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

Krishna Prasad Vadrevu
NASA Marshall Space Flight Center

Land-Cover / Land-Use Change Program

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GLOBAL OBSERVATION FOR FOREST AND LAND COVER DYNAMICS

NASA

Presentation topics

- **Background to the SARI initiative**

- **Meeting Objectives**

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

Meeting Summary-Need for SARI
NASA The Earth Observer

Summary of the 2013 NASA Land Cover/Land Use Change Regional Science Meeting, South India

Krishna Prasad Vadrevu, University of Maryland, College Park, krishna@hermes.geog.umd.edu
Chris Justice, University of Maryland, College Park, justice@hermes.geog.umd.edu
Prasad Thenkabail, United States Geological Survey, pthenkabail@usgs.gov
Garik Gutman, NASA Headquarters, ggutman@nasa.gov

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 Centre for Water Resources Development and Management (CWRDM), held in Kozhikode, Kerala in India, from January 7-8, and a Land Use (LU) Transect Study from Kozhikode, Kerala, to Coimbatore, Tamil Nadu, in India[1], on January 9;
- a NASA international regional meeting, held January 10-13, at Karunya University in Coimbatore, Tamil Nadu; and
- a training workshop titled *Remote Sensing and Geospatial Technologies for Land Cover and Land Use Change Studies and Applications,* held January 14 at Karunya 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. Atmosphere/land-use interactions (aerosols, 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 (SARIN) (including prospects, opportunities, and challenges).

The meeting was a joint effort of the NASA LCLUC Program; GOFC–GOLD Program; International System for Analysis Research and Training (START) Program; Monsoon Asia Integrated Regional Studies Program (MAIRS); University of Maryland College Park (UMD); Centre for Water Resources Development and Management (CWRDM) in Kozhikode, Kerala; and Karunya University, in Coimbatore, Tamil Nadu.

NASA LCLUC Workshop on Water Resources and Land Use Transect

Thirty top-level delegates from different institutes and universities in India attended the meeting in addition to twelve researchers from the U.S. **Narasimha Prasad** [CWRDM], welcomed the participants and highlighted the CWRDM water research activities.

After the welcome, **Garik Gutman** [NASA Headquarters] addressed the workshop's participants, presenting an overview of LCLUC issues in South Asia, with focus on agricultural land-cover conversion,

[1] Kerala and Tamil Nadu are two of the 28 states in India.

Water resource-focused workshop participants. **Images Credit:** All photos in this article were taken by author or other members of the LCLUC team.

Rhizophora mangle, known as the "red mangrove," near Kadalundi bird sanctuary in Kerala.

On January 9, participants departed for a Land Use Transect Study from Kozhikode, Kerala, to Coimbatore, Tamil Nadu, involving local scientists. The processes of urban expansion and forest degradation were quite evident during the transect study. During the transect, the participants observed forest fires in the mountains, 50 km (~31 mi) away from Coimbatore.

forest-cover loss, increasing urbanization, and air pollution. **Chris Justice** [UMD] stressed that much needs to be done in terms of the underpinning 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 India is *paddy fields* (wetlands) being converted to urban areas and/or left abandoned, with the attendant deficit in rice production.
- This *paddy conversion* is complex, and crosses economic, ecological, sociocultural, structural, and class dimensions.
- Economic return from paddy cultivation does not tend to encourage conservation—due to labor costs.
- At present, land is seen only as real estate needed for residence status, and is the safest and best investment to maximize profits.
- Coconut farming is shrinking due to the unavailability of skilled labor.
- Pollution and sedimentation from *anthropogenic* activities seriously affects aquatic systems/wetlands in South India. This requires more-stringent regulations and greater wetland protection.
- The roles of coastal vegetation and mangroves in protecting lives and property require more research to address contamination—possibly due to saline water intrusion, likely from inadequate drainage systems and poor maintenance of the well surroundings.

The CWRDM arranged several field visits to highlight local LCLUC issues and responses, including urban green park and wetlands conservation, mangrove conservation, and coastal and riparian land use management.

Coconut, arecanut, banana, and yam plantations, Kozhikode, Kerala.

Smoke from forest fires, Palakkad, Western Ghats, Kerala.

March/April 2013

http://eospso.gsfc.nasa.gov/eos_homepage/for_scientists/earth_observer.php

SARI - Goal

SARI is initiated by the NASA LCLUC program

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 Priority

- Involve National Researchers and Practitioners – Universities, Institutes and Operational Agencies;
- Strong emphasis on Applied Research with regional / national societal applications and benefits.
- Facilitate strengthening regional/national projects through co-design and collaborations;

NASA ROSES – 2015-2018 LCLUC South Asia Projects

Agriculture and Food security

- Landscapes In Flux: The Influence of Demographic Change and Institutional Mechanisms on Land Cover Change, Climate Adaptability and Food Security in Rural India

- The Future of Food Security in India: Can Farmers Adapt to Environmental Change?

- Understanding Changes in Agricultural Land Use and Land Cover in the Breadbasket Area of the Ganges Basin 2000-2015: A Socioeconomic-Ecological Analysis

Urban

- Urban Growth, Land-Use Change, and Growing Vulnerability in the Greater Himalaya Mountain Range Across India, Nepal, and Bhutan

Human Health

- Understanding the Role of Land Cover/Land Use Nexus in Malaria Transmission Under Changing Socio-Economic Climate in Myanmar

2015-2016 LCLUC South Asia Projects

Forests

- 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
- Complex Forest Landscapes and Sociopolitical Drivers of Deforestation - The Interplay of Land-use Policies, Armed Conflict, and Human Displacement in Myanmar
- Impacts of Afforestation on Sustainable Livelihoods in Rural Communities in India
- Tropical Deciduous Forests of South Asia: Monitoring Degradation and Assessing Impacts of Urbanization

SARI Research Needs and Priorities – Meetings/Workshops Funded by International/Regional partners

Collaborations are the Key !

Current Meeting Sponsored and Facilitated by 20-Different Organizations

National Astronomical Research Institute of Thailand

Chiang Mai University

Sponsors and Partners

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SARI

GEOGLAM Global Agricultural Monitoring

Asia-RiCE Crop Estimation and Monitoring

START
global change SysTem for Analysis, Research & Training

adpc

Global Environmental Forum

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UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Multidisciplinary Science Research Centre

Faculty of Science,Lampang Rajabhat University

SESE

RCCES
Regional Center for Climate and Environmental Studies

Atmospheric Science and Astronomy Research Unit
ASARU
Lampang Rajabhat University

SARI Focussed Thematic Meeting – Agriculture - New Delhi, India, May, 2017

-Total Meeting Participants = 94

-Total Presentations – 42;

-Meeting Outputs – IJRS Special Issue

International Journal of Remote Sensing

Submit your papers to this special issue on Remote Sensing of Agriculture in South/Southeast Asia

Deadline: 31 December 2017

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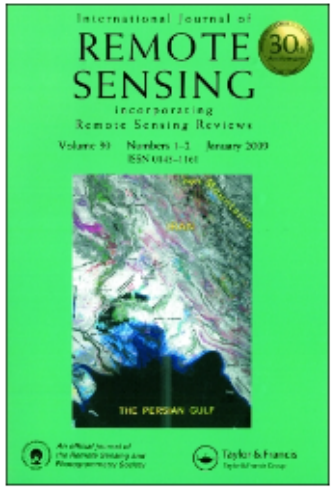

South/Southeast Asian countries are growing rapidly in terms of population, industrialization and urbanization. One of the key challenges in the region is food security. Although total food production and productivity has increased in the region because of additional land area converted to agricultural land use during 1960's to 2000 and improved varieties and crop management, growth rate of food production in recent times has slowed down, mostly due to loss of agricultural lands related to increasing urbanization and industrialization and less optimal use of available technology. Further, the weather and climate systems in the region, driven primarily by monsoon variability are characterized by extreme weather events, resulting in droughts or flooding which can impact agricultural production. In this region, monitoring the agricultural crop production in a timely manner is essential to predict and prepare for disruptions in the food supply. Further, improved and up-to-date information on agricultural land cover and associated land use practices can help in understanding the role and response of the agricultural sector to environmental change and for improved land management and planning.

Despite the progress in remote sensing and geospatial technologies, little emphasis has been placed on developing robust methods for operational mapping/monitoring of cropped areas and forecasting crop production. In most countries of South/Southeast Asia, the mapping efforts have focused on the classification of land cover types and generalize cropland areas into a single or limited number of thematic classes. Crop-specific LULC information is currently limited to very few countries in

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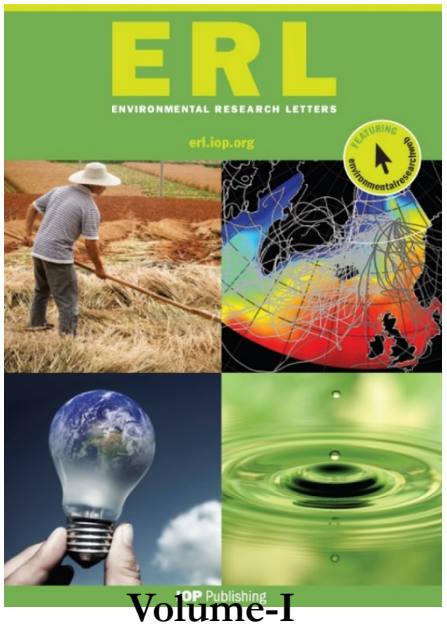
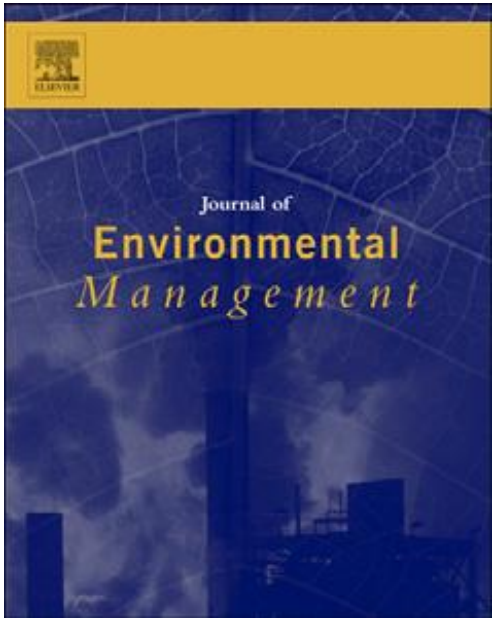
http://explore.tandfonline.com/cfp/est/tres-remote-sensing-in-asia-cfp

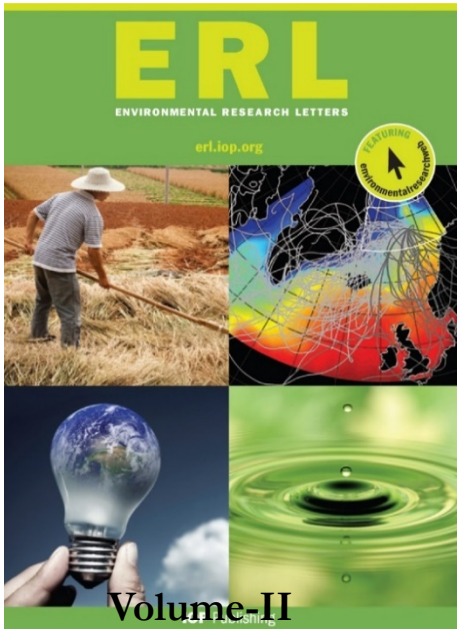
Eds: Krishna Vadrevu, Vinay Dadhwal, Garik Gutman and Chris Justice

SARI - Peer Reviewed Publications

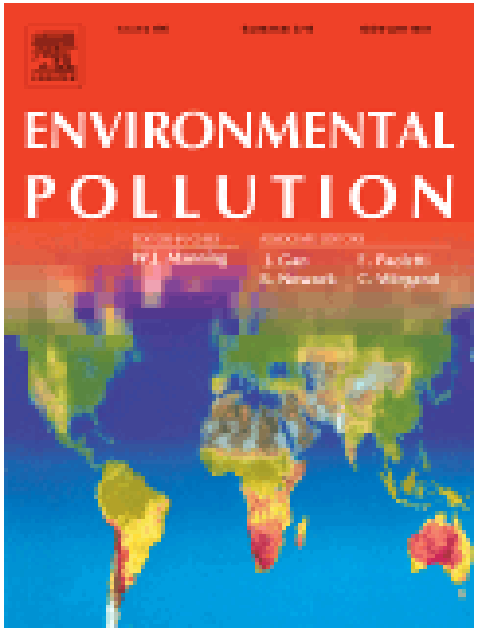


Volume-I





Volume-II



Springer

springer.com

Land-Atmospheric Interactions in Asia

Book Series: Springer Remote Sensing/Photogrammetry

Editors: Krishna Prasad Vadrevu, Toshimasa Ohara, Chris Justice

Forthcoming, Summer 2016

- Maximizes reader insights into the quantification of land cover/land use changes (LC:LUC) and greenhouse gas emissions in Asia.
- Focuses on large spatial scales integrating satellite remote sensing and ground based approaches.
- Broadens understanding on integrated approaches combining top down and bottom up methodologies including modeling for characterizing LC:LUC and emissions.
- Explores the causative factors and impacts of LC:LUC and emissions due to population growth, industrial activities and energy demand in Asia.

In Asia, high population growth together with rapid economic development are causing immense pressure to convert land from natural and agricultural areas to residential and urban uses with significant impact on emissions and ecosystem services. This edited volume sheds new light on the causative factors and impacts of LC:LUC on the greenhouse gas (GHG) and aerosols in Asia. The volume will also focus on the use of remote sensing, geospatial technologies, and integrated approaches to characterize LC:LUC and emissions.

Articles are invited from international researchers working on remote sensing of LC:LUC, fires, GHG emission inventories, aerosols, and land-atmospheric interactions in Asia.

Submission Deadline: December 31st, 2015
Email: krkvkp@umd.edu

Dr. Krishna Prasad Vadrevu *(krkvkp@umd.edu), Associate Research Professor, Department of Geographical Sciences, University of Maryland, College Park, USA.*

Dr. Toshimasa Ohara *(tohara@nies.go.jp), Researcher, National Institute of Environmental Studies (NIES), Japan.*

Dr. Chris Justice *(cjustice@umd.edu), Head, Department of Geographical Sciences, University of Maryland, College Park, USA.*

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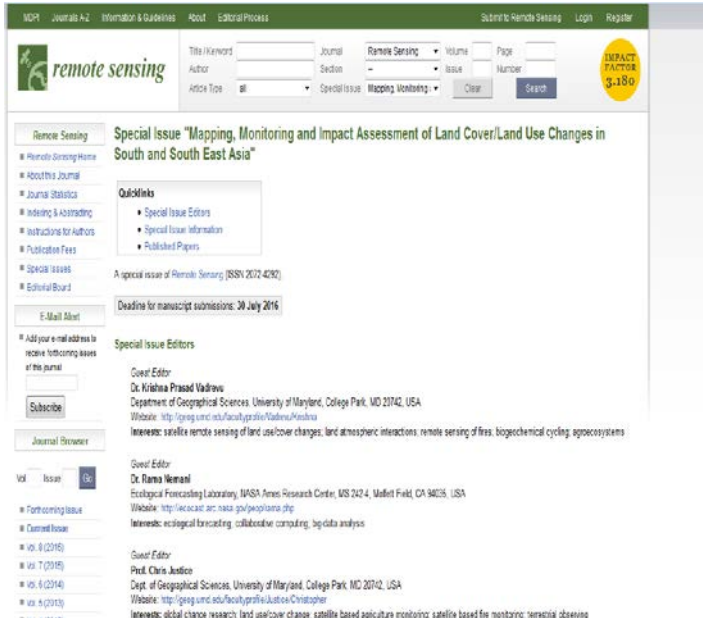


SARI forthcoming meetings (2018)

- 2018 - SARI LCLUC regional meeting in Philippines/Laos
  - Meeting: March 17-18-19
  - Training: March 20-21-22

- 2018 - LCLUC in Mountain Environments, Bhutan
  - Meeting: November, 2018
  - Training

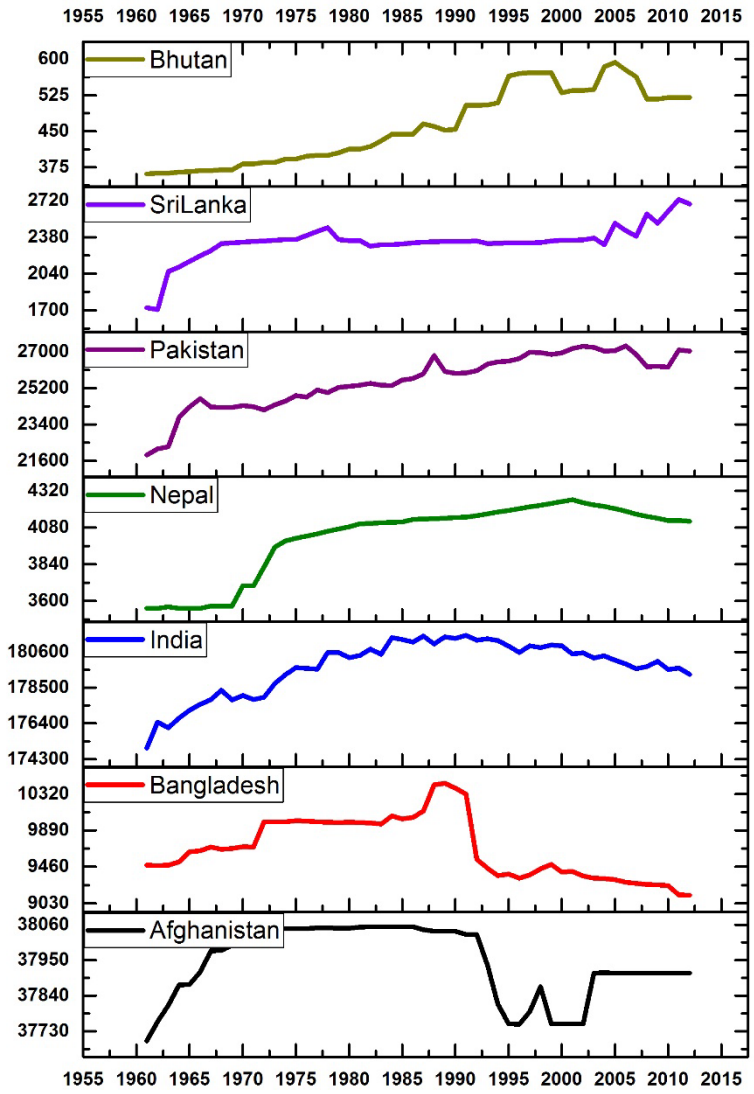
LCLUC in SARI Countries and Meeting Objectives

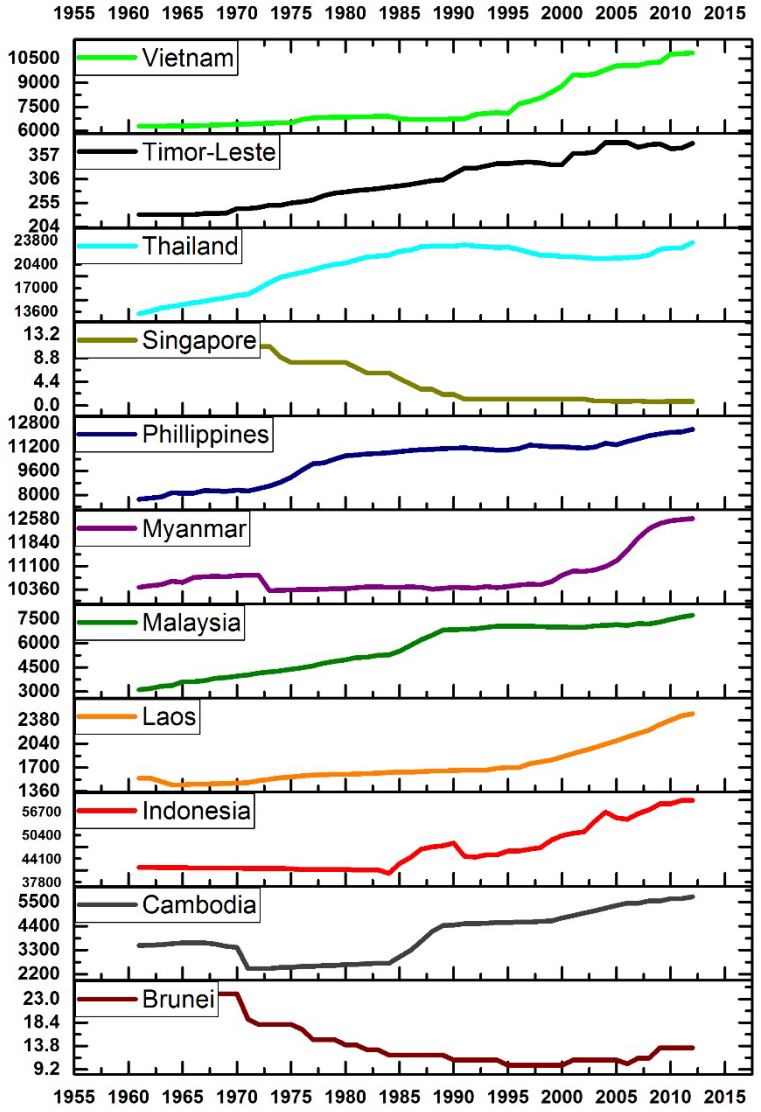
LCLUC Themes (this meeting)

- **Session-1** – Agricultural Land Use/Cover Changes
- **Session-2** – Land Atmospheric Interactions
- **Session-3** – Urban Land Use/Cover Changes
- **Session-4** - Forest and Land Use/Cover Changes

- **Dedicated Poster Session – Day-2**
- **Panel Discussions (Day-2) :** Research needs;
  - 3-independent panels on Agriculture, Atmosphere and Land Use
- **Discussion Session (Day-3):** User needs and priorities.

Agricultural land use in South/SE Asia



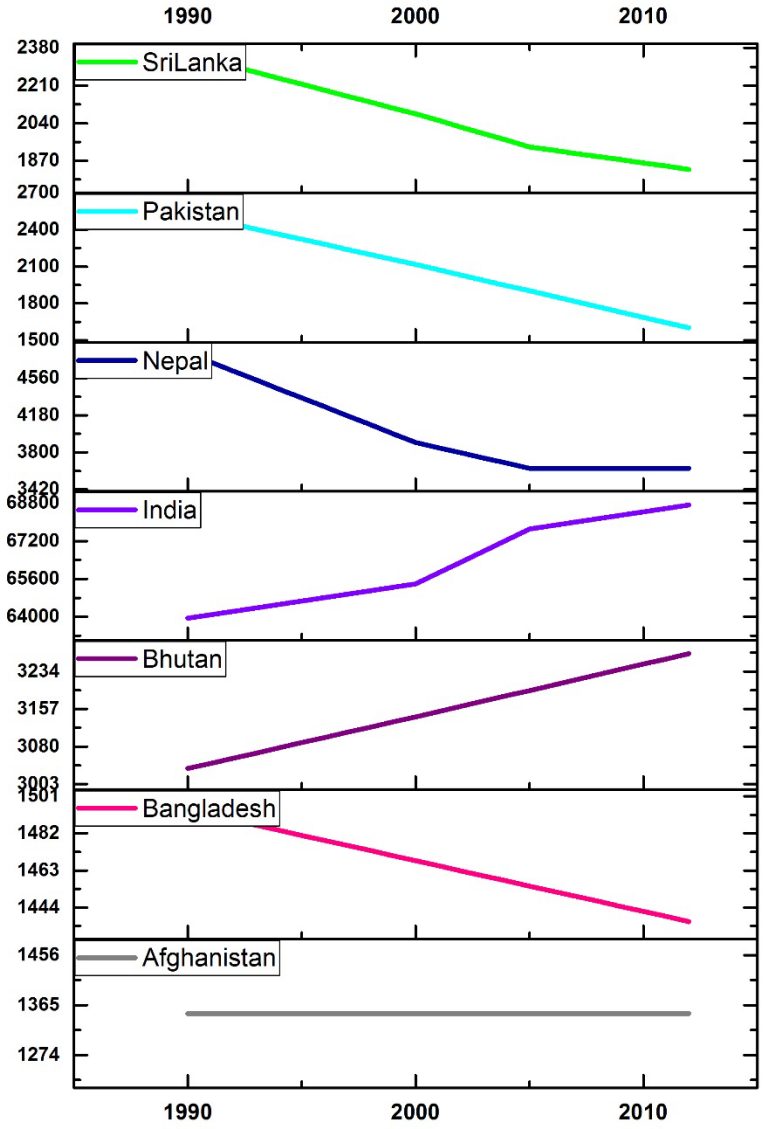


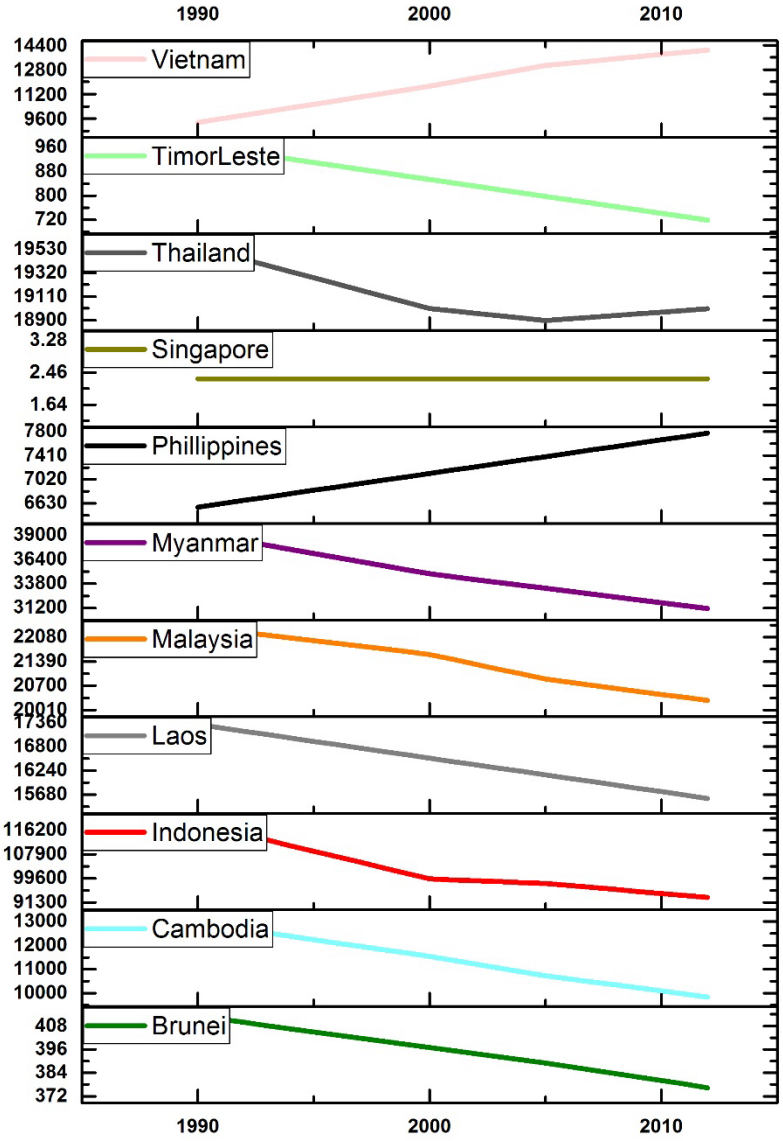
Significant increase in Agricultural Land Area (x 1000ha) in Several South and Southeast Asian Countries

Vadrevu et al., 2017, ERL (in press)

Data Source: FAO, 2015

Forest Area in South/SE Asia





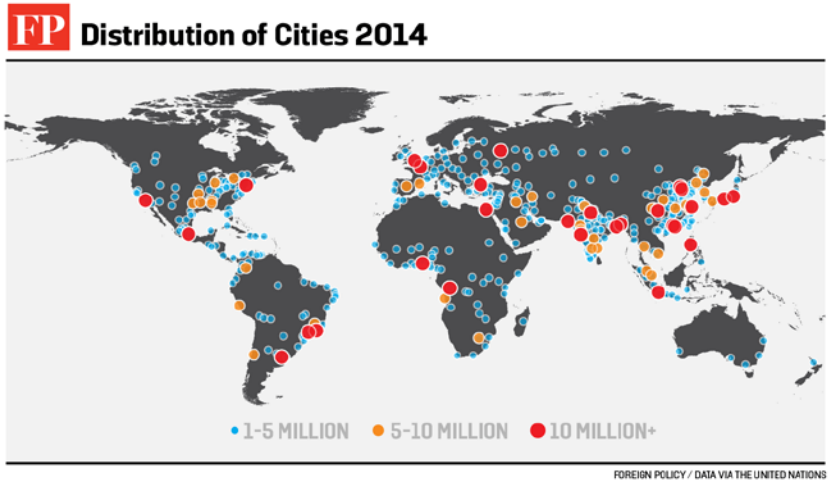
Significant decrease in Forest Area (x 1000ha) in Several South and Southeast Asian Countries

Vadrevu et al., 2015, ERL (in review)

Data Source: FAO, 2015

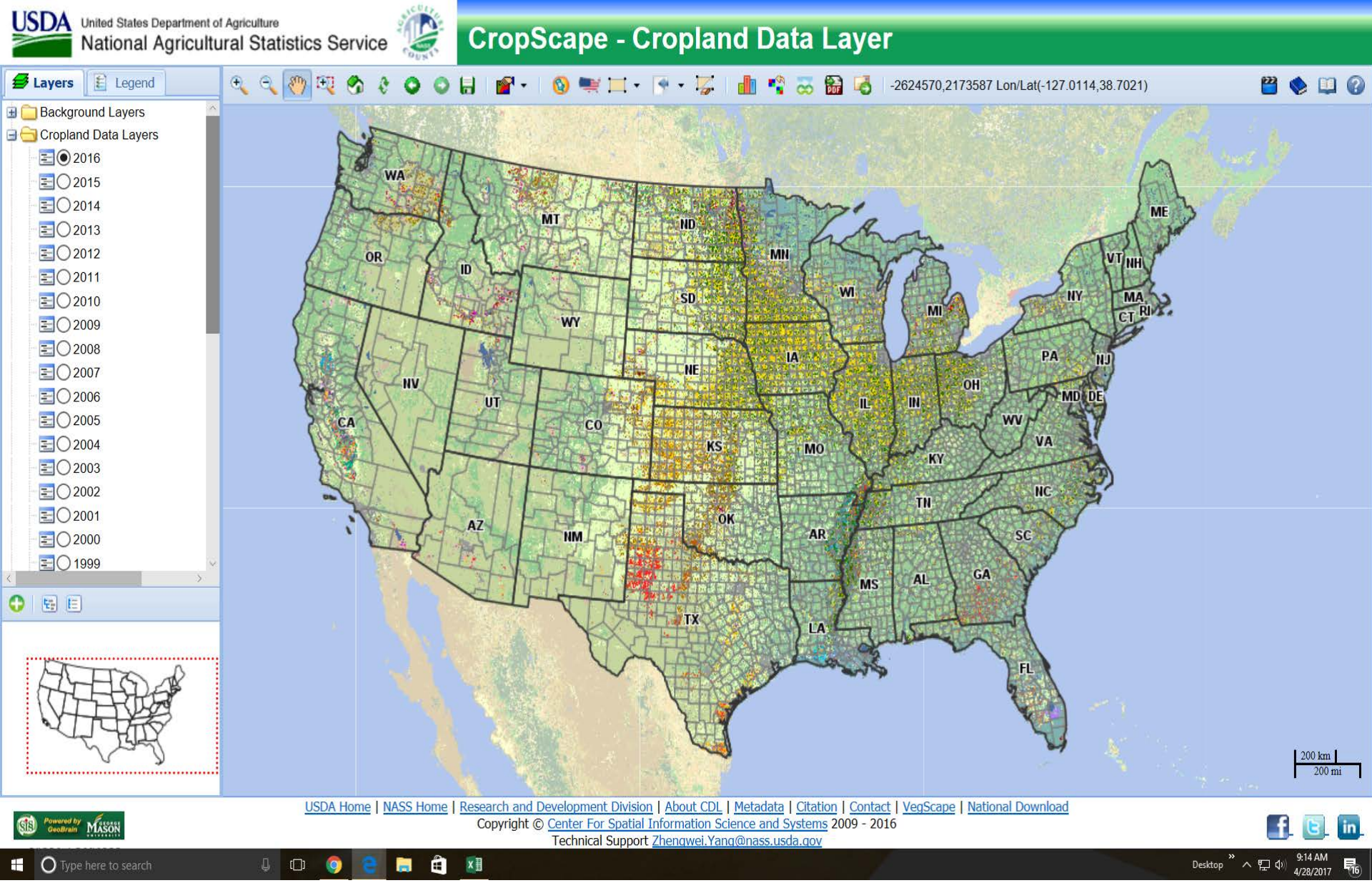
Urbanization and LCLUC

- Urbanization is occurring rapidly at the cost of agriculture and forest lands.



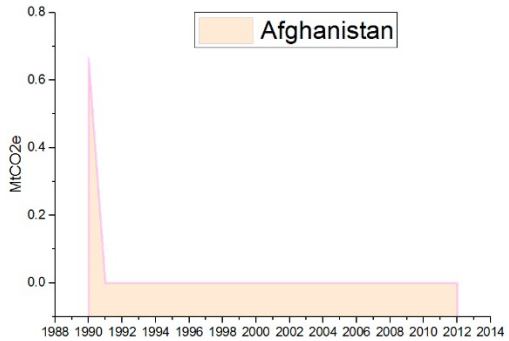
- Currently, 28.33% of South/Southeast Asian population lives in urban areas and it is estimated that by 2030, more than 55% of the population will be urban.

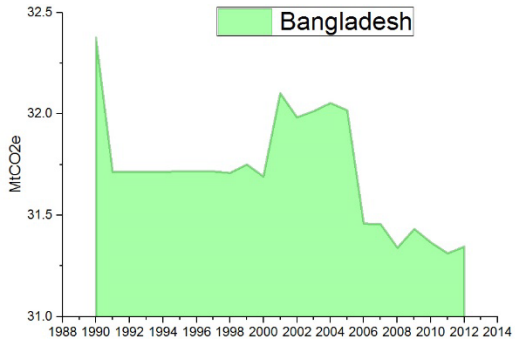
- Urbanization is resulting in air, water and solid waste pollution problems in most cities.

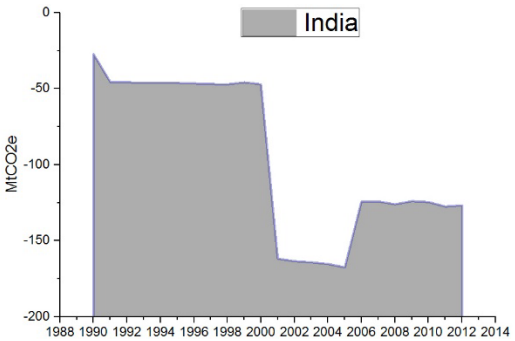


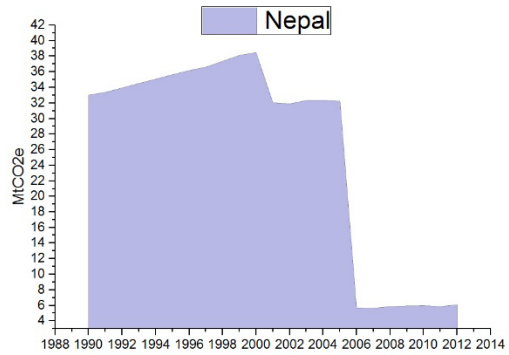
1997-2016 – possible because of strong validation data at a plot scale from Farm service bureau; such data may not be available in S/Seast Asia

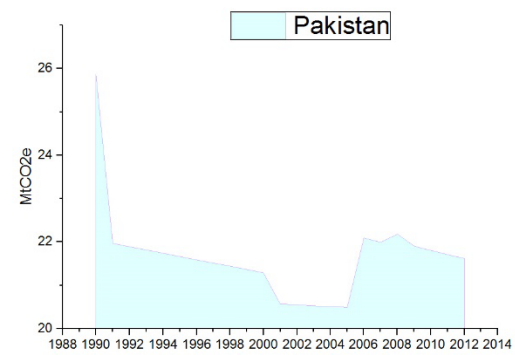
GHG emissions from LUCF in South Asia

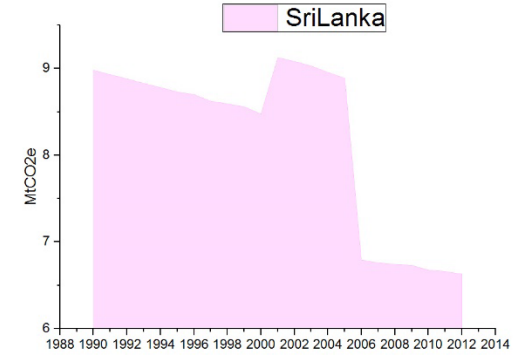


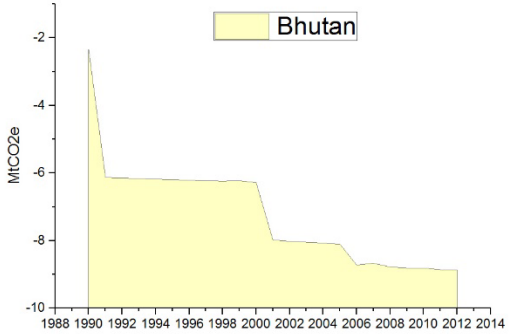










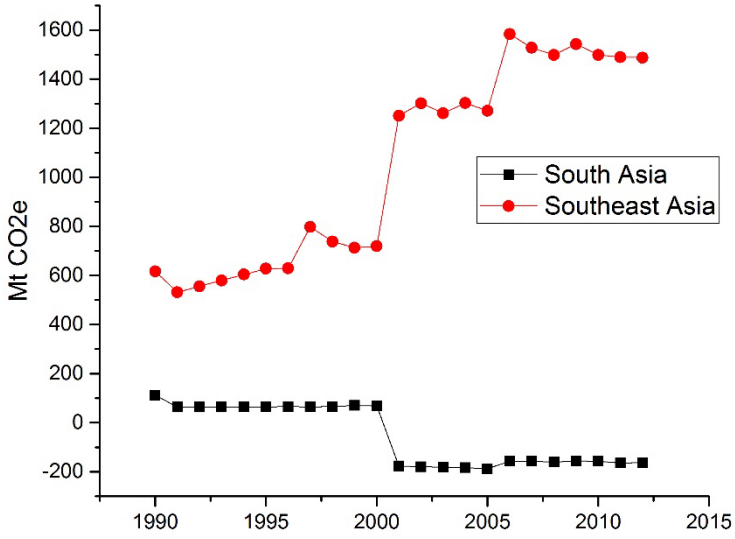


GHG emissions from LUCF sector seems decreasing significantly in South Asia

Vadrevu et al., 2017, ERL (in review)

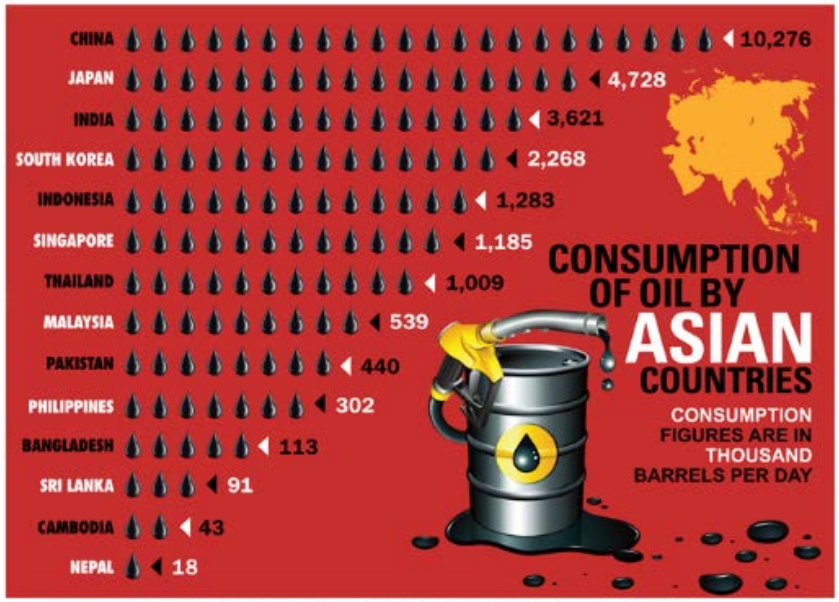
GHG emissions from LUCF in Southeast Asia

GHG emissions from LUCF sector in Southeast Asia seems relatively higher than South Asia countries.

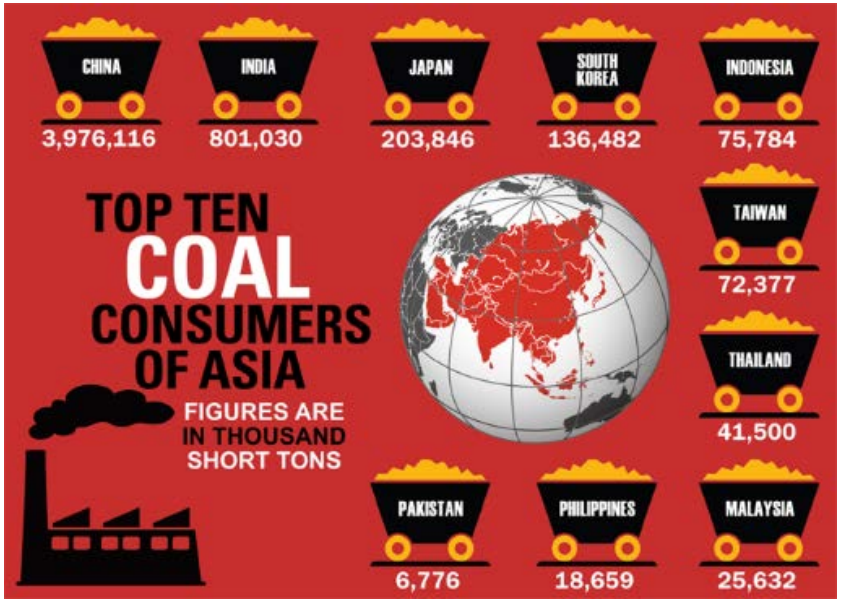


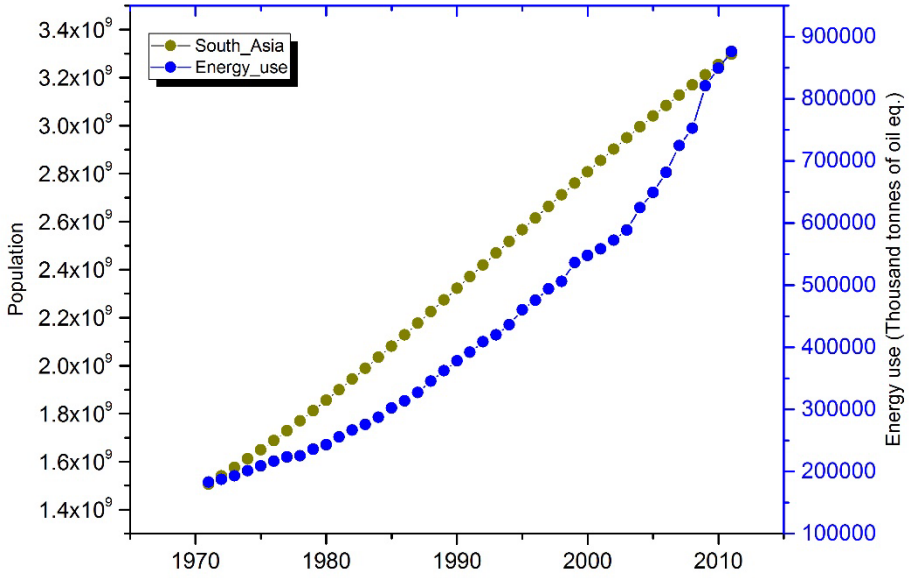
Some of the drivers to be discussed in this meeting

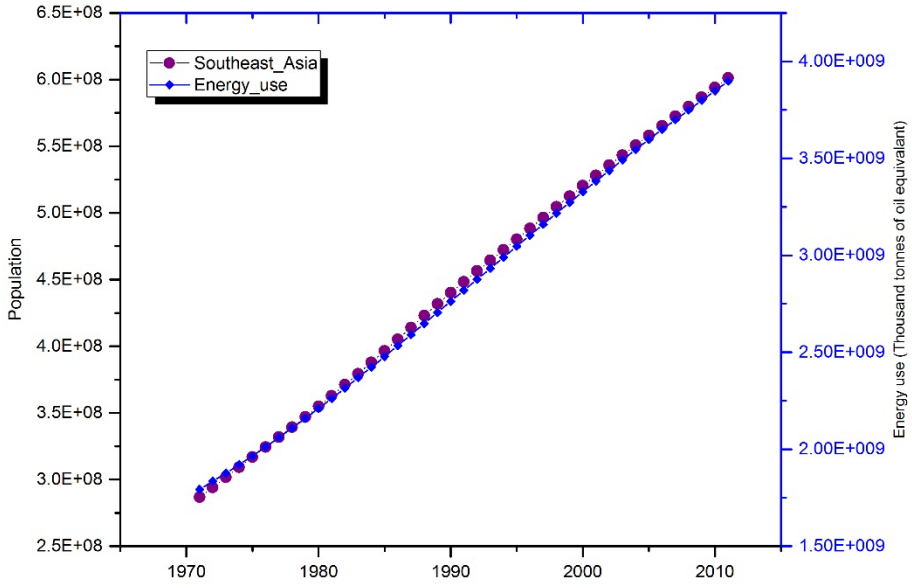
Population and Energy Use



(SOURCE: US ENERGY INFORMATION ADMINISTRATION, 2012)








Fires and smoke in Indonesia (6/19/2016) – Also a Recurring Event

Fires, Riau province, Indonesia, June, 2013, 2016

Meeting Focus

- Review regional and national science initiatives, relating to LCLUC in the region;
- Review the causes and impacts of LCLUC specific to agriculture, forests, urban and coastal ecosystems in the Asian region;
- Review GHG and aerosol sources, sinks and impacts in the Asian region;
- Strengthen the SARI activities in the region.

Current Meeting Outputs

Special Issue:

Remote Sensing of Land Use/Cover Changes (LU/CC) in South/Southeast Asia

Editors:

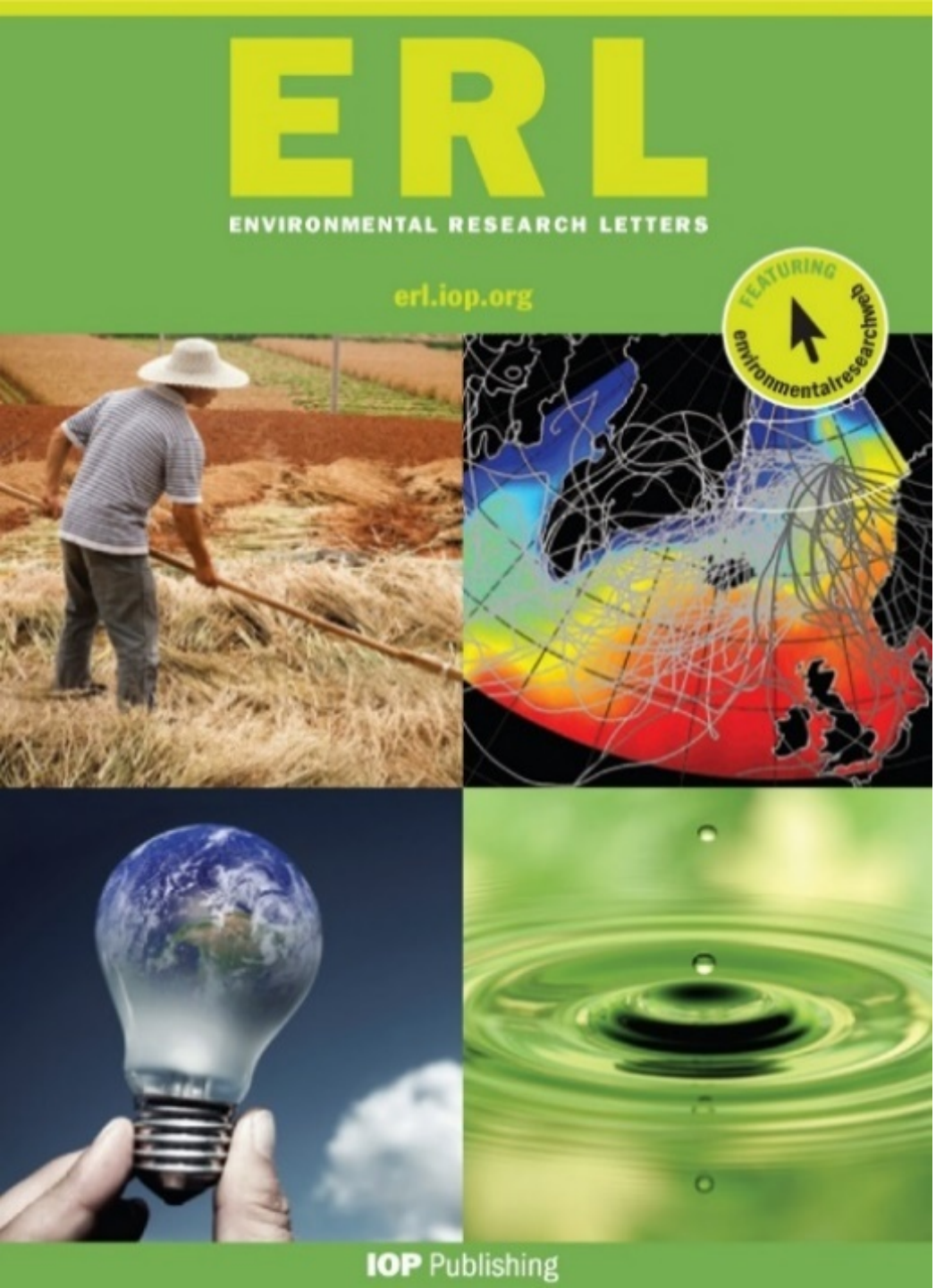
-Krishna Vadrevu, NASA MSFC)

-Andreas Heinimann (Univ. of Bern, Switzerland)

-Chris Justice (Univ. of Maryland, USA)

-Garik Gutman (NASA HQ)

Deadline: March 31st, 2018



Special Issue:

Land Use/Cover Changes (LU/CC) in South/Southeast Asia

Editors:

-Krishna Vadrevu, NASA MSFC)

-Toshimasa Ohara (NIES, Japan)

Deadline: March 31st, 2018

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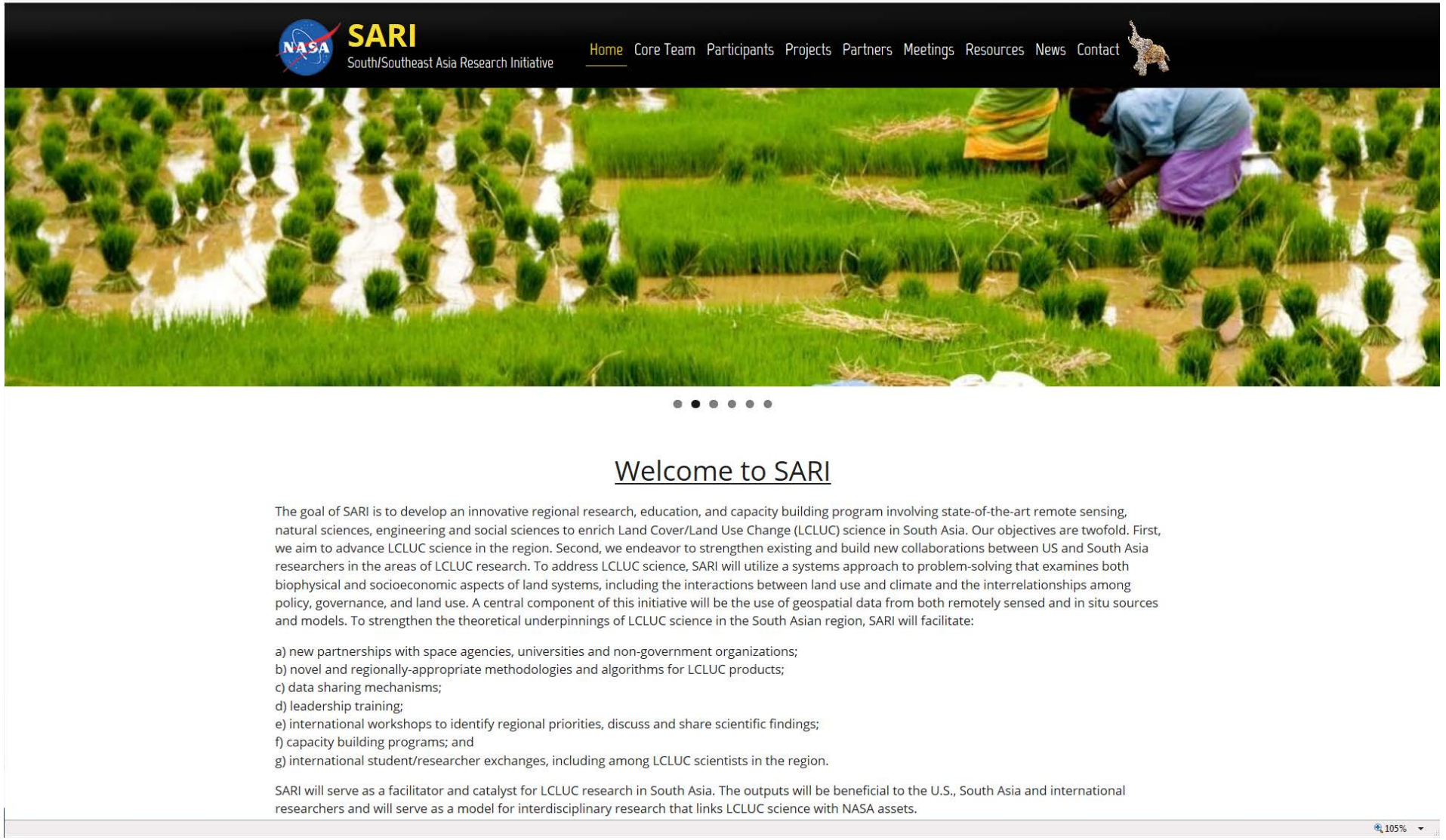

SARI website

www.sari.umd.edu