NASA Science Mission Directorate
Research Opportunities in Space and Earth Sciences -2021
NNH21ZDA001N-SARI
A.47 NASA Land-Cover/Land-Use Change-SARI Synthesis

This synopsis is for the Land-Cover and Land-Use Change (LCLUC) part of the NASA Research Announcement (NRA) ROSES-2021 NNH21ZDA001N-SARI. This NRA offered opportunities for conducting synthesis of research over South/Southeast Asia with multi-source remote sensing technologies to improve understanding of human interaction with the environment, and thus provide a scientific foundation for understanding the sustainability, vulnerability and resilience of land-cover and land-use systems. NASA LCLUC research contributes toward the goals of the U.S. Global Climate Research Program (USGCRP) by providing critical scientific information about LCLUC-climate interactions and the consequences of land-cover and land-use change on environmental goods and services, the carbon and water cycles and the management of natural resources. NASA received 10 proposals and selected 1 proposal for a total funding of $2.1 Million for three years. More details are available at: http://nspires.nasaprs.com.

David Skole/Michigan State University
South Asian Smallholder Forests and Other Tree-Based Systems: Synthesizing LCLUC Data and Approaches to Foster a Natural Climate Solution that Improves Livelihoods
21-SARI-21-0005

This proposed SARI synthesis project for South Asia is focused on understanding LCLUC patterns and processes related to agricultural landscapes of smallholder tree-based systems and their potential as natural climate solutions. The synthesis shall provide an observation-based evaluation of the degree to which these landscapes are increasing in terms of cover and biomass, and then evaluate what conditions lead to increases in tree and forest cover in South Asia, and under what conditions do improvements in tree and forest cover contribute to improving rural livelihoods. The objective of the proposed SARI South Asia Synthesis Consortium (SARI-SAS) is twofold: 1) synthesize current and recent NASA research on LCLUC to contribute to a fundamental understanding of their patterns and drivers and 2) translate fundamental science into evidence-based contributions to important climate mitigation and adaptation policy for the region.

The team proposing this synthesis effort is comprised of all the current SARI projects in South Asia, 6 university teams with 12 regional counterparts and collaborators. The SARI-SAS Consortium will synthesize existing research to assess the current state and trends of land-use change in the SARI region and identify important emerging trends and themes relevant to global change science and climate change policy. This shall advance our understanding of the processes, drivers and impacts on carbon emissions and removals, with the ultimate goal of developing new understanding of the landscape-level drivers of biotic emissions and removals. To do this in a tractable and focused way that illuminates new and emerging issues, the SARI-SAS Consortium shall evaluate the importance of tree-based systems in non-forest landscapes outside the well-understood

forest estate, with a focus on atmospheric emissions and removals of carbon and the processes that drive or mediate increasing woody cover and biomass at the landscape scale.

The project deploys a synthesis framework around the concept of Sustainable Landscapes (SL), which is an emerging framework that combines evidence from empirical and process-based scientific research with policy and development oriented models that integrates biophysical and socio-economic analysis. The SL framework is adept at translational work that links evidence from empirical analysis to successful policy interventions; a central focal point being linking LCLUC observations to their social and economic drivers to support climate change mitigation and adaptation.

The strategic flow of synthesis begins with assessments of the observational data from remote sensing. We synthesize all reporting on tree cover change, with an emphasis on where we see increases in trees outside of forest (TOF). We assess trends based on both medium resolution data analysis as well as very high resolution data analyses of individual trees. We extend beyond cover analysis to explicitly assess biomass and carbon increases. Next, we examine questions related to process and drivers of observed change. First, we review the relationship between TOF and a range of social and economic indicators. The proposed framework here benefits from the LCLUC work that integrates satellite remote sensing data with downscaled socioeconomic indicators to generate a broad view of causes of tree cover change. The second line of inquiry reviews what we can synthesize from LCLUC projects specifically related to income and livelihood drivers. The third line of inquiry seeks to understand how farmers internalize values of ecosystem services. The fourth line of inquiry seeks to understand how governance, farm-scale decision-making and policy influences tree cover. Lastly, we shall develop a knowledge base that informs more effective policies on natural climate solutions and interventions for climate change mitigation and adaptation in the AFOLU sector.
