South Asia Research Initiative (SARI)

Updates & Next Steps

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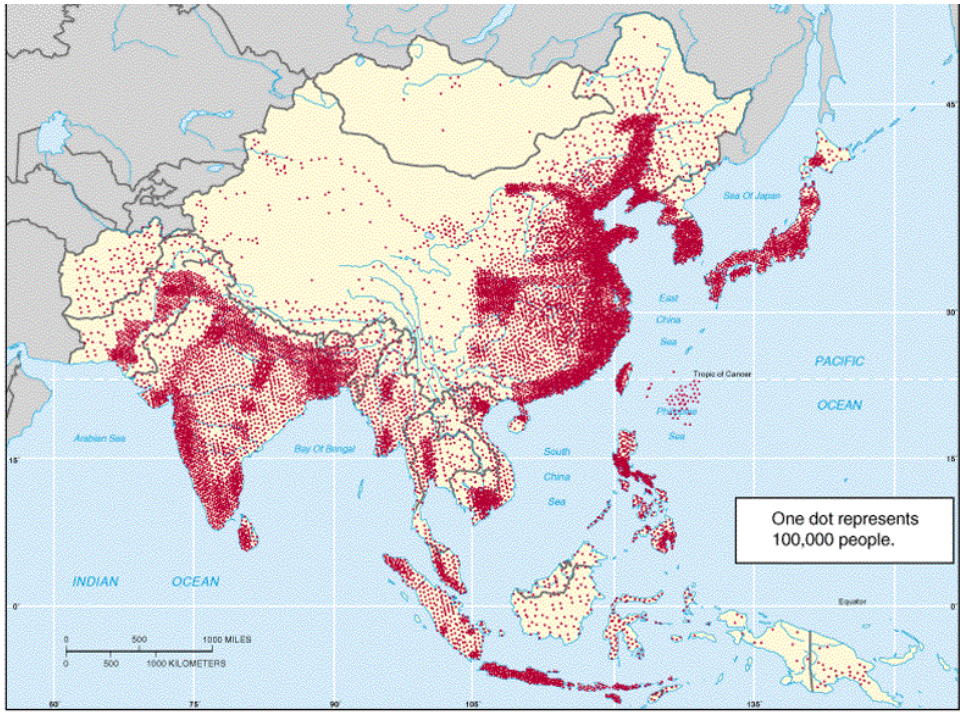
Land-Cover / Land-Use Change Program

Why South Asia?

- In the region, most of the land transformations are driven by the food security, industrialization and urbanization, and all are driven by increasing population.

- The population is expected to rise from the current 1.62 billion to 2.3 billion in 2050 (World Bank, 2013).

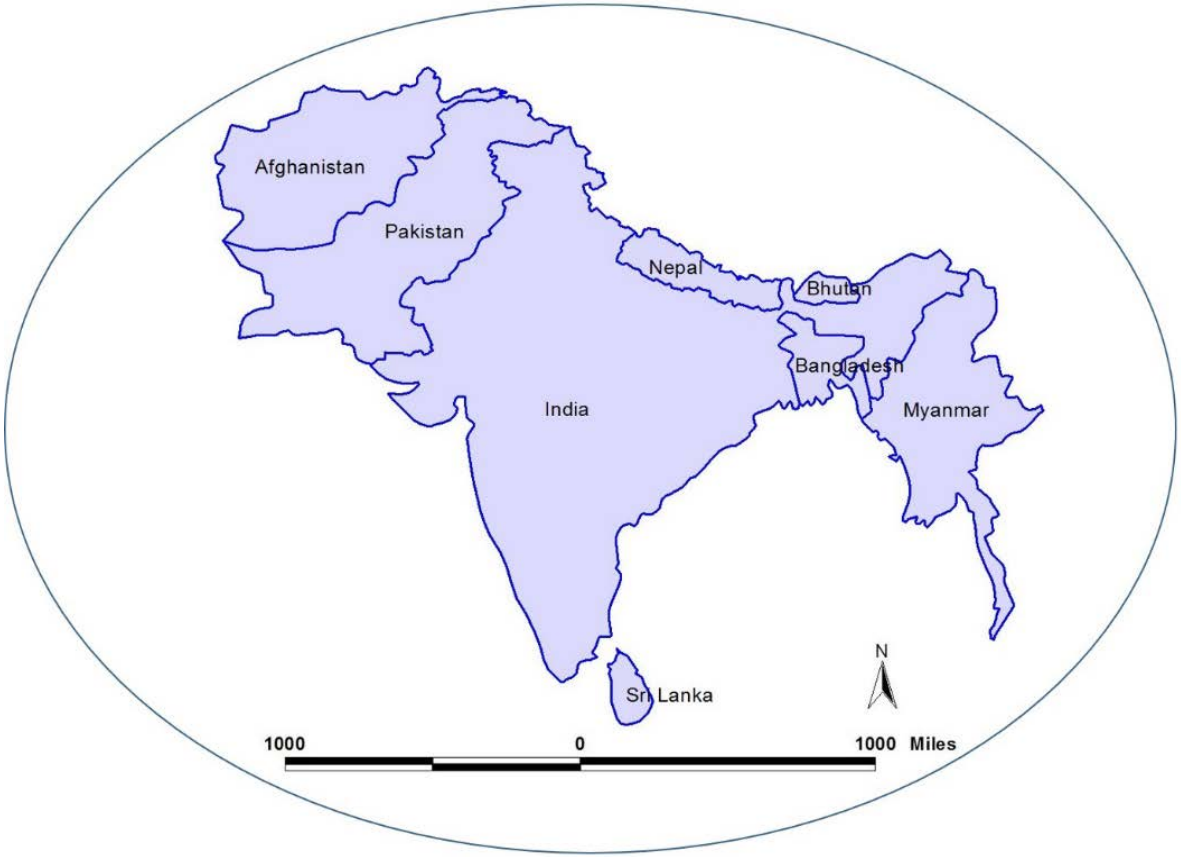
- Since 1900's – Agricultural Expansion has led to drastic loss of Forests, with maximum loss in Srilanka, followed by Bhutan and Nepal.



A more precise understanding of the links between population growth, LCLUC and the environment can aid in more sustainable environmental management in S Asia.

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 Asia.



Objectives

To strengthen the theoretical underpinnings of LCLUC science in the South Asia region, SARI will facilitate:

- **Creation of new partnerships with space agencies, universities and non-government organizations;**
- **Development of integrated methodologies for regional scale LCLUC products and data sharing mechanisms,**
- **Programs for leadership training and experience,**
- **International workshops to identify regional priorities, conducting capacity building programs, and**
- **International student/researcher exchanges.**

Need for SARI came from local scientists

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

Total participants =120

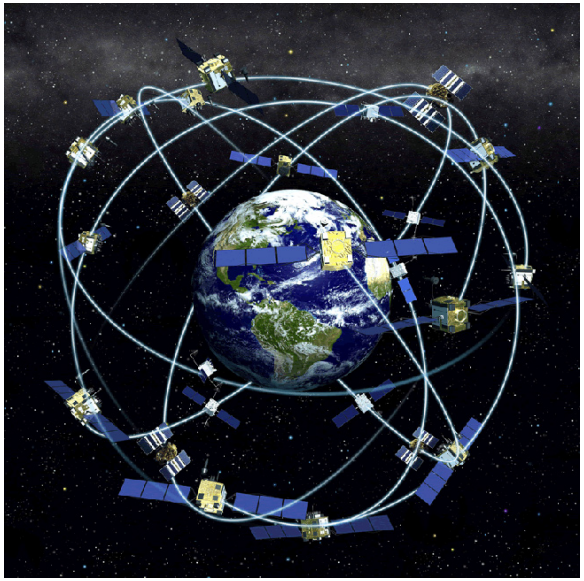
US – 18 researchers

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

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.
- In contrast to other countries in South Asia, data access seems to be improving in India; however, lot needs to be done.
- Free access to raw data (not pdf files or JPEG maps) seems highly challenging. Example. forest maps in India!
- **Most of the south Asia researchers seems to be using global products (GPP, NPP, burnt areas, any of the ECV's), as local products are lacking. There is a strong need for local products.**
- Expertise/technical know-how and latest processing methods useful to create science based products seems highly clustered.
- Inter-agency cooperation seems limited.

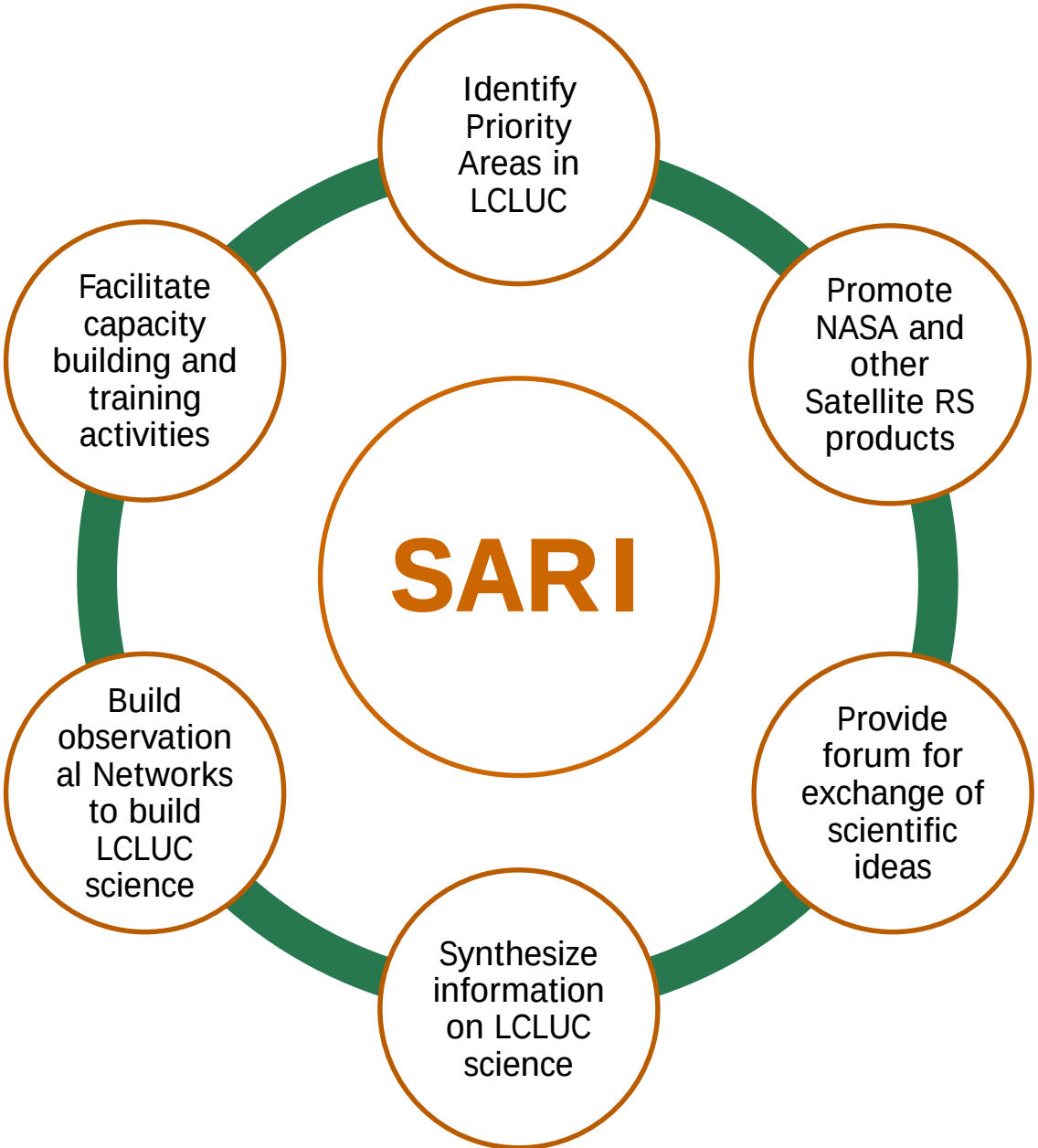
Earth Observations Data/Products(what is needed)

- Data sharing a major issue! Coordinated policy efforts are needed to resolve this issue!
- International cooperation between NASA, ISRO, and other space agencies in the region is needed to secure satellite data continuity and to 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.

Research Strengths in SA

- Strong sense of collaboration among South Asian scientists with US scientists;
- Highly diverse ecosystems/land cover types in South Asia for building case studies and underpinning LCLUC science;
- Presence of education and research organizations with focus on space research, forests agriculture, urban, water management, climate, atmospheric sciences, etc.
- Easy to communicate in English with researchers, students, and local people;
- Dedicated student support from Universities;
- High computer literacy;
- Relatively safe working environment in some of the Asian countries;
- High cost-to-benefit ratio due to high dollar value.

SARI – Facilitator and Catalyst for LCLUC Research in Asia



SARI in motion

- **Phase-I – Concept Development**

  Developing a white paper

- **Phase-II – Science Planning**

  Organizing regional workshop to bring researchers together

- **Phase-III – Implementation**

Phase I Concept Development

- Organizational committee with Co-leads and Task Force members formed
  - SARI Formulation Leads: Rama Nemani and Krishna Vadrevu
  - Task-force leads: Ruth DeFries, Thenkabail Prasad, Karen Seto, Dan Brown, and Ivan Csiszar
  - Regional leads: In progress

White paper prepared highlighting the need for SARI and Action Plan – to be submitted to NASA LCLUC program.

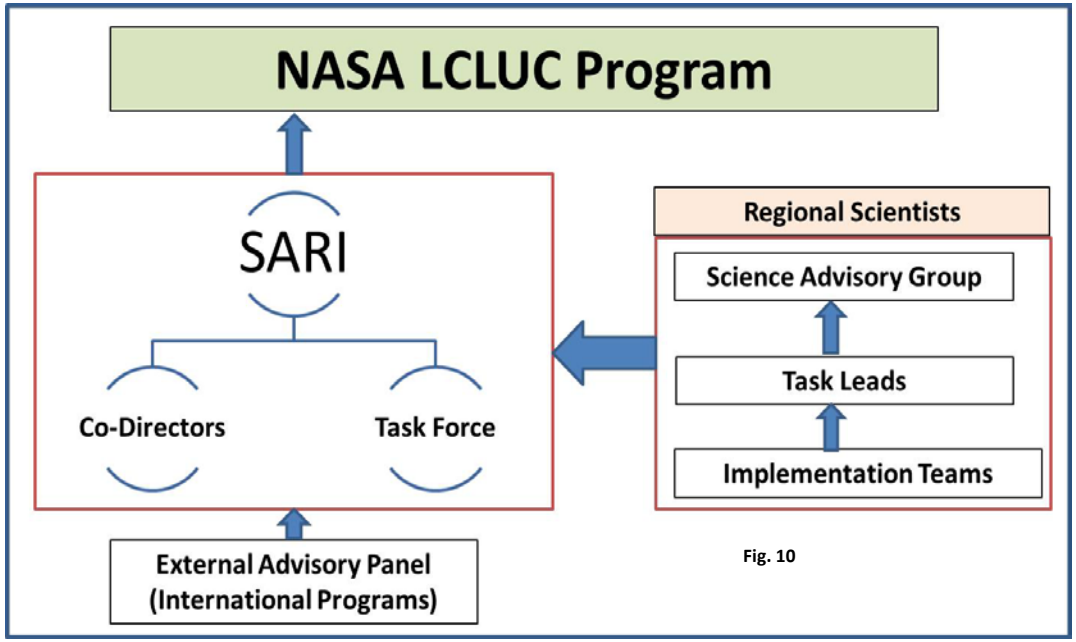


Fig. 10

Phase-II – Science Planning

(many themes to choose from)

LCLUC as related to

- Urbanization
- Land-Atmospheric Interactions
- Forests
- Extreme events
- Climate change
- **Agriculture and Food production**

Agricultural LCLUC

- South Asia has 14% of global cropland and 34% of global irrigated lands.

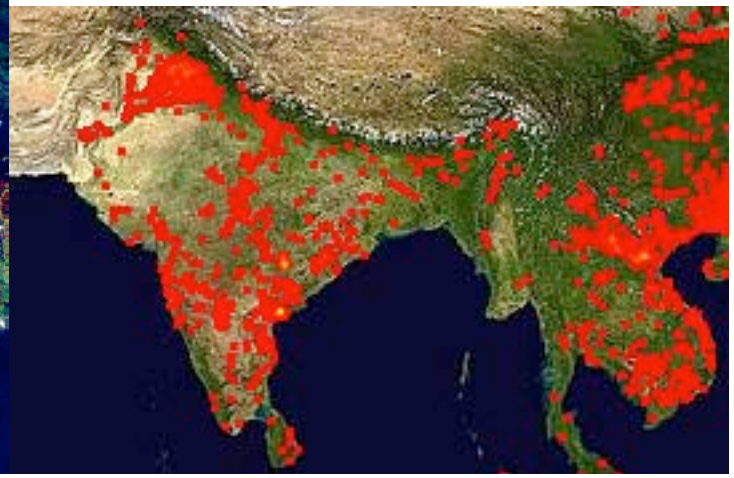
- Croplands in the region are have been decreasing rapidly due to increasing urbanization and industrialization.

- To meet the demands of the growing population, more than 80% of the increase in production will have to come from yield increase, since there is very little scope for expansion of agricultural lands.

- Increasing extreme events are negatively affecting agricultural production

Understanding cropland changes and the impact of intensive agricultural practices on ecosystem services requires integrated approaches.

Agriculture, economy and the environment



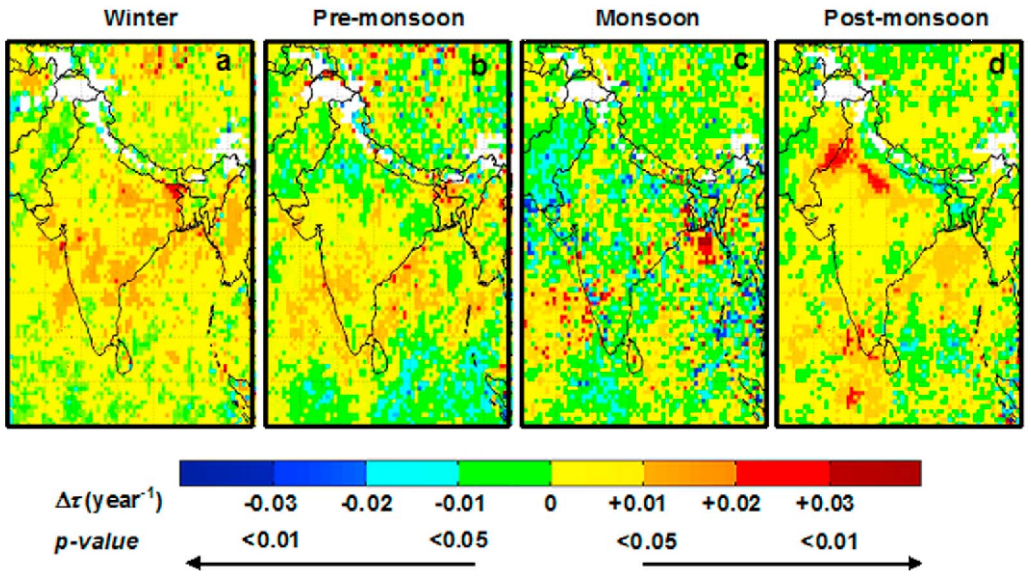
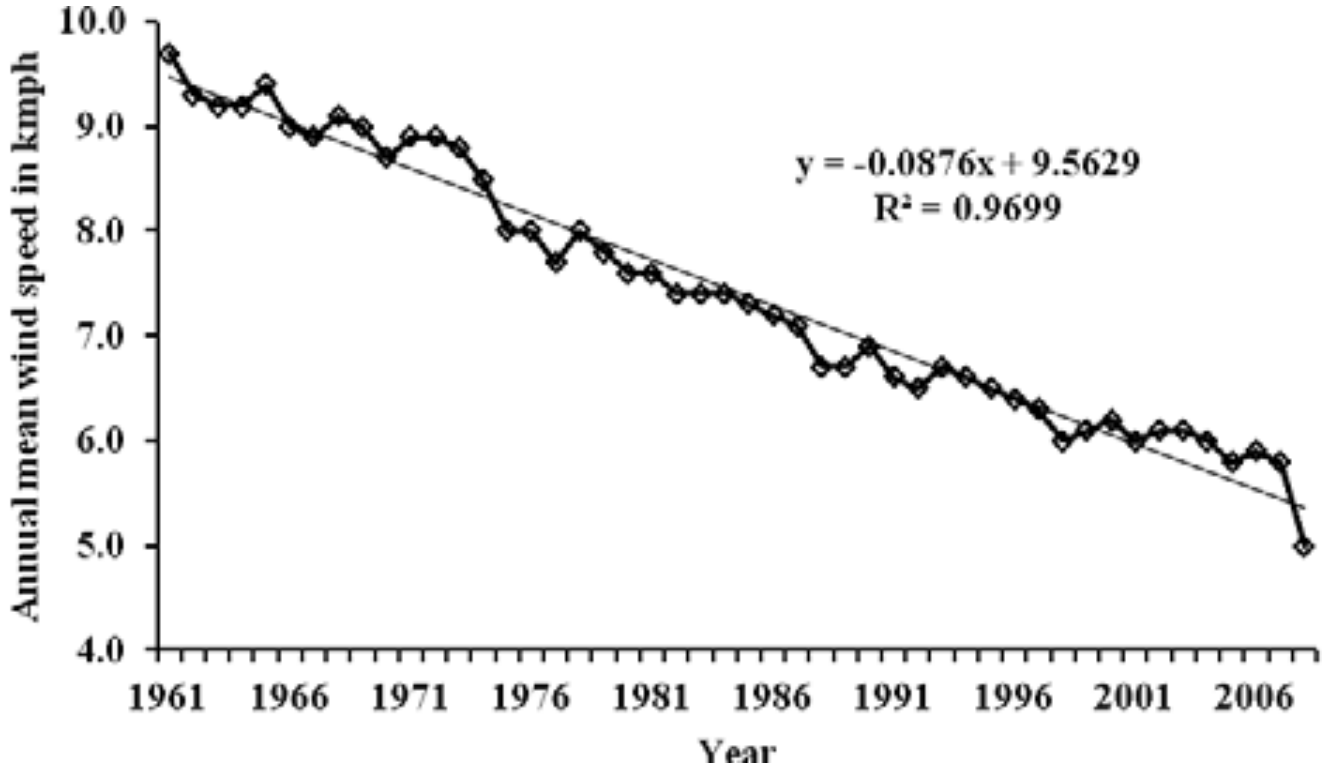
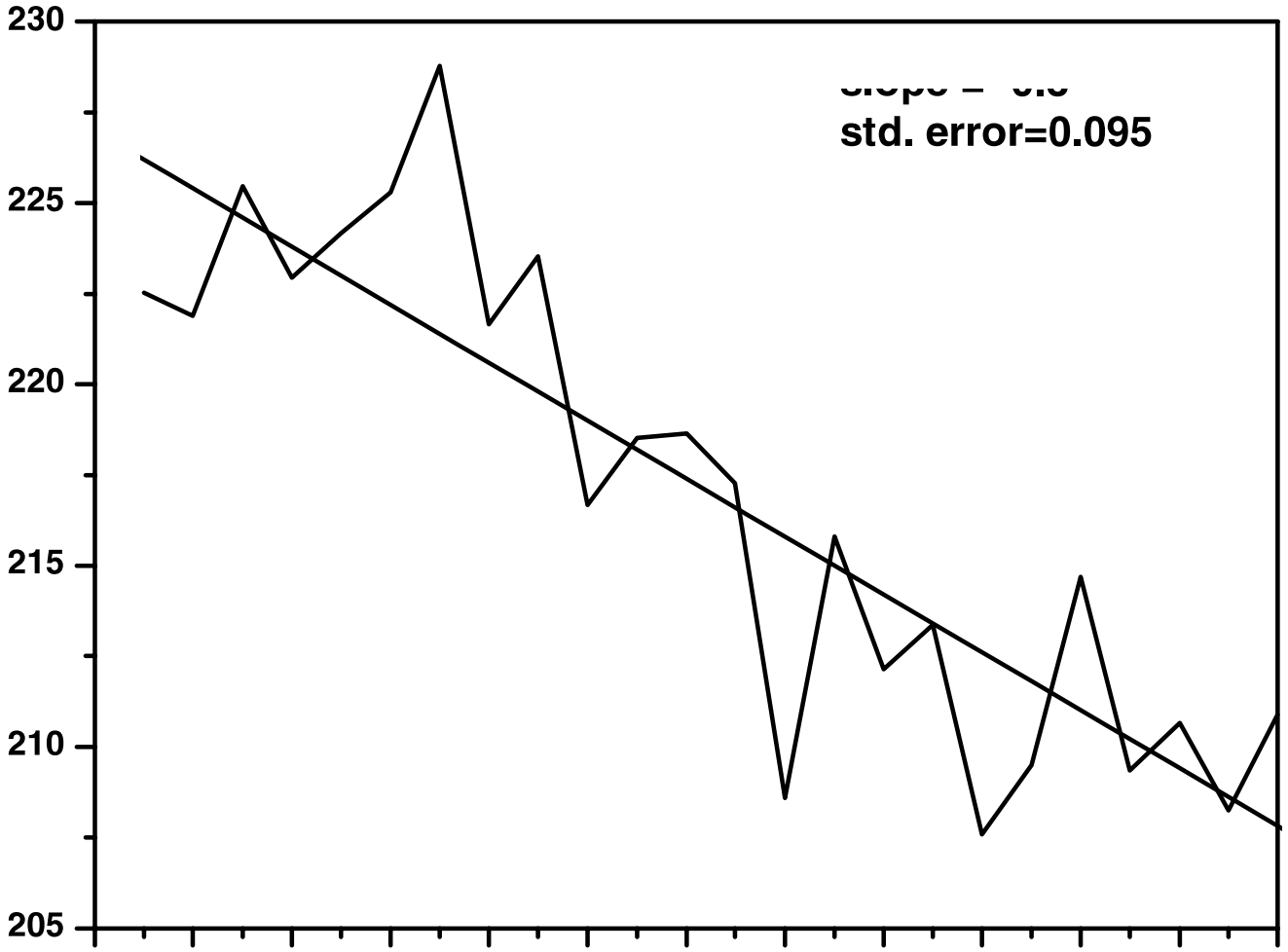


Figure 1. Spatial distributions of rate of changes in t per year and the associated statistical significance (in terms of p‐values) during the (a) winter (Dec‐Feb), (b) pre‐monsoon (Mar‐May), (c) monsoon (Jun‐Sep) and (d) post‐monsoon (Oct‐Nov) seasons for the period Mar 2000–Feb 2010. White regions represent 'no data'. Statistically significant trends are considered for $p < 0.05$.

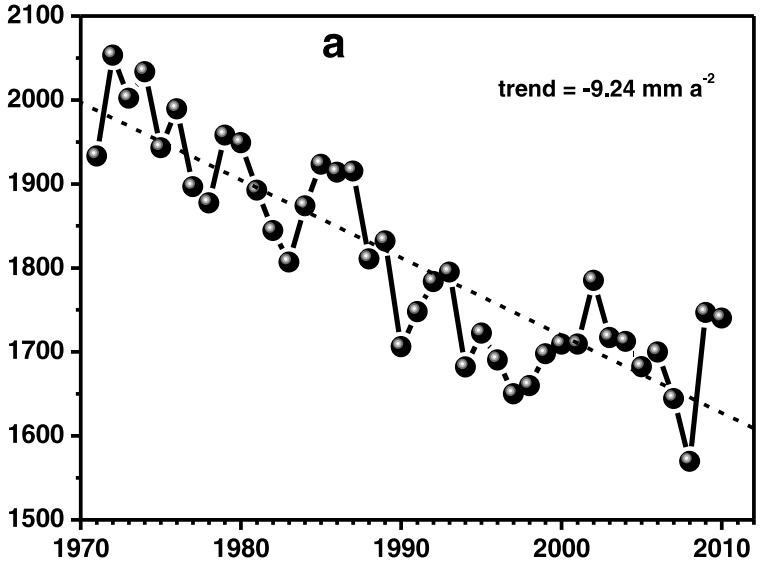
Declining winds



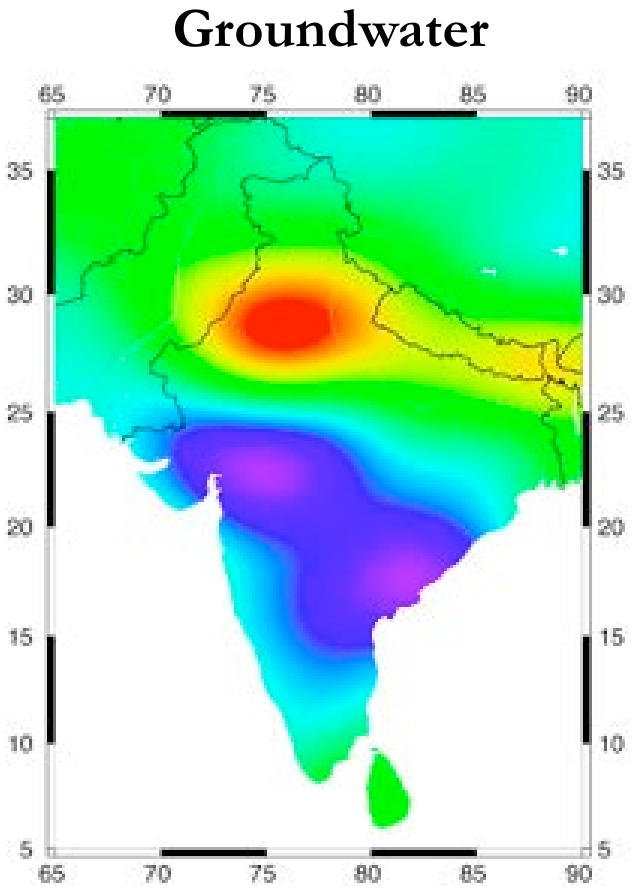
Declining solar radiation at the surface



Declining evaporation rates



Irrigation expansion impacting climate



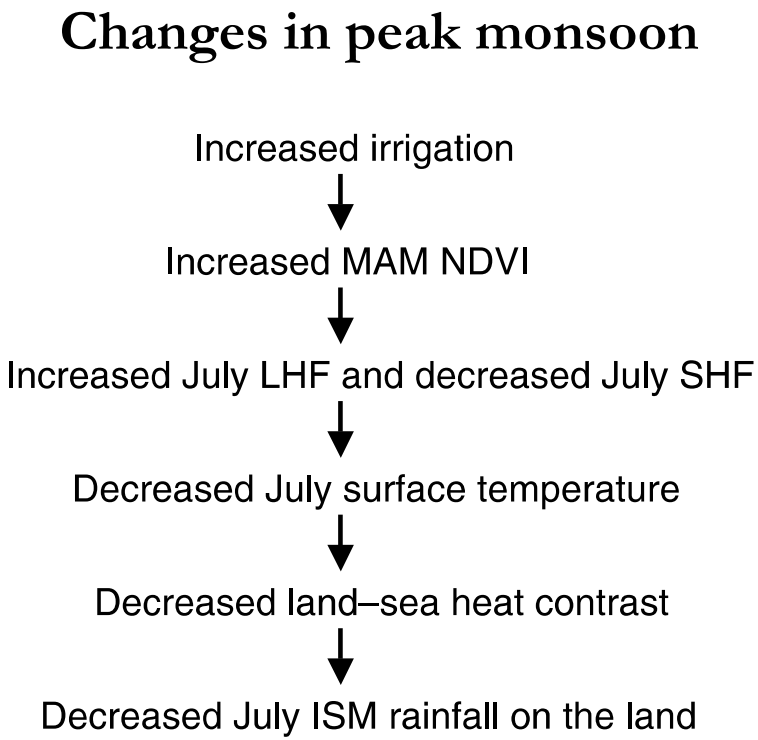


Figure 6. Physical linkages proposed between irrigation and vegetation activity and early ISM rainfall.

Interest from regional players

- Indian Council of Agricultural Research (ICAR)
  - Land use planning
  - Food production systems

- Indian Institute of Tropical Meteorology (IITM)
  - Climate-Aerosol interactions
  - Climate variability and trends

- Indian Institute of Science (IISc)
  - Climate modeling
  - Water resources
  - Ecosystem services
  - Aerosol observations

- National Remote Sensing Center (NRSC)
  - Land use mapping
  - Satellite observations

Next Steps

- **Complete the whitepaper with feedback from this meeting.**
- **Formulate 2-3 science questions related agriculture**
  - *Data/methods for studying LCLUC*
  - *Land-atmosphere interactions (regional)*
  - *Land use and water resources (local)*
- **Engage partners outside India**
- **Plan for a workshop.**