A.4 TERRESTRIAL ECOLOGY

1. Scope of Program

NASA Terrestrial Ecology research addresses changes in Earth's carbon cycle and ecosystems using space-based observations. The goals of NASA's Terrestrial Ecology research are to improve understanding of the structure and function of global terrestrial ecosystems, their interactions with the atmosphere and hydrosphere, and their role in the cycling of the major biogeochemical elements and water. This program of research addresses variability in terrestrial ecosystems, how terrestrial ecosystems and biogeochemical cycles respond to and affect global environmental change, and future changes in carbon cycle dynamics and terrestrial ecosystems. The research approach combines (i) use of remote sensing to observe terrestrial ecosystems and their responses; (ii) field campaigns and related process studies to elucidate ecosystem function; and (iii) ecosystem and biogeochemical cycle modeling to analyze and predict responses. Research to establish a theoretical and scientific basis for measuring Earth surface properties using reflected, emitted, and scattered electromagnetic radiation and to develop the methodologies and technical approaches to analyze and interpret such measurements is an important component of the Terrestrial Ecology research program.

2. Types of Proposals

Priorities for new research within NASA's Terrestrial Ecology program continue to derive from the goals and objectives for Earth Science in NASA's Strategic Plan (http://nasascience.nasa.gov/about-us/science-strategy), the research agenda of the U.S. Global Change Research Program (USGCRP) (http://www.globalchange.gov/), and the science priorities of the U.S. Carbon Cycle Science Program (http://www.carboncyclescience.gov/). This solicitation calls for research on specific topics of current, strong scientific interest and programmatic relevance. The NASA Terrestrial Ecology program requests the following types of research investigations:

- Analyses of the vulnerability to and responses of terrestrial ecosystems to global environmental changes.

- Science investigations to advance the development and utilization of new and/or multisensor remote sensing approaches to address important terrestrial ecosystem and biogeochemical cycling questions. Studies using new, advanced airborne sensors to apply and evaluate approaches relevant to future satellite missions are of special interest.

- Successor studies that offer to significantly advance the results of prior NASA Terrestrial Ecology research toward meaningful answers to important NASA and USGCRP carbon cycle and ecosystems research questions.

2.1 Vulnerability and responses of terrestrial ecosystems

Integrative research is needed to better interpret observations and to extend analyses of terrestrial ecosystem responses to global environmental change so as to characterize impacts, adaptation,

and vulnerability. Terrestrial ecosystems respond to global change in a variety of ways and vary in both their vulnerability (i.e., exposure, sensitivity, resilience) to and impacts from change. Some responses to global environmental change are major, greatly affecting the sustainability of ecosystem functions or causing large feedbacks (positive or negative) to the climate system. Some changes are abrupt while others take much longer (decades to centuries) to become manifest. Research is needed to identify the most significant of these responses and vulnerabilities, to understand the processes controlling them, and to assess the likely magnitude of change(s) associated with them. The USGCRP has identified specific areas of priority for integrated research on the coupled, physical-biological-human Earth system in 2014. These include detection of trends in extremes, integration of observations into models, attribution of change to human or natural causes, integrated research on Earth and human systems; simulation and prediction at spatial and temporal scales conducive to decision making; and adaptation responses to changing frequency and intensity of extreme events. These areas of research are essential if we are to anticipate the type and degree of future environmental changes and to devise strategies for mitigation and/or adaptation.

Research is sought to apply remote sensing observations to the characterization of terrestrial ecosystem vulnerabilities and/or responses to global environmental change. Within the domain of terrestrial ecology, a wide variety of ecosystem vulnerabilities and ecological responses could be addressed in the proposals submitted in response to this element of the solicitation, but not all will be of equal significance. Therefore, proposals must offer compelling rationales as to 1) why the vulnerabilities and/or responses to be studied are expected to be highly significant, representing major perturbations to the Earth system, and 2) how the remote sensing data and data products to be utilized in the study provide unique and powerful information for addressing the research issues/questions posed. Preference will be given to research conducted at regional to global scales or that has well-explained, broad regional or global applicability. However studies working at local scales will be considered responsive if they demonstrate high significance and a strong potential for their findings to be extended to larger-scales or other ecosystems.

NASA is seeking under this subelement research that is centrally focused on the vulnerabilities to and response of terrestrial ecosystems to global environmental change. While aspects of and consequences to biogeochemical cycling may be addressed in such studies, proposers offering studies centrally focused on carbon cycle science are encouraged to respond instead to appendix A.5, *Carbon Cycle Science,* of this solicitation.

2.2 <u>New and/or multisensor remote sensing approaches</u>

NASA seeks research to evaluate and scientifically apply new remote sensing data sets and/or new data analysis methodologies for extracting ecological and biogeochemical cycle information from aircraft- and/or space-based observations of terrestrial ecosystems. Multisensor analysis approaches are especially important and relevant given that abundant, complementary types of satellite and airborne and data products have been developed, several new types of observations are becoming available from new airborne and satellite instruments, and adequate computational resources and analytical tools exist. In the past few years, NASA has developed several new airborne remote sensing instruments. Research offering to address ecological and/or

biogeochemical cycling research questions and further evaluate the performance and utility of new NASA airborne sensors is also of interest under this subelement.

Research is solicited to address key terrestrial ecosystem and biogeochemical cycling questions through the application of data from satellite or airborne sensors. Studies must actively utilize such data and data products in ecosystem and biogeochemical cycle analysis, modeling, or synthesis research. Two types of investigations are solicited:

- Studies that integrate multiple satellite data products, employ data fusion approaches, and/or bring multiple types of remote sensing data to bear on an ecological or biogeochemical cycling research question. Preference will be given to new combinations of data and/or new analytical approaches.
- Studies that analyze data from a single, new airborne sensor or analyze it in combination with data from other airborne or satellite sensors. In order for a new airborne instrument to be considered eligible for research application under this subelement, its specifications and performance must have already been documented through openly available publications, NASA Technical Memoranda, or other suitable reports, and this documentation must be cited in the proposal.

2.3 Successor Studies

This solicitation provides opportunities for research relevant to the goals and objectives of the Terrestrial Ecology program element that will significantly advance the results of prior research toward meaningful results relevant to NASA's and USGCRP's carbon cycle and ecosystems research questions and current and future NASA missions. Successor proposals and follow-on research from past NASA Terrestrial Ecology research projects will be considered. Such proposals must offer demonstrable scientific advances beyond the earlier study and explain the continuing relevance and priority of the research to be pursued to the NASA Terrestrial Ecology Program.

Proposals that do not cite and demonstrate a relationship to a recent, competitively awarded NASA Terrestrial Ecology grant, contract, interagency transfer, or RTOP and cite the predecessor award number in Section II on the NSPIRES proposal cover page will be considered nonresponsive under this subelement.

3. Additional Proposal Requirements

3.1 Requirement Regarding Remote Sensing

Substantive use of remote sensing data is required in all proposals.

3.2 Requirement to Address Errors and Uncertainties

All proposals submitted in response to this solicitation must include a section in the Technical Plan describing how errors and uncertainties will be addressed. The research supported will be expected to characterize uncertainties and quantify errors associated with data, analytical

approaches, model results, and scientific interpretations. This work must be described in the proposal.

3.3 Requirement for a Data Management Plan

Proposals must include a data management plan of no more than two pages that addresses the dissemination and sharing of research results and compliance with the NASA Earth Science data policy (http://science.nasa.gov/earth-science/earth-science-data/data-information-policy/). The data management plan should include, when relevant to the type of study being proposed, the types of data and data products or other materials to be produced in the course of the project, the standards to be used for data and metadata formats, and plans for providing access to and/or archiving the data and other research products. The data sharing plan called for in section 2.3.5 of the *Guidebook for Proposers* may be included in the data management plan. The data management plan must be included within the 15-page limit for the Scientific/Technical/Management section of the proposal.

A valid data management plan may include only the statement that no detailed plan is needed, as long as a clear justification is provided.

3.4 Requirement for Proposals Requesting Acquisition of New Airborne Data

Proposals requiring data from airborne sensors must detail in their cost plan all costs for acquiring the new data sets, including costs for aircraft hours, deployment costs, mission peculiar costs, data processing costs, and other costs associated with deploying the sensors and aircraft (this includes NASA sensors and platforms as well as non-NASA sensors and platforms). In addition, for any proposed activities requiring NASA aircraft or NASA facility sensors, proposers should submit a Flight Request to the Airborne Science Flight Request system at http://airbornescience.nasa.gov (and then click on "FLIGHT REQUEST"). Questions regarding the flight request system or process should be addressed to Marilyn Vasques, Flight Request Manager (Marilyn.Vasques@nasa.gov or 650-604-6120). If the instrument or aircraft platform are not NASA facilities, proposers must take responsibility for making all arrangements to secure the availability of the needed sensors and aircraft and explain these plans in the proposal.

4. Programmatic Information

4.1 Proposal Evaluation Criteria

Proposals will be evaluated according to the criteria specified in section C.2 of the *Guidebook for Proposers*. In addition to the factors given in the *Guidebook for Proposers*, the determination of a proposal's intrinsic merit shall take into account the following additional considerations as aspects of the offeror’s and investigator team’s capabilities:

- The quality and completeness of the data management plan, including the experience of the investigators and their institutions in engaging in data sharing and providing timely access to data and research products on related and relevant projects, and

- The quality and appropriateness of the approach to characterizing uncertainties and quantifying errors.

5. Summary of Key Information

Expected program budget for first year of new awards	~ $2.5M
Number of new awards pending adequate proposals of merit	~10-20
Maximum duration of awards	3 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	January 1, 2014
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 of ROSES and the reference 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	NNH13ZDA001N-TE

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