

# NASA South/Southeast Asia Research Initiative (SARI) Updates

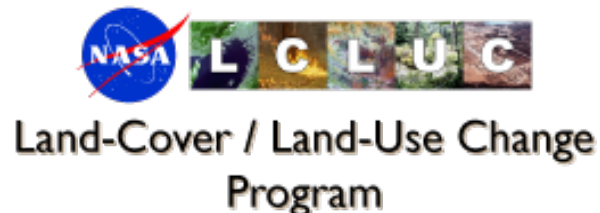
**Krishna Prasad Vadrevu**

SARI Lead

Deputy Program Manager, NASA LCLUC Program (HQ)

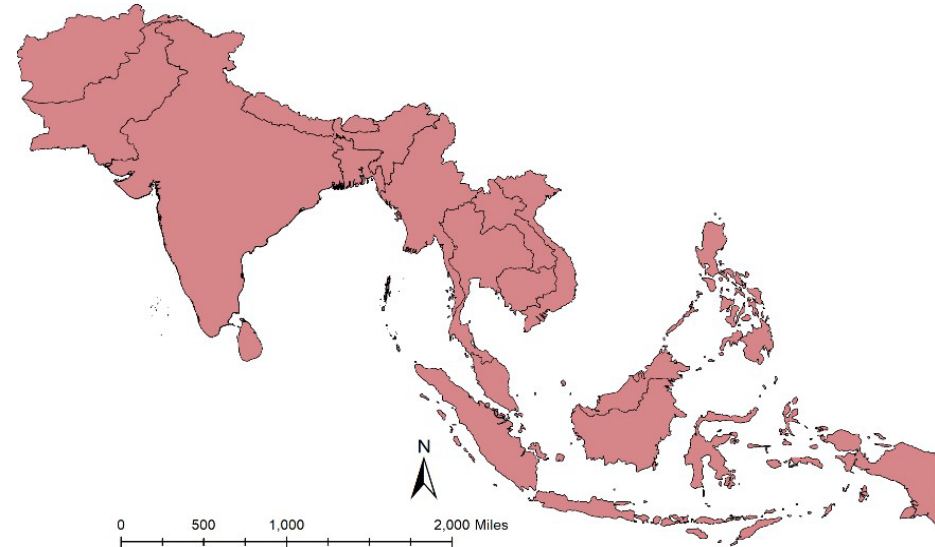
NASA Marshall Space Flight Center

Huntsville, Alabama



# Outline

- Background to the South/Southeast Asia Research Initiative(SARI)
- SARI Outputs and Updates
- SARI Southeast Asia Synthesis Vietnam Meeting Summary
- SARI South Asia Synthesis Meeting forthcoming



# How SARI started-Strong interest from regional scientists



Jan-10-13th, 2013-LCLUC 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





# Needs Identified

- Focus LCLUC thematic areas
- Collaborative projects focused on Asia
- Strengthen Research ties with various organizations
- Training opportunities
- Data access (how to access ISRO satellite data)

# Meeting Summary- SARI Research Needs and Priorities - The Earth Observer

24

meeting/workshop summaries

The Earth Observer March - April 2013 Volume 25, Issue 2

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

Krishna Prasad Vidaveru, University of Maryland, College Park, [krishna@terracore.gsfc.nasa.gov](mailto:krishna@terracore.gsfc.nasa.gov)  
 Chris Justice, University of Maryland, College Park, [justice@terracore.gsfc.nasa.gov](mailto:justice@terracore.gsfc.nasa.gov)  
 Prasad Thirukhatal, United States Geological Survey, [pthirukhat@usgs.gov](mailto:pthirukhat@usgs.gov)  
 Garik Guttman, NASA Headquarters, [gguttman@nasa.gov](mailto:gguttman@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<sup>1</sup>, 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);

<sup>1</sup>Kerala and Tamil Nadu are two of the 28 states in India.



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

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

The Earth Observer March - April 2013 Volume 25, Issue 2

25

meeting/workshop summaries



Rhizophora mangroves, known as the "red mangrove," near Kadalmudi bird sanctuary in Kerala.

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.

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.



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



Smoke from forest fires, Piddiladi, Wintersham, Kerala.

March/April 2013

[http://eospsso.gsfc.nasa.gov/eos\\_homepage/for\\_scientists/earth\\_observer.php](http://eospsso.gsfc.nasa.gov/eos_homepage/for_scientists/earth_observer.php)

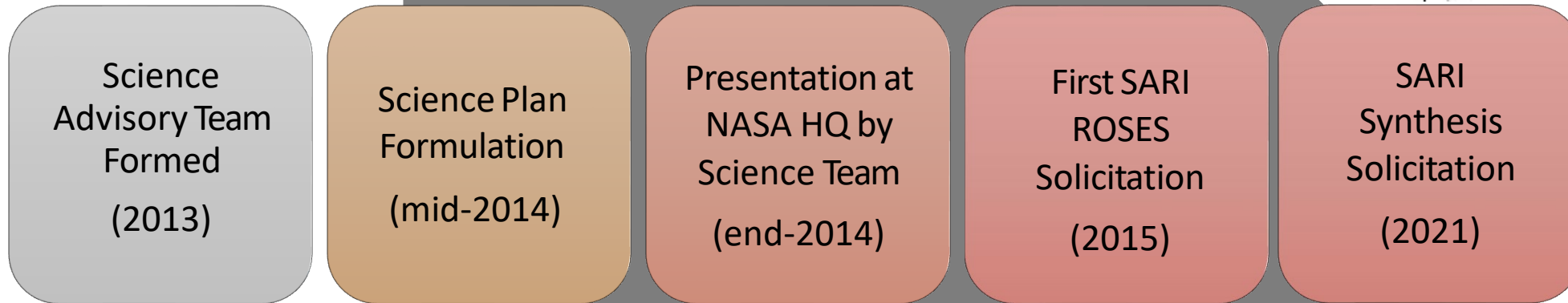




# NASA Land Cover/Land Use Change (LCLUC) Program South/Southeast Asia Research Initiative (SARI)

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.

**Dr. Krishna Vadrevu, SARI Lead, NASA MSFC**



**-Balancing Act**

**-Research + outreach activities should be blended to achieve successful science outputs**

# SARI Projects - ROSES-2015 Selections

S.No	2015	Region	PI	Theme
1	Tropical Deciduous Forests of South Asia: Monitoring Degradation and Assessing Impacts of Urbanization	South Asia	Ruth De Fries, Columbia University	Forest degradation and urbanization
2	Understanding Changes in Agricultural Land Use and Land Cover in the Breadbasket Area of the Ganges Basin 2000-2015: A Socioeconomic-Ecological Analysis	South Asia	Li Ping Di	Agricultural land use
3	Impacts of Afforestation on Sustainable Livelihoods in Rural Communities in India	South Asia	Forrest Fleischman/Texas A&M University	Afforestation and sustainable livelihoods
4	The Future of Food Security in India: Can Farmers Adapt to Environmental Change?	South Asia	Meha Jain, University of Michigan	Food security and adaptation
5	Complex Forest Landscapes and Sociopolitical Drivers of Deforestation - The Interplay of Land-use Policies, Armed Conflict, and Human Displacement in	South Asia	Peter Leimgruber/Smithsonian Institution	Deforestation, armed conflicts and policy
6	Understanding the Role of Land Cover/Land Use Nexus in Malaria Transmission Under Changing Socio-Economic Climate in Myanmar	South Asia	Tatiana Loboda/University of Maryland	Malaria
7	Urban Growth, Land-Use Change, and Growing Vulnerability in the Greater Himalaya Mountain Range Across India, Nepal, and Bhutan	South Asia	Karen Seto/Yale University	Urbanization and vulnerability
8	Landscapes In Flux: The Influence of Demographic Change and Institutional Mechanisms on Land Cover Change, Climate Adaptability and Food Security in Rural India	South Asia	Philip Townsend/University of Wisconsin-Madison	Food security and adaptation
9	Consequences of Changing Mangrove Forests in South Asia on the Provision of Global Ecosystem Goods and Services	South Asia	Jeffrey Vincent/Duke University	Mangroves and Ecosystem services
10	Spatiotemporal Drivers of Fine-Scale Forest Plantation Establishment in Village-Based Economies of Andhra Pradesh	South Asia	Randolph Wynne/Virginia Polytechnic Institute and State University	Plantations and agricultural transitions

(10 projects over South Asia)



# SARI Projects - ROSES-2016 and 2018 Selections

S.No	2016	Region	PI	Theme
11	Agricultural Land Use Change in Central and Northeast Thailand: Effects on Biomass Emissions, Soil Quality, and Rural Livelihoods	Southeast Asia	Varaprasad Bandaru/University of Maryland, College Park	Emissions, soil quality
12	The Agrarian Transition in Mainland Southeast Asia: Changes in Rice Farming - 1995 to 2018	Southeast Asia	Jefferson Fox/East West Center	Rice Farming
13	A Cobra in the Forest? Quantifying the Impact of Perverse Incentives from Indonesia's Deforestation Moratorium, 2011 to 2016	Southeast Asia	Matt Hansen, Umd	Deforestation, moratorium policies
14	Land-Cover/Land-Use Change in Southern Vietnam Through the Lenses of Conflict, Religion, and Politics, 1980s to Present	Southeast Asia	Jessica McCarty, Miami University	Land use change, religion conflicts and policies
15	Land Use Status, Change and Impacts in Vietnam, Cambodia and Laos	Southeast Asia	Son Nghiem/Jet Propulsion Laboratory	Land use change
16	Assessing the Impacts of Dams on the Dynamic Interactions Among Distant Wetlands, Land Use, and Rural Communities in the Lower Mekong River Basin	Southeast Asia	Qi, Michigan State University	Water resources

S.No	2018	Region	PI	Theme
17	Land-Use Transitions in Indonesian Peatlands	Southeast Asia	Mark Cochrane/University of Maryland, Cambridge	Peatlands and land use
18	Divergent Local Responses to Globalization: Urbanization, Land Transition, and Environmental Changes in Southeast Asia	Southeast Asia	Peilei Fan, Michigan State University	Urbanization, land use and pollution
19	Sowtime: Climate Adaptive Agriculture in the Eastern Gangetic Plains	South Asia	Josh Gray, North Carolina State University	Agriculture and climate
20	Shifting Cultivation at a Crossroad: Drivers and Outcomes of Recent Land-Use Changes in Laos PDR	Southeast Asia	Peter Potapov, University of Maryland, College Park	Shifting cultivation, land use drivers
21	New Transitions in Smallholder Agricultural Systems that Promote Increased Tree Cover Outside of Forests	South Asia	David Skole, Michigan State University	Small holder agriculture and Trees outside forests
22	Forced and Truncated Agrarian Transitions in Asia Through the Lens of Field Size Change	Southeast Asia	Lin Yan, South Dakota State University	Agriculture and field size change

(6 projects on Southeast in 2016; 4 on Southeast and 2 on South Asia in 2018; 3 more in 2019)





S.No	2020	PI	Theme
23	Where are the Missing Burned Areas? Global Hotspots of Burned Area - A Multiresolution Analysis	David Roy, Michigan State U	Burned area mapping
24	Global Hotspots of Change in Mangrove Forests	Marc Simard, JPL	Mangrove mapping
25	Multi-Resolution Quantification and Driver Assessment of Hot Spots of Global Forest Disturbance	Alexandra Tyukavina, UMD	Forest disturbance mapping



# LCLUC Meetings



Inventories, Modeling and Climatic Impacts of Carbon and Sulfur emissions from Economic Activities in the Asian Region

June 24th-26th, 2014



Logos for NIES JAPAN, GOFU-GOLD, UNIVERSITY OF MARYLAND, and START.

Local Host  
VNU UNIVERSITY OF ENGINEERING AND TECHNOLOGY





# Collaborations are the Key - Meetings Facilitated with Different Partners





# Meeting Summaries – NASA Earth Observer Thematic Meeting on LCLUC and Air Pollution in Asia, Feb-2023

## International Meeting on Land Cover/Land Use Change (LCLUC) in South/Southeast Asia and Synthesis



Local Host

Vietnam National Space Center (VNSC)  
Hanoi, Vietnam



Hanoi, Vietnam

Meeting Date:  
01/31/2024 to 02/02/2024

Venue:  
Vietnam National Space Center,  
Hanoi, Vietnam

Training Start Date:  
01/29/2024

Training End Date:  
01/30/2024

Training Location:  
Vietnam National Space Center,  
Hanoi, Vietnam

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28

## South/Southeast Asia Meeting on Air Pollution in Asia—Inventories, Monitoring and Mitigation

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*Chris Justice, University of Maryland College Park, USA; cjustice@umdl.edu*

### Introduction

The 2023 NASA Land Cover and Land Use Change (LCLUC) program's South/Southeast Asia Research Initiative (SARI) thematic meeting was held February 1–3, 2023 in Hanoi, Vietnam—see **Photo 1 below**. The Vietnam National University of Engineering and Technology (VNU-ET), the Vietnam National Space Center (VNSC), and the Vietnam Academy of Science and Technology (VAST) served as local meeting hosts. The meeting had 90 participants from several South/Southeast Asian countries and the U.S. It was organized into eight different sessions over three days. The content included invited presentations, reports from the SARI Principal Investigators (PIs), and reports from regional scientists.

The tagline for the meeting was *Air Pollution in Asia—Inventories, Monitoring and Mitigation*. Meeting participants included SARI researchers as well as representatives of several other international programs, e.g., the **Global Observations of Forest and Land Use Dynamics (GOFC-GOLD)**, **South/Southeast Asia Regional Information Networks**, researchers from

Japan's **National Institute of Environmental Studies (NIES)**, Regional and Space Agencies—including the **Association of Southeast Asian Nations (ASEAN)** intentionally gathering such a diverse group of participants allowed the meeting to achieve its objectives which were to:

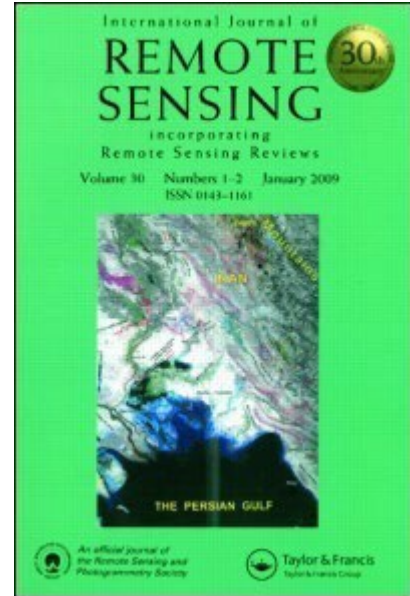
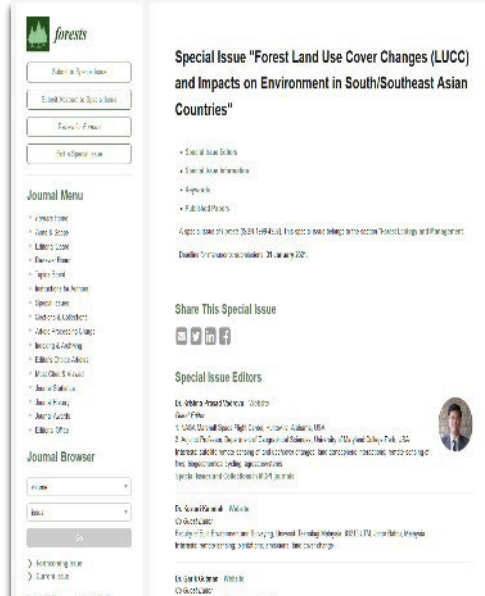
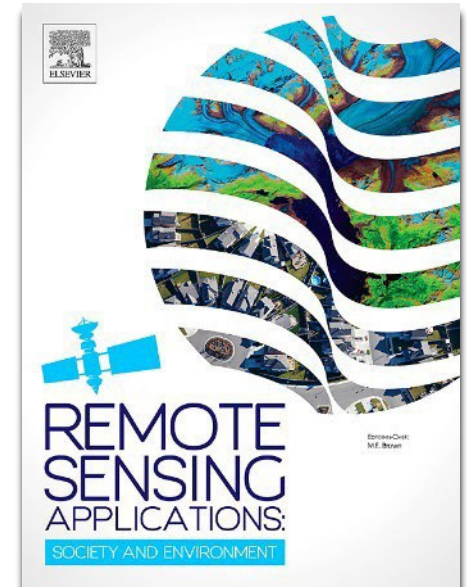
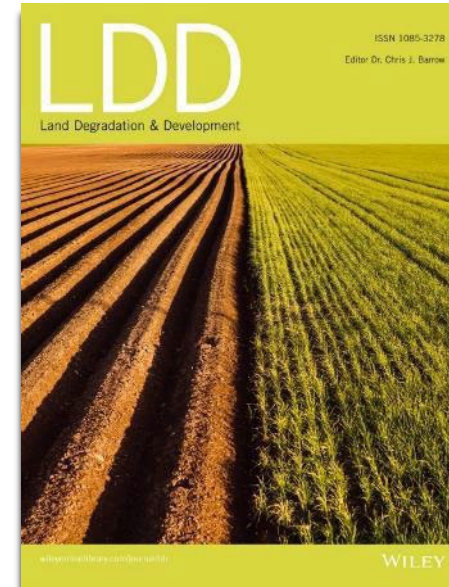
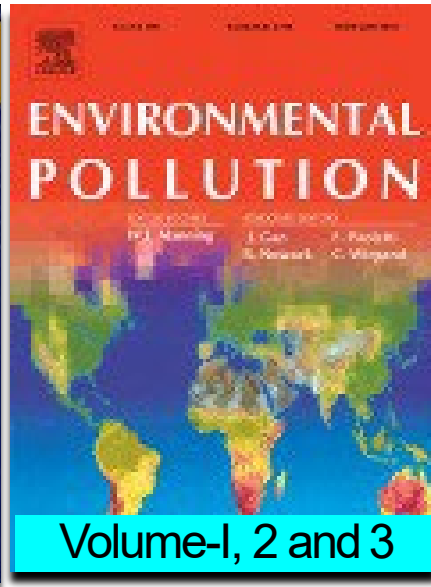
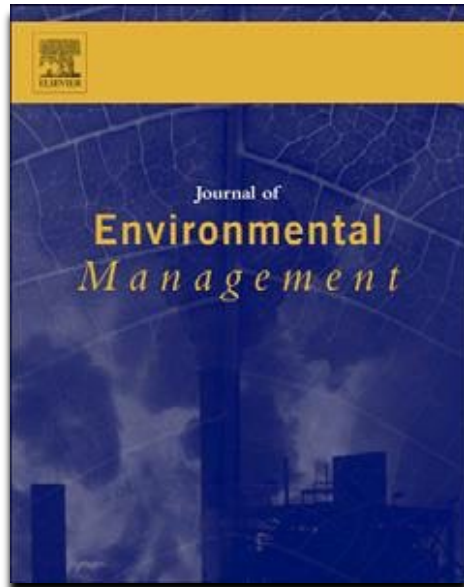
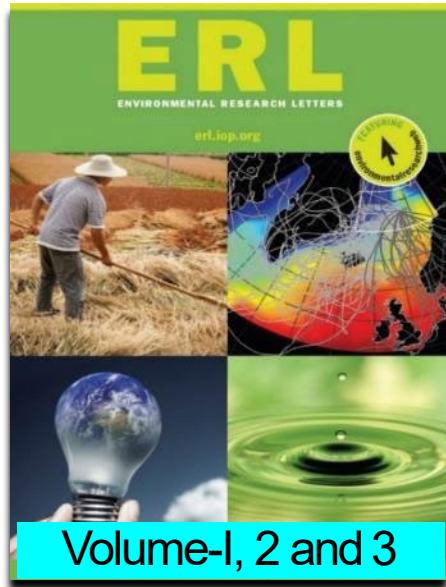
- review greenhouse gas (GHG) and short-lived climate pollutant (SLCP) emission estimates and methodologies from different sources, including biomass burning in the Asian region;
- understand the impact of GHGs and aerosols on local climate, including health effects;
- explore the potential of satellite remote-sensing datasets for quantifying pollutants, aerosols, and pollution episodes;
- review modeling approaches for characterizing emissions; and
- strengthen regional information exchange and training activities through effective collaborations.



Photo 1. Participants at the NASA LCLUC SARI International Meeting on Air Pollution in Asia: Inventories, Monitoring and Mitigation, held February 1–3, 2023 in Hanoi, Vietnam. Photo credits VNU-ET staff



# Peer-Reviewed Journal Publications – 17 different Special Issues



*remote sensing*

Volume-I



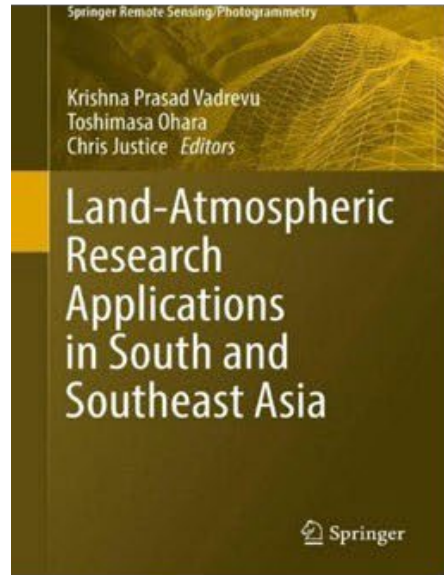
*remote sensing*

Volume-II and III

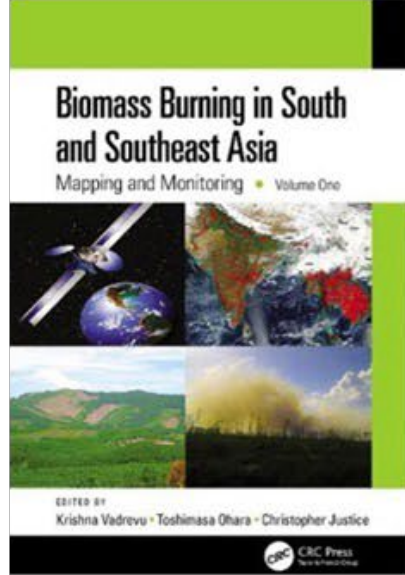
~180 peer reviewed publications



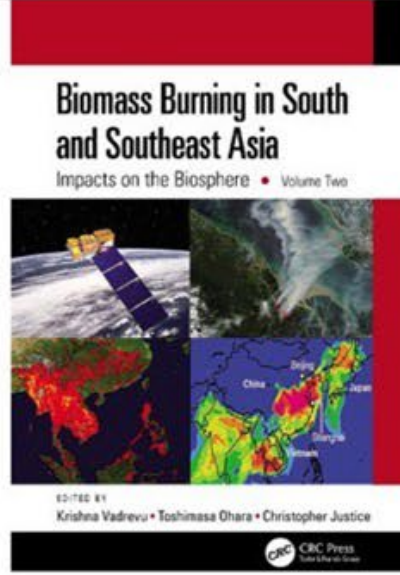
# LCLUC Outputs



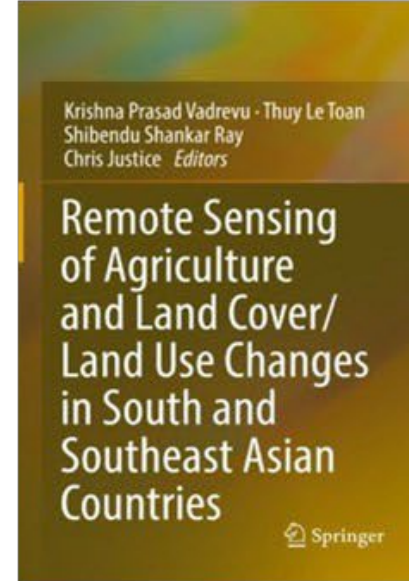
Springer  
2018



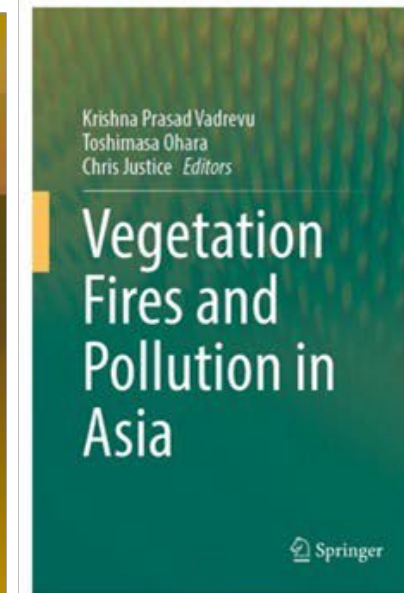
CRC Press  
2021



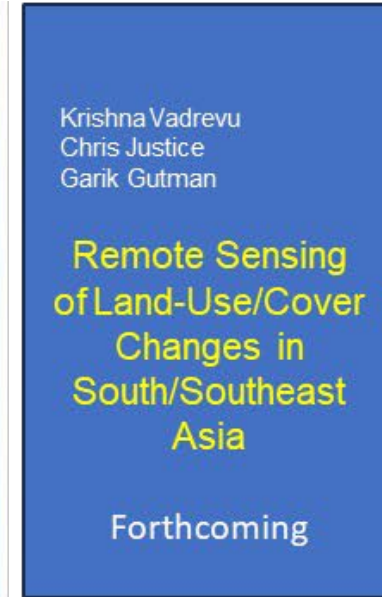
CRC Press  
2021



Springer  
2022



Springer  
2023



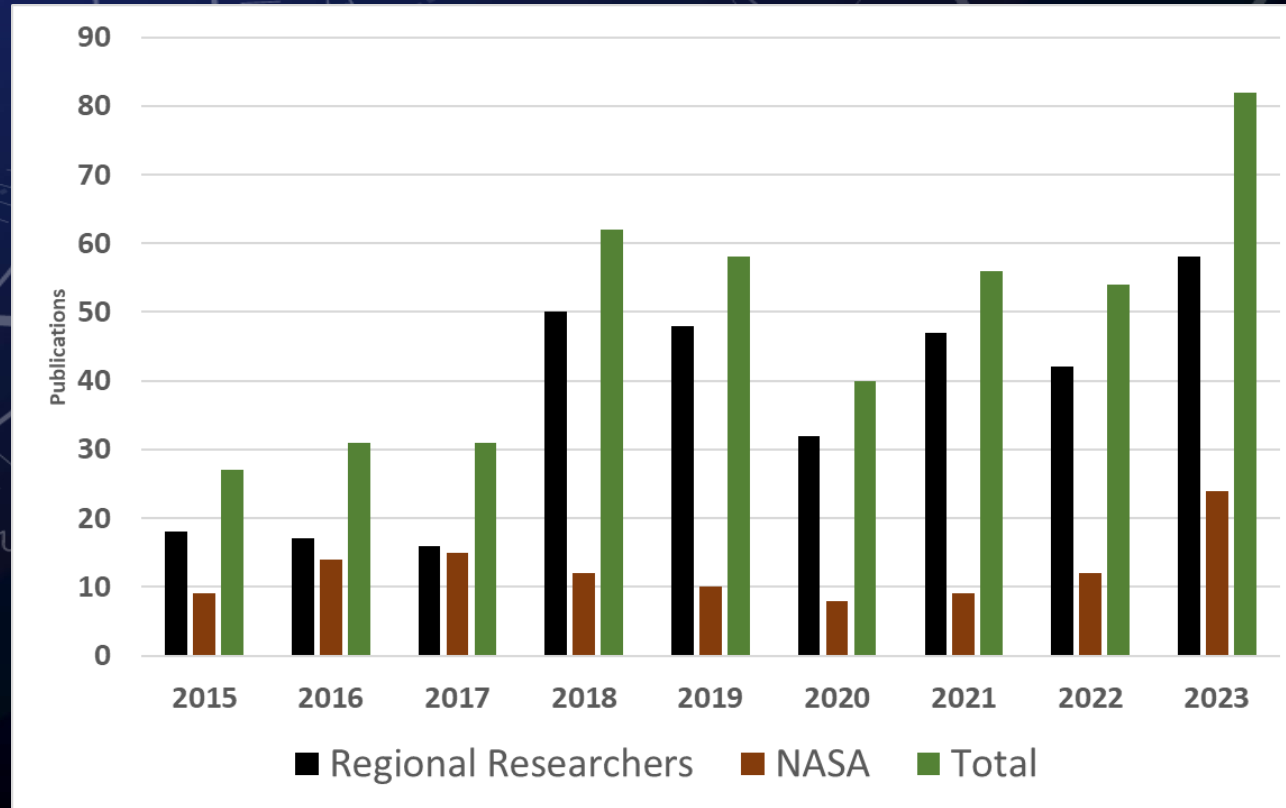
CRC in Press  
2024



# SARI 8 YEARS OF SCIENCE

~30 projects and more being added  
>400 scientists  
>200 institutions

16-different  
Special  
Issues in  
Journals

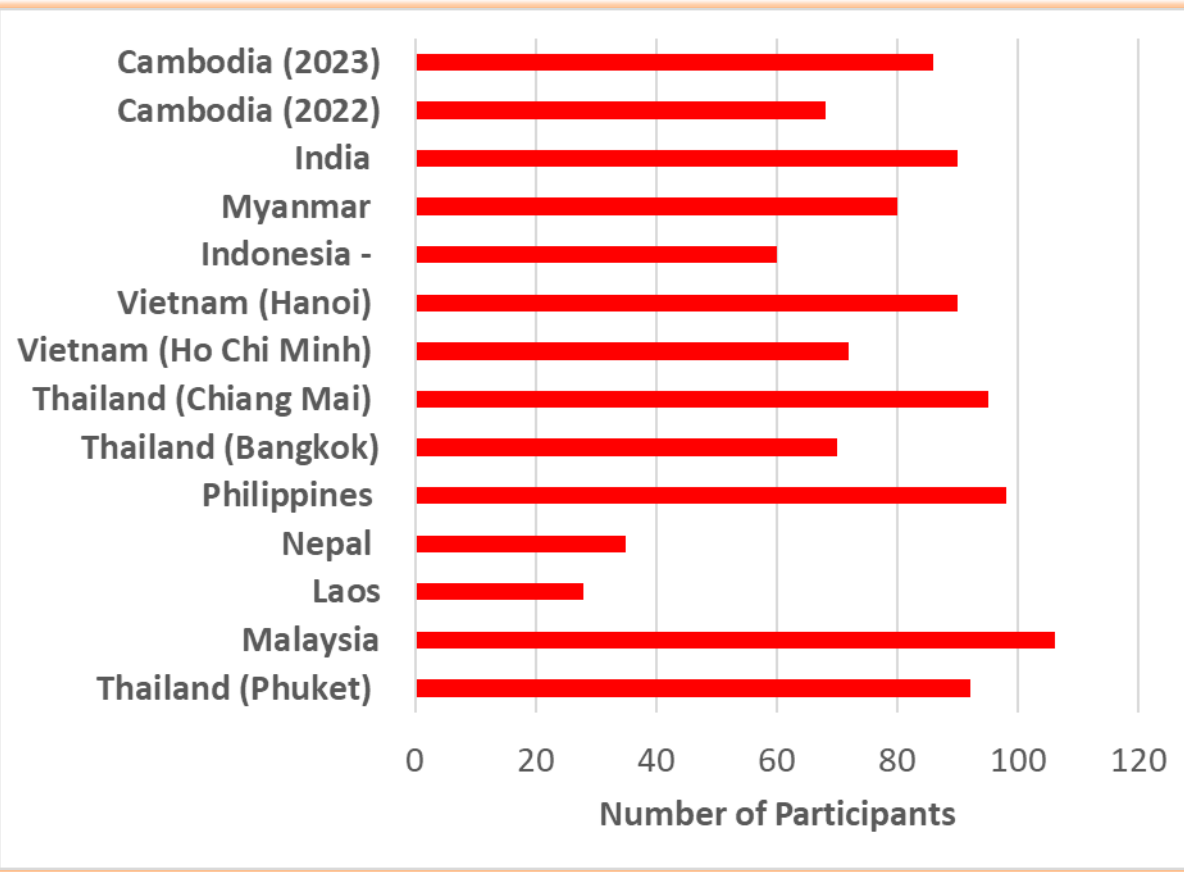


Nearly 450  
publications  
in Peer  
reviewed  
journals  
and Books

## South-Southeast Asia

*Oct-2013 – India Meeting – SARI idea proposed  
2015-SARI First SARI Solicitation*

# International Training Events



Training Workshop, Royal Agriculture University, Cambodia, 2023

## Promoting Open Source Tools and Cloud Computing Platforms For LCLUC Research (Ex: GEE)



- SARI PI's documented several LCLUC involving past and Recent changes.



# Land Conversions- Past 50 or more years ago versus Recent 20 years



**Land Conversion for Subsistence Agriculture through Slash and Burn**



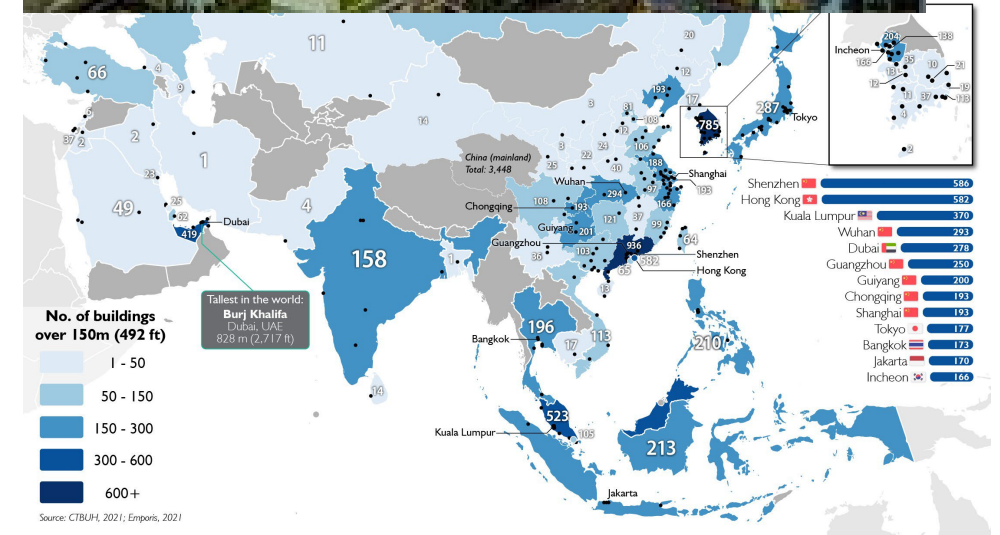
**Land Conversion for Industrial Plantations (Oil Palm and Rubber in Southeast Asian countries**



# Urbanization - Past 50 or more years ago versus Recent 20 years



Horizontal expansion



Vertical Expansion

# Agriculture - Past 50 or more years ago versus Recent 20 years



Smallholder farms



Large scale industrial farms

- Need for Synthesizing these studies!
- What is Synthesis ?



# Synthesis in LCLUC Solicitation

**Synthesize the accumulated knowledge from previous studies in the SARI domain**

**Assess the current state and trends of land-use change in the SARI region**

**Provide a conceptual framework or generalized theory appropriate to land transformations in the region useful for Policy interventions**



**The synthesis should include research findings, methods, theories, practices or applications of different projects in the region**

**Synthesis of not just funded under earlier SARI focused solicitations and other international, regional and local agencies.**

# Land Cover/Land Use Change



Mapping



Monitoring



Drivers



Impacts

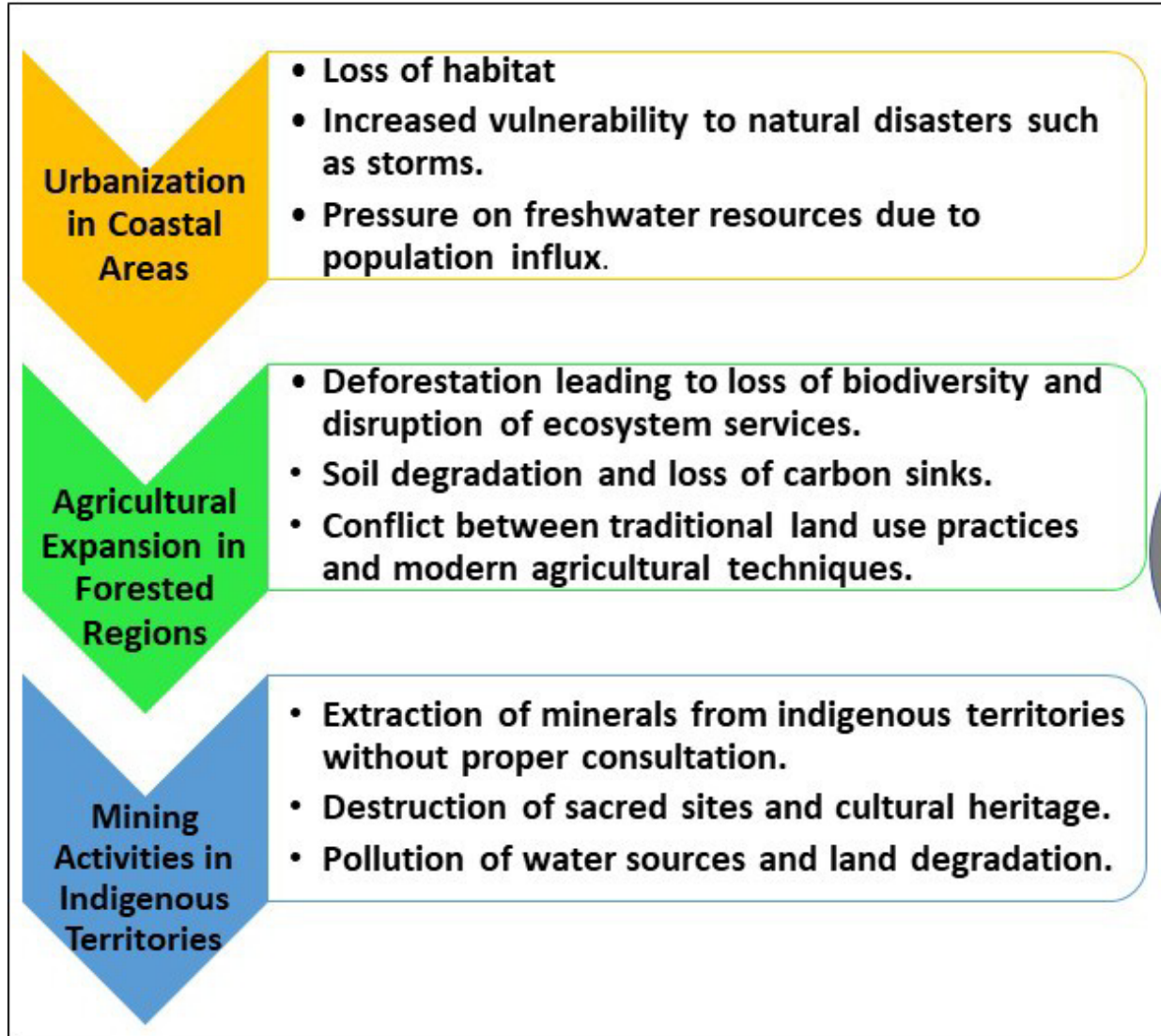
**SYNTHESIS**



## 3-different Synthesis Projects Funded

- **South Asian smallholder forests and other tree-based systems: synthesizing LCLUC data and approaches to foster a natural climate solution that improves livelihoods – David Skole (MSU)**
- **Southeast Asia Synthesis – Son Nghiem (JPL) and Peilei Fan (Tufts U)**
  - **Synthesis Study of Land Cover, Land Use, and Demographic Change under Multi-Dimensional Developments and Climate Pressures in Southeast Asia - Son Nghiem (JPL, USA)**
  - **Decoding Land Transitions across the Urban-Rural Continuums (URC): A Synthesis Study of Patterns, Drivers, and Socioenvironmental Impacts in Southeast Asia - Peilei Fan (Tufts University, USA)**

# Case Studies



## Synthesis

# Synthesis

- Diverse case studies; however, they highlight common themes such as **environmental degradation, loss of biodiversity, and socio-economic conflicts.**
- They highlight the need for integrated approaches that consider environmental, social, and economic dimensions of land use.
- Need for development of holistic and sustainable land use policies that balance conservation with development goals.
- Encouraging the adoption of sustainable practices through incentives, regulations, and capacity-building initiatives.

Synthesizing the case studies allows for a comprehensive understanding of the challenges and opportunities in managing land use sustainably, guiding the formulation of evidence-based policies and practices.



# Rapid development in Mapping Algorithms in the recent 20-years

## 1. Supervised Classification Algorithms:

1. Maximum Likelihood Classification (MLC)
2. Support Vector Machines (SVM)
3. Random Forest (RF)
4. Decision Trees (DT)
5. Neural Networks (NN)
6. k-Nearest Neighbors (k-NN)
7. Gaussian Mixture Models (GMM)

## 2. Unsupervised Classification Algorithms:

1. K-means clustering
2. ISODATA (Iterative Self-Organizing Data Analysis Technique)
3. Self-Organizing Maps (SOM)
4. Hierarchical Clustering

## 3. Object-Based Image Analysis (OBIA):

1. Segmentation algorithms (e.g., Mean Shift, Watershed, Graph-based segmentation)
2. Classification algorithms applied to segments (e.g., SVM, RF)

## 4. Fuzzy Logic and Expert Systems:

1. Fuzzy classifiers
2. Expert systems combining rules and knowledge

## 5. Feature Selection and Dimensionality Reduction:

1. Principal Component Analysis (PCA)
2. Linear Discriminant Analysis (LDA)
3. Independent Component Analysis (ICA)

Development  
of Novel  
Algorithms

## 1. Deep Learning Algorithms:

1. Convolutional Neural Networks (CNN)
2. Recurrent Neural Networks (RNN) for temporal analysis
3. Fully Convolutional Networks (FCN)
4. U-Net
5. Deep Belief Networks (DBN)

## 2. Ensemble Methods:

1. Bagging
2. Boosting
3. Stacking

## 1. Semantic Segmentation:

1. Algorithms designed for pixel-wise classification while considering spatial context
2. Deep learning-based methods such as FCN, U-Net

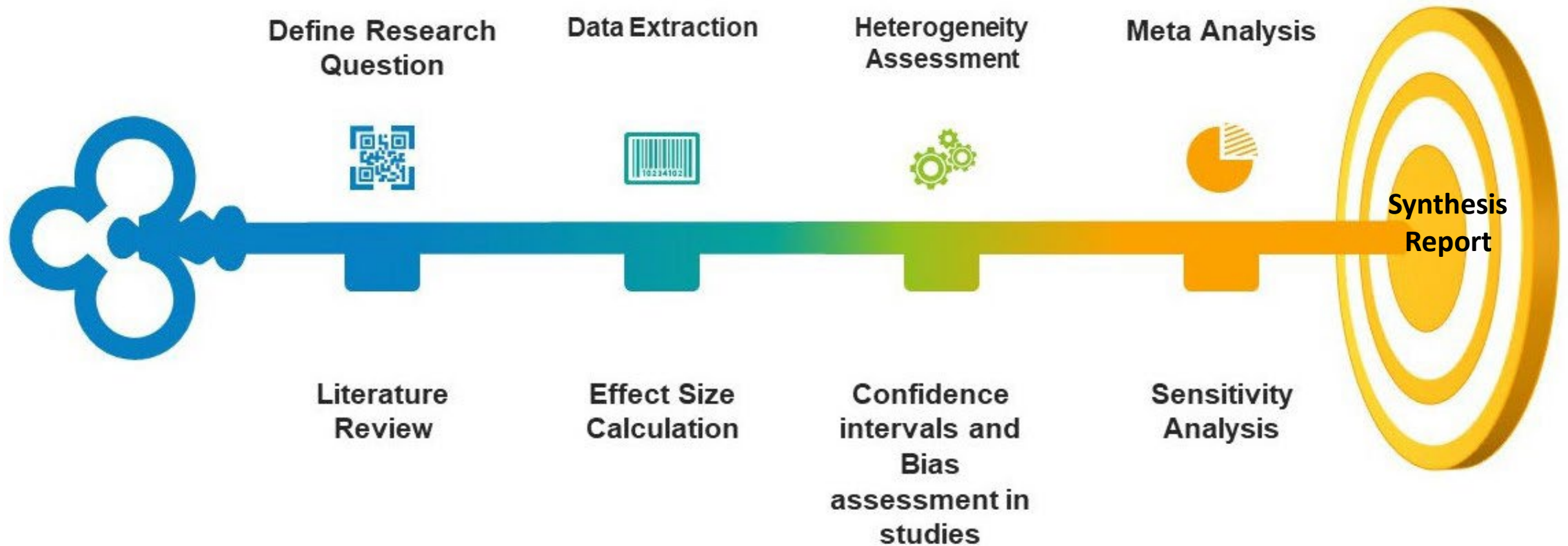
## 4. Transfer Learning:

1. Leveraging pre-trained models on large datasets and fine-tuning for land cover mapping tasks

## 5. Data Fusion Techniques:

1. Combining information from multiple sensors (e.g., optical, radar, LiDAR) using fusion algorithms.

# Synthesis Studies – Quantitative Framework





# First Synthesis Kickoff meeting Southeast Asia – January 31<sup>st</sup> – February 02<sup>nd</sup>, Hanoi, Vietnam



**Local Host: Vietnam National Space Center (VNSC); Total participants: 70**

# Meeting Themes

## **Day-1 - January 31st (Wednesday)**

- Session-I: Opening Session
- Session-II: Programmatic and Space Agency Presentations
- Session-III: Land Cover/Land Use Change
- Panel Discussion

## **Day-2 - February 1st (Thursday)**

- Session-IV: Urban Land Cover/Land Use Change
- Panel Discussion
- Session-V: LCLUC, Agriculture and Water Resources
- Panel Discussion

## **Day-3 - February 2nd (Friday)**

- Session VI. Fires, Greenhouse Gas Emissions, and Pollution
- Session VII. Discussion Session on Synthesis



# Panel Discussion Questions

**Q1. What are the current (last 3-years) major trends in LCLUC occurring in your country? What are your projections for these changes? (LCLUC, Agriculture, Urban, Atmosphere – separate panels)**

**Q2. What are the major positive and negative implications and impacts of these changes?**

**Q3. How can LCLUC related research help inform more sustainable land use policies?**

# Major Trends in LCLUC in Recent Years

**Vietnam** – agricultural transitions to urbanization is most concern. and agriculture conversion is most important; Farms conversion to aquaculture during the boom; however, now the land lost productivity; COVID impacted real estate business, thus, more abandoned lands can be seen.

**Myanmar** – Past 3-years; Political reasons/policy/civil war. Apart from urbanization, industrial development, mining is most important and problematic. Myanmar-Chinese border is most concern.

**Indonesia** – Forest degradation stabilized in recent years; Agricultural transitions are occurring at a rapid pace

**Thailand** – Urban expansion to rural areas; holiday resorts increasing (driving land prices) in rural areas



# Impacts of LCLUC in Recent Years

**Vietnam:** Positive: living standard have increased in some places due to development;

Negative: Issues of pollution, ecological damage impacting ecosystem services, etc.

**Myanmar:** GDP growth due to real estate boom.

Mining impacts are huge; land and forest degradation is rampant.

**Indonesia:** Urbanization expansion

Transportation issues are huge.

**Thailand:** land prices are increasing; supply chain dynamics are changing. Farmers are not getting rich, but land owners are!

# How can research help inform sustainable land use policies

- Develop methodologies that highlight environmentally safe and sustainable solutions
- End-to-end studies on LCLUC impacts, management and planning
- Policy sector advocacy
- Stakeholder engagement
- *Modeling future scenarios with good methodologies*
- Promoting innovation, integrating latest scientific data and evidence based studies to reach policy
- Need for LCLUC linking environmental justice studies
- Invite and engage policy makers in scientific meetings
- Promote research through building projects, capacity building and training activities

# Meeting Outputs – Focus issue in ERL solicited Earth Observer Report (In progress)

NASA's Earth Observing System  
Project Science Office

Home Missions Data Communications People The Earth Observer Newsletter

Recent Imagery

OCO-2 Landsat 7 SMAP Suomi NPP

Science Calendar

Current Issue: The Earth Observer

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Submission Guidelines

Articles, contributions to the meeting calendar, and suggestions are welcomed. Contributions to the calendars should contain location, person to contact, telephone number, and e-mail address. Newsletter content is due on the weekday closest to the 15th of the month preceding the publication—e.g., December 15 for the January–February issue; February 15 for March–April, and so on. Please email your suggestions to Executive Editor Alan Ward ([alan.b.ward@nasa.gov](mailto:alan.b.ward@nasa.gov)).

The Earth Observer Index

Social Publications

## ENVIRONMENTAL RESEARCH LETTERS

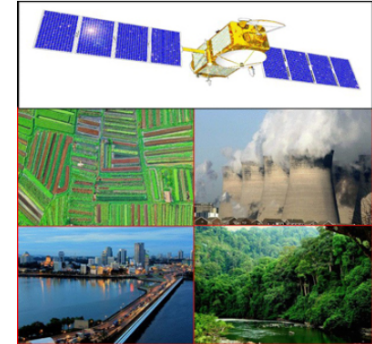
### Focus on Land Use Cover Changes and Synthesis in South and South East Asia

#### Guest Editors

Krishna Vadrevu, *NASA Marshall Space Flight Center, USA*  
Son Nghiem, *Jet Propulsion Laboratory, USA*  
Peilei Fan, *Tufts University, USA*  
Chris Justice, *University of Maryland College Park, USA*  
Garik Gutman, *NASA Headquarters, USA*

#### Scope

Driven by population growth, rapid anthropogenic changes and recent economic development, many countries in South/Southeast Asia have experienced land-use/cover change (LUCC) and degradation. For example, the Southeast Asian region has experienced substantial deforestation over the years, particularly in Cambodia, Indonesia, Malaysia, and Thailand, primarily driven by agricultural expansion, palm oil production, and logging activities. Additionally, agriculture land use constitutes a vital economic activity in South/Southeast Asia, and countries such as India, Pakistan, Myanmar, Indonesia, Thailand, and Vietnam are major producers of rice and other crops. Rapid urbanization is transforming landscapes in almost all South/Southeast Asian countries, from India to Sri Lanka, Indonesia, Thailand, the Philippines, and Vietnam, often replacing productive agricultural land. Furthermore, mining activities, including both legal and illegal operations, have increasingly contributed to land-cover changes in Indonesia, Myanmar, the Philippines, and Vietnam. LUCC has significant implications for biodiversity conservation, carbon emissions, climate change, and sustainable development in South/Southeast Asia.



Numerous individual studies have been undertaken focusing on various aspects of LUCC in both South and Southeast Asia, however, synthesis studies are lacking in the literature. While individual studies provide valuable insights into specific drivers, impacts, and patterns of LUCC, the lack of synthesis studies hinders our ability to comprehensively understand the broader



# Meeting Outputs – Already ONGOING Journal Special Issues

Journals / Remote Sensing / Special Issues / Remote Sensing of Land Cover Change, Degradation, and Impacts on...



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## Journal Menu

- Remote Sensing Home
- Aims & Scope
- Editorial Board
- Reviewer Board
- Topical Advisory Panel
- Photography Exhibition
- Instructions for Authors
- Special Issues
- Topics
- Sections & Collections
- Article Processing Charge
- Indexing & Archiving
- Editor's Choice Articles
- Most Cited & Viewed
- Journal Statistics
- Journal History
- Journal Awards
- Society Collaborations
- Conferences
- Editorial Office

## Journal Browser

volume

issue

Go

- Forthcoming issue
- Current issue

Vol. 16 (2024)	Vol. 8 (2018)
Vol. 15 (2023)	Vol. 7 (2015)
Vol. 14 (2022)	Vol. 6 (2014)
Vol. 13 (2021)	Vol. 5 (2013)
Vol. 12 (2020)	Vol. 4 (2012)
Vol. 11 (2019)	Vol. 3 (2011)
Vol. 10 (2018)	Vol. 2 (2010)
Vol. 9 (2017)	Vol. 1 (2009)

## Remote Sensing of Land Cover Change, Degradation, and Impacts on Environment in South/Southeast Asia

- Print Special Issue Flyer
- Special Issue Editors
- Special Issue Information
- Published Papers

A special issue of *Remote Sensing* (ISSN 2072-4292). This special issue belongs to the section "Environmental Remote Sensing".

Deadline for manuscript submissions: closed (30 November 2023) | Viewed by 524

## Share This Special Issue



## Special Issue Editors

**Dr. Krishna Vadrevu** E-Mail Website  
Guest Editor  
Earth Science Office, NASA Marshall Space Flight Center, Huntsville, AL, USA  
Interests: remote sensing of land-cover/land-use changes and fire mapping and monitoring

**Prof. Dr. Chris Justice** E-Mail Website  
Guest Editor  
Department of Geographical Sciences, University of Maryland, College Park, MD, USA  
Interests: global change research; land use/cover change; satellite-based agriculture monitoring; satellite-based fire monitoring; terrestrial observing systems/remotely sensed  
Special Issues, Collections and Topics in MDPI journals

**Dr. Garik Gutman** E-Mail Website  
Guest Editor  
NASA Headquarters, Washington, DC, USA  
Interests: remote sensing of land use/cover change; land-atmospheric interactions; big-data processing; remote sensing of the environment  
Special Issues, Collections and Topics in MDPI journals

## Special Issue Information

Dear Colleagues,

The major causes of land-cover change (LCC) and degradation in several Asian countries are the rapid increase in population and economic development. Inappropriate land-use systems and land-tenure policies are further importance causes of land degradation. For example, forest degradation and deforestation in South/Southeast Asia are due to slash and burn agriculture, conversion to rubber and oil palm plantations and dependence on forest resources. The other drivers of LCC and degradation include government policies, inappropriate land management, etc. Variability in weather, climate and socioeconomic factors also affect LCC and degradation. Some of the impacts of LCC include the disruption of biogeochemical cycles, radiation and the

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25 January 2024

### Greenhouse Gas Emissions and Air Pollution in Asia – Measurements, Mapping and Monitoring

Air pollution-related emissions in Asia have increased significantly over the last few decades, primarily due to rapid industrialization, urbanization, and land use conversions such as slash-and-burn agriculture. Of the world's top twenty most polluted countries, thirteen are in Asia. The increased emissions are not only affecting local air quality but also regional climate. Therefore, reducing emissions and mitigating their impacts is an urgent task. Accurate measurements and inventories of air pollutants, as well as their mapping and monitoring, are crucial in addressing these impacts, including air quality and health. In particular, very high spatial and temporal resolution measurements from various satellites, combined with ground inventories, can fill critical observational gaps in quantifying greenhouse gas emissions. Integrating modeling approaches constrained by robust ground and satellite measurements can accurately quantify GHG emissions from various sources at local to regional scales, and the results can aid in pollution mitigation. The current special issue solicits articles on the below key topics specific to South/Southeast Asian (S/SEA) countries at local, landscape to regional scales. • Emission inventories that involve both ground-based measurements and satellite data from various sectors such as industrial, transportation, waste, energy, etc.;

- Methodology papers that integrate top-down and bottom-up approaches for emissions quantification, source apportionment and air quality;
- Addressing the impact of Greenhouse Gas (GHG) emissions and aerosols on local climate, ecosystems and human health;
- Quantifying Agriculture, Forests and Other Land Use Emissions (AFOLU) and impacts;
- Quantifying emissions and impacts related to biomass burning emissions;
- Quantifying Aerosols, Particulate Matter (PM) pollution, air quality, and impacts;
- Addressing long-range transport of pollutants, pollutant modeling, and impacts at local, landscape to regional scales.

Overall, this special issue aims to provide a comprehensive understanding of the air pollution problem in S/SEA countries and highlight potential solutions for mitigating its impact.

25 January 2024

Greenhouse Gas Emissions and Air Pollution in Asia – Measurements, Mapping and Monitoring

12 September 2023

Advanced Sustainable Processes for Waste Treatment and Remediation 2023

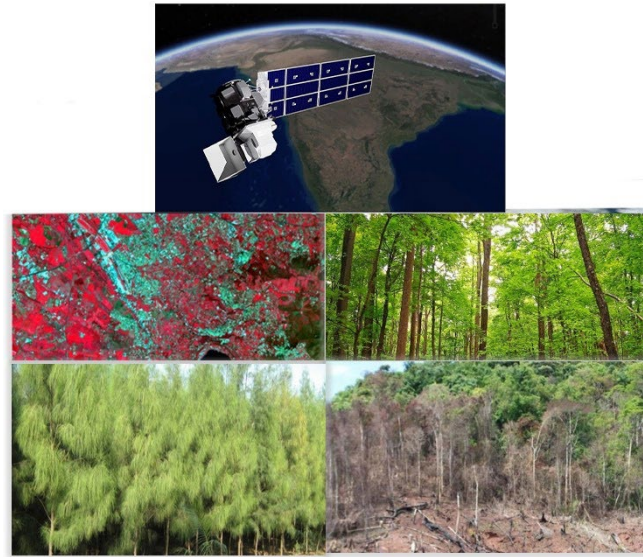
8 September 2023

Innovation of biochemical and biomedical technology: Assessment

Remote Sensing journal: Guest Editors: Vadrevu, Justice and Gutman

Environmental Pollution: Guest Editors: Vadrevu, Ohara and Justice

# International Meeting on Land Cover/Land Use Change (LCLUC) in South Asia and Synthesis – April 9-11<sup>th</sup>, Haryana, India



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**Local Host: Ashoka University, Sonipat, Haryana**

*Dr. Gutman (NASA HQ)  
and  
Prof. Justice (UMd)*



*Vision, support and  
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