FARI – Future Agroecosystems Research and Innovation

A Monitoring and Assessment Initiative on Hainan Island, China

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Future Earth NEXUS KAN SC

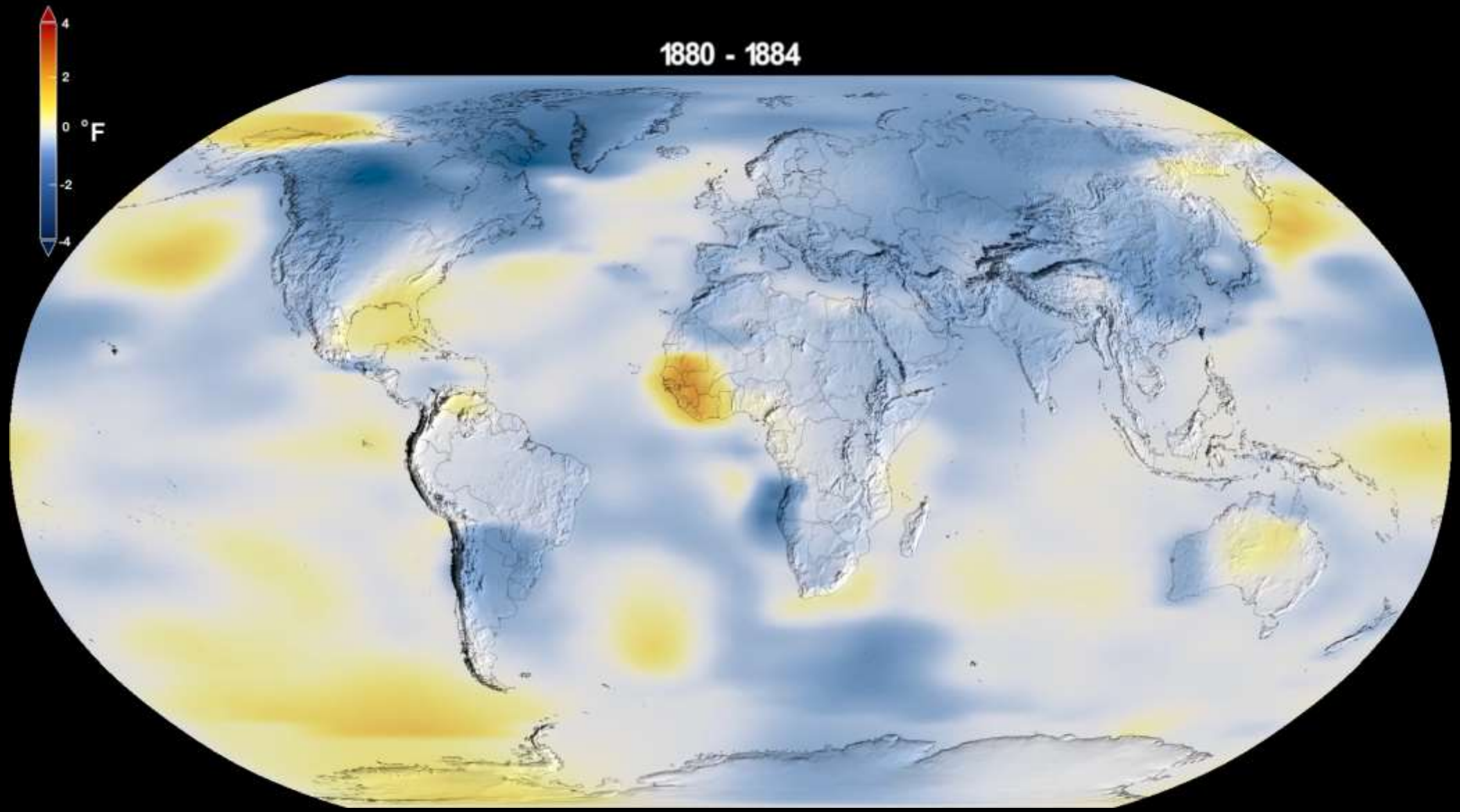
Michigan State University

MICHIGAN STATE UNIVERSITY

The 19th China-US Carbon Consortium Annual Meeting

Asia Hub

Global Temperature Anomalies



https://svs.gsfc.nasa.gov/4964

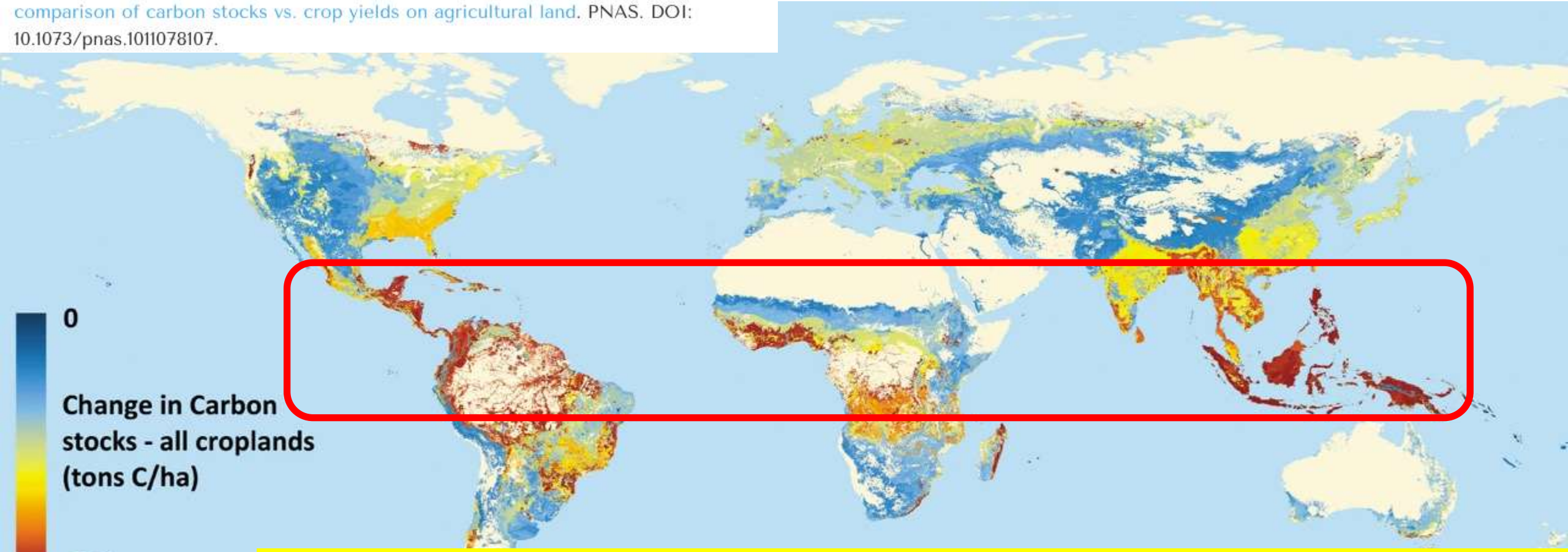
Grand Challenges and Opportunities

Climate change, water, energy, food and land securities in an era of rapid economic development and population increases.

- Critical elements of the SDGs
- Risks and opportunities co-exist

Agroecosystems, particularly in the tropical regions around the world, are critical in regulating key ecological processes but subjected to human intervention.

CITATION: Paul C. West, Holly K. Gibbs, Chad Monfreda, John Wagner, Carol C. Barford, Stephen R. Carpenter, and Jonathan A. Foley. Trading carbon for food: Global comparison of carbon stocks vs. crop yields on agricultural land. PNAS. DOI: 10.1073/pnas.1011078107.



Map shows changes in carbon stocks due to cropland conversion between 1998 and 2002. Blue is less carbon emissions due to land conversion, while red is more. Tropical areas with high conversion of croplands, such as Southeast Asia, have the highest emissions due to land conversion. Notice the high spatial variability, thus requiring site-specific understanding of the agroecosystems.

https://news.mongabay.com/2010/11/tropical-agriculture-double-whammy-high-emissions-low-yields/

10 Findings based on The 2023 IPCC Report

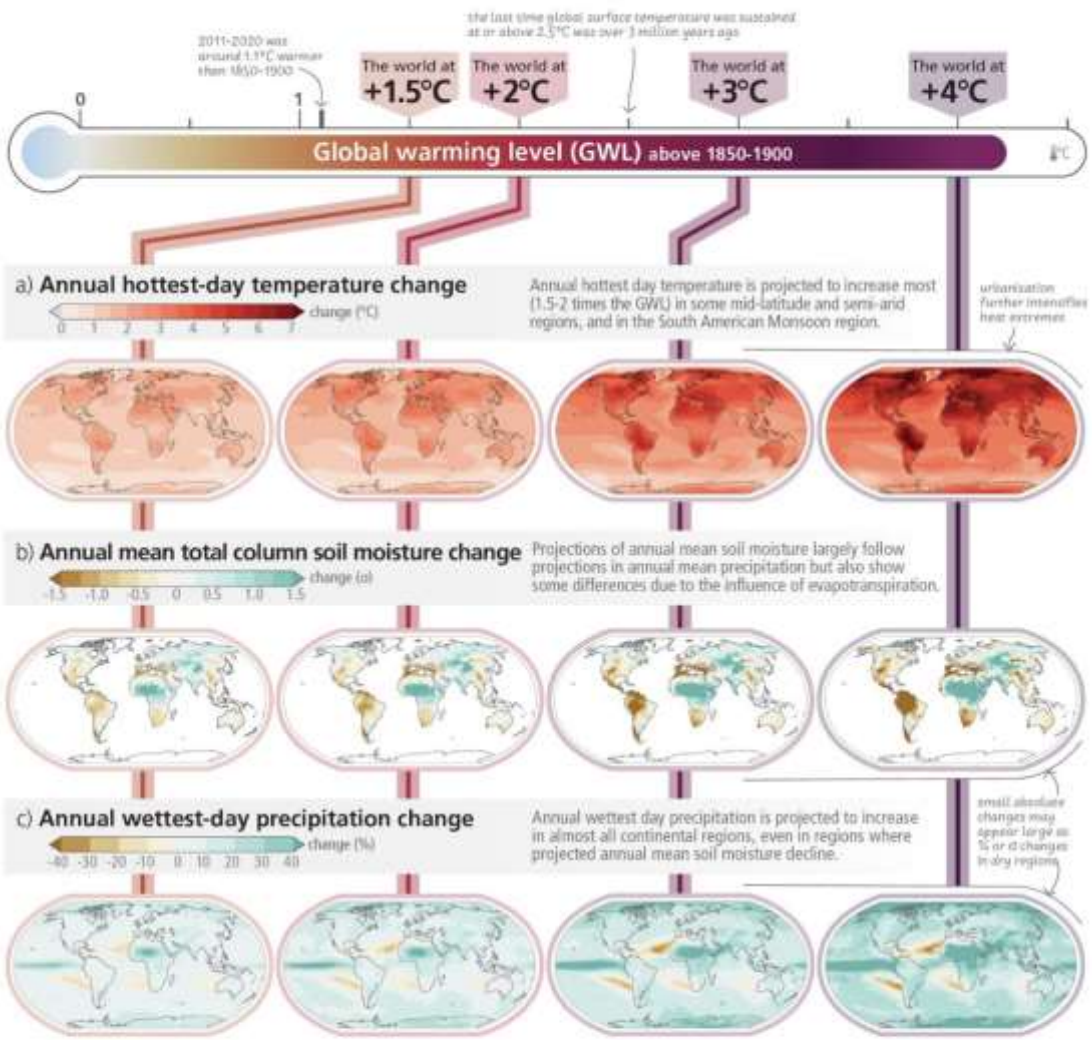


Figure SPM.2: Projected changes of annual maximum daily maximum temperature, annual mean total column soil moisture and annual maximum 1-day precipitation at global warming levels of 1.5°C, 2°C, 3°C, and 4°C relative to 1850–1900. Projected **(a)** annual maximum daily temperature change (°C), **(b)** annual mean total column soil moisture (standard deviation), **(c)** annual maximum 1-day precipitation change (%). The panels show CMIP6 multi-model median changes. In panels (b) and (c), large positive relative changes in dry regions may correspond to small absolute changes. In panel (b), the unit is the standard deviation of interannual variability in soil moisture during 1850–1900. Standard deviation is a widely used metric in characterising drought severity. A projected reduction in mean soil moisture by one standard deviation corresponds to soil moisture conditions typical of droughts that occurred about once every six years during 1850–1900. The WGI Interactive Atlas (https://interactive-atlas.ipcc.ch/) can be used to explore additional changes in the climate system across the range of global warming levels presented in this figure. {Figure 3.1, Cross-Section Box.2}

2. Climate impacts on people and ecosystems are more widespread and severe than expected, and future risks will escalate rapidly with every fraction of a degree of warming.

Results

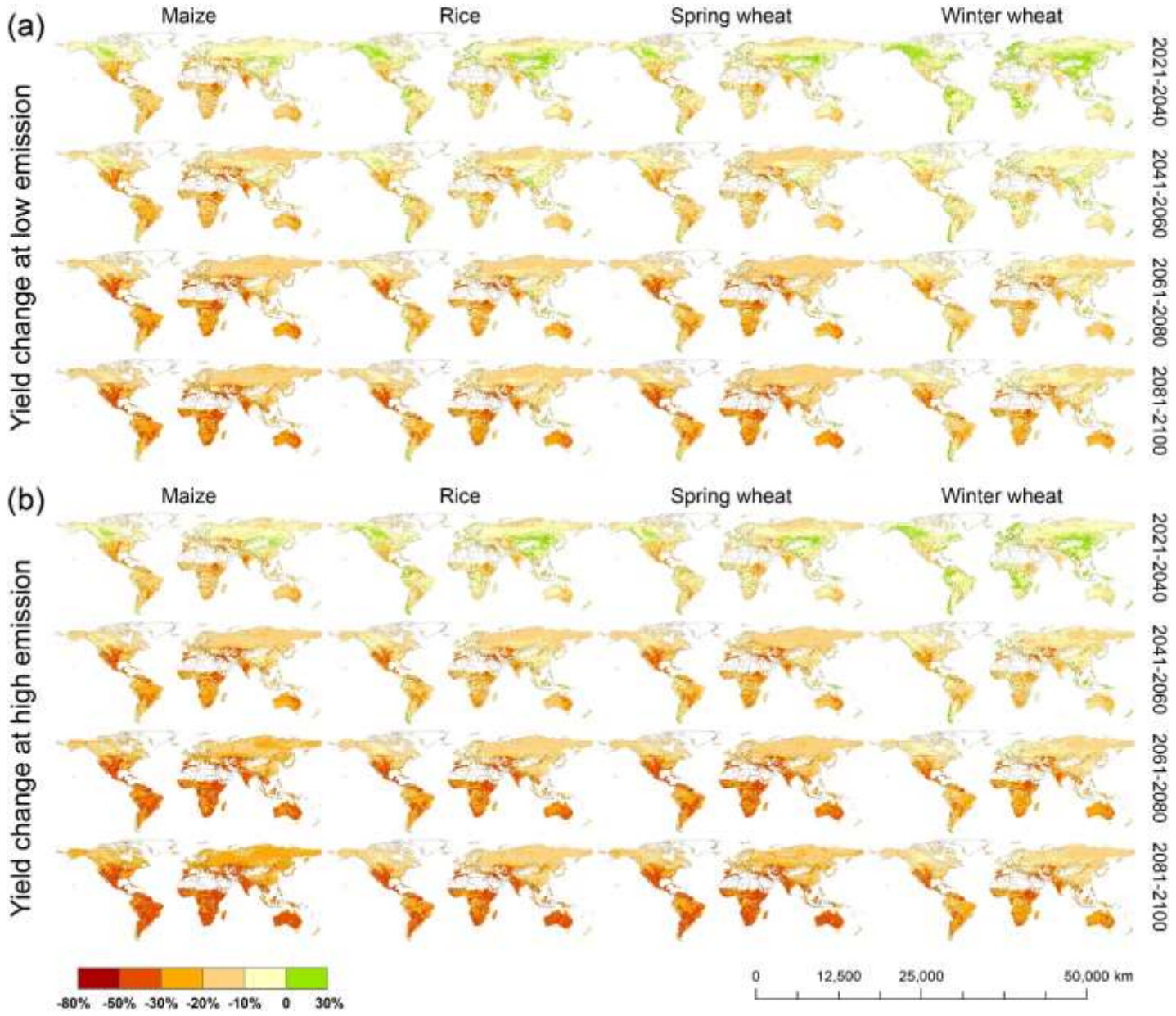


Fig. 1. The global yield change rate for the three major food crops under the future climate scenario: (a) low emission pathway and (b) high emission pathway.

Provided by Zhang, F. @ Lanzhou University

Results

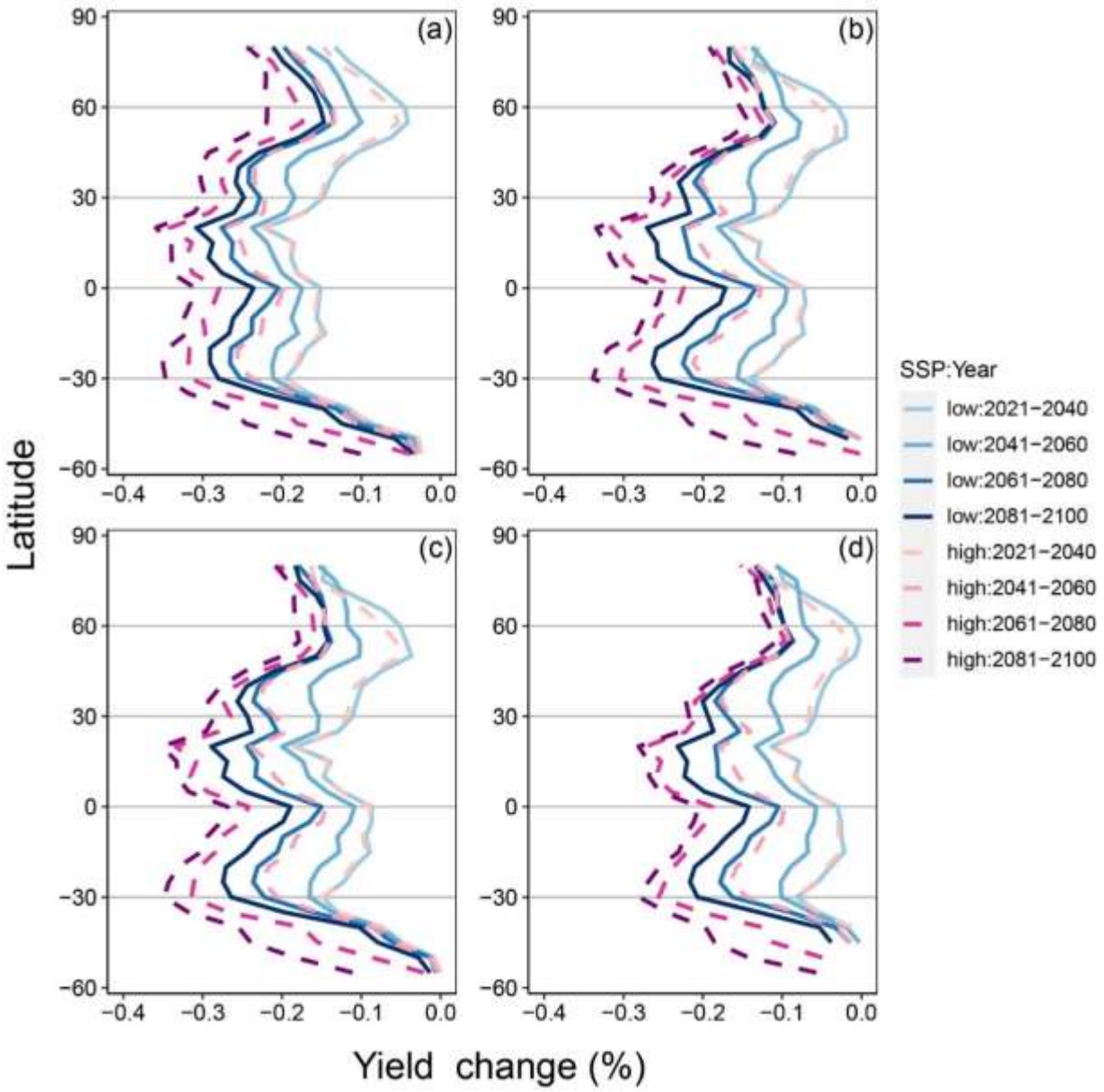
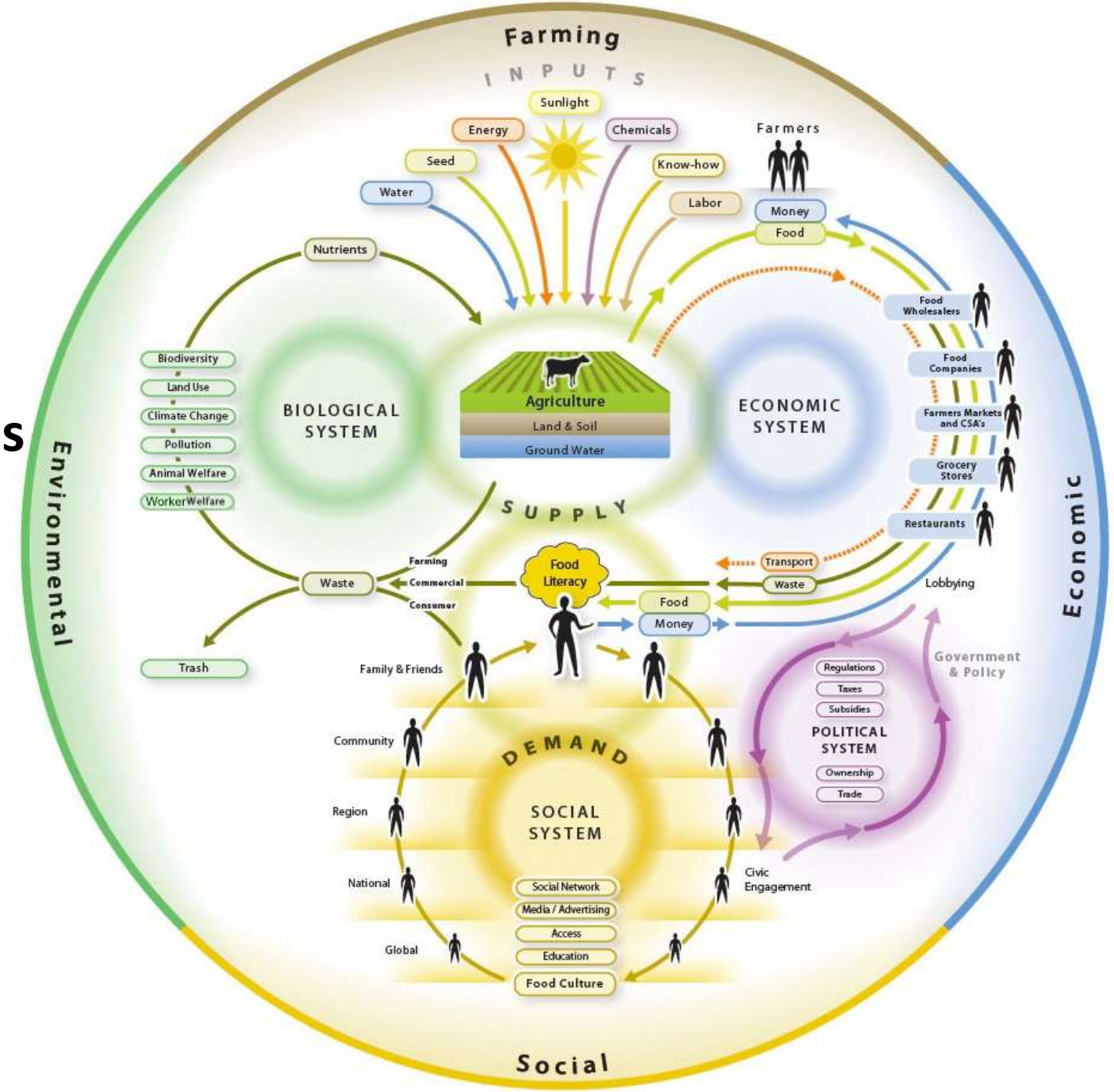


Fig. 2. Yield change rate at different latitude range for (a) maize, (b) rice, (c) spring wheat and (d) winter wheat under the future climate scenario.

Provided by Zhang, F. @ Lanzhou University

The NEXUS

- Key processes and ecological, climate and WEF systems implications are far from being fully understood;
- Science-based intervention and policy are needed but lacking



https://westoahu.hawaii.edu/ekamakanihou/?p=5767

Asia Hub 2.0, NEXUS IPO, FARI, New Initiatives and Priorities

Jiaguo Qi (齐家国)
Director and Professor, Asia Hub, Michigan State University

Asia Hub – An International Platform

Collaboration & Partnership

Next-Generation Education Programs

Engagement across Continents & Disciplines

Innovative Solutions for Lasting Impact

Asia Hub
Nodes

East Asia
- China （中国海南, 南京）

South Asia?
- India?（印度）

Southeast Asia
- Indonesia（印度尼西亚）
- Thailand（泰国）

Central Asia
- Uzbekistan（乌兹别克斯坦）
- Kazakhstan （哈萨克斯坦）

Asia Hub Partnership

- ✓ Kazakh National Agrarian University
- ✓ S. Selfullin Kazakh Agrotechnical University
- ✓ Agri-tech Hub Kazakhstan

- ✓ Natural Resources Institute Finland (LUKE), Finland

AgriTech Hub Kazakhstan on Water Resources in Central Asia, Almaty, Kazakhstan

GLP (Global Land Project – North America Nodal Office), Unite States

Future Earth NEXUS KAN, Paris, France

MAIRS-FE (Monsoon Asia Integrated Research for Sustainability-Future Earth), Beijing, China

Regional Center for Future Earth in Asia, Tokyo, Japan

- ✓ Michigan State University

- ✓ Tashkent Institute of Irrigation and Agricultural Mechanization Engineers

Central Asia and South Caucasus Consortium of Agricultural Universities for Development, Kazakhstan

- ✓ Nanjing Agricultural University
- ✓ Capital Normal University

MAIRS-FE Regional Office, Bangalore, India

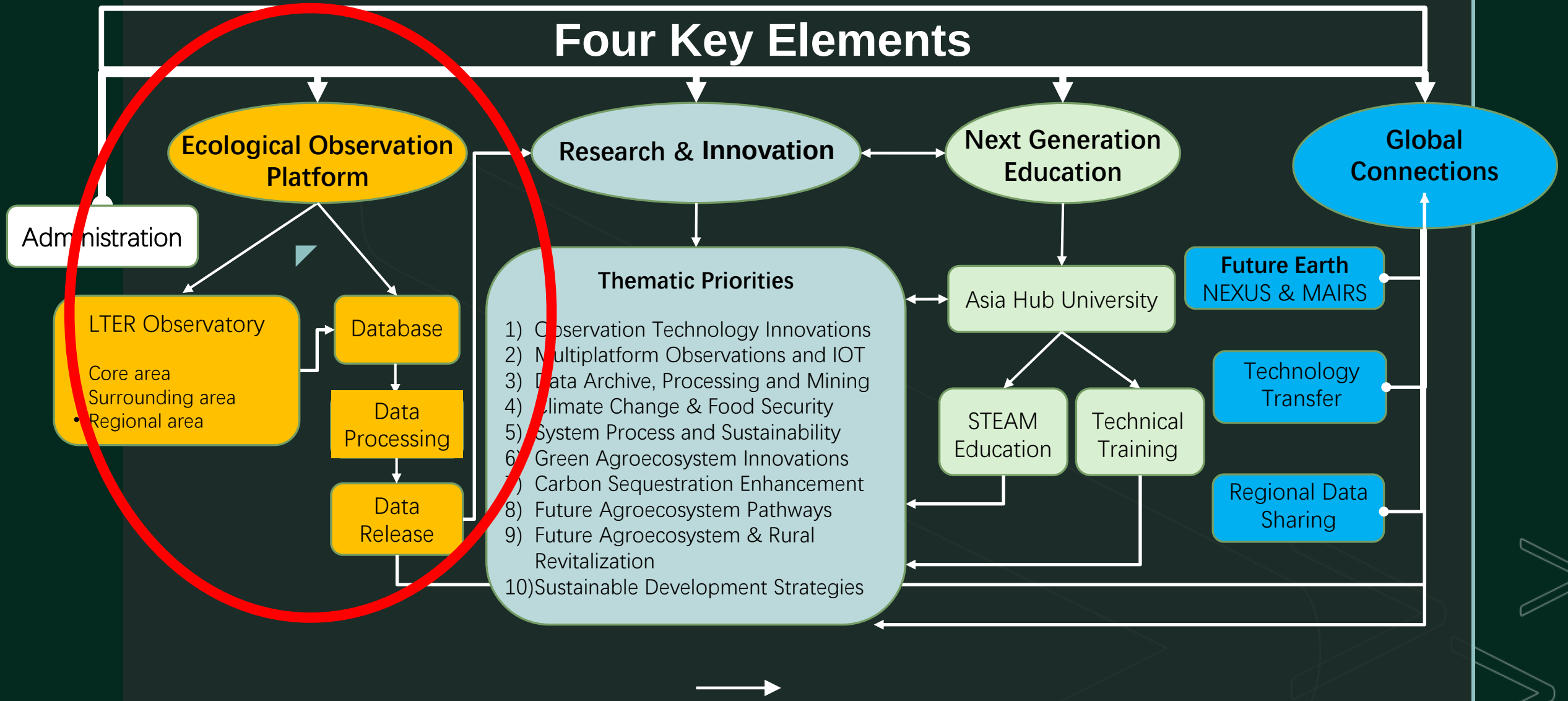
- ✓ BRAC University,
- ✓ Bangladesh University of Engineering and Technology

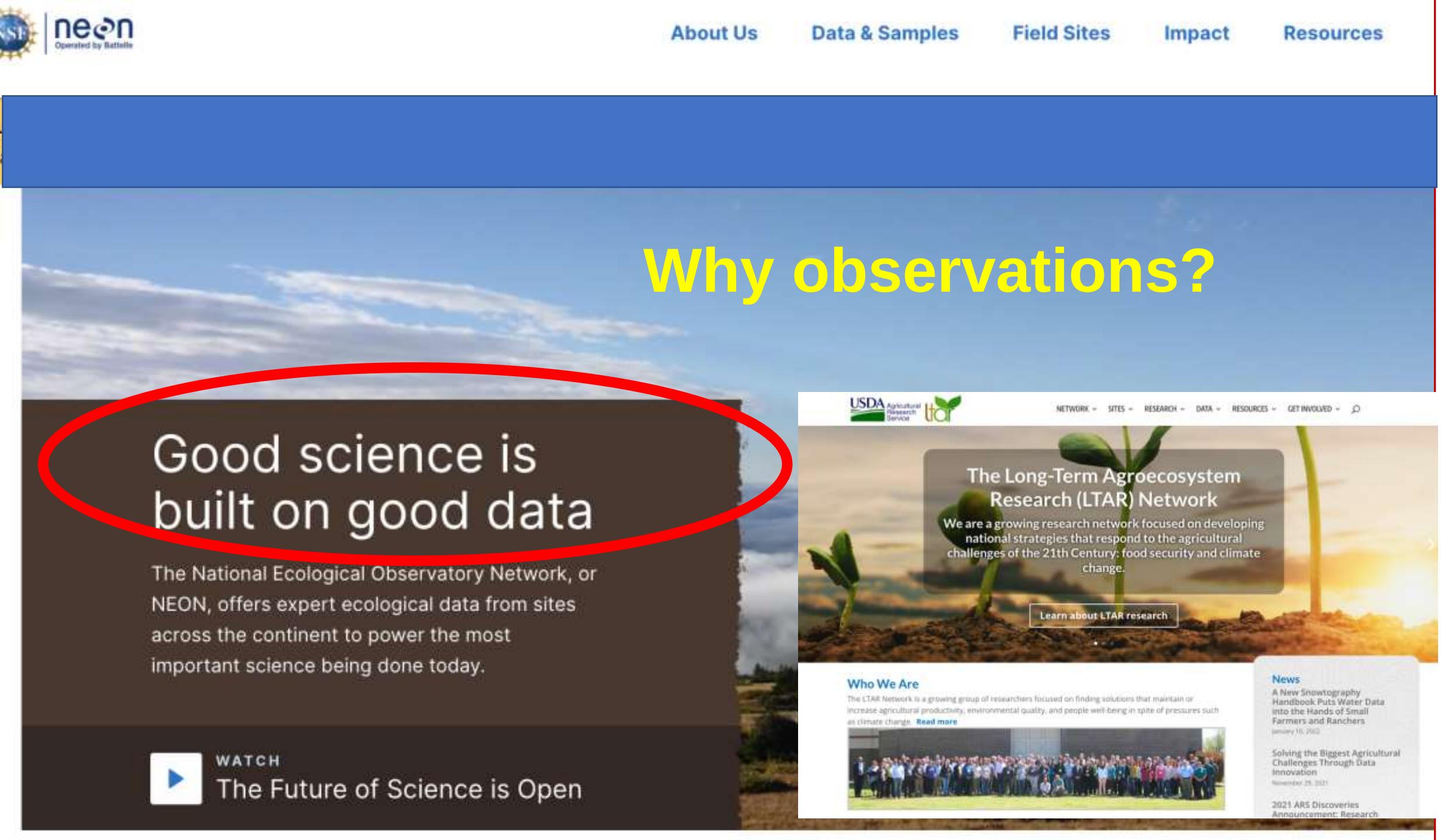
- ✓ Mandalay Technology
- ✓ Chiang Mai University
- ✓ Kasetsart University
- ✓ Mae Fah Luang University
- ✓ Mahidol University
- ✓ Khon Kaen University
- ✓ King Mongkut's University of Technology Thonburi
- ✓ Nakhon Phanom University
- ✓ Land Development Department
- ✓ Surindra Rajabhat University

- ✓ University of the Philippines Los Baños
- ✓ IPB University
- ✓ Can Tho University
- ✓ Northern Mountainous Agriculture & Forestry Science Institute
- ✓ Cambodian Institute for Urban Studies
- ✓ National University of Laos
- ✓ Mekong River Commission

- 13 Countries
- 25 International institutions
- 7 International organizations

FARI Approach




neon
Operated by Battelle
About Us
Data & Samples
Field Sites
Impact
Resources
Why observations?
Good science is built on good data
The National Ecological Observatory Network, or NEON, offers expert ecological data from sites across the continent to power the most important science being done today.
WATCH
The Future of Science is Open
USDA Agricultural Research Service
ltar
NETWORK
SITES
RESEARCH
DATA
RESOURCES
GET INVOLVED
The Long-Term Agroecosystem Research (LTAR) Network
We are a growing research network focused on developing national strategies that respond to the agricultural challenges of the 21th Century: food security and climate change.
Learn about LTAR research
Who We Are
The LTAR Network is a growing group of researchers focused on finding solutions that maintain or increase agricultural productivity, environmental quality, and people well-being in spite of pressures such as climate change. Read more
News
A New Snowtography Handbook Puts Water Data into the Hands of Small Farmers and Ranchers
Solving the Biggest Agricultural Challenges Through Data Innovation
2021 ARS Discoveries Announcement: Research

Sanya

- **Location**:
  18°N，108-109°E
- **Land**: 1921 km^2
  Sea: 3226 km^2
- **Population**: 1 million with more than 20 ethnic minorities
- **GDP**: RMB 69.5 Billion

- The East Hawaii
- Best air quality and longest living life
- Preferred Tourist Destination in China
- China National Ecological Demonstration City

(Data by 2020)

Observations

FARI:

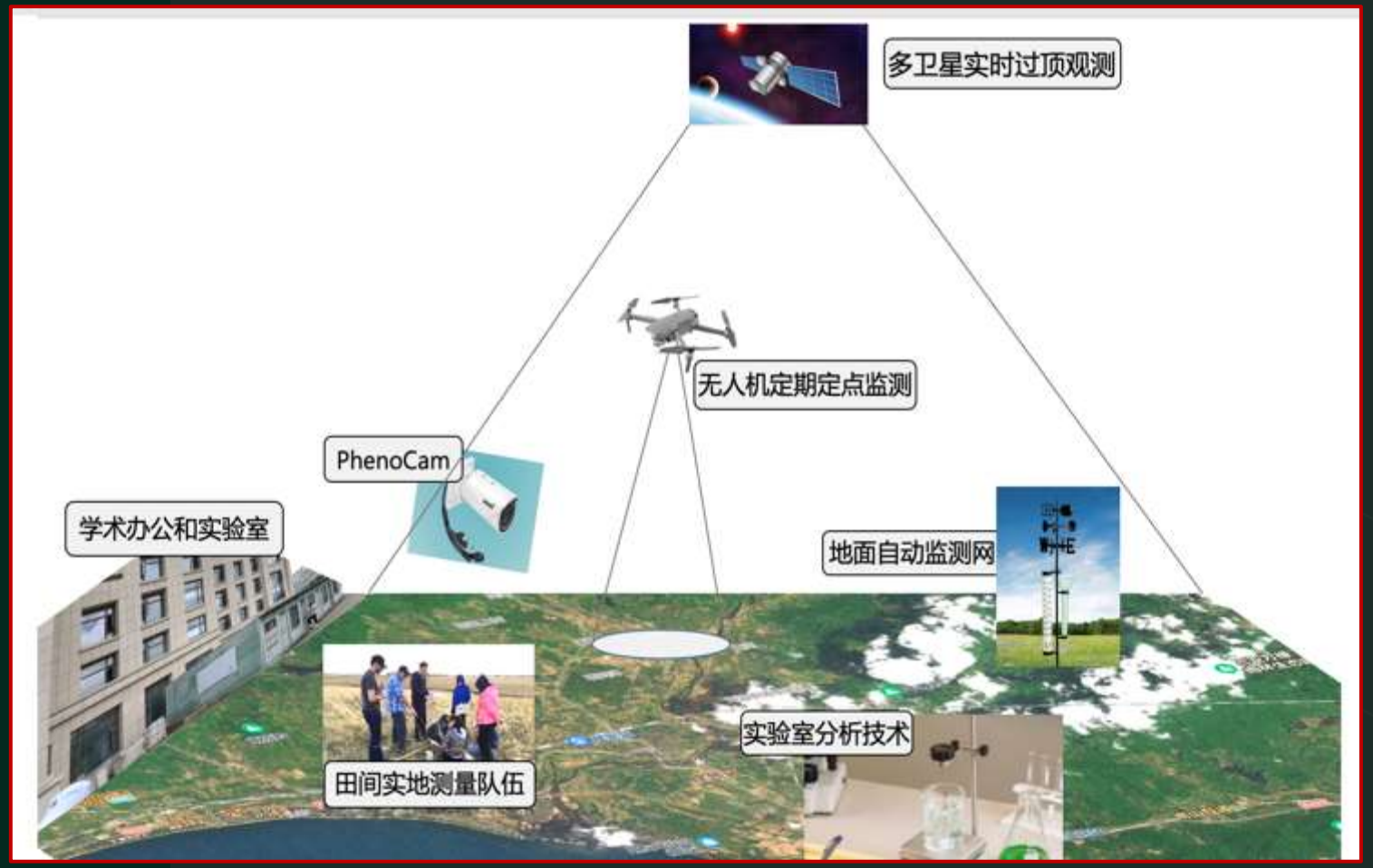
Future Agroecosystems Research and Innovations

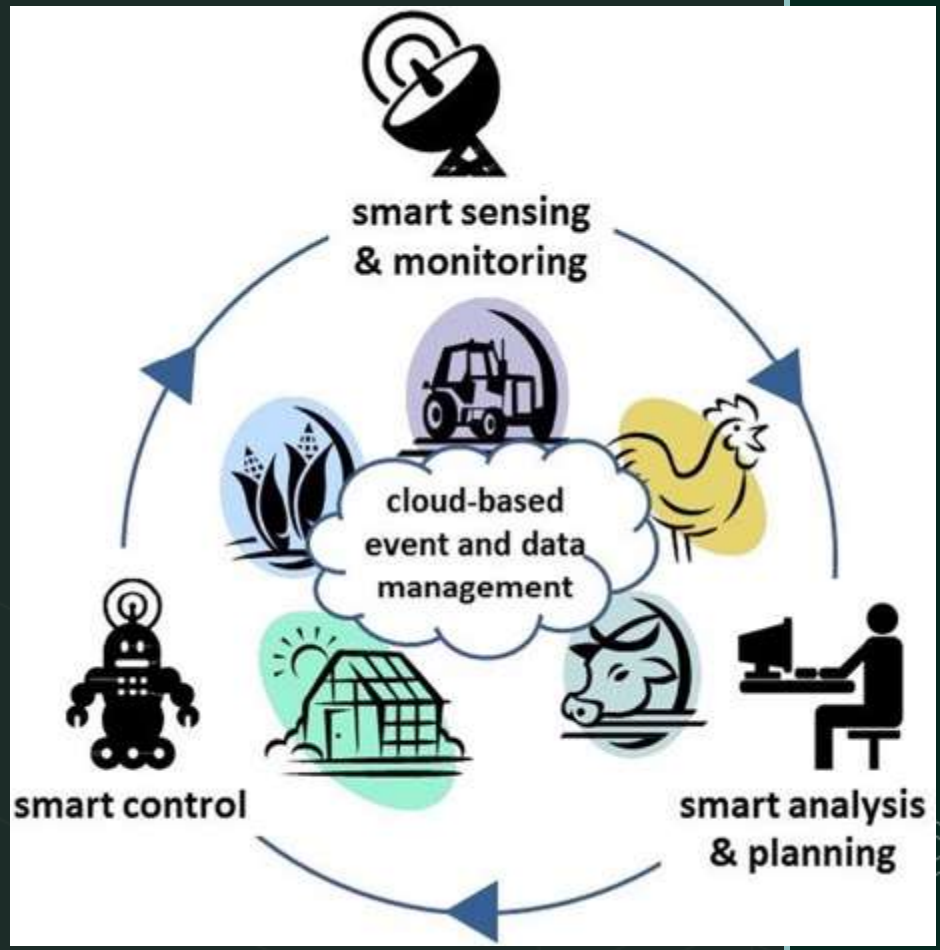
- **Long-term ecological research station networks to be established as part of Asia Hub and Yazhou Bay regional initiatives.**
- **Three-tiered network design: 1) Core area, 2) extended and 3) regional stations**

1 个中心 （One Research Center)
5 个基地 (5 Research Stations – Large fields)
7 个观测点 (7 Sites/Plot)

Observations

Smart sensing & monitoring, smart control, smart analysis & planning, all are based on cloud computing





Research Innovation

1 – BigData

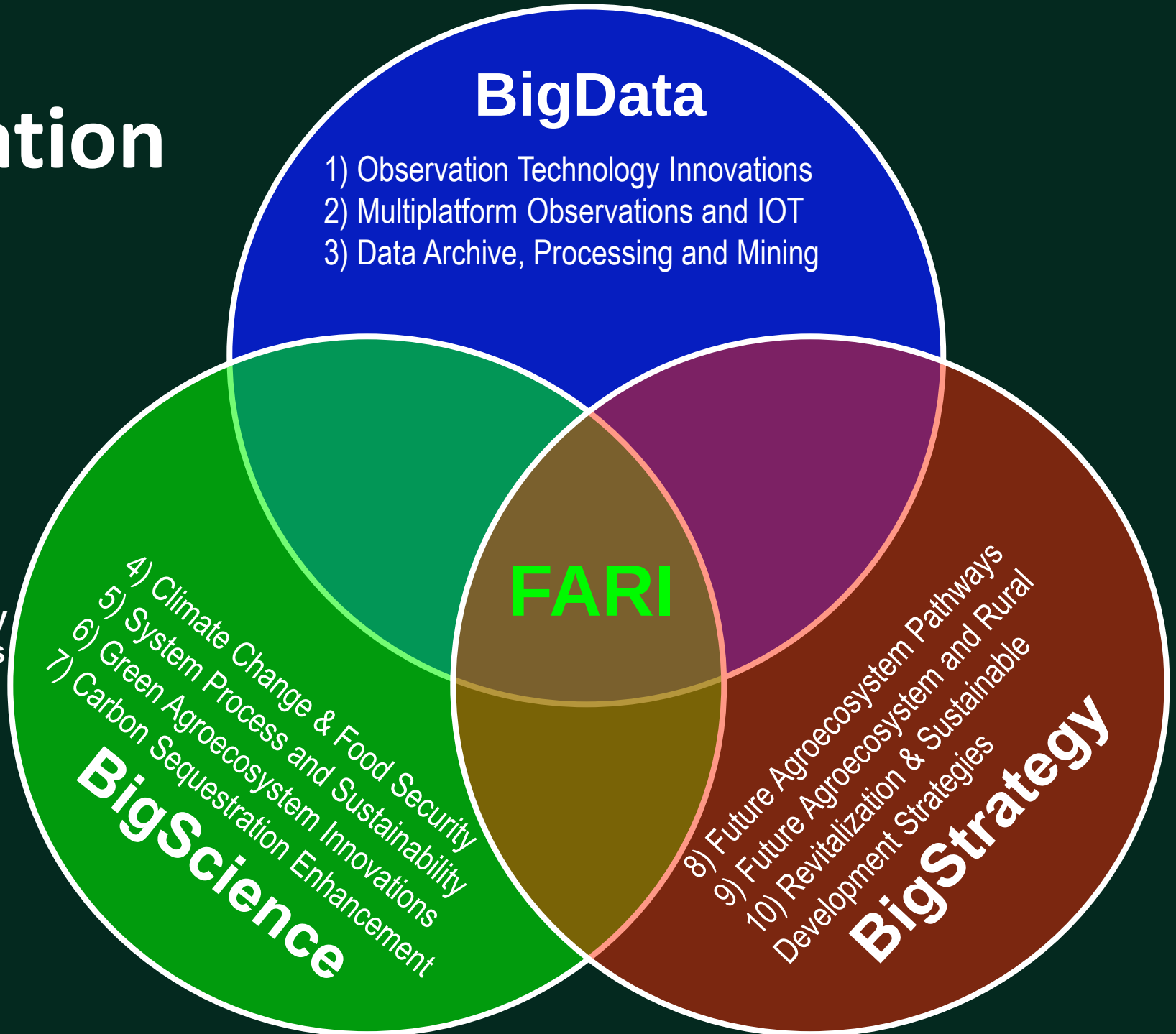
- Observation Technology Innovations
- Long-term Multiplatform Monitoring System
- Data and Data Mining

2 – BigScience

- Climate Change & Food Security
- System Process and Sustainability
- Green Agroecosystem Innovations
- Carbon Sequestration Enhancement

3 – BigStrategy

- Future Agroecosystem Pathways
- Future Agroecosystem and Rural
- Revitalization & Sustainable Development Strategies



A Call for Participation and An Expression to Contribute

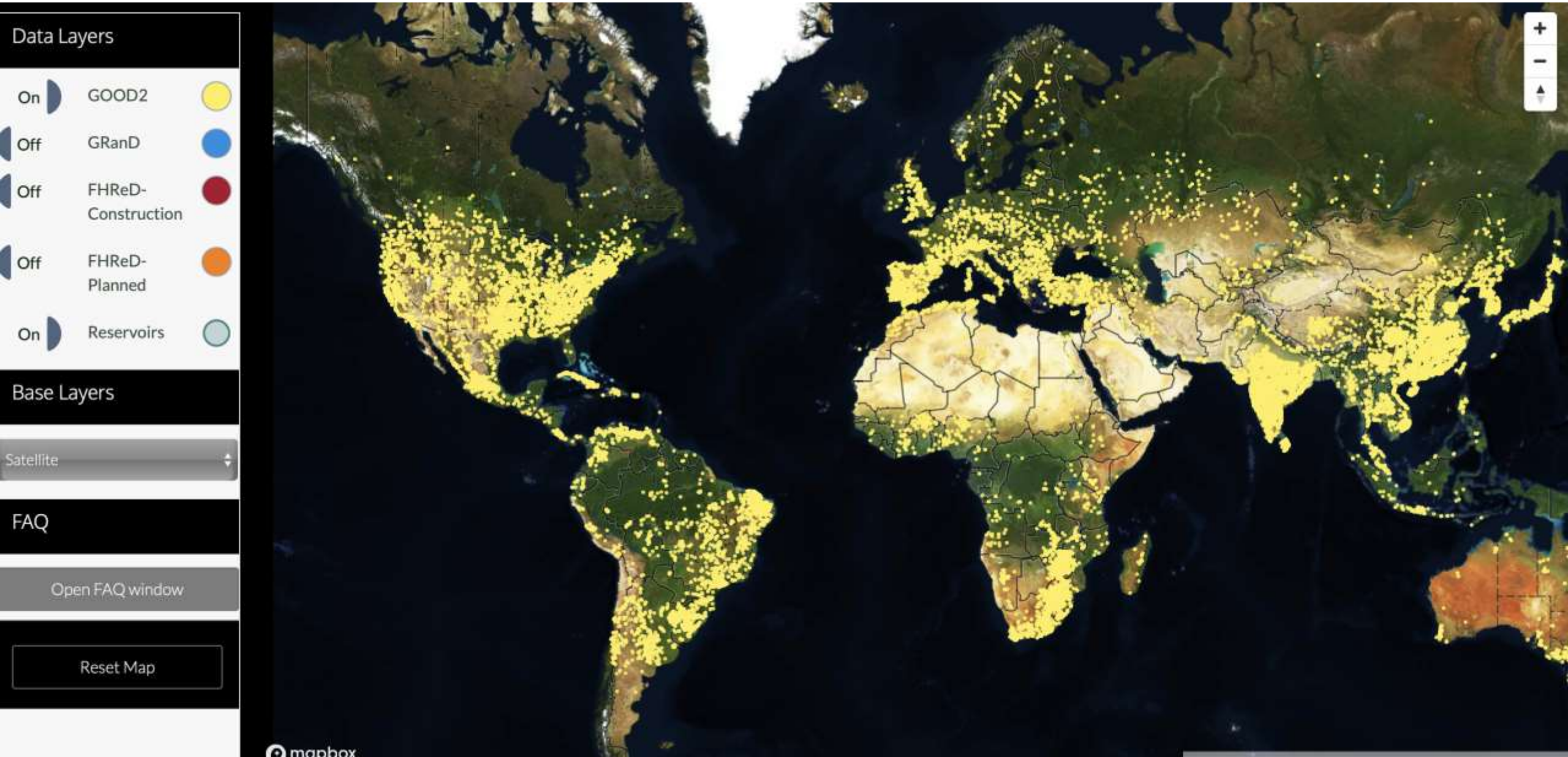
to the USCCC and Other International Organizations

Summary

- **Tropical Agroecosystems are critical in WEF securities and believed to be important in “fluxes to flows”**
- **Systematic observations are important to understand both short and long-term trajectories and processes**
- **Agroecosystems are highly connected, and there is a need to *collaborate across sectors, scales, and borders for national and regional sustainability***
- ***Trade-offs* are critical priority issues and thus needed research**

GlObal geOreferenced Database of Dams (GOOD^2)
Global Reservoir and Dam Database (GRanD)
Future Hydropower Reservoirs and Dams (FHReD)

Global Dam Watch is an international collaboration between an expanding group of researchers who are passionate about understanding the costs and benefits of dams to our world

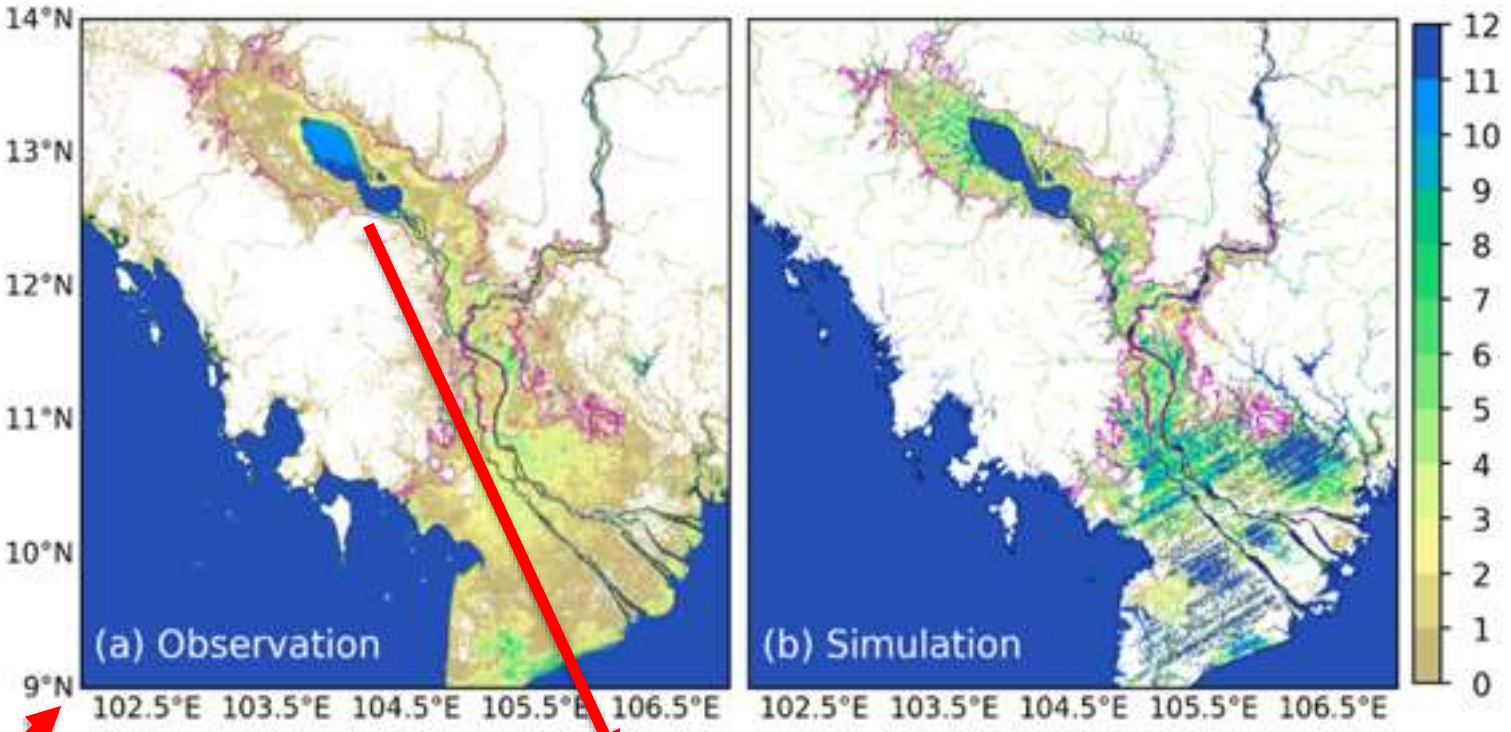


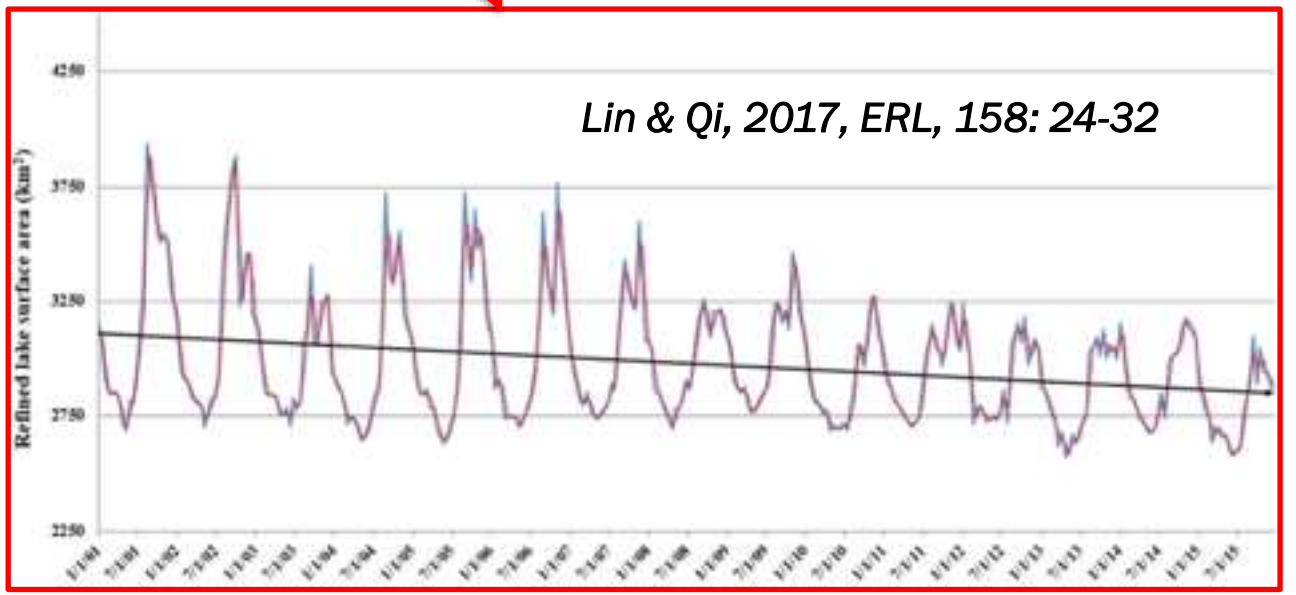
Lower Mekong River Basin Issues

- Competition for different water uses
- Hydropower dams (more than 100 dams)
- Irrigation for crops
- Significant impacts on
  - Hydrology, wetlands, agriculture, fisheries and rural communities!

W: Different Uses
E: Hydropower
(Battery of Asia)
F: Crops and Fish

Selected watersheds





Lin & Qi, 2017, ERL, 158: 24-32

Balancing Ecosystem Services and Environment

Water Sources, Uses, and Services

Thank you for your attention!

Questions?

Thank you for your Attention!

Questions?