Monitoring and Evaluation Tools for Adaptation Reporting: Insights from the African Water-Energy-Food-Health (AWEFH) Nexus initiative and Soil Moisture Applications

Global Environment and Natural Resources Institute (GENRI)

Department of Geography and GeoInformation Science (GGS)

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Outline

- Introduction to the AWEFH Nexus initiative
- Linking AWEFH Nexus to Adaptation reporting
- Monitoring and Evaluation Tools (M&E)
- Case Studies: Examples from Africa
- Capacity Building
- Recommendations for Integrating AWEFH Nexus into ETF reporting
- Conclusion and discussion

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Environmental Science and Technology Center

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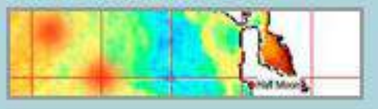
Welcome to ESTC

RESEARCH



Research projects will include land, water and atmosphere environmental remote sensing, and will involve collaborations with international partners.

>> Details

PEOPLE

ESTC is a new research center at George Mason University. Its personnel includes affiliated faculty, researchers, students, and staff members.

>> Details

EDUCATION

ESTC is mainly affiliated George Mason University, Tsinghua University and China's Ministry of Water Resources (MWR).

>> Details

PUBLICATIONS

Research projects will lead some cutting-edge interdisciplinary research projects including land, water and atmosphere environmental remote sensing.

>> Details

- **Brings experts from different fields together to solve environmental problems.**
- **Welcomes researchers from all over the world, allowing diverse perspectives.**
- **Helps researchers gain skills to make a big difference worldwide.**

Global Environment and Natural Resources Institute (GENRI)

Mission

- Program: education, training, application & research
- Scope: global, interdisciplinary & credible academics & research
- Design & implement local adaptive and sustainable solutions for place-based planning & management of natural resources (global food security, renewable energy and water resource)
- Synergistic application of local knowledge-based science and technologies from multiple scales, sources & disciplines

Objectives

- Promote international collaboration to foster development of local solutions for global problems
- Establish a network of global centers of excellence, emphasizing an inter-disciplinary and holistic approach to problem solving and sustainable resource management

- Focus on metrics for measuring sustainability progress
- Funded projects by WMO, NOAA, NASA, USGS, USDA

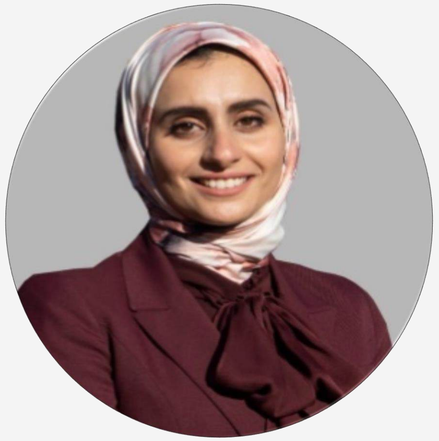
http://genri.gmu.edu

GENRI

AWEFH Nexus initiative Team & Partners

Prof. John J. Qu
Director of GENRI and ESTC

Dr. Raymond P. Motha
Co-director of GENRI



Ms. Bouchra Taouil,
African coordinator, GENRI

Dr. Xianjun Hao
Associate director of ESTC, WMO
WAMIS Coordinator, Tech Lead

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USDA
UN environment
UNIVERSITY OF FLORENCE
ITALY

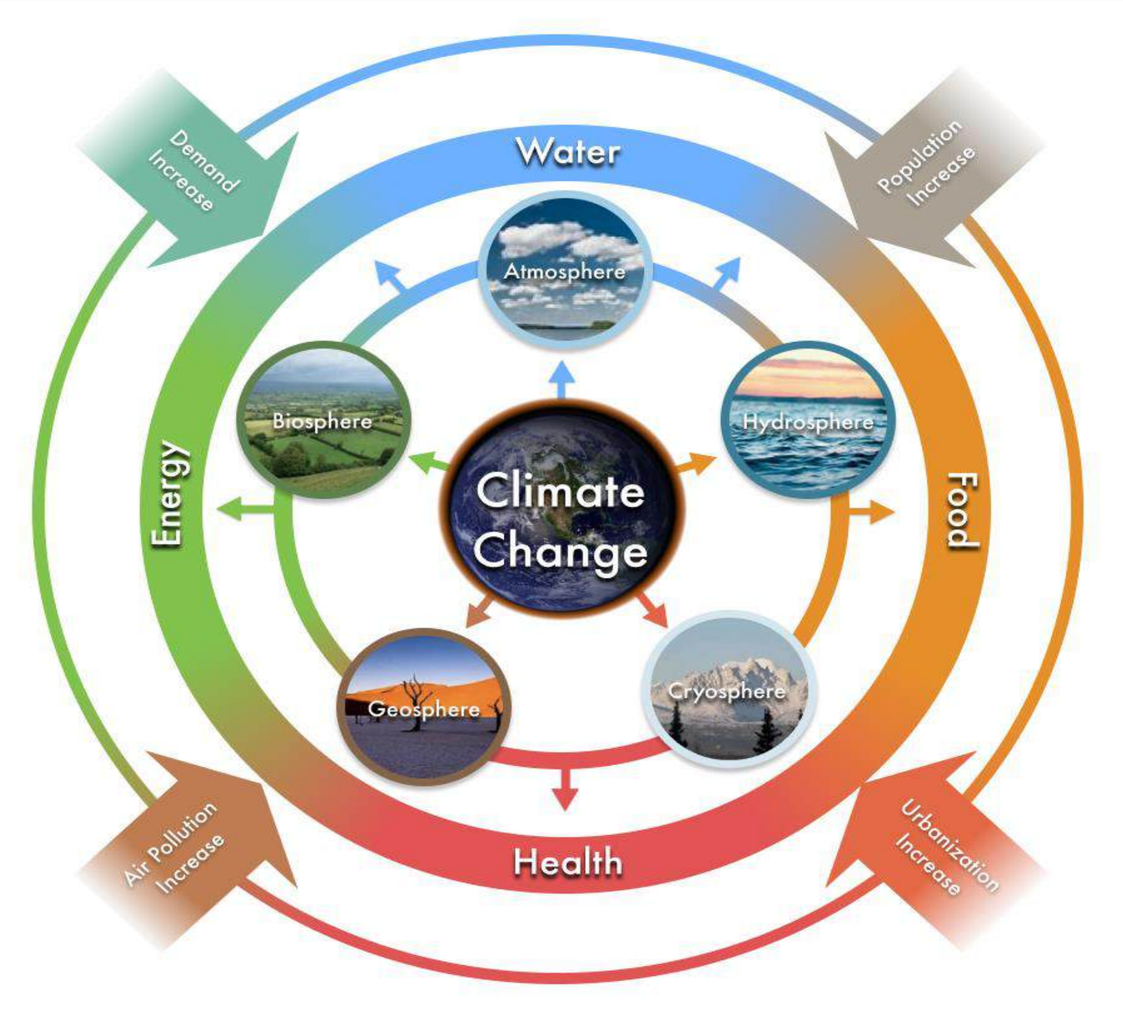
AWEFH Nexus initiative

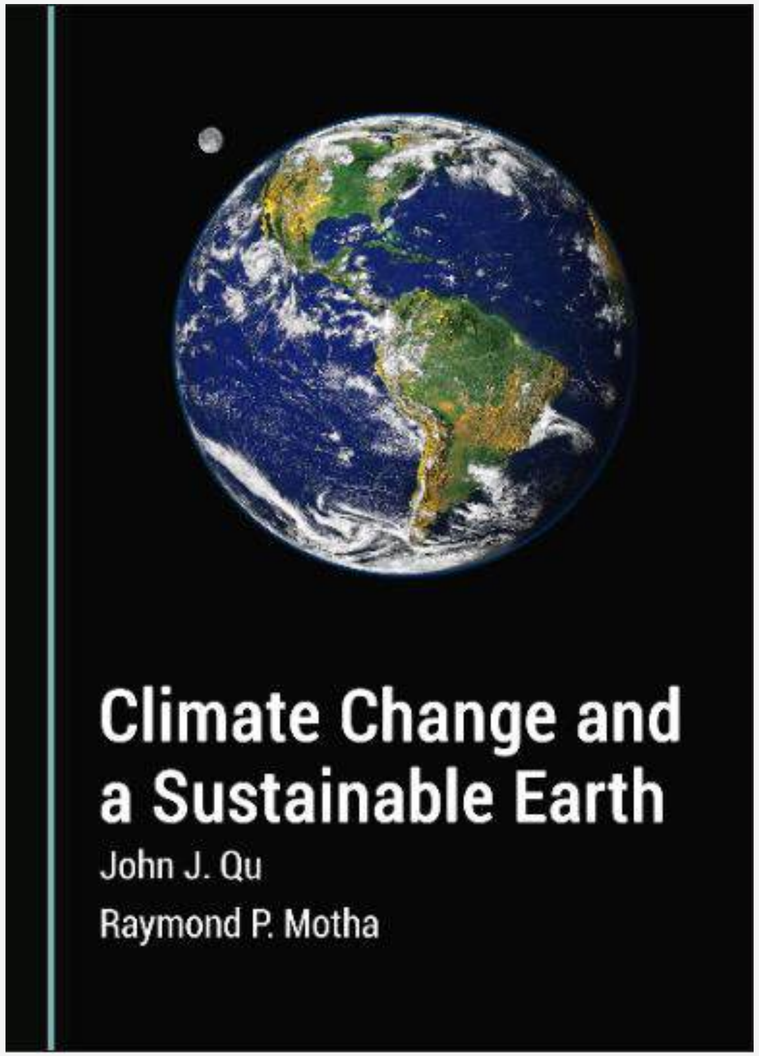
What’s the problem?

- Climate change is one of the great challenges and its impacts on natural resources are among the greatest challenges that threaten our sustainable Earth.

- A multidisciplinary approach that combines the principles of changing climate with the specialized fields of the water–energy–food–health (WEFH) nexus is needed to examine how the Earth operates as an interconnected, integrated system.

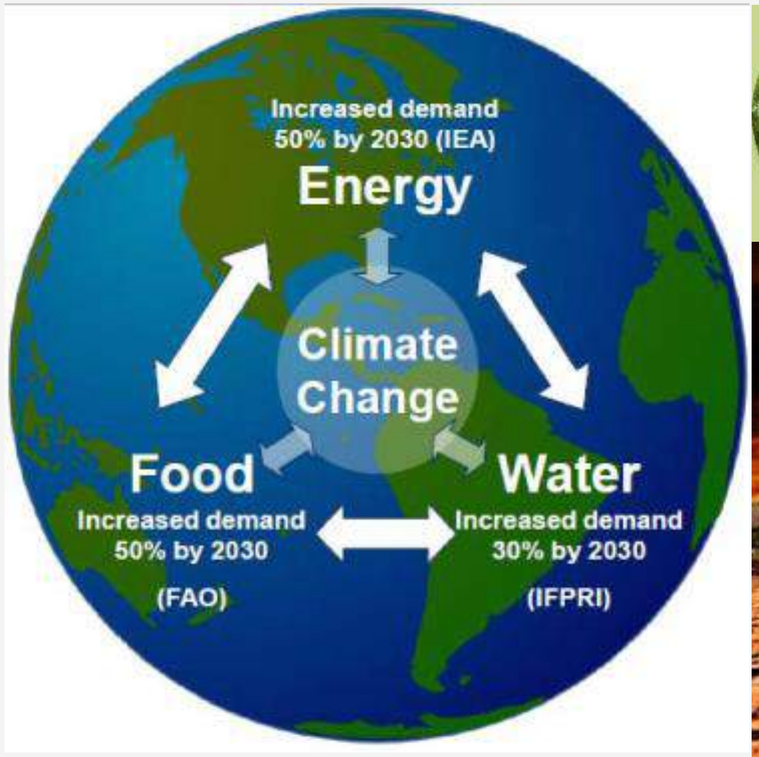
Climate change, the Earth system, and the WEFH Nexus



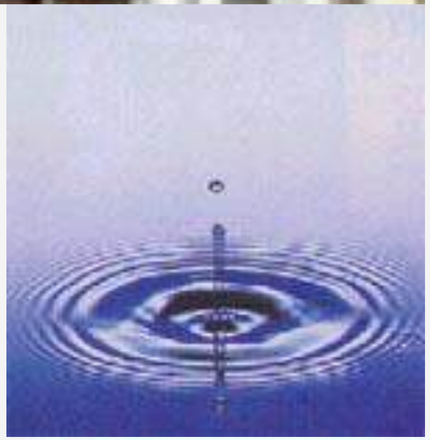


Source: Qu, J, J and R. P. Motha, 2021, Climate Change and a Sustainable Earth, Cambridge Scholars Publishing, (in press)

Water-Energy-Food-Health (WEFH) Nexus



It is predicted that by 2030 the world will need to produce around 50 per cent more food and energy, together with 30 per cent more fresh water, whilst mitigating and adapting to climate change (adapted from: BIS and WMO GFCS) http://www.wmo.int/gfcs/



Water-Energy-Food-Health Nexus

Water Quantity, Air Quality, Surface Water, Underground Aquifers, Reservoir Management, Urban Supplies, National Policy, International Water Rights, and Public Healthy.

AWEFH - Objective / Innovation

- Objective

Enhance collaboration to build an interdisciplinary knowledge-based and operational climate action program in Africa emphasizing on a synergistic approach to climate change

- Innovation

Exploit satellite remote sensing, modeling, machining learning, and information technology for AWEFH Nexus monitoring and early warning

Linking AWEFH Nexus to Adaptation reporting

1. Impacts, Risks, and Vulnerabilities:

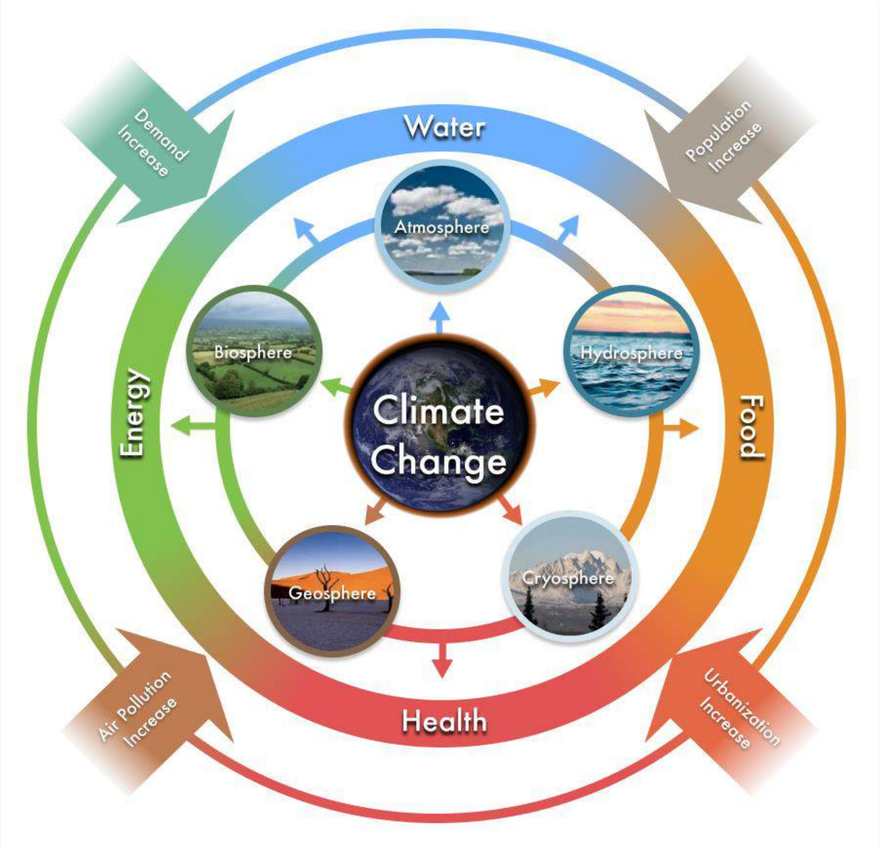
- Assesses climate impacts on water, energy, food, and health systems.
- Provides critical data for understanding national vulnerabilities.

2. Adaptation Actions:

- Promotes integrated solutions like water-efficient energy production and sustainable agricultural practices.
- These actions can be reported as part of national adaptation strategies.

3. Monitoring and Evaluation:

- Uses advanced data systems like LIDMIS (Large Integrated Data Management Information System).
- Provides a robust framework for tracking adaptation progress and outcomes.



Linking AWEFH Nexus to Adaptation reporting

1. Ground Measurements, Remote Sensing, and GIS Technology:

- Monitors water, energy, and agricultural resources with high accuracy.

- Aligns with the ETF’s need for comprehensive data to inform adaptation reporting.

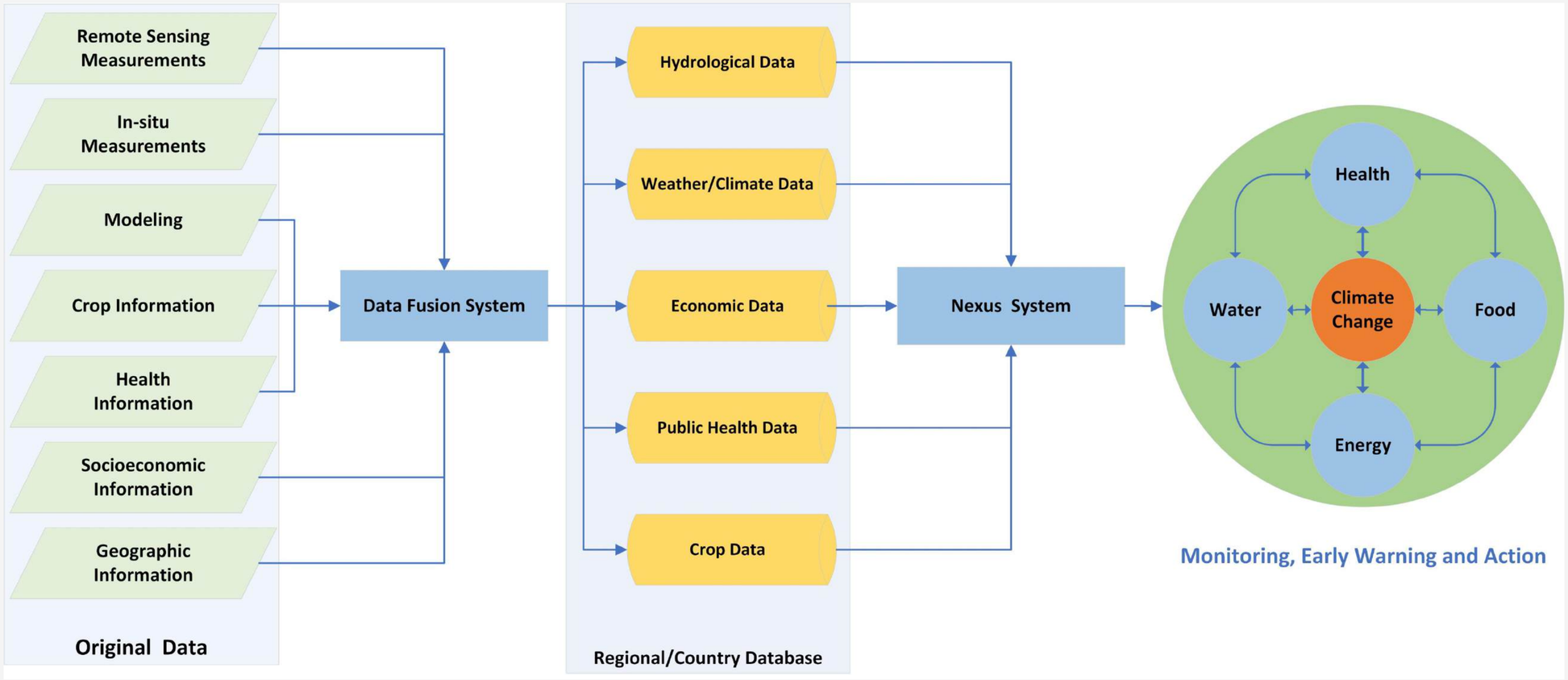
2. Decision Support System (DSS):

- Provides actionable insights for policymakers.

- Essential for effective adaptation planning and reporting.

Monitoring and Evaluation Tools

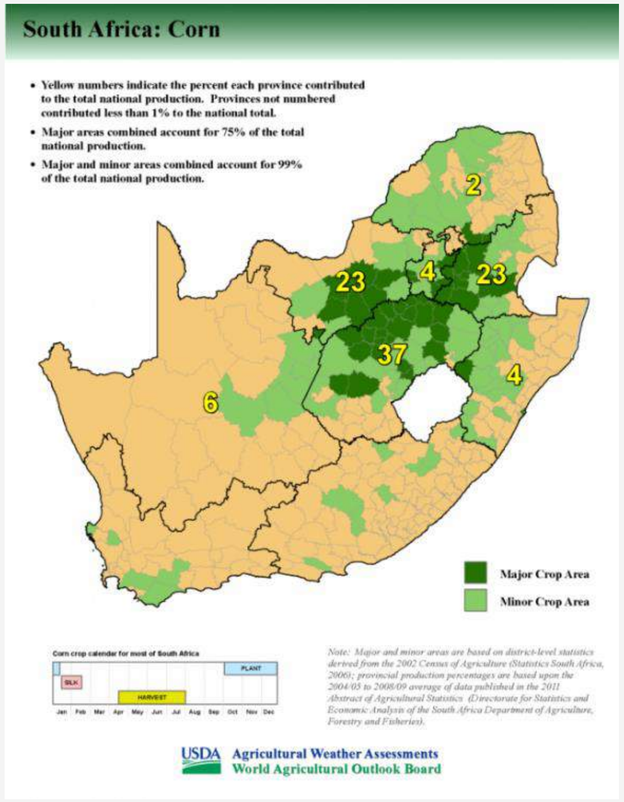
- Monitoring and early warning of the AWEFH Nexus

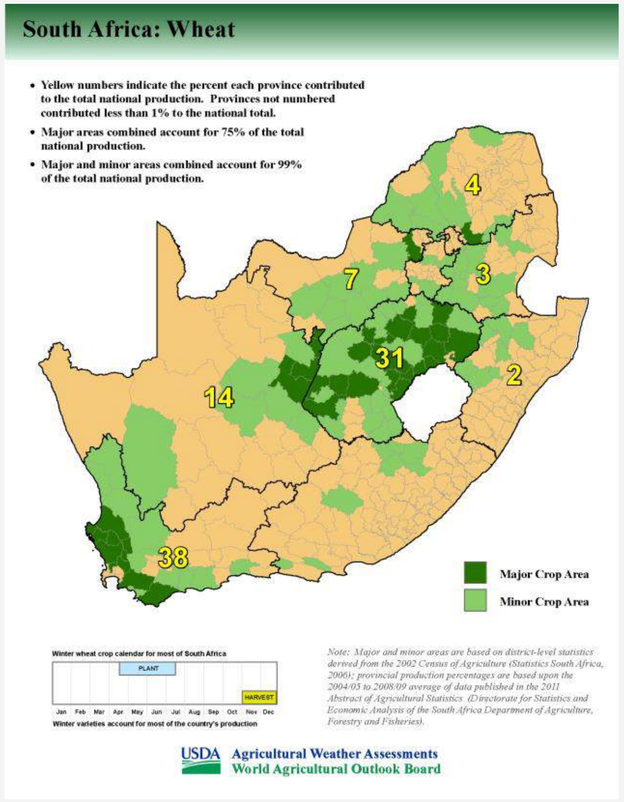


Case Studies: Examples from Africa

- Crop Mapping

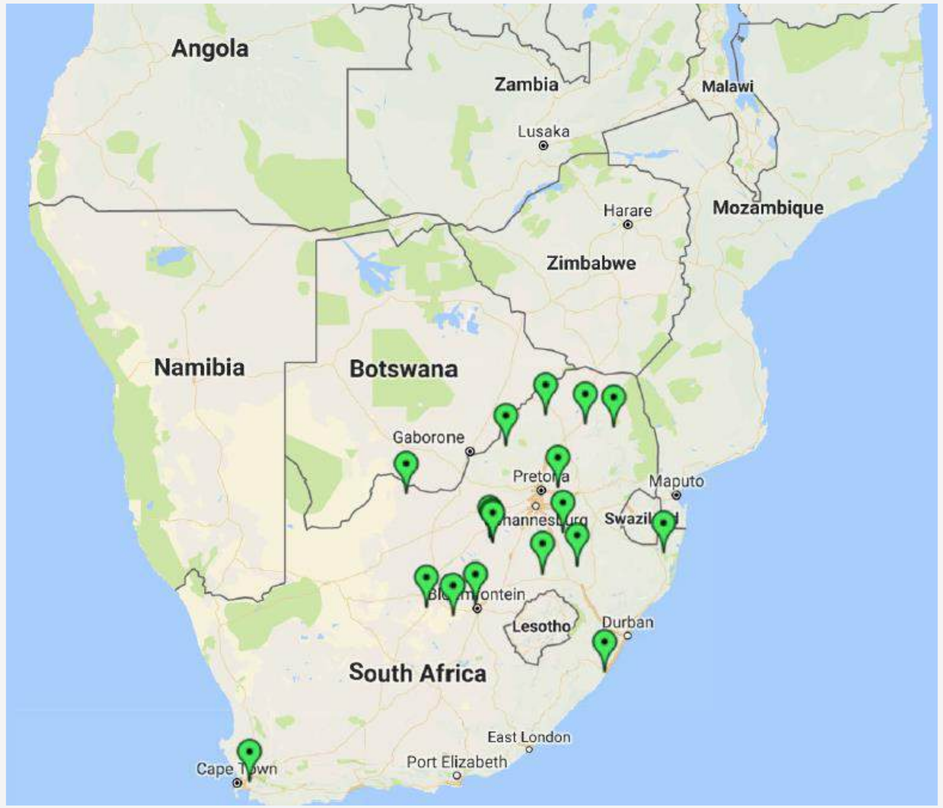
Supported by USDA World Agricultural Outlook Board (WAOB)
Map crop type, calendar, yield, planting areas, production of each country at state or county level.

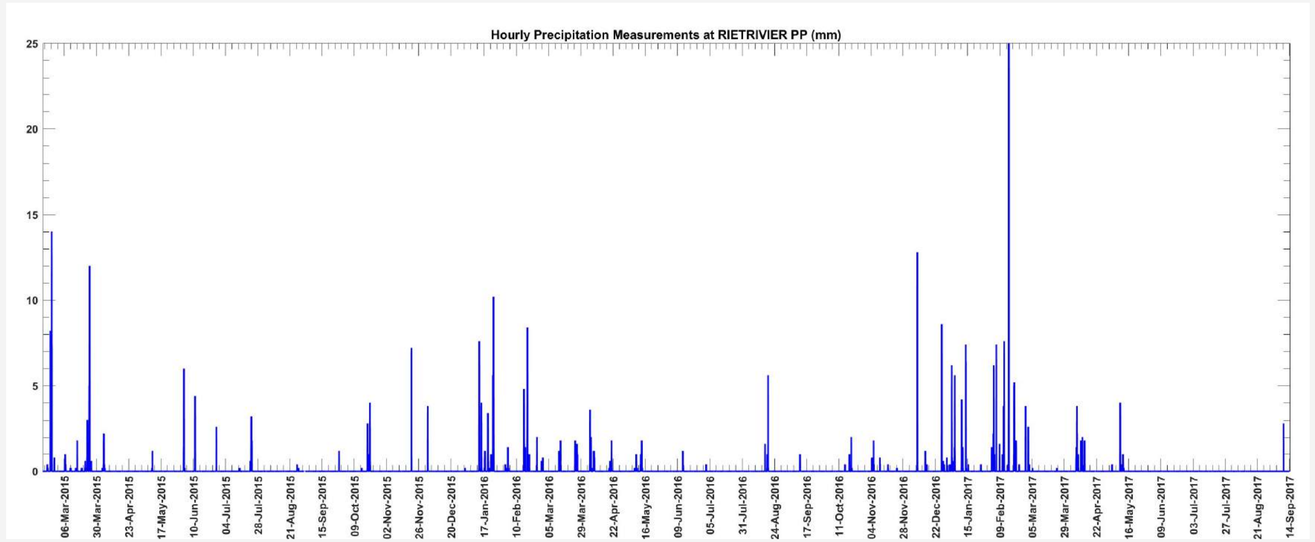


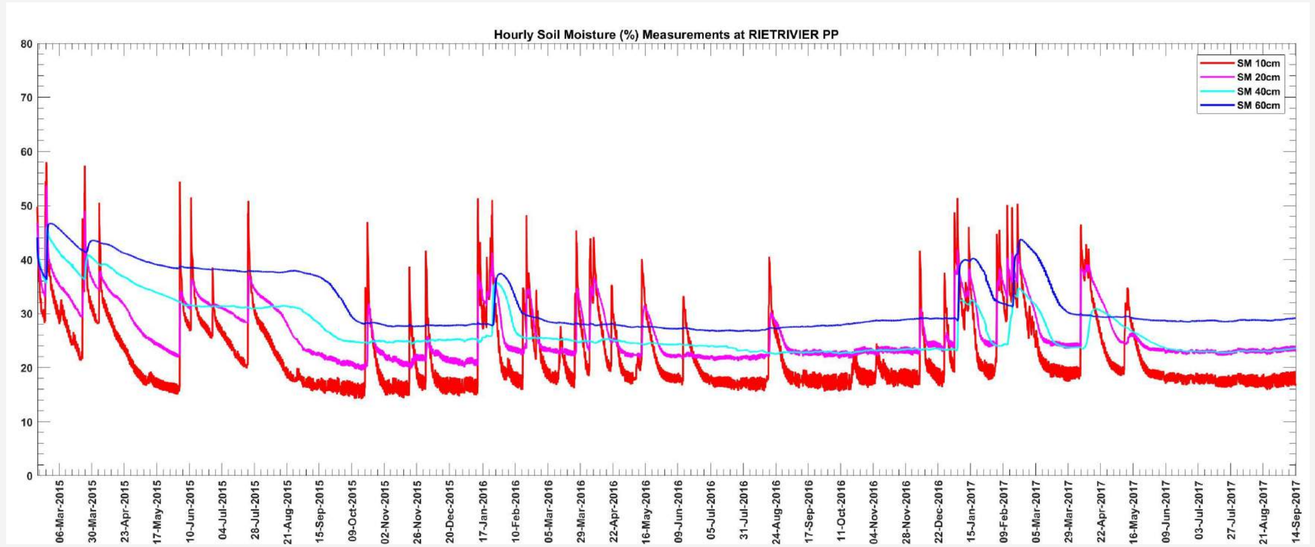


❑ WMO SMDP Project in South Africa

Built system for drought monitoring and food security assessment. Integrate satellite remote sensing and ground observations in South Africa.







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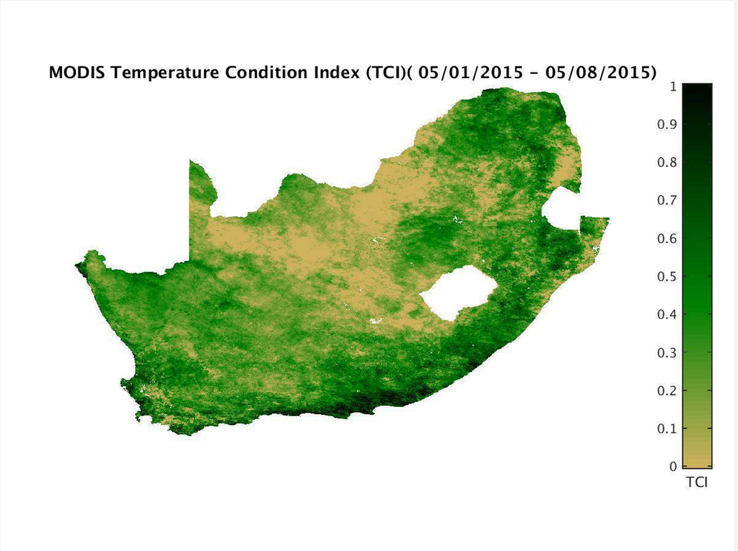
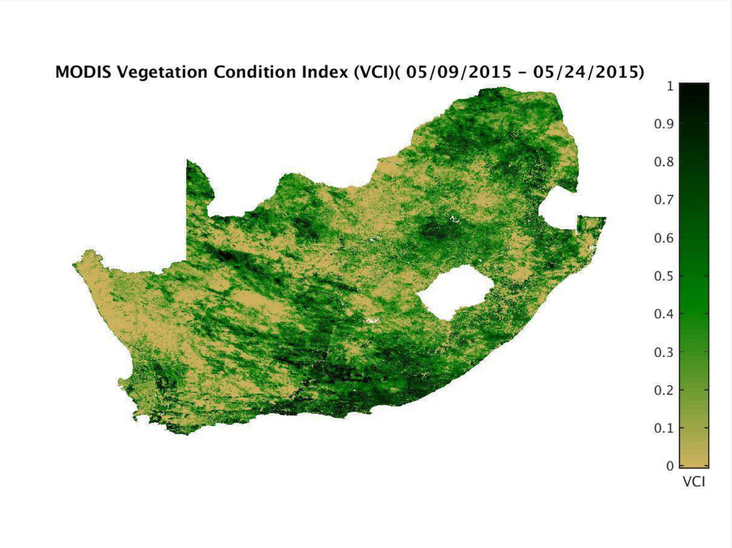
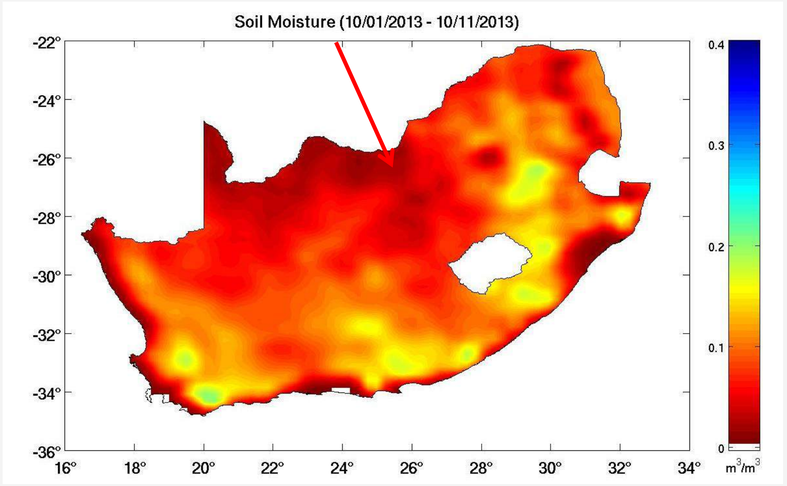
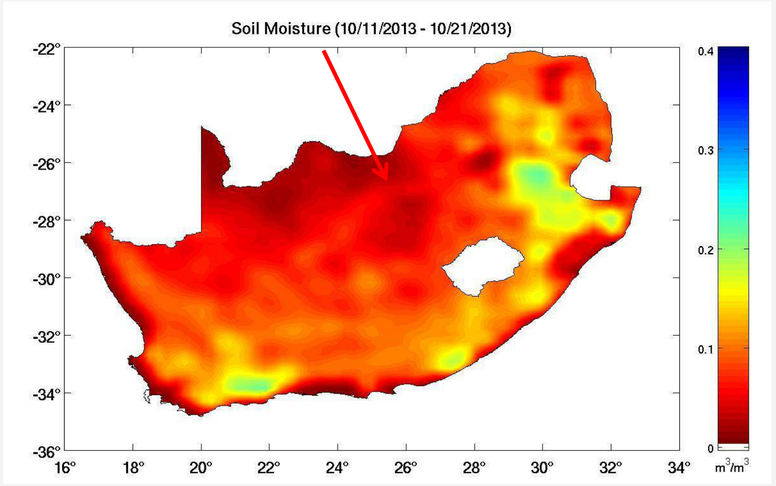
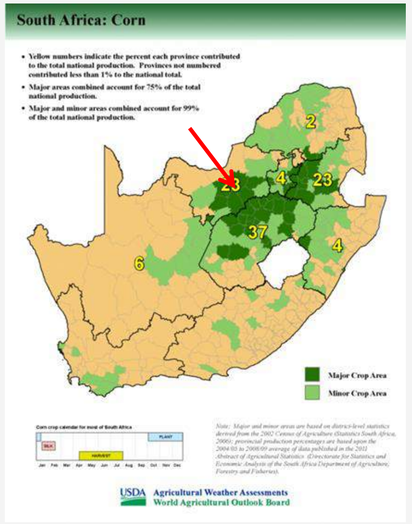


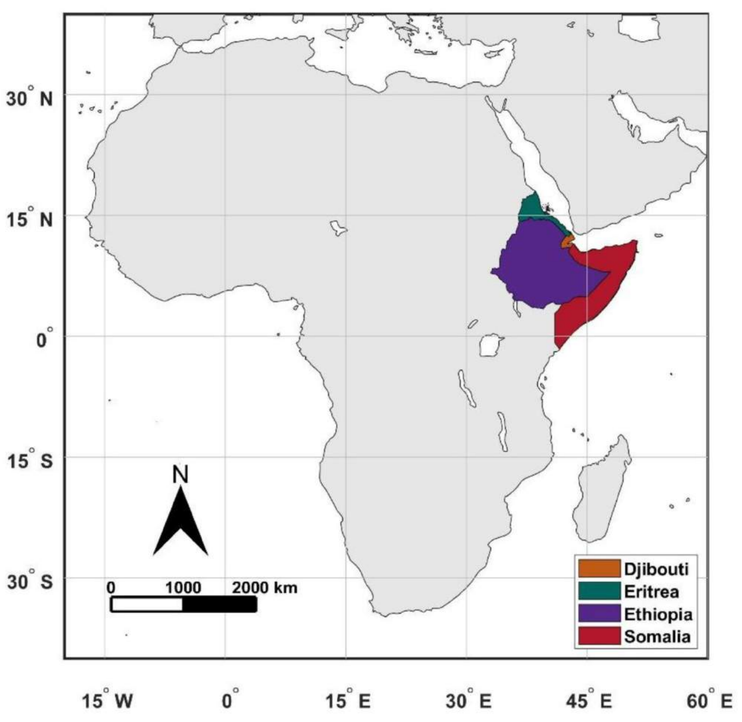


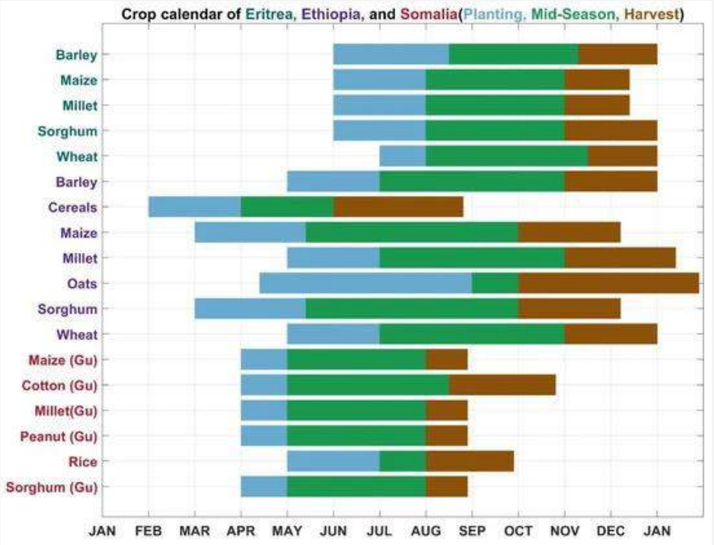


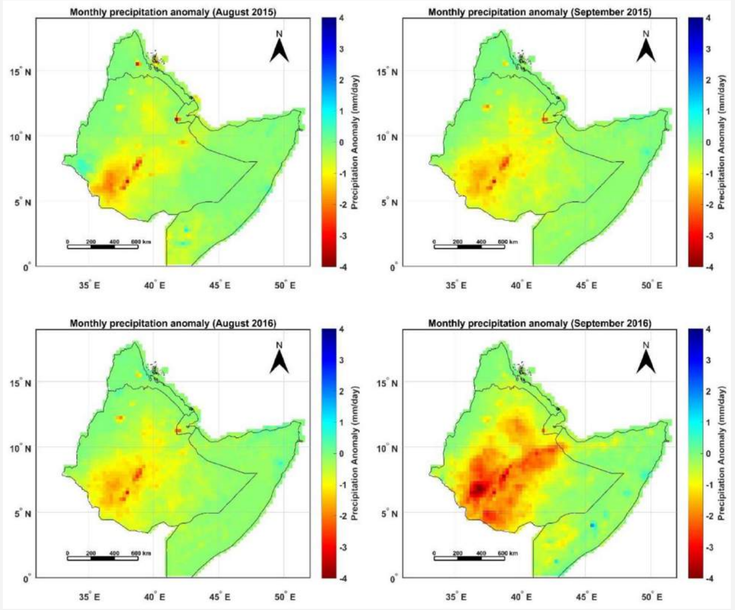


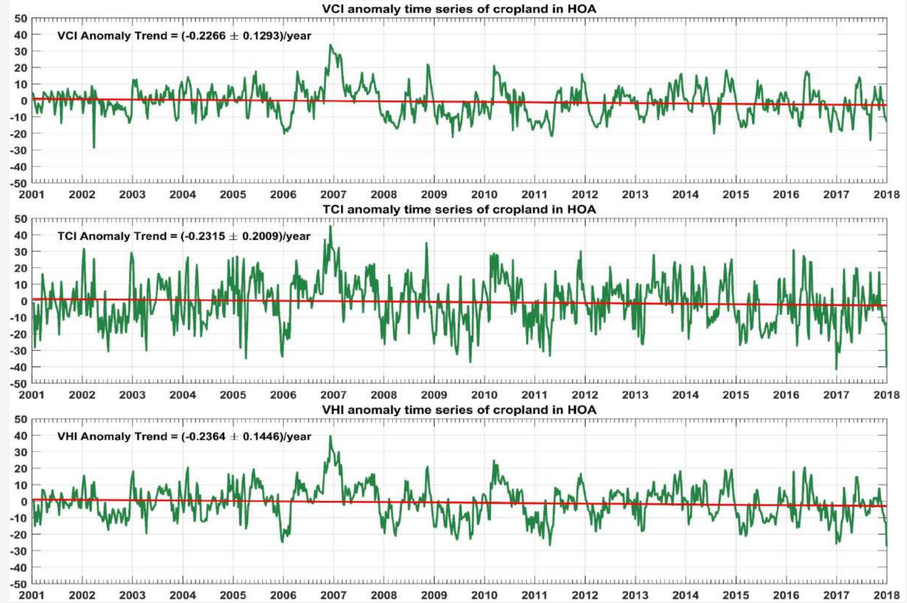


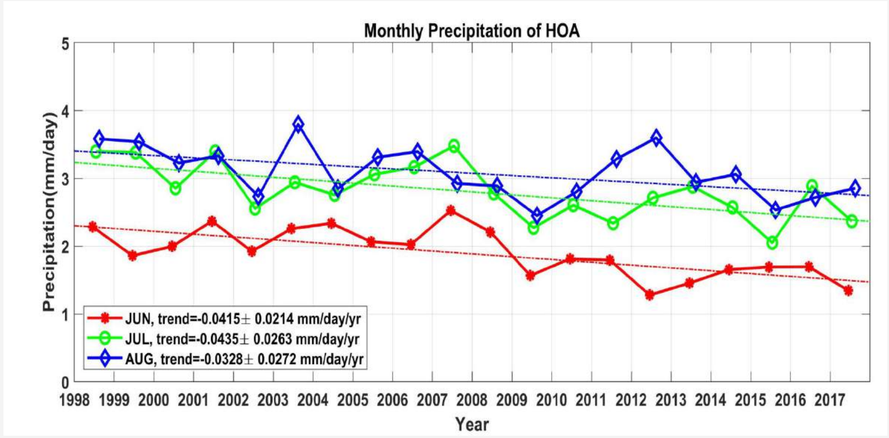
❑ Drought and food security monitoring in Horn of Africa



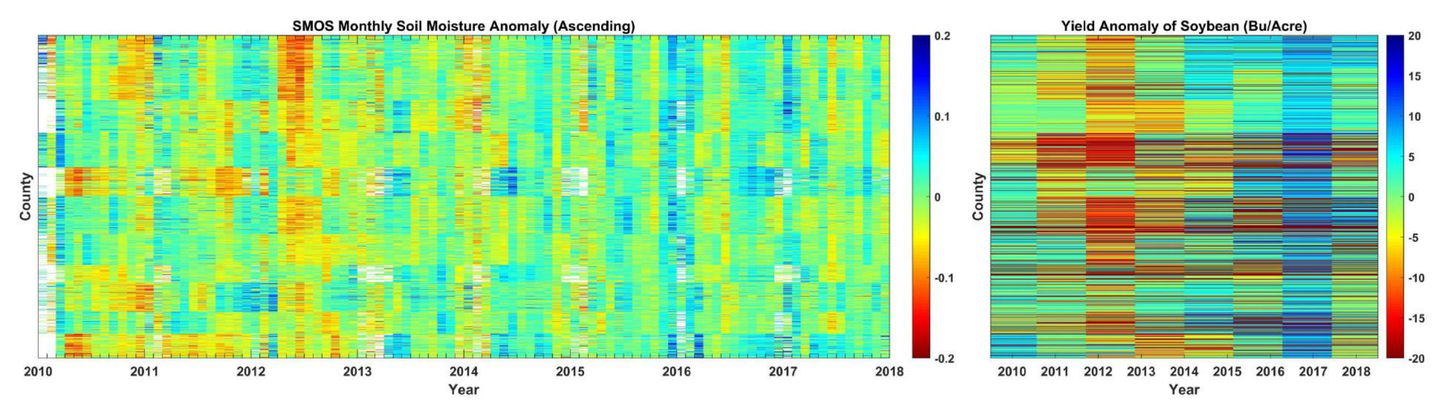


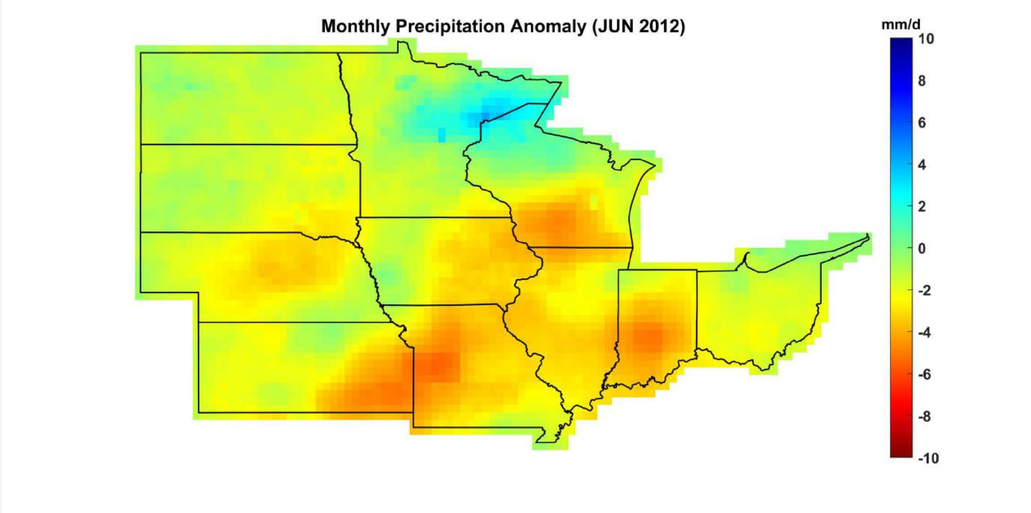


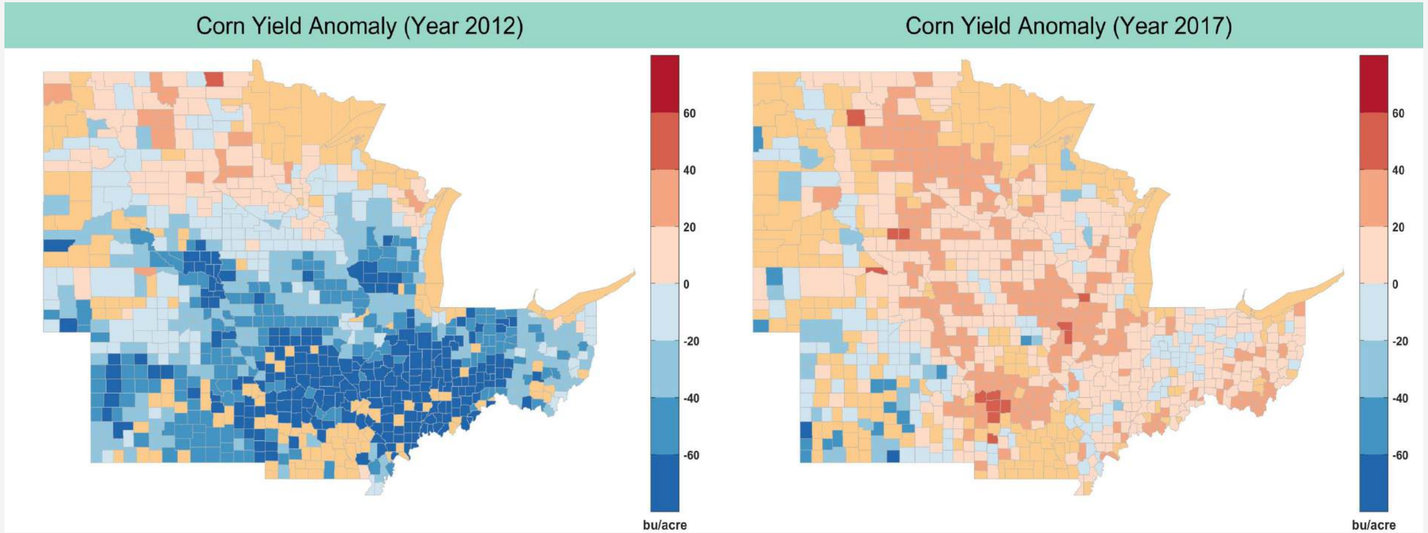


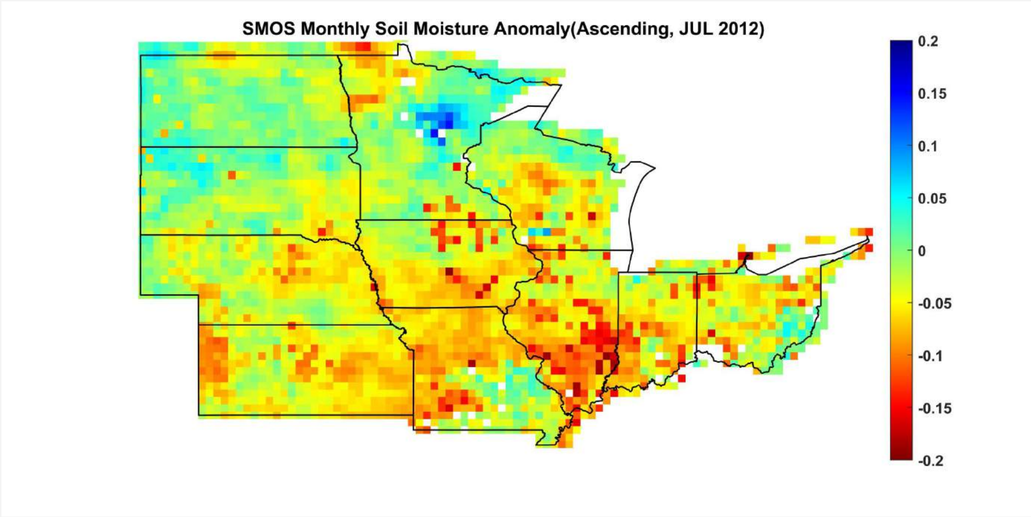


❑ US drought and food security monitoring









Capacity Building

UNEP/GMU Training Workshops on Mapping and Monitoring Natural Resources of Africa Using Remote Sensing and GIS Data

- Advanced remote sensing techniques to tackle environmental issues

Empower professionals to address：

- Air quality
- Energy resources
- Natural capital

Recommendations for Integrating AWEFH Nexus into ETF reporting

1. Policy integration

- Integrate AWEFH Nexus data and tools into national adaptation reporting (e.g., NAPs, BTRs).
- Develop standardized guidelines for using AWEFH Nexus outputs in ETF reporting.

2. Scaling up

- Expand the AWEFH Nexus to other vulnerable regions to address adaptation challenges.
- Share best practices and lessons learned to enhance global adaptation reporting.
- Build partnerships with international organizations (e.g., WMO, UNEP, FAO) to support scaling efforts.

Conclusion

Through the AWEFH Nexus, we've demonstrated how integrated approaches to water, energy, food, and health systems can enhance climate adaptation. Our experience highlights the value of combining satellite data, ground measurements, and decision support tools to address complex climate challenges. By sharing these insights, we hope to inspire similar efforts globally and support effective adaptation reporting under the ETF.

THANK YOU