A.2 LAND-COVER/LAND-USE CHANGE (LCLUC)

NOTICE: January 13, 2016. NASA has removed the requirement (towards the bottom of Section 2.3) that Step-2 proposals discuss changes made in response to NASA's response to the Step-1 proposals. NASA will not provide panel evaluations to those invited to submit a Step-2 proposal.

This program element uses a binding two-step proposal process (see Section 2.3), in which only those who are invited may submit a Step-2 proposal.

1. The LCLUC Program

The LCLUC program is developing interdisciplinary approaches combining aspects of physical, social, and economic sciences, with a high level of societal relevance, using remote sensing tools, methods, and data. One of its stated goals is to develop the capability for periodic satellite-based inventories of land cover and monitoring and characterizing land-cover and land-use change. Additional information on the NASA LCLUC program can be found at http://lcluc.hq.nasa.gov or contact Dr. Garik Gutman, the NASA Land-Cover/Land-Use Change Program Manager, see Section 3, below.

1.1 The Scope of the Current Solicitation

The current solicitation consists of two components:

A) LCLUC in rural and urban areas in South Asia. - South Asia is experiencing rapid land transformation, driven by food security, industrialization and urbanization. The population of the region is expected to rise from 1.6 billion to 2.3 billion by 2050. Feeding the increased population will be a significant challenge. South Asia currently has 14% of global cropland and 34% of global irrigated lands. Increasing demand for land and increased agricultural production is leading to land cover and land use change. Changes in the supply and demand for agricultural products are leading to changes in agricultural practices. For example, over recent years, the changes in the land-use pattern in the coastal belt of southern India have been creating considerable negative effects on the ecology and society. For example, almost half of paddy fields were converted for construction of buildings or for planting other crops, which has affected ground water sources. At the same time, land speculation has taken farmers off the land and reduced agricultural production. Rapid urban expansion in South Asia has presented a significant land-cover change over the last few decades, as the population becomes increasingly urban. 28% of South Asian population currently lives in urban areas and this is projected to grow to 55% by 2030. India's loss of agricultural land to urban growth has reached 0.7-1 million hectares in this Century and the amount of agriculture land converted has been steadily increasing, with implications for national food security. These significant types of land-cover change can be quantified and characterized using different types of satellite-based remote sensing.

This solicitation is focused on improving the detection and monitoring of, explaining and attributing LCLUC changes in urban and rural areas to their primary causes, and examining the implications of the changes in terms of their impacts, for example, on the vulnerability of the associated land use or social systems and their adaptability to a changing climate. The South Asia geographic region of interest for this solicitation extends from Pakistan in the west to Myanmar in the east and from the Indian Ocean in the south to Nepal in the north. The LCLUC Program is considering a regional science initiative in South Asia and successful proposals will provide a foundation for this initiative - (http://lcluc.umd.edu/Documents/ScienceTeamMtg/2014APR/Presentations/23_Program_SARI_RN.pdf.)

For regional proposals on South Asia, the LCLUC program strongly encourages the participation of regional science collaborators with experience and insight on the topic of the proposal. It is intended that such collaboration will strengthen the research with local knowledge. Collaboration will need to be developed following the guidelines provided below (Section 1.2.3) and with the appropriate letters of support at Step 2.

B) Synthesis of LCLUC studies. - With the growth in land-cover and land-use research around the globe in recent years and the proliferation of case studies, the LCLUC program has embarked on the development of synthesis studies. Synthesis is an essential component of scientific research, which integrates and in some cases augments information from previous studies. Synthesis requires developing a new understanding and conceptual framework. This process should enhance the conceptual underpinning of LCLUC science and summarize the state-of-the-art knowledge to advance our understanding of some aspect of the processes, drivers, or impacts of changes in land-cover and land-use. The way to accomplish this includes, but is not limited to, compilation of available relevant datasets and comparative research analysis, data integration and model development, and articulating and publishing a refined or a new conceptual framework for an aspect of LCLUC research. Synthesis can be useful for identifying gaps in data and research and proposing ways to fill these gaps, as well as opening new research areas. The goal is to generate critical syntheses that will produce new, emergent insights that are more than the sum of their individual parts (e.g., individual research projects or a suite of publications). The focus would be on integration and synthesis of existing results rather than development of new data, models, or studies. For a Synthesis proposal to be competitive, it must include a social or economic sciences component, such as the use of socioeconomic data or a socioeconomic model, as an integral part of the study, preferably based on available data or data being collected by an ongoing study funded by another agency. Studies could involve small synthesis teams or one to two scientists and should include at least one community workshop, for example, using workshops funded through Program Element E.2, TWSC to support broader community participation. Note that TWSC solicits proposals for scientific meetings, so the LCLUC proposal should not include this in its budget, but the intention to propose to the TWSC element should be mentioned.

1.2 Principles of the LCLUC program to be reflected in proposals

1.2.1 *Social and economic sciences in the NASA LCLUC program*

The NASA LCLUC program is aimed at using satellite observations to improve our understanding of land-cover and land-use change as an important component of global and climate change. The LCLUC program includes studies that quantify land-cover and land-use changes; examine their impact on the environment, climate, and society; or model future scenarios of land-cover and land-use change and its various impacts and feedbacks. Humans play an important role in modifying land cover and are instrumental in land-use change. To understand the process of land-use change it is, therefore, important to address its human dimensions.

Social and economic science research plays an important role in the NASA LCLUC program and includes analyses of the impacts of changes in human behavior at various levels on land use, studies of the resultant impacts of land-use change on society, or how the social and economic aspects of land-use systems adapt to climate change.

The LCLUC program evaluates a proposal's responsiveness to the above aspects in terms of a meaningful integration of social and economic science theories, perspectives, methods, and data (quantitative and/or qualitative) with innovative analyses of land system dynamics in the proposed research. In this context, simple treatments of human dimensions, such as mere correlations of socioeconomic variables in lieu of rich empirical analyses linked to theorized social dynamics, or summary descriptions of potential societal or policy benefits of the proposed study without demonstrable linkages to the same, are not considered adequately responsive to the socio-economic aspect of the program. Successful proposals will fully integrate social and economic sciences into the research questions, data used, and analytical approaches in order to couple remote sensing observations of land-cover with research on the human dimensions of land-use change.

1.2.2 *Remote Sensing Component*

The NASA LCLUC program will only support proposals with a strong remote sensing component. The use of observations and data products from U.S. and non-U.S. Earth-observing satellites, especially those of NASA, is a requirement for each proposal. The use of commercial satellites with fine spatial resolution is also encouraged (see, e.g., http://www.digitalglobe.com/).

To get the most out of current remote sensing capabilities, we encourage data fusion from various sources with different spatial and/or temporal resolution and different parts of the solar and microwave spectra. Proposals that undertake fusion of data from various sources of Landsat- type data (e.g., Landsat, Indian Remote-Sensing Satellite (IRS), China–Brazil Earth Resources Satellite (CBERS), Satellite Pour l'Observation de la Terre (SPOT) Sentinel-2), with coarser or higher resolution data, as well as radar observations, are welcome. This approach may provide better temporal-spatial coverage and contribute to a Land Surface Imaging constellation paradigm for future systems

(http://www.ceos.org/index.php?option=com_content&view=category&layout=blog&id=47&Ite mid=38). Special attention should be given to the dissemination of data and products associated with the proposed research. We also encourage using NASA's new collaboration facility for the NASA Earth science community: NASA Earth Exchange (NEX) web portal. This portal includes a state-of-the-art supercomputing Earth system modeling system for the use of remote sensing data from NASA and other agencies. Much of the global Landsat data have been transferred to that facility. The NEX web portal represents a scientific social networking platform to deliver a complete work environment in which users can explore and analyze large Earth science data sets, run modeling codes, collaborate on new or existing projects, and share results. Principal Investigators of the selected proposals are encouraged to register on the NEX website at https://c3.nasa.gov/nex/.

1.2.3 *International Collaboration*

NASA's policy welcomes the opportunity to conduct research with non-U.S. organizations on a cooperative, no-exchange-of-funds basis. Although Co-Is or collaborators employed by non-U.S. organizations may be identified as part of a proposal submitted by a U.S. organization, NASA funding may not normally be used to support research efforts by non-U.S. organizations at any level. Paragraph (c)(8)(iv) of Appendix B of the *NASA Guidebook for Proposers* states "NASA funding may not be used for foreign research efforts at any level, whether as a collaborator or a subcontract. The direct purchase of supplies and/or services, which do not constitute research, from non-U.S. sources by U.S. award recipients is permitted." Note that travel by a non-U.S. participant in the research investigation, whether for the purpose of conducting the research, for collaboration, or for attending a conference, is considered to be a research expense. Therefore, NASA funding may not be used for research efforts by foreign organizations at any level, including payment of travel expenses by any participant who is not employed either full-time or part-time by a U.S. organization (see Section 1.6 of the *NASA Guidebook for Proposers*; see also Appendix B, part (c)(8)(iv) of that document and Section III (c) of the *Summary of Solicitation* of this document for restrictions involving China).

2.0 Programmatic Information

2.1 Period of Performance for Selected Proposals

Research awards will be for three-year period of performance (or less) with annual funding contingent upon satisfactory progress reporting and available funding.

2.2 Funding Available for Support of Selected Proposals

Approximately $2M per year is expected to be available for this solicitation. Support can be anticipated for eight to ten investigations each with annual budgets in the $200-250K range. NASA will make selections for this announcement in the fall of 2016. Anticipated starts for selected projects will be in the spring of 2017.

A budget for travel to at least one LCLUC Science Team Meeting per year is required in the proposal. In addition, international travel should be included in the proposal budget if the region of investigation is outside of the U.S. Involvement of local scientists from the selected region is strongly encouraged and letters of endorsement from foreign partners, with financial commitments, although not needed at Step-1, will be required at Step-2. Note that direct support of research by foreign investigators is not allowed (see the *NASA Guidebook for Proposers,* Sections 1.6 and 2.3.11(b)(vi)). Services and supplies that constitute research are not allowed. See more details above in Section 1.1 on what is and what is not allowed in the budget concerning non-U.S. participation.

2.3 The Two-Step Proposal Process

To streamline the proposal process and relieve the work load on the community of interested applicants and those that help NASA in reviewing proposals, the LCLUC program is using a two-step process (see also Section IV(b)(vii) of the *ROSES Summary of Solicitation*). Step-1 Proposals replace the Notice of Intent (NOI). Step-1 Proposals must be submitted electronically by the NOI/Step-1 Due Date (see Tables 2 and 3 in the *ROSES Summary of Solicitation*). Unlike a NOI, Step-1 Proposals must be submitted by one of the officials at the P.I.'s organization who is authorized to make such a submission.

NSPIRES will be open for the submission of Step-1 Proposals starting ~30 days in advance of the Step-1 Due Date. NASA will then review each Step-1 Proposal to determine whether or not the anticipated research project is considered of sufficient merit, responsiveness, and relevance to warrant submission of a full Step-2 Proposal. A separate Step-1 Proposal must be submitted for each intended (and thus corresponding) Step-2 Proposal.

Only proposers who submit a Step-1 Proposal and are invited to submit a Step-2 Proposal are eligible to submit a Step-2 Proposal. Submission of a Step-1 Proposal is, therefore, required in order to submit a Step-2 Proposal. Step-2 Proposals must contain the same scientific goals proposed in Step-1, but the proposal team identified at Step-1 is not considered binding and (other than the Principal Investigator) can be adjusted in an invited Step-2 Proposal. However, the submission of a Step-1 Proposal is not a commitment to submit a Step-2 Proposal.

The NSPIRES system will guide proposers through submission of all required proposal information. Please note that the Proposal Summary, Business Data, Program Specific Data, and Proposal Team are required Cover Page Elements for a Step-1 Proposal. A budget should not be included with the Step-1 Proposal, but will be needed with a budget explanation at Step-2.

To facilitate the work by reviewers on Step-1 Proposals, the following abbreviated guidance is suggested: Step-1 Proposals must be uploaded as a PDF document not to exceed five pages, including any references or citations. The five-page, Step-1 Proposal should:

a) Emphasize responsiveness, clearly indicating how it addresses the call and which remote sensing assets are to be used. Identify social science aspects in the proposed study.

b) Describe the proposed research, showing knowledge of previous research carried out by the international scientific community in the subject area. Identify new research aspects being proposed.

c) Outline the expected outcomes of the research. Identify proposed deliverables. Provide a tentative schedule.

Step-2 Proposals should provide more detail on the previous studies related to the research topic and the proposed research methodology, the anticipated results and deliverables, and schedule. Step-2 Proposals should include a budget and the associated explanation. For consistency and to ease the burden of reviewing, it is preferable that Step-2 Proposals follow approximately the same structure as outlined for the Step-1 Proposals, but are expanded to 15 pages. ~~A Step-2 Proposal will also need to indicate how it responds to the Step-1 Panel Review feedback.~~ **[Removed January 13, 2016]**

Step-2 Proposals must be submitted electronically by the Proposal Due Date (see Tables 2 and 3 in this NRA's *Summary of Solicitation*) in full compliance with the requirements specified in this NRA's *Summary of Solicitation* and the *NASA Guidebook for Proposers* (see Section 3 below).

2.4 Evaluation of Proposals

All proposals will be submitted to the NASA peer review process in accordance with the guidelines provided in this NRA and the *NASA Guidebook for Proposers*. This peer review will be followed by a programmatic review in which NASA will assess program balance across the competitive range of proposals, and evaluate any logistical, implementation, cost, and/or management concerns. The funding recommendations will then be forwarded to the Selecting Official for confirmation. NASA then will announce the official selection of proposals for award via NSPIRES.

3. Summary of Key Information

Expected program budget for new awards	~ $2M per year
Number of new awards pending adequate proposals of merit	8-10
Maximum duration of awards	3 years
Due date for Step-1 proposals	See Tables 2 and 3 in the *ROSES Summary of Solicitation*.
Due date for Step-2 (full) proposals	See Tables 2 and 3 in the *ROSES Summary of Solicitation*.
Planning date for start of Investigation	Spring of 2017

Page limit for the central Science-Technical-Management section of proposal	5 pages for Step-1 proposals.15 pp for Step-2 proposals; see also Chapter 2 of the *NASA Guidebook for Proposers*
Relevance to NASA	This program is relevant to the Earth Science questions and goals in the NASA Science Plan. 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 proposals via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Web site for submission of proposals 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	NNH15ZDA001N-LCLUC
NASA point of contact concerning this program	Garik Gutman Earth Science Division Science Mission Directorate NASA Headquarters Washington, DC 20546-0001 Telephone: 202-358-0276 Email: ggutman@nasa.gov