Workshop Report on

Training Workshop on Building Earth Observation Capacities to Address the Water-Energy-Food Nexus in Asia

December 10, 2024

Asia Hub

Water-Energy-Food Nexus Knowledge-Action Network

Monsoon Asia Integrated Research for Sustainability- Future Earth

EXECUTIVE SUMMARY

The two-day training workshop convened seven (8) researchers and policymakers, and 20 early-career scientists to address Asia's pressing Water-Energy-Food (WEF) Nexus challenges—exacerbated by climate change, urbanization, and population growth—through Earth Observation (EO) technologies. By fostering regional capacity-building and collaboration, the event emphasized EO's role in enabling data-driven decision-making for sustainable resource management, aligning with Future Earth's Nexus Knowledge-Action Network (NEXUS KAN) and the Monsoon Asia Integrated Research for Sustainability – Future Earth (MAIRS-FE)

Key Challenges Addressed

1. *Data Gaps:* Fragmented ground-based monitoring systems and inconsistent reporting standards hinder effective WEF governance.
2. *EO Solutions*: Satellite data (e.g., NASA's Landsat, ESA's Sentinel, Thailand's THEOS-2) offer scalable, real-time insights into land-use changes, water availability, and climate impacts. These solutions align with NEXUS KAN's focus on leveraging big data for transdisciplinary problem-solving and MAIRS-FE's emphasis on monsoon-driven climate dynamics and socio-environmental systems.

Objectives Achieved

1. *Capacity Building*: Enhanced technical skills in EO data processing, coding, and analysis through hands-on training.
2. *Awareness & Collaboration*: Introduced cutting-edge EO tools (e.g., NASA, ESA, GISTDA datasets) and fostered partnerships across institutions and space agencies.
3. *Policy-Science Bridge*: Highlighted EO's potential to translate research into actionable policies for WEF resilience, complementing NEXUS KAN's emphasis on science-policy integration.

Key Outcomes

1. *Empowered Young Researchers*: 20 early-career scientists from Global South countries participated in the training workshop, gaining mentorship and technical expertise.
2. *Advanced EO Applications*: Case studies demonstrated EO's utility in monitoring food production, assessing climate variability, and modeling policy scenarios.
3. *Regional Synergies*: Strengthened ties between Asian and international stakeholders, with calls for sustained collaboration, echoing NEXUS KAN's push for cross-sectoral and transboundary solutions.

Key Takeaways

1. *Capacity Building*: Need for continuous training programs tailored to non-English speakers and low-bandwidth users, an ongoing challenge recognized by Asia Hub and NEXUS KAN.
2. *Interdisciplinary Action*: EO integration requires collaboration across sectors (academia, governments, space agencies).
3. *Policy Integration*: EO data must inform frameworks for sustainable WEF governance, supporting NEXUS KAN's goal of co-producing actionable knowledge.

Recommended Next Steps

1. *Expand Training*: Develop follow-up workshops and online resources to deepen EO expertise.
2. *Form Working Group*: Establish an Asia Hub-led group to advance EO-WEF synergies, leveraging the existing networks established by the Asia Hub, MAIRS-FE, and NEXUS KAN in the region.
3. *Policy Engagement*: Translate research into actionable insights for decision-makers, ensuring EO-informed policies contribute to climate resilience and sustainable development.

Conclusion

The workshop underscored EO's transformative potential in addressing Asia's WEF challenges. By prioritizing capacity-building, collaboration, and policy relevance—key principles of Future Earth's NEXUS KAN and MAIRS-FE programs— the event laid the groundwork for scalable, data-driven solutions to enhance regional climate resilience and resource security.

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WORKSHOP REPORT

1. Introduction

The Training Workshop on Building Earth Observation (EO) Capacities to Address the Water-Energy-Food (WEF) Nexus in Asia took place from November 10-12, 2024, at Chiang Mai University, Thailand. Organized by Asia Hub in collaboration with MAIRS-FE and NEXUS GRNs, the workshop aimed to strengthen regional capacity in EO applications for WEF sustainability.

Asia faces growing challenges in managing its water, energy, and food resources due to climate change, rapid urbanization, and increasing population pressures. Effective decision-making within the WEF systems requires high-resolution, timely, and reliable data—yet many regions suffer from data scarcity, fragmented monitoring networks, and inconsistent reporting standards. Ground-based measurements, while valuable, are often limited in spatial and temporal coverage, making it difficult to assess large-scale environmental changes or predict future trends accurately. Remotely sensed data from satellites and other Earth Observation (EO) platforms provide a transformative solution to these challenges. EO technologies offer: 1) Consistent and large-scale monitoring of land, water, and atmospheric conditions; 2) Real-time and historical data for analyzing long-term trends and sudden environmental shifts; and 3) High-resolution insights that support decision-making in agriculture, hydrology, and energy planning.

Traditionally, the WEF community has relied on EO data from global space agencies such as NASA (e.g., Landsat, MODIS, SMAP) and ESA (e.g., Sentinel satellites). However, recent advancements in Asia's EO satellite programs provide additional resources for WEF applications. Other space agencies, such as Thailand's GISTDA (Geo-Informatics and Space Technology Development Agency), have developed EO missions tailored to local environmental and resource management needs. For instance, Thailand's THEOS-2 provides high-resolution imagery-based monitoring capabilities that are increasingly being used in WEF studies.

This workshop served as a platform to train researchers, policymakers, and early-career scientists in applying EO methodologies to WEF challenges while fostering interdisciplinary collaboration across academic and institutional partners. By equipping participants with technical skills and access to diverse EO datasets, the workshop aimed to enhance data-driven decision-making, improve resource management strategies, and build climate resilience in the region.

2. Rationale and Objectives

The workshop was designed to:

1) Strengthen regional EO expertise for WEF sustainability,
2) Introduce state-of-the-art EO technologies, tools, and datasets to researchers and practitioners,
3) Provide hands-on training to enhance technical skills in EO-based analysis,

4) Foster collaboration between institutions, space agencies, and researchers working on WEF Nexus challenges, and
5) Bridge the gap between scientific research and policy-making for WEF resilience in Asia.

The event focused on both theoretical and applied aspects of EO in the WEF studies and included technical training, interactive discussions, and case studies to ensure that participants could translate EO capabilities into WEF Nexus studies.

3. Reflection and Key Takeaways

1) Empowering Young Scientists and Early-Career Researchers

A major success of this workshop was its ability to engage young scientists, engineers, and early-career researchers in geospatial science from global south countries in their research and studies on WEF-related issues. Through the training lectures and exercises, participants benefited in the following aspects:

- Exposure to cutting-edge EO data, products, and information for WEF nexus research and applications.
- Hands-on training that enhanced technical skills in remote sensing and geospatial analysis, including data searching, downloading, processing, computer program coding, and applications.
- Mentorship opportunities through interactions with leading experts in EO and WEF to learn the challenges, progress, and future directions in WEF research and applications.

The active participation of young researchers demonstrated the growing interest and need for EO-driven WEF research, reinforcing the importance of sustained capacity-building efforts in Asia.

2) Advancing EO Awareness and Applications in the WEF Community

The workshop provided valuable exposure to geospatial technologies and EO data sources from various international and regional agencies, including NASA (Landsat, MODIS, SMAP), ESA (Sentinel satellite missions), and regional EO programs such as those from Thailand (GISTDA). Through interactive sessions and case studies, participants explored the potential of EO in several important areas related to WEF security:

- Monitoring land-use change, water availability, and food production.
- Assessing climate variability and its impacts on WEF security.
- Developing predictive models for policy and decision-making.

These discussions helped bridge theoretical knowledge and real-world applications, reinforcing EO as a powerful tool for addressing WEF challenges.

3) Capacity Building as a Catalyst for Regional Collaboration

The workshop demonstrated the value of long-term capacity building for tackling emerging WEF challenges. Key insights included:

- The need for continuous training programs to ensure that EO tools are widely accessible, particularly to communities with limited bandwidth and non-English language users.
- The importance of interdisciplinary and multi-institutional collaboration to maximize EO's impact.
- The role of EO in supporting policy frameworks for sustainable WEF governance.

Participants expressed strong interest in sustained engagement and follow-up activities, highlighting the demand for additional workshops, networking opportunities, and collaborative research initiatives in the region.

4. Outcomes Achieved

The workshop successfully:

- Enhanced technical skills in EO applications for WEF research.
- Strengthened collaboration between Asian and international researchers.
- Expanded awareness of geospatial data sources and analytical tools.
- Facilitated knowledge exchange on climate adaptation and WEF resilience strategies.
- Identified future research priorities, ensuring that EO-driven WEF studies remain a key focus in the region.

Feedback from participants emphasized the practical value of EO training and the importance of interdisciplinary approaches in addressing Asia's pressing WEF challenges.

5. Conclusion and Next Steps

The workshop reinforced the critical role of Earth Observations in WEF research, demonstrating its potential for informed decision-making and policy development. Moving forward, the Asia Hub and its partners plan to 1) Further expand training opportunities with follow-up workshops and online learning resources; 2) Strengthen regional collaboration by creating a working group (WG) within the Asia Hub network on EO-WEF synergies and integration; 3) Promote policy engagement by translating EO-WEF research into actionable insights for decision-makers.

By fostering capacity-building efforts and interdisciplinary research, this workshop marked an important step toward advancing EO applications for WEF research in Asia.

Appendix A: Training Workshop Agenda

November 10-12, 2024
Chiang Mai University, Chiang Mai, Thailand

Workshop Objectives:

This is a strategic initiative within the water-energy-food (WEF) nexus community to enhance the utilization of Earth Observations (EO) in decision-making. It builds upon ongoing regional efforts by the Asia Hub partners, leveraging collaboration with MAIRS-FE and NEXUS GRNs. The goal of this workshop is to enhance regional capacity, expanding the scope of EO applications within the framework of Future Earth's WEF Nexus studies and other relevant GRNs. The technical skills through this workshop should help enhance the local capacity to advance WEF Nexus research.

Expectations:

Participants should make every effort to attend the lectures and hands-on exercises, prepare EO and WEF-related questions/issues in their research, contribute to in-class discussions, and participate in workshop surveys.

Workshop Venue:

Workshop: Uniserv Building, Chiang Mai University – 239 Huay Kaew Road Suthep District, Chiang Mai 50200 Thailand

Lodging: L-Nimman Hotel - 19 Nimmanahaeminda Road, Suthep, Mueang Chiang Mai District, Chiang Mai 50200, Thailand

Workshop Agenda:

Saturday, November 9, 2024

- Workshop participants arrive and check in at the L-Nimman hotel
- Registration will be from 15:00-17:00 in the lobby of L-Nimman and again Sunday morning
- Reception at Ginger Farm at 6:00 pm

Sunday, November 10, 2024 – EO WEF Training Workshop, Uniserv, CMU

8:00 – 9:00	Check-in/registration
9:00 – 9:10	Workshop logistics • Sanchai Jatursitha, CMU
9:10 – 9:30	Workshop introduction and objectives • Jiaguo Qi, Asia Hub / MSU
9:30 – 10:30	Session 1: EO for WEF Studies – US Experiences • Richard Lawford, EO4WEF
10:30 – 11:00	Coffee break
11:00 – 11:30	Session 1 (*cont.*): EO for WEF Studies – US Experiences • Richard Lawford, EO4WEF
11:30 – 12:00	Q/A and discussion • Facilitator: Richard Lawford
12:00 – 13:00	Lunch break
13:00 – 15:00	Session 2: EO for WEF Studies – EU Experiences

- Quentin Paletta, ESA

15:00 – 15:30 Q/A and discussion with Quentin Paletta
- Facilitator: Quentin Paletta

15:30 – 16:00 Coffee break

16:00 – 17:30 Session 3: Hands-on GEE Exercises – EO Data Sources and Processing
- Shiqi Tao, Asia Hub / NAU

17:30 – 18:00 Session 4: Reflection on Day 1 training
- All workshop participants

18:30 – 20:00 Dinner at Ruen Rak Thai Kitchen

Monday, November 11, 2024 – EO WEF Training Workshop, Uniserv, CMU

8:30 – 9:30 Session 5: EO for WEF Studies – Thai EO's systems, products & services
- Tanita Suepa, GISTDA, Thailand

9:30 – 10:30 Session 6: EO for WEF Studies – Applications and Demonstration for WEF
- Siam Lawawirojwong, GISTDA, Thailand

10:30 – 11:00 Visit with MSU Provost and Coffee break

11:00 – 12:30 Session 7: EO Data in WEF Studies – Examples from Asia Hub /MSU
- Yadu Pokhrel, Asia Hub / MSU

12:30 – 13:30 Lunch break

13:30 – 14:30 Session 8: EO WEF Research experiences and future priorities
- A.K. Saiful Islam, BUET, Bangladesh

14:30 – 15:30 Session 9: Interaction with experts
- Workshop participants will present their questions and future plans
- Quentin Paletta, Rick Lawford, Saiful Islam, Siam Lawawirojwong, Tanita Suepa, Yadu Pokhrel

15:30 – 16:00 Coffee break

16:00 – 17:00 Workshop summary, survey, and wrap-up
- Jiaguo Qi