The South/Southeast Asia Research Initiative (SARI)
Update and Meeting Objectives

Krishna Prasad Vadrevu
SARI Lead
NASA Marshall Space Flight Center
Presentation Outline

- Background to the SARI initiative
- Regional Science Issues
- Meeting Objectives
- Science outputs
How it started - strong interest in a SARI from local scientists

Jan-10-13th, 2013-Regional Science Meeting, Coimbatore

Total participants = 120
US – 18 researchers
Nepal-3; Srilanka-2; Myanmar-1; Afghanistan, Myanmar, Bangladesh-1 each
Pakistan, China invited but could not attend – Visa issues
India – University Researchers, Government, Non-Government, NGO’s
Introduction

The 2013 NASA Land Cover/Land Use Change (LCLUC) Regional Science Meeting was held in South India and had three components:

- a focused workshop on water resources at the Center for Water Resources Development and Management (CWRDM), held in Kochi, Kerala, in India, from January 7-9, and a Land Use (LU) Transient Study from Kochi to Kerala to Coimbatore, Tamil Nadu, in India, on January 9.
- a NASA international regional meeting, held January 10-13, at Kanpur University in Kanpur, Uttar Pradesh.
- a training workshop on Satellite Sensing and Geospatial Technologies for Land Cover and Land Use Change Studies and Applications, held January 14 at Kanpur University.

The goal of the meeting was to discuss land cover/land use change (LCLUC) issues and impacts in the South Asia region. The meeting was organized around eight technical sessions:

1. Agricultural land-use change;
2. LCLUC-related Earth observations (missions, data, and products);
3. Atmospheric land-use interactions (erosion, greenhouse gases);
4. LCLUC and the carbon cycle;
5. Forests and LCLUC in mountainous areas;
6. Coastal zones and water resources;
7. Urban LCLUC; and
8. Working towards a Regional Global Observation for Forest and Land Cover Dynamics (GOFC–GOLD) South Asia Regional Information Network (SARIIN) (including programs, opportunities, and challenges).

The meeting was a joint effort of the NASA LCLUC Program, GOFC–GOLD Program; International System for Analysis Research and Training (ISART) Program, Monsoon Asia Integrated Regional Studies Program (MAIRS); University of Maryland College Park (UMCP); Center for Water Resources Development and Management (CWRDM) in Kochi, Kerala, and Kanpur University, in Kanpur, Uttar Pradesh.

NASA LCLUC Workshop on Water Resources and Land Use Impact

Thirty top-level delegates from different institutions and universities in India attended the meeting to discuss research from the U.S. NASA-funded project (CWRDM), welcomed the participants and highlighted the CWRDM water research activities.

After the welcome, Earth Governance [NASA Headquarters] addressed the workshop participants, presenting an overview of LCLUC issues in South Asia, with focus on agricultural landcover conversion, forest cover loss, increasing urbanization, and air pollution. Chris Justice [UMCP] stressed that much needs to be done in terms of understanding the science of LCLUC and the linkages with global climate change in South Asia.

Some highlights from the workshop are summarized here:

- The most important LCLUC issue impacting agriculture in South Asia is poverty, especially poverty-related environmental degradation, and urbanization.
- Urbanization acts as a catalyst for environmental degradation, both directly and indirectly, through increased demands for land and water resources.
- Economic growth, driven by urbanization, has led to increased demand for land and water resources, which has resulted in deforestation, loss of biodiversity, and increased vulnerability to natural disasters.
- The impact of urbanization on the environment is complex, and it is important to understand the interactions between economic, social, and environmental factors.
- Economic pressure on natural resources is increasing, which is leading to increased pressure on natural resources, such as water and land.
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SARI - Goal

To develop an innovative research, education, and capacity building program involving state-of-the-art remote sensing, natural sciences, engineering and social sciences to enrich LCLUC science in South/Southeast Asia.

*SARI is a NASA Land Cover/Land Use Change Program Funded Initiative*
NASA ROSES Ongoing SARI Projects - 2016-Current

- Assessing the Impacts of Dams on the Dynamic Interactions Among Distant Wetlands, Land Use, and Rural Communities in the Lower Mekong River Basin
- Land Use Status, Change and Impacts in Vietnam, Cambodia and Laos
- Land-Cover/Land-Use Change in Southern Vietnam Through the Lenses of Conflict, Religion, and Politics, 1980s to Present
- The Agrarian Transition in Mainland Southeast Asia: Changes in Rice Farming - 1995 to 2018
- Agricultural Land Use Change in Central and Northeast Thailand: Effects on Biomass Emissions, Soil Quality, and Rural Livelihoods
- Spatiotemporal Drivers of Fine-Scale Forest Plantation Establishment in Village-Based Economies of Andhra Pradesh
- Consequences of Changing Mangrove Forests in South Asia on the Provision of Global Ecosystem Goods and Services
- Landscapes In Flux: The Influence of Demographic Change and Institutional Mechanisms on Land Cover Change, Climate Adaptability and Food Security in Rural India
- Urban Growth, Land-Use Change, and Growing Vulnerability in the Greater Himalaya Mountain Range Across India, Nepal, and Bhutan
- Understanding the Role of Land Cover/Land Use Nexus in Malaria Transmission Under Changing Socio-Economic Climate in Myanmar
- Complex Forest Landscapes and Sociopolitical Drivers of Deforestation - The Interplay of Land-use Policies, Armed Conflict, and Human Displacement in Myanmar
- The Future of Food Security in India: Can Farmers Adapt to Environmental Change?
- Impacts of Afforestation on Sustainable Livelihoods in Rural Communities in India
- Tropical Deciduous Forests of South Asia: Monitoring Degradation and Assessing Impacts of Urbanization
- The Global Land Rush: A Socio-Environmental Synthesis

More projects to add in the coming months.
A total of 26 projects funded from the NASA in South/Southeast Asia countries involving regional scientists

Total SARI projects in 4-years— (18.2 Million USD)

Forestry focused projects in India – 5

Thanks to the NASA LCLUC and the SARI team
Regional Science Issues Specific To Forestry
Sri Lanka, Pakistan, Nepal, Bangladesh had a significant decrease in forest cover.

Forest cover in India, Bhutan increasing.

Drivers and impacts poorly understood! Vadrevu et al., ERL, 2018, (12) 120201

Data Source: FAO, 2015
Global green leaf area has increased by 5 percent since the early 2000s, an area equivalent to all of the Amazon rainforests. At least 25 percent of that gain came in China.

China and India—the world’s most populous countries—are leading the increase in greening on land. The effect comes mostly from ambitious tree-planting programs in China and intensive agriculture in both countries.

Key point: The crop land area in China and India has not changed much since the early 2000s; yet both countries have greatly increased both their annual total green leaf area and their food production through multiple cropping practices (Myneni et al., 2019; Nature)!
Significant increase in plantations such as Casuriana, Eucalyptus, Rubber, Teak, Hemp, Coconut, Palm Oil, Acacia, etc.

*Plantation area estimation using sampling methods – not Remote Sensing*
Except for India – no such systematic biennial forest cover mapping and monitoring system exist for other South Asian Countries
Carbon is traded like any other Commodity – Thus, accurate mapping and monitoring of forests is important

UN questions India's forest cover data over lack of transparency & clarity

India had submitted data to access potential funds from global carbon trade under Paris Agreement after 2020

Nitin Sethi | New Delhi
Last Updated at January 3, 2019 01:17 IST

Doubts have been raised by a UN body over India's claims that its forest cover has been increasing steadily for years.

Questions have been raised by experts of the UN Framework Convention on Climate Change at a time when future claims of increase and enrichment of India's forest cover could lead to potentially millions of dollars of easy income annually once the Paris Agreement is implemented. The global agreement envisions setting up a global mechanism for countries to trade in the greenhouse gas emissions avoided by either growing more forests, enriching existing ones or ...

Recheck forest cover data, UN body tells India; flags concern about definition

India's definition of forests has been criticised by scientists in the past on the grounds that it doesn’t provide an accurate picture of the extent of biodiversity in rich natural forests.
3.2 Definition of forest

As per 13/CP.19, Annex, paragraph 2 (g), the forest definition used for the construction of the FRL should be consistent with definition used for GHG inventory. India has used the same definition as was used for GHG inventory, which is given as follows:

“All lands, more than one hectare in area, with a tree canopy density of more than 10 percent irrespective of ownership and legal status. Such lands may not necessarily be a recorded forest area. It also includes orchards, bamboo and palm.”

(The definition of forest has been taken exactly as was used for GHG inventory and FRA 2015. The only difference in above definition is that it has been explained further. The separate area under orchards, bamboo and palm are not available as it is not possible to delineate these areas from satellite. However, the area under TOF/plantation given under forest types includes these areas partly based on the ancillary information from State Forest Departments, toposheet etc. Scrubs and shrubs are not the part of the forest cover.)
Very High Resolution Data can assist in mapping plantations, trees outside forests. Still challenges remain such as mapping of “Bamboo intermixed forests, rubber intermixed with evergreen forests, etc.”
Global Carbon Emissions Hit Record High During 2018

Growing disconnect between the climate agreements and emissions

Since Paris agreement (Dec-2015), emissions have risen in each of the first two full years !.

High Energy Demand ! – High Oil Consumption in the US and more Coal Burning in China and India.

Energy demand grew 2.3 percent last year, the most in a decade (IEA). It showed a record 33 gigatons of carbon emissions from energy, up 1.7 percent from the previous year. Global electricity demand rose 4 percent and was responsible for half the growth in overall energy demand.
GHG emissions from LUCF in South Asia

Vadrevu et al., 2017, 2018, ERL

GHG emissions from LUCF sector seems decreasing significantly in South Asia

Vadrevu et al., 2017, 2018, ERL
GHG emissions from LUCF in Southeast Asia

Some of the drivers to be discussed in the workshop

Vadrevu et al., 2017, ERL
Forest Fires most common in the region
Increasing Agricultural Fires in South/Southeast Asia

Vadrevu et al., 2019. Nature Scientific Reports
In Papua New Guinea, about 95 percent of forests are under community control. Similarly, Mexico (75%); China (55%); Bolivia (35%); Nepal (25%) Brazil (13%)

Even after 12 years after the enactment of the 2006 Forest Rights Act, fewer than 3% percent of community forest rights have been recognized in India.

In India, Government has already signed the UN's Reducing Emissions from Deforestation and Forest Degradation (REDD) program and enacted Compensatory Afforestation Fund Act 2013 (CAF), which is geared towards aggressive commercial plantation and tapping carbon markets. *This might be useful to address REDD+ and generate funds useful for forestry sector.*

In contrast, granting forest rights to tribal communities have potential to reduce conflicts as it ensures tenurial security and vests decision-making on forest resources.
GOFC-GOLD

Global Observation of Forest and Land Cover Dynamics

An international forum for coordination concerning land cover observations

- Earth Observations for land cover change, forests, fires, biomass and REDD+ studies
- Communication between Science and Decision Makers
- Coordination with other programs – e.g. UN REDD+, GCOS ECVs, CEOS LPV, GEOGFOI
- Implementation through Global Regional Networks

Land Cover Characteristics and Change
Figure 2. This map shows the currently active GOFC–GOLD RNs. 1. Southeast Asia Regional Research and Information Network (SEARRIN); 2. South Asia Regional Information Network (SARIN); 3. South Central European Regional International Network (SCERIN); 4. Red Latinoamerica de Teledeteccion e Incendios Forestales (RedLaTIF); 5. West African Regional Network (WARN); 6. Observatoire Satellital des Forets d’Afrique Central (OSFAC); 7. Miombo Network (MIOMBO); 8. Southern Africa Fire Network (SAFNET); 9. Central Asia Regional Information Network; 10. Caucasus Regional Information Network (CaucRIN); 11. Mekong Regional Information Network (MekRIN). See Table for a summary of the current and potential activities of each RN.

https://gofcgold.org/
Purpose: is to discuss the latest updates in the forestry sector covering the South Asian countries

- Mapping/monitoring of forest cover, plantations, and trees outside forests including degradation in South Asian countries
- REDD+, GHG emissions in the forestry sector and other land uses
- Forest fires, post-fire vegetation recovery and dynamics
- Forest carbon inventory and management; Forest ecosystem functions
- Social forestry, community forest management, and conservation
SARI Focus and Priorities
SARI Focus and Priorities

- **SARI Focuses on building research collaborations between the US and regional scientists**

- **Meetings/Workshops help in identifying Needs and Priorities for the region (NASA LCLUC calls)**

- **Research and capacity building training events are integral to SARI**
SARI Research Needs and Priorities – Meetings/Workshops
Funded by International/Regional partners
2019 LCLUC SARI Meeting – Malaysia

182 participants – 21 countries representation
3-day meeting + 3-day training
Collaborations are the Key
SARI Malaysia Meeting Facilitated by 20-Different Partners

Local Host

Sponsors and Partners
Book Published (2018)

- 30 Chapters
- 101 (authors + co-authors)
- 732 pages

2-other books in progress:

- Biomass burning in Asia (CRC Press – 2 Volumes, 2020)
- Remote sensing of Agriculture in Asia - Springer (2020)
SARI: RECENT 4 YEARS OF SCIENCE

Over 150 papers and 3 books 4th to be announced

10-different Special Issues in Journals

>200 scientists >100 institutions >18 projects

South-Southeast Asia

Oct-2013 – India Meeting – SARI idea proposed 2015-SARI formed; 2016- 1st SARI proposals funded;
Training Events – Early Career Researchers

Certificate of Participation

This is to certify that

has participated in the training sessions on
Remote Sensing and Geospatial Technologies for Land Cover and
Land Use Change Studies and Emissions Modelling
October 20th, 21st and 23rd, 2016

Presented by NASA Land-Cover/Land-Use Change Program, South/Southeast Asia Research Initiative (SARI) and the
University of Maryland, College Park
Hosted by Ho Chi Minh University of Technology, Vietnam

Prof. Nguyen Phoc Dan
HCMUT, Vietnam

Dr. Krishna Prasad Vadrevu
NASA MSFC, SARI Program Scientist

Prof. Chris Justice
NASA LCLUC Project Scientist

Promoting Open Source Tools and Cloud Computing Platforms
(Ex: GEE)
3-Different Outputs for the Current Meeting

Guest Editors
Dr. Krishna Vadrevu (NASA)
Dr. Garik Gutman (NASA)
Dr. Tsuneo Matsunaga (NIES)
Prof. Chris Justice (UMd)

Strongly encourage everyone to submit

Please talk to us for publication ideas
   Training: December, 17-19th, 2019

2020 - WEF-SARI LCLUC Meeting, Cambodia
   Meeting: February
   Training: February

2020 - LCLUC advanced training, Philippines, Bhutan
   Training: April

2020 - SARI LCLUC meeting, Sri Lanka or Taiwan
   Meeting: July
   Training: July
Vision, support and guidance to build the SARI regional science initiative
Highly Indebted to Dr. KVS Badarinath, Scientist, National Remote Sensing Center (ISRO) (1959-2013) – 54 yrs

Atmospheric Physics and Remote Sensing

h-index = 66

I'm so grateful you were my mentor
Welcome to New Delhi