystems are linked together to form Earth's biosphere. NEON is proposed as a continental-scale, centrally managed, and centrally coordinated research infrastructure for discovering and understanding the fundamental ecological principles that govern the dynamics of the large-scale biosphere (including responses to land-use and climate change) and feedbacks between the biosphere and the geosphere, hydrosphere, and atmosphere. NEON will support ecological forecasting by being a sentinel for quantifying both gradual and sudden ecological changes and their causes and consequences and by enabling focused critical ecological measurements, experiments, and modeling to improve our understanding of ecological processes.

Near-real time measurements collected by NEON's networked backbone of fixed towers and associated sensor arrays, field and laboratory instrumentation, experimental infrastructure, and biodiversity archive facilities will be fed via cyberinfrastructure to NEON's advanced computational, analytical and modeling infrastructure. NEON backbone infrastructure will be deployed across the country, connecting 20 climate domains in the continental US, Alaska, Hawaii, and Puerto Rico. Cyberinfrastructure will provide a comprehensive end-to-end digital framework for NEON — from the acquisition of data by field-based sensor arrays and remote sensing, through data and information processing, to the transfer of data, information, and knowledge to all segments of society (<http://neoninc.org/documents/NIBD2006Jan27.pdf>).

In addition to fixed infrastructure, NEON shared and centrally coordinated mobile and re-locatable environmental observation systems will be deployed to understand the nature of change along major environmental gradients, to evaluate ongoing transitions between land use/land cover types, and to respond to major perturbations (e.g., hurricanes, droughts, pest outbreaks). Both satellite and NEON aircraft borne remote sensing will permit scaling of important ecological phenomena from the local to continental scale. Sentinel measurements will measure important biological response variables and provide ground-truthing for remotely sensed images.

The integration of the data collected with NEON infrastructure will transform ecological science. Advances in sensor and cyberinfrastructure technologies will enable the new scientific approaches needed to quantify and understand complex biosphere processes and interactions. In-situ sensors are increasingly becoming smarter, smaller and more precise, robust, and reliable. Remote sensing

through aerial and satellite platforms provides new capacities to conduct research at multiple scales. Cyberinfrastructure will support distributed networks, harvest legacy data, integrate data, manage large data repositories, provide analysis and visualization capabilities, service data and data products through portals, and provide end to end security.

NEON, Inc. is developing the construction plan for NEON that will provide the ecological research and education communities with a “shared-use” continental-scale research platform. This plan will be submitted to the Biological Sciences Directorate for consideration of funding through the NSF Major Research Equipment and Facilities Construction Account. Prior to that submission, a number of reviews to establish the “construction readiness” of the NEON plan must occur. The first, called the Conceptual Design Review (a conceptual, top-down budgeted, site independent review), will occur in November 2006. Experts in large facilities construction will evaluate the general soundness of the NEON design developed so far. The next review, called the Preliminary Design Review (bottom-up budgeted, detailed, site dependent review), will evaluate the design in much greater detail, assessing the adequacy of specific instrumentation requirements and infrastructure deployment sites. The goal of this RFI is to request information from the environmental science community to further refine the NEON design and prepare the Project Execution Plan, a document required for the Preliminary Design Review.

Part 1: Research Designs

A Research Design should contain one or more scientific questions that examine ecosystem processes and responses, fall under the purview of either or both of the two fundamental NEON Science Challenges and can only be answered using NEON’s continental-scale infrastructure. These research questions must be continental in scale, be of national importance, span multiple NEON climate domains, and represent a scientific undertaking that cannot be achieved solely with traditional research sites or even regional approaches using current field facilities, centers, or research networks.

Research Designs must not only identify the question but describe what NEON components would be used in the research, how they would be used and where they should ideally be located. As an example, a Research Design may propose the placement of observational infrastructure along an extensive gradient using equipment from the “NEON Continental Toolbox” (See ISEP, Box 3.1). The latter comprises standardized instruments that can be deployed in either fixed locations, relocated at alternate locations at pre-determined intervals, or deployed for short term campaigns. Examples of national / large-regional gradients (henceforth referred to as “continental gradients”) include temperature, precipitation, and soils.

Alternatively, a Research Design may propose a question that can only be answered by comparing observational data from all or a subset of domains collected by “NEON Domain Toolbox” instruments deployed along some gradient within a domain. Examples include a land-use gradient (e.g., urban to unmanaged), an environmental gradient (e.g., elevation, precipitation, edaphic factors), or other factors like vegetative structures (e.g., forest, grassland, or desert) or dynamics (e.g., rate of urbanization). Respondents may suggest additional resources beyond that currently contained in the toolbox. Of particular interest, are the leveraging of existing research networks, facilities, and existing infrastructure.

NEON also offers exceptional opportunities for large-scale experiments, where discovering underlying principles, mechanisms, or trends depend on quantifying the response of organisms or ecosystems to specific treatments in a range of different settings. NEON has the potential to provide networks of manipulative experiments to explore parts of the space-time domain that are inaccessible with other

approaches. Experiments may be arrayed along an extensive gradient (see example above), or within domains.

Experimental set-asides in wildland core sites constitute another resource that can be utilized for experiments if that wildland core site is situated in a location compatible with the experiment's research objectives. (See ISEP, Box 3.1). If your institution / consortium is proposing an experiment that utilizes the experimental set-aside within a wildland core site, and if your submission includes a recommendation for such a wildland site, please state this in your response.

For manipulative experiment recommendations, information on what infrastructure/resources are needed in addition to the current NEON suite of infrastructure should be provided.

The specific format for Research Designs using Observational Data and the relevant evaluation criteria is located at <http://www.neoninc.org/RFI/observe.html>. The specific format for Research Designs for manipulative experiments and the evaluation criteria is located at <http://www.neoninc.org/RFI/experiment.html>.

Respondents may choose to submit either or both types of Research Designs.

Part 2: NEON Core Wildland Sites

Respondents to this RFI can also propose specific locations within each of the designated 20 NEON climate domains where a NEON core “wildland” site should be established. NEON core wildland sites should represent spatially extensive habitat found within the domain. Such sites should be predominantly unmanaged ecosystems that have vegetation characteristics representative of the NEON domain (see <http://research.esd.ornl.gov/~hnw/neon/withindomainrep2/>). Twenty core sites will be established in wildland areas, with one core site per domain. When networked, these 20 sites will become the NEON continental infrastructure backbone. Respondents can suggest one site, several, or all 20 sites, but each site requires submission of a separate response document. See below for the detailed response requirements.

Each core site should have sufficient size to allow for a reasonable footprint of one Advanced BioMesoNet Tower System, four Basic BioMesoNet Tower Systems (one for the experimental set-aside area), and expression of the spatial dynamics of the organisms likely to be under study, and deployment of the NEON sensornets. In many ecosystems, this can be delineated by the boundaries of a low-order watershed, which also allows for the use of the aquatic system as an integrator. In other systems (deserts, cities), watersheds may not provide the most logical or feasible boundaries, but a similar minimum scale of continuity (from a few to a few tens of km) within the site should be sought. In proposing sites for consideration, particular attention needs to be paid to potential environmental concerns that require permitting or regulatory considerations.

The specific format for providing a response to the NEON Core Wildland Sites and evaluation criteria is located at <http://www.neoninc.org/RFI/core.html>.

Remote Sensing Considerations

Remotely sensed data will be available for the entire network. Satellite images and products will be provided via NEON cyberinfrastructure. Remote sensing campaigns will be conducted using aircraft borne LIDAR and multi-spectral imagers. See the ISEP for details. Specific requirements for remote sensing needs should be included in the responses. In particular, two issues that need to be addressed

are (1) the identification of permanent targets that can be used to calibrate the remote sensors, and (2) issues related to protected airspace. Permanent targets include natural or semi-natural land covers with known (or knowable) spectral properties, such as deep, clear water or pavement; targets might also include manufactured structures such as colored targets.

The airborne component of NEON has some additional constraints imposed by common air traffic issues. For instance, the airspace over sites may have restrictions due to military areas, homeland security issues, and common airways and terminal control areas. If a NEON site is located directly in the approach corridor for a major airport, then it may be very difficult or even impossible to conduct scientific aerial campaigns over the site in the desired manner. Homeland security zones (FAA 'Prohibited Areas') have flight restrictions at low altitudes, and these are of a permanent character. Military airspace regions do not necessarily coincide with military activities on the surface (e.g., some military airspace is above national parks, etc.). Military airspace areas are often released for public use when no military training is taking place, thus, NEON measurements can take place in most of these regions, but not necessarily at the optimal times for NEON. Often the decision to release military airspace is done as late as the day before, and this makes NEON planning difficult, but not impossible. Airport terminal approach areas in general pose significant operational difficulties due to coordination with air traffic control.

To summarize, Prohibited Areas should be avoided (e.g., Washington, DC), airport terminal approach areas should be avoided, and military airspace should be avoided if possible.

Submission of RFI Responses

Deadline

All RFI responses must be received electronically by the NEON Project Office by **January 5, 2007, 5pm PST**.

Submission

Respondents should email the required materials as a **single** compressed ZIP file to neon.rfi@aibs.org. Include your RFI responses as Word document(s). Optionally, you may include PDF equivalents as well. Your ESRI shapefile (in Arc/Info E00 Interchange format) should also be included in the ZIP file. If your mail server limits the size of file attachments, please contact Dr. Brian Wee (bwee@aibs.org) at the NEON Project Office to arrange for an alternate means of transmission.

Format

Respondents are required to use the specific formats. Be sure to use the specific URL following each area described in the RFI for the appropriate details. The documents should be formatted using a 12-point font, single line spacing, and 2.5-cm margins. Each response must contain a budget with acquisition, maintenance and operations costs for all infrastructure/resources that are beyond what is specified in the ISEP. Please use the standard budget form (NSF Form 1030). This form is available through FASTLANE (<http://www.fastlane.nsf.gov>) or on the NEON Project Office Website (<http://www.neoninc.org/RFI/>). A budget justification of up to three pages may be used to provide the necessary documentation of proposed costs.

Respondents should not assume that budget items included in their response will be included in the final NEON design or supported in whole or in part by the NEON Project Office, NEON, Inc. or by the NSF.

Acceptance

The NEON Project Office reserves the right to reject responses that arrive late, or do not meet all of the specified requirements.

Public Release of Responses

All summary pages will be posted on the NEON Project Office website.

RFI Consideration Process

The NEON Integrated Science and Education Plan is nearing completion and the NEON Conceptual Design is under review. Revisions to these documents may occur after this RFI is released. To ensure that you have the most recent information related to this request, if you are considering submitting a response please register at http://surveys.aibs.org/opinio/s?s=rfi_registration to receive email updates. Please note that the person who registers should be available to answer questions (via videoconference / teleconference) about their submission from the NSF RFI Committee when they meet in mid to late January 2007.

For Research Designs, respondents must clearly demonstrate the relationship between the science question, the measurements that need to be taken, and the sensors or manual sampling that are needed to acquire the measurements.

The overall process from receipt of RFI responses to the refinement of the preliminary NEON design will follow the general outline below:

1. RFI responses are received by NEON, Inc. and compiled for dissemination to a scientific and technical committee whose members will be selected by NSF.
2. The committee will read the responses, prioritize the proposed science questions, and recommend a refined NEON design, including backbone core sites, on the basis of scientific merit, logistical factors, and broader impacts.
3. The results of the committee assessment will be provided to NEON, Inc.
4. NEON, Inc., will consider the recommendations in the assessment, especially the prioritized specific science questions and experiments, and use them as a basis for developing a final integrated, site-specific plan for NEON infrastructure deployment.
5. The final design will be submitted by NEON, Inc. to NSF as part of the documentation required for the Preliminary Design Review.