

# RIHN Initiative Projects

RIHN Initiative Projects are developed through intensive discussion at RIHN of past, present and future research objectives (see page 5). They operate within a major field of thought roughly analogous to the ancient Greek realms described by Gaia, Oikos and Ethos.

## **GAIA Initiative**

As human societies design their futures they require best understandings of the Earth's natural dynamism, and the significance of human action within it. The Gaia Initiative therefore performs investigations of the biophysical bases of humanity at multiple spatial and temporal scales. The Initiative emphasizes description of physical standards related to boundaries and thresholds so as to allow analysis of, and best eco-technological adaptations to, dynamic Earth environments.

## **OIKOS Initiative**

Research in the Oikos Initiative investigates the practices and knowledge systems through which cultures and communities humanize environments. It emphasizes the human ecologies and economies—from modern techno-centric to traditional—associated with environmental commons. The Oikos Initiative therefore emphasizes examination of the values associated with resource use, and the importance of linking a range of eco-technologies and social equity.

## **ETHOS Initiative**

The Ethos Initiative examines the values and dynamics affecting human ecological knowledge, especially in relation to the key areas of food production and human health. The Initiative describes the relationship between environmental knowledge, including that embedded as cultural value and sense of self, on quality of individual and community life.



# Designing Local Frameworks for Integrated Water Resources Management

Project Leader **WATANABE Tsugihiko** RIHN

Tsugihiko WATANABE received his doctor's degree in agricultural engineering from Kyoto University in 1986. He was the leader of RIHN's Research Project "Impacts of climate change on agricultural production system in arid areas", which had been implemented from 2002 until 2007, mainly in the Mediterranean region of Turkey. He is interested in irrigation as an expression of local wisdom of land and water, and its functions to sustain local environment and to adapt to global changes.



World water and food resources are under pressure. Population growth and development will increase aggregate demand for freshwater just as climate change is predicted to affect the historical spatial and temporal patterns of water availability. Since hydrologic cycles and agricultural systems are so closely linked, human societies must plan for change in both in relation to increasing demand and predicted increases in water-related disasters such as flood and drought.

This project conducts extensive historical and contemporary evaluation of several local-scale agricultural water management regimes, seeking principles that promote, or blockages that hinder, efficient water-use. Combining best quantitative measures of water flow, use, and quality, and insights from irrigation engineering, historical description and institutional analysis, it evaluates and describes scenarios for culturally relevant and institutionally and economically feasible re-design of local water management regimes in several case-study sites. It seeks to improve the adaptability of the integrated water resources management (IWRM) framework to local cultural and economic contexts. The project then turns to fundamental re-design of local land- and water-management systems in relation to the combined social, economic and environmental challenges of the future.

## Main results to date

Case studies are designed to illuminate water- and food-related challenges in specific environmental and social contexts. To date, project objectives and research activities have been appreciated by national and international researchers and institutes, governments, and local user associations as highly significant and worthy of their participation. The project has exchanged Memoranda of Understanding with six universities and research institutes in Turkey, Indonesia and Egypt, conducted collaborative works with FAO and IWMI, and anticipates collaboration with the Water-Culture Institute (USA) and Turkish Water Institute (see Figure.).

In Southeastern Turkey, a large scale irrigation development project is underway. Farmers in newly irrigated areas often practice inappropriate water management that results in land degradation. Project research examines the sources and processes of the problems, including structure and function of the institutions and organizations related to irrigation development. In Bali, there is a famous local water management system 'subak', which has been elaborated historically, but is now challenged by contemporary issues related to expansion of cash crop production and agrotourism. On the other hand, in South Sulawesi, Indonesia,



**Photo 1** Diversion work in a traditional water management system 'subak' in Bali of Indonesia

Elaborated and precise management practices contribute to equitable and sustainable water distribution.



**Photo 2**

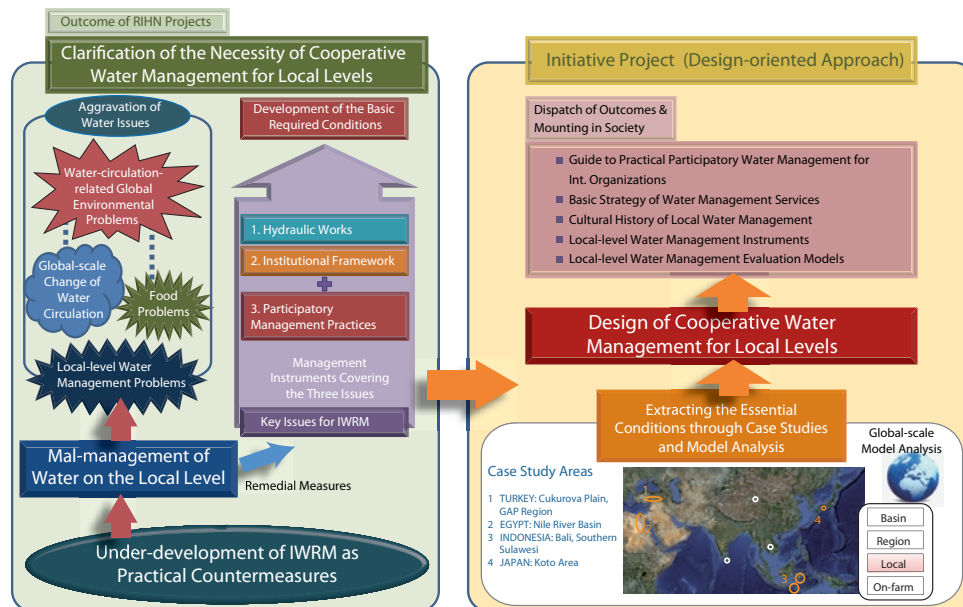
**People picking up cotton flowers in the GAP Region (the South-Eastern Anatolia Development Project Region) of Turkey**

Cotton production with higher income has been expanded widely and very rapidly with irrigation development, while it causes problems of soil salinity and water shortage in the region due to inappropriate water management practices.



**Photo 3** Interview with farmers on water management practices in the Biri-Biri Irrigation scheme of South-Sulawesi, Indonesia

They share space for regular meetings of water use farmers.



**Figure Background and flow of the project research**  
 Many of global environmental problems are water-related and caused by inappropriate water management of local level. The integrated water resources management (IWRM) is proposed world widely to improve the situation. To date, however, IWRM has not achieved its potential. Local water management, or district level management, is a key component of IWRM, and its basic policy and framework are to be re-designed in the context of contemporary global environmental changes. This project research, based on several completed and ongoing projects of RIHN, entails interdisciplinary investigation of the merits and demerits in conventional regimes of local/distinct water management, especially related to irrigation, in several environmental contexts. Main research foci are agricultural productivity, water balance and environment, management institutions and organizations, and human behavior and consciousness. Field and modeling studies are integrated to develop an advanced description of the knowledge systems affecting water management; it will allow comprehensive analysis of the key elements in improved management of basin water resources and in human–water–land relationships more generally.

modern irrigation has been developed in order to provide irrigation in the dry season. Based on observation of actual water and crop conditions in this area, project research establishes the necessity of modifying this management system in order to provide supplementary irrigation in the wet season. Project research also examines the processes of farmer participation organized by newly established NGOs,

In Egypt, the long history of irrigation and cooperation in water use is to be reproduced with paleo-climate data, hydrological modeling, and historical proxies and references. Based on this historical review, current projects for participatory irrigation management are reviewed. In the Echi River Basin of Shiga, Japan, reformation and empowerment of local water management is an urgent issue caused by changes of farming system and the complicated system of water-use developed in the last decades. Here, research describes the impacts of management on water quality of Lake Biwa downstream and on the hydrological cycle of the region.

### Research plan

The system of local water management in each location is to be examined according to the following three main themes: 1) environment, including soil and water-use, and hydrology; 2) socio-economy, including institutions, land holding system, agriculture and local industry, and development organizations; and 3) culture, including environmental consciousness, tradition and customs,

and behavior. A dedicated sub-team will investigate each theme at each study site. Sub-teams are to share, integrate, communicate their findings, and propose improved scheme of local water management from community and district level up to region or basin. Cross-site integration is overseen by a central coordination group composed of researchers from each of the study sites as well as representatives of relevant international agencies. Such proposed modifications in local water management and basin hydrological models will establish the significance of, and necessity of improving, local water management within the global hydrological regime.

This research project will therefore contribute to the design of place-specific water policies and practices and to the concepts, models and theories that describe the multi-scale and linked nature of human-ecological systems. The models or method to be developed in the project can simulate and evaluate the impacts and implication of water management practices on agricultural production and hydrological conditions both qualitatively and quantitatively. They also can provide stakeholders with basic requirements of better management and guide selection of options available to improve their systems.

Expected outcomes, including the fundamental frame of cooperative water management, are to be disseminated to local communities, decision makers, and international aid organizations, so that they can be widely examined, debated, and applied to the significant water-agriculture problems and pressures faced in different areas in the world.

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# Creation and Sustainable Governance of New Commons through Formation of Integrated Local Environmental Knowledge (ILEK project)

Project Leader **SATO Tetsu** RHIN

Professor Tetsu Sato studied the ecology and behavior of cichlid fishes of Lakes Tanganyika and Malawi for 20 years, and has since expanded his research areas to community-based conservation and natural resource management. Throughout his career, including as associate professor in the University of Malawi and as Conservation Director of WWF Japan, he focused on creating scientific knowledge bases for sustainable development and community-based management of ecosystem services. He also served as Professor of Ecology and Environmental Sciences at Nagano University from 2006 to 2012, leading a project to create a network of local scientists producing Integrated Local Environmental Knowledge all over Japan.



This project examines three important frontiers of contemporary environmental studies. First, it examines the processes of local knowledge production related to environmental problems and solutions. Second, it recasts the fields of environmental perception and action so that their dimensions and complexity in real social settings are more accurately indicated: it addresses the ‘new commons’, a term used to indicate the overlapping of biophysical and human forces and materials that constitute social-ecological systems and the range of actors beyond single communities that are implicated in management of these commons. Finally, the project advances the theory and practice of transdisciplinarity, as the project itself progresses through a process of co-design and co-production among a wide range of scientists, theoreticians, and local and nonlocal stakeholders and intermediaries.

This project studies and develops processes of local knowledge production and circulation that can lead to bottom-up solutions to global environmental problems. It examines and facilitates dialogue between scientific explanation and everyday ways of understanding, and it monitors how this knowledge changes as it is utilized at different points and levels of social networks. The knowledge produced is called Integrated Local Environmental Knowledge (ILEK).

This project is based on the conviction that bottom-up approaches are essential to provide solutions to global environment problems. Its goal is to facilitate adaptive governance of diverse local ecosystems as an expression of new commons. Project research focuses on the formation and circulation of local knowledge, or ILEK. ILEK is formed through transdisciplinary dialogue of scientific research and the knowledge produced in the daily practices of local stakeholders. If recognized and mobilized, ILEK can deepen the knowledge bases used to make decisions and design community-based adaptive governance of diverse ecosystem services. The project therefore also aims to facilitate production and circulation of ILEK in order to understand how community-based adaptive governance systems emerge and function.

We examine the local stakeholder networks and societal impacts of ongoing and completed RIHN research projects, as well as those of a range of cases of stakeholder-scientist interactions around the world. Meta-analysis and modeling allows us to elucidate the key actors and mechanisms facilitating ILEK production and adaptive governance. Integration of case observations, meta-analysis, and theoretical modeling will allow us to design a series of social experiments for the case study sites in order to examine in real time the adaptive governance systems facilitating collaboration among diverse stakeholders. With this approach to co-design and co-production of knowledge, we aim to shape a new approach of design-oriented science supporting bottom-up solutions of global environment problems.

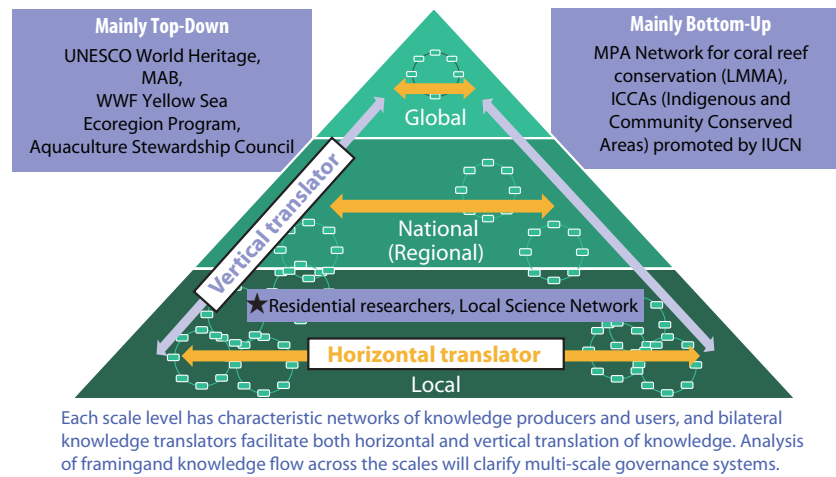


**Figure 1 Structure of local knowledge for environment and sustainability**  
Production and circulation of ILEK is not exclusively performed by professional scientists. Rather, it is often produced and circulated by diverse actors in local communities, including skilled workers in primary industries, local government officials, local companies and NGOs, most of them being knowledge users at the same time. ILEK is formed and utilized through dynamic interactions among different actors/stakeholders in local communities, integrating scientific knowledge and local knowledge produced in daily livelihood and culture among local stakeholders.

## Main activities to date

During the Feasibility Study in 2011, we established preliminary analytical frameworks for meta-analysis of case studies, based on guidelines of collaboration between scientists and stakeholders published by the Local Science Network for Environment and Sustainability (LSNES). The LSNES and guidelines are the product of a research and development project entitled Construction of a Pragmatic Scientist Community Contributing to Stakeholder-driven Management of Local Environment (2008 to 2012), funded by JST Research Institute of Science and Technology for Society (RISTEX).

The Case Study Group consists of three research teams (East Asia, Europe and North America, and Developing Countries); it conducted preliminary analyses of eleven



**Figure 2 Hypothetical framework of multi-scale analyses**  
 This framework will be used to analyze the role of bilateral knowledge translators in supporting knowledge flow and adaptive governance across different scales from local to global.

RIHN projects, multiple LSNEs sites, as well as others around the world, and selected 38 case study sites and 11 candidate sites so far. We are currently designing common criteria of meta-analysis from the viewpoints of knowledge users as well as from responsive potentials of local stakeholder networks to the production and circulation of ILEK.

Early analysis has demonstrated the significance of key individuals in knowledge production and communication networks. Residential researchers and bilateral translators in various local communities were found to play important roles linking local knowledge users to global perspectives, and at the same time, in translating locally accumulated knowledge among stakeholders into scientific languages. We also identified ‘vertical’ translators, individuals and organizations that facilitate flow of knowledge between local and global scales and so offer insight into the challenging problem of designing multi-scale governance systems. We established a Multi-scale Analysis Group, with two research teams corresponding to top-down and bottom-up processes respectively, in order to examine these scalar dimensions of knowledge production and circulation.

The Theory and Modeling Group includes mathematical and conceptual theoreticians with experience in network analyses, complex systems theories, and dynamic system games. Their task is to develop the transdisciplinary methodologies capable of integrating case studies and illuminating the processes of knowledge production that facilitate adaptive and bottom-up governance. Their results will be regularly communicated to ongoing case studies and social experiments, stimulating interactions between theory-development and empirical study. The Theory and Modeling Group will work in close collaboration with a Managing Group consisting of team leaders and other members with strong backgrounds in integrative methodologies, who in-turn act as intra-project knowledge



**Photo A stone tidal weir restored by local stakeholders of Shiraho coral reefs, Ishigaki Island, Okinawa, Japan**  
 This example of restoration of a traditional fishing gear to create and improve coral reef ecosystem services is underpinned by transdisciplinary ILEK including integrated knowledge on ecosystem functions of the stone weir, history and traditional knowledge on the local practice, and social mechanisms to utilize it. (photo by Masahito Kamimura)

translators, facilitating knowledge flow among diverse project members.

These integrative analyses will be used to develop methods used in social experiments that can clarify mechanisms for adaptive governance of new commons. Social experiments will be co-designed with residential researchers and local translators. They will entail monitoring the deliberate production and circulation of ILEK to measure its impact within stakeholder networks.

As described, the design and approach of this initiative-based project is an extraordinary experiment in design-oriented science that explores how innovative knowledge production practices and social systems can offer solutions to global environment problems.

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