

LCLUC South Asia Regional Workshop, 2013

Meeting Summary

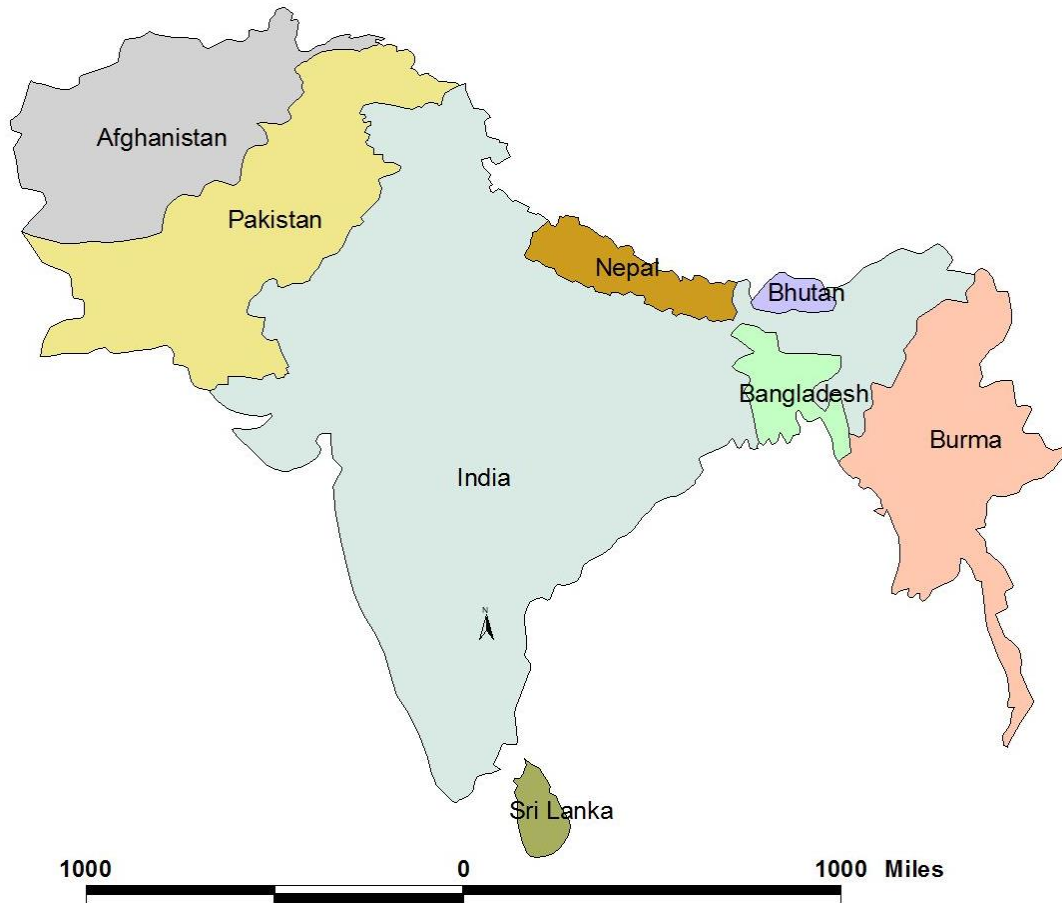
Krishna Prasad Vadrevu

University of Maryland College Park
Maryland, USA





South Asia - Regional Workshop



Previous workshops

09-16/2007 - Urumqi, China

01/12/09- Khon Kaen, Thailand

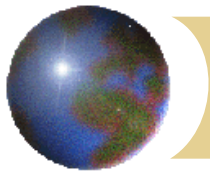
09/15/09- Almaty, Kazakhstan

08/25/2010 - Tartu, Estonia

11/05/2011- Hanoi, Vietnam

01/07/2013 - Kerala, India

01/10/2013 - Coimbatore, India



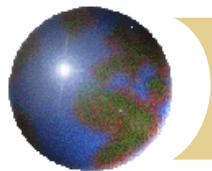
South Asia - Regional Workshop

Jan 7-8th: A focused workshop on water resources at the Centre for Water Resources Development and Management (CWRDM), Kozhikode, Kerala;

Jan 9th: Land Use Transect Study, Kozhikode, Kerala to Coimbatore, Tamil Nadu;

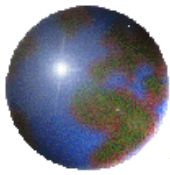
Jan 10-12th: International regional meeting, Karunya University, Coimbatore, Tamil Nadu; and

Jan-14th: A training workshop “*Remote Sensing and Geospatial Technologies for Land Cover and Land Use Change Studies and Applications*”, held January 14th, Karunya University.



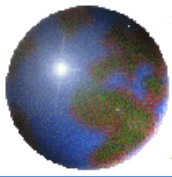
South Asia Meeting Objectives

- ✦ Review LCLUC research in South Asia.
- ✦ Gain a better understanding of current land use change issues in the region.
 - ✦ to advance the understanding of large scale land cover changes underway in Southern Asia – their spatial extent, intensity and social consequences, feedback to regional climate and future projections.
- ✦ To explore opportunities for collaborative research.
- ✦ To promote and enhance the use of remotely sensed data in land use research.
- ✦ To identify regional LU research priorities and explore the possibility of establishing a regional network of scientists on LCLUC issues – strengthening land use science and the regional LU research community



Jan-7-8-Water Resources Workshop, CWRDM, Kerala





Jan-7-8-Water Resources Workshop, Kerala

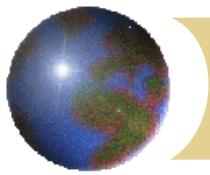


Total participants =30

National: NRSC; NIT-K & C; NIO (Kochi & GoA); CSIR; Univ. of Karunya & Mangalore.

International: USGS, NASA, UMd, UIUC, OSU, MSU

Kerala State: KSREC, KSCSTE, CESS, KFRI, CUSAT, Thrissur college of Engineering, etc.



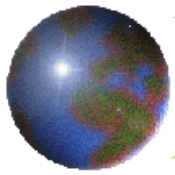
CWRDM, An Excellent Institute for collaborative research on water resources

CWRDM focus:

- **Agricultural water management**
- **Ground water development**
- **Water quality management**
- **Wetland management**
- **Hydrology**
- **Irrigation and drainage**
- **Watershed development**
- **Wetland studies**
- **Socioeconomic surveys**



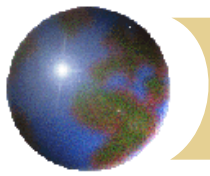
CWRDM- Open for Collaborative Research



LCLUC Issues – Kerala, South India

- Agricultural land use change is a major concern.
- Conversion of Paddy fields to aquaculture (shrimp farming, fishery).
- States deficit in rice has increased from 55% (1950's) to more than 80% (current) requirement.
- Reduction in Coconut plantations due to labor costs.
- Agriculture has shrunken into a minor sector offering limited employment.
- Loss of fresh water canals, ponds and Mangroves due to urbanization.
- Deteriorating water quality and salt water intrusion into wells.

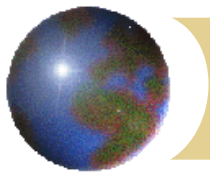




LCLUC Field Trips – Kerala, South India

- ✦ SAROVARAM PARK-Eco-friendly bio-park meant for conservation of wetlands.
- ✦ Chaliyar river & water resource potential
- ✦ KADALUNDI BIRD SANCTUARY-Mangrove rich area; More than 100 species of native birds and 60 species of migratory birds flock during Oct-Mar.
- ✦ MALABAR COAST–Place where Vasco da Gama landed first in India





Jan-10-13-Regional Science Meeting, Coimbatore



Total participants =120

US – 18 researchers

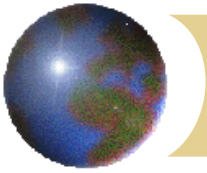
**Nepal-3; Srilanka-2; Myanmar-1; Afghanistan, Myanmar, Bangladesh-1 each
Pakistan, China invited but could not attend – Visa issues**

India – University Researchers, Government, Non-Government, NGO's



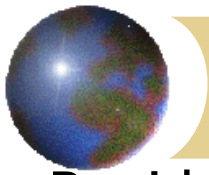
Technical Sessions (8)

- ✦ **I. Global, Regional & National Land-Use and Land-Cover Change Science Programs : summary introductions**
- ✦ **II: Agricultural Land Use Change**
- ✦ **III. LCLUC-related Earth Obs. (Missions, Data and Products)**
- ✦ **IV. Atmosphere/Land Use Interactions (Rain/Clouds/Aerosols/GHG)**
- ✦ **V. LCLUC Forestry and Carbon Cycle**
- ✦ **VI. LCLUC in Mountainous Areas**
- ✦ **VII. Synthesis Presentations on Land use in Coastal Zones and Water Resources (including synthesis of the CWRDM Meeting)**
- ✦ **VIII. Urban LCLUC**
- ✦ **Panel Discussion on S. Asia Research Priorities**



LCLUC Themes

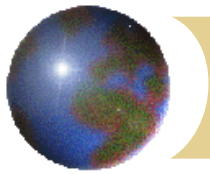
**What we have learned and what
needs to be addressed?**



Agriculture

- Rapid agricultural land loss due to urbanization with changes in agricultural production and produce flows, leading to changes in regional dependencies.
- Rapidly changing cropland area, crop types, and rotations with agricultural intensification.
- Increasing extreme events are negatively affecting agricultural production in South Asia.
- Global projects GEOGLAM, GCAD, etc., are unique examples focusing on mapping and monitoring of agriculture including decision support systems.
- In India, ISRO has a wealth of satellite data useful for ag. research. Other Asian countries still lacking.

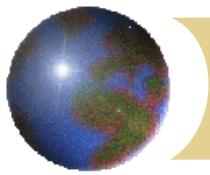




Agriculture (what is needed)

- Key variables at multiple scales, yet to be mapped: e.g. Crop types, crop calendars, field size, crop phenology, drought indicators, evapotranspiration, etc.
- Agricultural land loss and drivers at multiple scales.
- Developing indices of crop productivity growth/decline integrating land use/soils data.
- Water resource research tying with agricultural land use (e.g. indicators to minimize water use and increasing productivity; crop diversification potential).
- *Land capability of Agricultural classification.*
- *Link land cover/agriculture mapping research with DSS useful for farmers*
 - Irrigation and drainage management; farm nutrient requirements; estimate market size and reach of agricultural commodities; effective distribution systems.

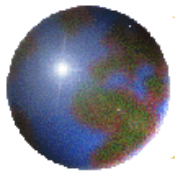




Earth Observations Data and Products

- In India, a wealth of satellite data is available for LCLUC and environmental studies. Other countries yet to develop such capabilities.
- Free access to raw data (not pdf files or JPEG maps) seems highly challenging. Example. forest maps of India!
- At a regional scale, most of the south Asia researchers seem to be using global products (GPP, NPP, burnt areas, any of the ECV's), as locally generated products are lacking.
- Expertise/technical know-how and latest processing methods useful to create science based products seems *highly clustered*.
- Inter-agency cooperation seems limited.

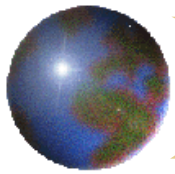




Earth Observations Data/Products(what is needed)

- Data sharing a major issue! Coordinated policy efforts are needed to resolve this issue!
- International cooperation between NASA, ISRO, and other space agencies would help increase effective dissemination of data!
- Capacity building is needed in geospatial and web-based technologies to address regional issues.
- Development of spatial tools using free and open-source software for geospatial applications shows promise for addressing LCLUC issues.
- Collaborative research can help building strong science.





Atmosphere/Land Use Interactions

- South Asian countries are hotspots for atmospheric research due to rapid LCLUC and economic development.
- Changes in LU in each of the categories impact atmosphere:
 - Forests – deforestation, C cycling, clearing and burning (highly prevalent in Myanmar, northeast India) impacting GHG's.
 - Urban – Atmospheric brown cloud phenomenon impacting aerosols and GHG's.
 - Agriculture – management, residue burning;
 - Wetlands – CH₄ emissions;
- There are many institutions, groups, and individual scientists making atmospheric, aerosol, and trace gas observations. However, most of these measurements seems local.
- Huge uncertainties in atmospheric GHG's and aerosols.
- South Asia has highly diverse ecosystems. Understanding C-cycling in these ecosystems require integrated approaches.





Atmosphere/Land Use Interactions (what needs to be done)

- Comparison/validation studies of satellite retrievals to surface-based measurements needed. Need for national level measurement campaigns.
- Improved coordination is needed for temporal long-term continuity of in situ and ground-based aerosols, GHG's and trace gas measurements.
- Data access through open geo-portals.
- Need for airborne campaigns to understand atmospheric chemistry.
- Individual as well as institutional capacity building and training in biogeochemical cycling/atmospheric models for improved understanding of non-linear processes.

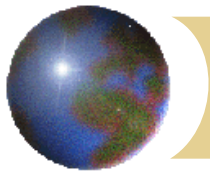




Mountains / Forestry

- Forest cover mapping using satellite data in India seems operational; other south Asia countries are still lagging.
- Definitions on what constitutes forest still seems debatable.
- Mangrove forests in the region seems increasing. The role of mangroves in serving as barriers against drastic hydrological events needs more attention.
- Methodologies to map forest cover (digital versus manual methods) and validation needs more attention and refinement.
- Mountain regions in South Asia are undergoing rapid changes due to climate as well as socioeconomic factors. LCLUC research linking drivers of change seems important.





LCLUC/Forestry and Carbon Cycle (what is needed)

- Linking top-down approaches from Remote sensing data with bottom-up measurements on forest measurements seems important.
- Long-term measurements/permanent plot data are needed to address uncertainties.
- Regionally fine-tuned algorithms to map forest cover and classification legends are needed through involving local scientists.
- Training and capacity building activities on LCLUC modeling and BGC modeling needed.
- Decision support systems for monitoring, reporting and evaluation of forest stocks/resources/are needed useful for generating revenues, effective forest management and also climate change studies.

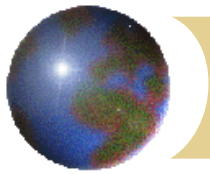




Urban LCLUC

- Urban sprawl is a major LCLUC issue in South Asian countries.
- Drivers and patterns of urban expansion are different in different regions.
- Urban clusters have become a key topic in economic innovation and globalization debates.
- Buying agricultural land and wastelands for real estate development is seen as a quick investment opportunity.
- Urban LCLUC and impacts such as increase in imperious areas, land surface temperature, air pollution, needs more attention. Remote sensing data has huge potential to map these variables.
- Urban transportation problems seems huge in Asian countries.



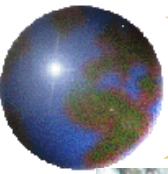


Urban LCLUC (what is needed)

- Several cities in the Asia still lack good infrastructure and has transportation problems.
- Urban LCLUC mapping may be tied with latest geospatial technologies to offer solutions in transportation research.
- Urban mapping projects can aid in infrastructure development projects (roads, new dwellings, sewerage, etc.) including regional land use planning.
- Urban sprawl mapping and monitoring information can be tied with impacts research to highlight the problem (e.g. urban heat island effect, increase in impervious areas; air pollution impacts, etc.)

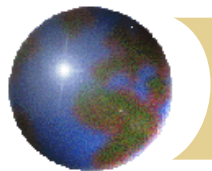






Height of Seriousness!





LCLUC Regional Priorities – Panel Summary

Afghanistan:

- Science programs need to be built from scratch; International help is needed
- Focus on education, training and data access relating to remote sensing and geospatial technologies.

Myanmar

- Deforestation and Biomass burning;
- Capacity building/training on using remote sensing and geospatial datasets.

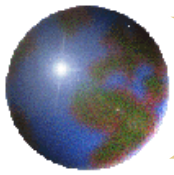
Bangladesh

- Coastal and water resource research;
- Training on advanced topics in remote sensing/geospatial techniques.

Nepal

- Need to develop a regionally consistent LC dataset;
- Focus on agriculture/rangeland monitoring studies, mountains including Himalayan water resources.

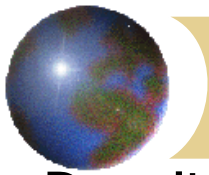




LCLUC Regional Priorities – Panel Summary (cont..)

SARIN

- Unanimous agreement for the development and need of a SARIN.
- International programs such as GOFCC-GOLD, START, MAIRS, GEO-GLAM, etc. should be engaged as a means to strengthen SARIN.
- A series of SARIN planning workshops needed to identify, prioritize and address local/regional scale research questions.
- *SARIN will aid in:*
 - Developing and strengthening bilateral collaborations among SARIN + US and other countries.
 - Assist in capacity building activities
 - Enable data collection and sharing mechanisms through data center.
- Funding mechanisms needs to be explored through local as well as international sources.



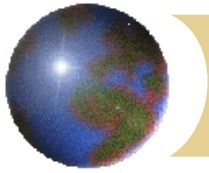
Jan-14th, Training Workshop, Karunya University

- Despite Holiday (festival day), 130 participants attended the training workshop. Participation certificate issued.

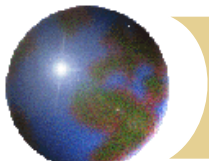


Topics:

- Fundamentals of remote sensing and geospatial technologies – [Dr. Qi, MSU](#).
- Advanced tools, methods and data products for LCLUC and air pollution studies – [Dr. Krishna Vadrevu](#).
- Environmental modeling, LCLUC and its impact on biogeochemistry (C,N) and biogeophysics (water and thermal energy)- [Dr. Atul Jain](#).
- Data, methods and tools for earth observation, global croplands, water use and food security – [Dr. Thenkabail Prasad](#).



Meeting Outputs



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

Krishna Prasad Vadrevu, University of Maryland, College Park, krishna@bermes.geog.umd.edu
Chris Justice, University of Maryland, College Park, justice@bermes.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 India¹, 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 (GOF-GOLD) South Asia Regional Information Network (SARIN) (including prospects, opportunities, and challenges).

The meeting was a joint effort of the NASA LCLUC Program; GOF-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.

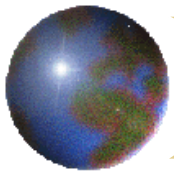
After the welcome, **Garik Gutman** [NASA Headquarters] addressed the workshop's participants, presenting an overview of LCLUC issues in South Asia, with focus on agricultural land-cover conversion,

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



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

See latest issue: March/April 2013



LCLUC Journal Articles Special Issue-2013

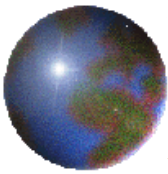
Timeline

- Abstract submission: March 15, 2013
- Decision on Abstracts: April 1st, 2013
- Manuscript submission: June 1st, 2013*
- Review Completion: October 1st, 2013*
- Tentative publication: November 2013*

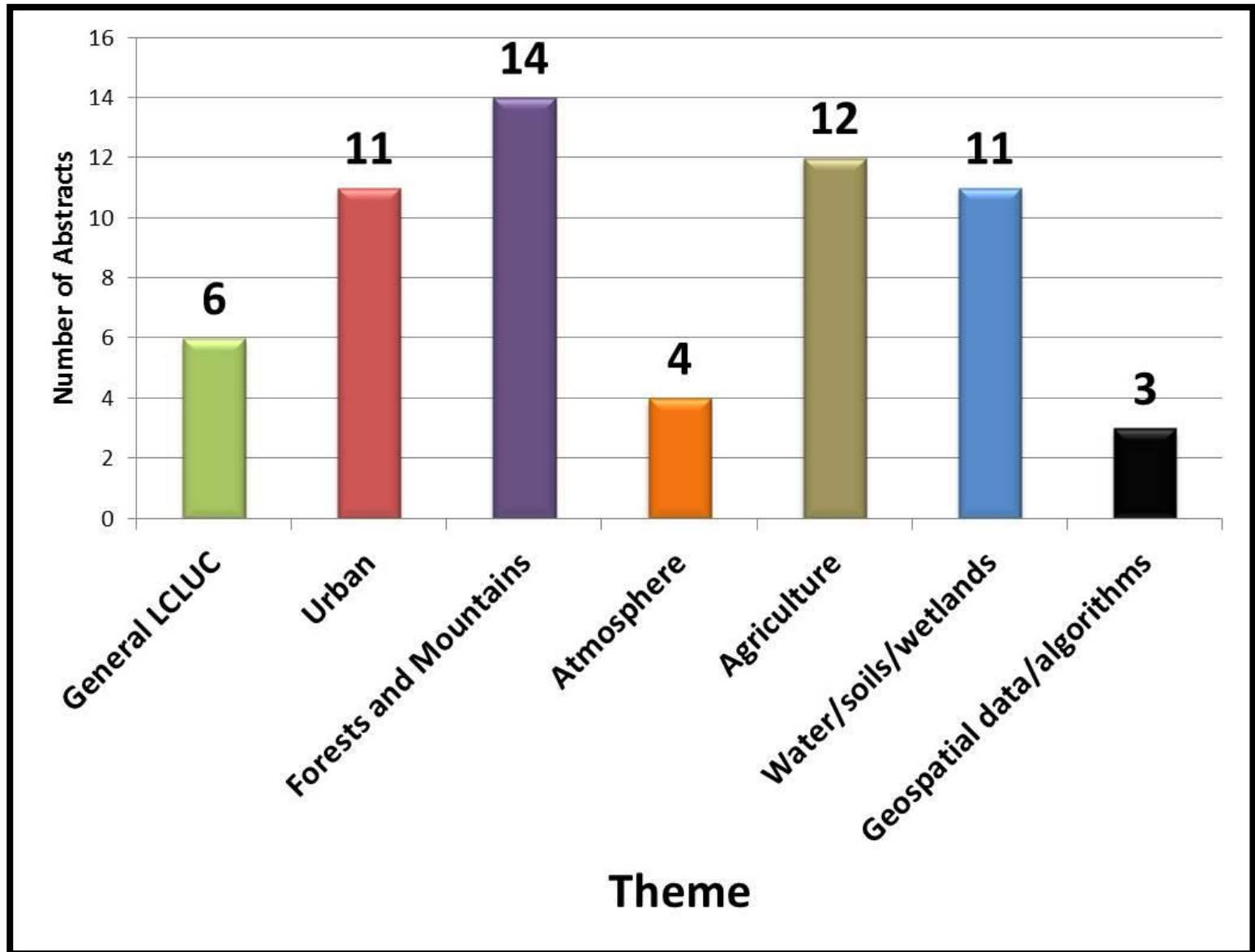
Special Issue Editors:

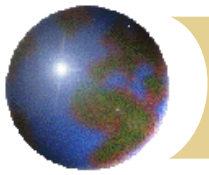
*Krishna Vadrevu, Chris Justice, Narasimha Prasad,
Thenkabail Prasad and Garik Gutman*

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Abstracts Received -61





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Dr. Jiaguo Qi, Michigan State University, USA

Dr. Krishna Vadrevu, University of Maryland, USA

Dr. Olga Krankina, Oregon State University, USA

Dr. Hassan Virji, START Program

Lydia Prentiss, UMD, USA

Skip Kaufman, START, USA

Special thanks to India hosts:

Dr. Narasimha Prasad, CWRDM, Kerala;

Prof. E. James, Karunya University, Tamil Nadu;

Several other students, researchers, scientists and staff of Karunya U and CWRDM.



Forethought, Planning and Accomplishment of
NASA LCLUC Program