

Optimizing the Water-Energy-Food Nexus in the Asia-Pacific Ring of Fire

**Inaugural Water-Energy-Food Nexus Workshop;
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Climate change and economic development are causing increased pressure on global water, energy, and food resources, presenting increased levels of trade-offs and conflicts among these resources and stakeholders. Because these resources are interconnected, policy development and resource management require careful consideration of the complex interconnections between nature and society. A balance between risk and resilience is critical for achieving human and environmental security, particularly in Asia's region within the "Ring of Fire," which is experiencing drastic social change alongside the huge potential risks and benefits associated with development. The 2011 Fukushima nuclear accident and aftermath underscore the importance of developing policy and management options that maximize security and minimize risk within the water-energy-food (WEF) nexus.

More than 50 scientists from the United States, Canada, Indonesia, the Philippines, and Japan gathered at the Research Institute for Humanity and Nature (RIHN) in Kyoto, Japan, to discuss the WEF nexus within these Ring of Fire countries. This inaugural workshop coincided with the launch of RIHN's

new 5-year project, Human-Environmental Security in the Asia-Pacific Ring of Fire: WEF Nexus. The outcomes of the workshop will help address the question of how communities can maximize human-environmental security by choosing policies and management structures that optimize the WEF nexus.

Participants presented country-specific conflicts and trade-offs in the WEF nexus; a common recommendation was that stakeholders would benefit from a decision-making process that is informed early by science. For example, in Japan, conflict resolution between geothermal power generation and hot spring businesses that tap a shared but limited geothermal resource requires an evaluation of social-economic-environmental trade-offs. Common research questions emerged from the presentations and discussions: How can we best manage the trade-offs between nexuses? What is the role of stakeholders in trade-offs and environmental security? What factors determine the optimal governance structure for environmental security? What general lessons can be drawn from each country and the Asia-Pacific region?

Participants discussed how studies can be designed to best meet country-specific objectives and allow for intercomparison. The consensus was a risk-based framework, which

allows for stressors and impacts to be evaluated using a place-based risk assessment. To enable intercomparison, a common set of risk and resilience indicators was proposed, and approaches for evaluating these indicators will be codeveloped as the project progresses.

Finally, the participants discussed and recommended four interdisciplinary approaches: environmental governance, science in/for society, and codesign/coproduction approaches; biophysical measurements/analyses using geochemical, coastal oceanographic, geophysical, satellite, hydrological, and ecological techniques; social measurements/analyses using community surveys, cost-benefit/efficiency analysis, and environmental valuation from socioeconomic, anthropology, psychology, and behavior science methodologies; and development of integrated indicators/indices and network analyses of feedback from stakeholder meeting/workshops.

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