A.30 CLIMATE AND BIOLOGICAL RESPONSE: RESEARCH AND APPLICATIONS

1. Scope of Program

As the Intergovernmental Panel on Climate Change (IPCC) noted in its 2007 Working Group II 4th Assessment Report (http://www.ipcc.ch/), a changing climate is a key factor determining the characteristics and distributions of biological systems, including the distribution and abundance patterns of plants and animals. Furthermore, this report also documents the vulnerability of freshwater resources and ecosystems to changing climate. However, our ability to anticipate how changes in climate will drive changes in biological systems remains limited.

The number and variety of climate data records has grown over the past two decades and these data sets increasingly provide robust time series of climate change. Still, there is much uncertainty with regard to what changes in these physical climate records mean for biological systems.

Leaving aside the important issue of biological feedbacks to climate, we need to make progress connecting climate drivers to biological responses in order to improve our basic understanding of climate change impacts and to develop tools for managing species and ecosystems, and their associated landscapes and seascapes, under a changing climate. Doing so requires bringing together time series of climate observations, time series of biological observations, and ecological and climate models. Connecting climate and biological observations allows us to detect correlations and patterns that may (or may not) link to causality. Using climate and ecological models allows us to incorporate our existing knowledge of connections between the physical and biological components of the Earth system and the critical processes resulting in biological responses, thus enabling a better understanding of causality. This improved understanding allows Federal, state, and local managers, along with the general public, to craft practical strategies for managing the impacts of a changing climate.

2. Types of Proposals Sought

This solicitation seeks two types of proposals: (a) basic research proposals and (b) applications proposals to support ecosystem and landscape management. While this solicitation is not exclusively focused on public lands and waters, proposals addressing these managed areas are especially welcome given the participation of land management agencies in this call for proposals.

Each type of proposal should combine several components.

2.1 Type A: Research Proposals

Research proposals should improve fundamental scientific knowledge of the impacts, in terms of patterns and processes, of climate change on the following elements of biological systems:

1. The distribution and/or abundance of species, populations, or functional groups of species; or

2. The sustainability over time and/or connectivity of ecosystems across landscapes or seascapes.

Research proposals should include:

1. Time series of existing climate-relevant observations (for example—but not limited to—temperature, precipitation, sea ice, snow cover, insolation, clouds, water vapor, aerosols, fires, floods, droughts, sea-level rise, etc.) from airborne or space-based platforms;
2. Time series of biological observations on (1) the distribution and/or abundance of species, populations, or functional groups of species or (2) the sustainability over time and/or connectivity of ecosystems across landscapes and seascapes from *in situ* (i.e., ground-based or in-water) devices, airborne platforms, and/or space-based satellites; and
3. Ecological models or their outputs (e.g., niche-based or physiological distribution models, population models, spatially-explicit individual-based models).

Research proposals may also wish to integrate the following:

1. Climate models or their outputs (e.g., through general circulation model downscaling, regional climate models); and
2. Biophysical data (e.g., soils, topography, geology, biogeochemistry) that may account for variations in response to climate variability within and among geographic areas.

As the Smithsonian Institution is a partner in this joint solicitation, proposers are encouraged to consider including biological and other ecosystems data from selected Smithsonian Institution Global Earth Observatories (SIGEO) sites (http://www.sigeo.si.edu/). Biological and ecosystems data from other sites are also welcome.

Given the relatively complex nature of these proposals and their multiple components, this solicitation anticipates proposals from multidisciplinary teams.

2.2 Type B: Applications Proposals to Support Ecosystem and Water Resource Management

Applications proposals should enhance the management of populations, species, communities, and ecosystems across landscapes and seascapes of concern through the development or improvement of forecasting tools for resource managers that project the impact of a changing climate on these populations, species, communities, and ecosystems. Ecosystems here may include forests and water resources important to landscape managers.

Proposers should fully explain how they plan to integrate the forecasting tools they develop or improve into the spatially-explicit geographic landscape or seascape management frameworks of participating user agencies with management responsibility. Within these landscape or seascape frameworks, proposers should clearly state the management endpoint (e.g., population, species, community, ecosystem, and important forest or water resources) they intend to address.

Applications proposals should include:

1. Time series of existing climate-relevant observations (please see Section 2.1 above for examples) from airborne or space-based platforms;
2. Time series of biological observations on (1) the distribution and/or abundance of species, populations, or functional groups of species or (2) the sustainability over time and/or connectivity of ecosystems across landscapes and seascapes from *in situ* (i.e., ground-based or in-water) devices, airborne platforms, and/or space-based satellites; and
3. Ecological models or their outputs (e.g., niche-based or physiological distribution models, population models, spatially-explicit individual-based models) or ground/surface water models (e.g., flow, transport, spatially-explicit process models).

Applications proposals may also wish to integrate the following:

1. Climate models or their outputs (e.g., through general circulation model downscaling, regional climate models); and
2. Biophysical data (e.g., soils, topography, geology, biogeochemistry) that may account for variations in response to climate variability within and among geographic areas.

Additionally, Applications proposals must include:

1. Participation by representatives of the agencies that would ultimately host the forecasting tools; and
2. Plans and a schedule for the transition of the forecasting tools into the host agency.

The National Park Service (NPS), the U.S. Fish and Wildlife Service (FWS), and the U.S. Geological Survey (USGS) are partners in this joint solicitation. Therefore, the following topics are of particular interest:

1) Landscape approaches to managing U.S. National Parks (http://www.nature.nps.gov/);
2) Landscape approaches to managing FWS trust resources including:
    a) refuges (http://www.fws.gov/refuges/index.html),
    b) migratory birds under the Migratory Bird Treaty Act (http://www.fws.gov/migratorybirds/), and
    c) threatened and endangered species under the U.S. Endangered Species Act (http://www.fws.gov/Endangered/); and
3) Work supporting other U.S. Department of Interior (DOI) agencies as USGS is the research arm of the DOI.

NPS, FWS, and USGS are currently developing the Landscape Conservation Cooperative concept for managing landscapes. Proposals working to support the development of this concept are welcome.

In addition, proposals addressing the forecasting needs of other U.S. land management agencies (e.g., the U.S. Forest Service, NASA Centers) or those of National Oceanic and Atmospheric Administration (NOAA) ecosystem managers are welcome.

Proposals should come from multidisciplinary teams with the expertise both to develop or improve the forecasting tools and transition the tools to use by the user agencies.

Also of interest are proposals, within the guidelines listed above, that support conservation management by ensembles of managed lands with different types of land owners and mixed uses, e.g., parks, refuges, National Forest lands, Bureau of Land Management landscapes, private lands managed by conservation organizations, etc.

2.3 Requirements Applicable to All Proposals

Proposals in both terrestrial and aquatic (freshwater and marine) environments are welcome.

Proposals must incorporate remotely-sensed data.

Proposers must indicate whether they are Research (Type A) or Applications (Type B) proposals or both. While some proposals may span both Types A and B, this solicitation anticipates that most proposals will be either Type A or Type B.

All successful project teams, whether Research or Applications, should plan on participating in annual NASA-hosted team meetings within the U.S. that will bring together both Research and Applications project personnel and facilitate the general transition of research results into applications activities.

The use of sensor webs (interconnected networks of sensors) and/or the incorporation of citizen science, social networking, and crowdsourcing techniques to enhance observational or modeling components of proposals is most welcome.

Arctic projects are encouraged to connect with the Study of Environmental Arctic Change (SEARCH, http://www.arcus.org/SEARCH/index.php), the interagency effort to understand the nature, extent, and future development of the system-scale change presently seen in the Arctic.

3. Education and Public Outreach Opportunities

NASA policy strongly encourages participation in Education and Public Outreach (E/PO) activities by members of the science community. You may be eligible to propose a supplemental Education or Outreach effort if your research proposal is selected for award. The research award must have more than 12 months remaining at the time of submission of the supplement proposal. For additional details concerning the submission of Outreach or Education supplement proposals, please see Supplemental Outreach Awards for ROSES Investigators (Appendix E.5) and Supplemental Education Awards for ROSES Investigators (Appendix E.6).

4. Summary of Key Information

Expected program budget for first year of new awards	~ $5M

Number of new awards pending adequate proposals of merit	~ 10 to 17
Maximum duration of awards	4 years
Due date for Notice of Intent to propose (NOI)	See Tables 2 and 3 in the *ROSES Summary of Solicitation*.
Due date for proposals	See Tables 2 and 3 in the *ROSES Summary of Solicitation*.
Planning date for start of investigation	8 months after proposal due date.
Page limit for the central Science-Technical-Management section of proposal	15 pp; see also Chapter 2 of the *NASA Guidebook for Proposers*
Relevance to NASA	This program is relevant to the Earth science strategic goals and subgoals in NASA's *Strategic Plan*; see Table 1 and the references therein. Proposals that are relevant to this program are, by definition, relevant to NASA.
General information and overview of this solicitation	See the *ROSES Summary of Solicitation*.
Detailed instructions for the preparation and submission of proposals	See the *NASA Guidebook for Proposers* at http://www.hq.nasa.gov/office/procurement/nraguidebook/.
Submission medium	Electronic proposal submission is required; no hard copy is required or permitted. See Section IV of the *ROSES Summary of Solicitation* and Chapter 3 of the *NASA Guidebook for Proposers*.
Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Web site for submission of proposal via Grants.gov	http://grants.gov/ (help desk available at support@grants.gov or (800) 518-4726)
Funding opportunity number for downloading an application package from Grants.gov	NNH10ZDA001N-BIOCLIM

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