



Science for Solutions decade: **HELPING**
Hydrology Engaging Local People IN one Global world
IAHS Scientific Decade 2023-2032
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Details of the Working Group – Water's integral role in the water-energy-food-ecosystem (WEFE) nexus

Describe the work and how your suggested working group will contribute to the goal(s): This working group seeks to build upon the collective strengths of its members to foster international research and educational opportunities related to the water-energy-food-ecosystem (WEFE) nexus. The group promotes co-creation, systems thinking and holistic solutions for water security through the following work: (1) Collaborative Research: Facilitation of research collaborations, co-creation and knowledge sharing among water, energy, food, and ecosystem experts from different regions to investigate the complex interactions between hydrological, socio-economic and ecological systems in a changing world.

(2) Data Integration and Sharing: Promotion of data exchange across disciplines and nexus case studies, which allows uncovering common patterns, unique challenges, and shared experiences to develop a holistic understanding of the interlinkages and feedback loops between sectors.

(3) Integration of innovative methodologies: Exploration of possible integrations of qualitative and quantitative approaches to enhance understanding and water-related decision-making in a complex interconnected system. Emphasis will be on the potential of using innovative data-driven methods to address key challenges in nexus research related to the multiplicity of scales, high dimensionality, and exposure of the nexus to extreme events.

(4) Framework Development and Modelling: Co-creation of flexible and adaptable frameworks that can accommodate the diverse aspects of nexus research and provide a structured approach to understanding and modelling the complex nature, interlinkages and feedback loops between water, energy, food and ecosystem services in a changing world.

(5) Policy and Management Recommendations: Synthesis of key insights and lessons learned from collaborative analyses and group discussions, which will be used to develop general guidelines and recommendations to support efficient policy processes and ensure sustainable water resource management practices that also prioritize sustainable resources use in the other sectors.

Describe the methods you will use to achieve the goal(s): The working group aims to establish a regular schedule of both online and offline meetings, workshops, seminars, and conferences, all designed to promote effective research collaborations. The group will actively seek funding to support these initiatives.

The group will employ various approaches such as literature reviews, data synthesis, framework development, data-driven modelling (including stochastic, system-dynamics, and agent-based approaches), Delphi studies, interviews, surveys, expert judgments, or case study analyses. These

diverse methods will enable a thorough exploration of water's integral role in the water-energy-food-ecosystem (WEFE) nexus and contribute to the group's objectives.

Describe the (a) short-term, (b) the long-term and (c) the ultimate results you hope to achieve:

(a) Short-term Results: Bringing together research groups and individuals by creating a platform for exchange and knowledge transfer. Initiating new research collaborations and concerted efforts to push the boundaries of nexus research, breaking disciplinary siloes and increasing the collaboration and knowledge sharing between hydrologists and other experts working on the WEFE nexus.

(b) Long-term Results: Advanced modelling and prediction techniques to address the diverse scales, high dimensionality, and vulnerability of the nexus to extreme events, eventually enhancing our ability to quantify and comprehend the complex interactions between water and other sectors, as well as the challenges and opportunities within the WEFE nexus.

(c) Ultimate Results: Adoption and implementation of integrated solutions that address the water-energy-food-ecosystem nexus challenges at different spatiotemporal scales and improve water security, energy efficiency, sustainable agriculture, and ecosystem health through holistic approaches.

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