

## Completed Research

When a project moves to Completed Research (CR) status, the contract with RIHN is concluded. Research teams disperse to university research, teaching, and other duties. Project publications and other communications and contributions may follow for several years and are assessed in the final project evaluation, conducted two years after formal project conclusion. At RIHN, however, each project forms part of the institute's heritage; project results and data are entered into the RIHN archives upon which future RIHN projects may be formulated.

Fiscal Year Completed	Leader	No	Research Project
2006	HAYASAKA Tadahiro	<b>C-01</b>	Emissions of Greenhouse Gases and Aerosols, and Human Activities in East Asia
	KANAE Shinjiro	<b>C-02</b>	Global Water Cycle Variation and the Current World Water Resources Issues and Their Perspectives
	WATANABE Tsugihiko	<b>R-01</b>	Impact of Climate Changes on Agricultural Production System in the Arid Areas
	NAKAWO Masayoshi	<b>H-01</b>	Historical Evolution of the Adaptability in an Oasis Region to Water Resource Changes
	YACHI Shigeo	<b>E-01</b>	Multi-Disciplinary Research for Understanding Interactions between Humans and Nature in the Lake Biwa-Yodo River Watershed
2007	FUKUSHIMA Yoshihiro	<b>C-03</b>	Recent Rapid Change of Water Circulation in the Yellow River and Its Effects on Environment
	ICHIKAWA Masahiro	<b>D-01</b>	Sustainability and Biodiversity Assessment on Forest Utilization Options
	AKIMICHI Tomoya	<b>R-02</b>	A Trans-Disciplinary Study on Regional Eco-History in Tropical Monsoon Asia: 1945-2005
2008	SEKINO Tatsuki	<b>E-02</b>	Interaction between Environmental Quality of the Watershed and Environmental Consciousness
	TAKASO Tokushiro	<b>E-03</b>	Interactions between Natural Environment and Human Social Systems in Subtropical Islands
2009	SHIRAIWA Takayuki	<b>C-04</b>	Human Activities in Northeastern Asia and their Impact on Biological Productivity in the North Pacific Ocean
2010	TANIGUCHI Makoto	<b>C-05</b>	Human Impacts on Urban Subsurface Environments
	YUMOTO Takakazu	<b>D-02</b>	A New Cultural and Historical Exploration into Human-Nature Relationships in the Japanese Archipelago
	SATO Yo-ichiro	<b>H-02</b>	Agriculture and Environment Interactions in Eurasia: Past, Present and Future
2011	KAWABATA Zen'ichiro	<b>C-06</b>	Effects of Environmental Change on the Interactions between Pathogens and Humans
	KUBOTA Jumpei	<b>R-03</b>	Historical Interactions between Multi-Cultural Societies and the Natural Environment in a Semi-Arid Region in Central Eurasia
	OSADA Toshiki	<b>H-03</b>	Environmental Change and the Indus Civilization
	UCHIYAMA Junzo	<b>H-04</b>	Neolithisation and Modernisation: Landscape History on East Asian Inland Seas
	UMETSU Chieko	<b>E-04</b>	Vulnerability and Resilience of Social-Ecological Systems
2012	OKUMIYA Kiyohito	<b>D-03</b>	Human Life, Aging and Disease in High-Altitude Environments: Physio-Medical, Ecological and Cultural Adaptation in "Highland Civilizations"
	SAKAI Shoko	<b>D-04</b>	Collapse and Restoration of Ecosystem Networks with Human Activity
	MOJI Kazuhiko	<b>R-04</b>	Environmental Change and Infectious Disease in Tropical Asia
2013	HIYAMA Tetsuya	<b>C-07</b>	Global Warming and the Human-Nature Dimension in Siberia: Social Adaptation to the Changes of the Terrestrial Ecosystem, with an Emphasis on Water Environments
	NAWATA Hiroshi	<b>R-05</b>	A Study of Human Subsistence Ecosystems in Arab Societies: To Combat Livelihood Degradation for the Post-oil Era
	KADA Ryohei	<b>R-06</b>	Managing Environmental Risks to Food and Health Security in Asian Watersheds
2014	MURAMATSU Shin	<b>C-08</b>	Megacities and the Global Environment

# Global Warming and the Human-Nature Dimension in Siberia: Social Adaptation to the Changes of the Terrestrial Ecosystem, with an Emphasis on Water Environments

Project Leader **HIYAMA Tetsuya** Nagoya University

The extent of Arctic summer sea ice has been decreasing, especially on the Eurasian continental side. Global warming is a partial cause. Cyclones have appeared frequently in summer in the region, bringing much precipitation to Siberia in particular. Meteorological data revealed high rates of summer precipitation in the upper and middle parts of the Siberian Lena River Basin from 2005 to 2008 and in 2012.

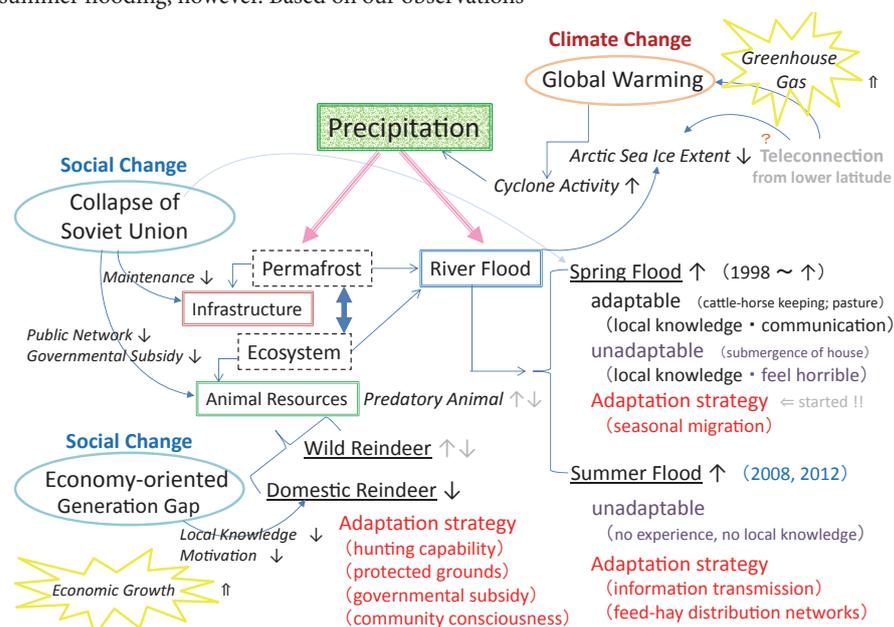
Summer river flooding around Yakutsk, capital city of the Sakha Republic of the Russian Federation, has become a problem, severely damaging local agriculture and pastoralism. River ice flooding also occurs along the Lena River in the spring, and can be severe when low winter temperatures are followed by gradually increasing spring temperatures. Such spring floods have caused severe damages to local residents living along the river in almost every year since 1998.

Our project investigated local perceptions and local governmental adaptation strategies for both spring- and summer-river flooding. Interestingly, spring flooding has been recognized as beneficial except when it causes damages to villages along the river. This is because spring floods bring nutrient-rich water to the river islands on which the farmers cultivate pastures for cattle and horses. Summer river flooding, on the contrary is seen as a hazard, because it submerges the pasture completely in summer, and prevents harvesting of hay for cattle and horses. Village relocation was one of the adaptation strategies to prevent damages from spring floods. Because local people prefer to live along the river on which their subsistence depends, they agreed, with government support, to migrate seasonally. There have been no similar adaptations to summer flooding, however. Based on our observations

and analysis, we intend to promote sustainable subsistence activities in the region by proposing strategies to facilitate information transmission and improvement of feed-hay distribution networks that can aid in adaptation to spring and summer river flooding.

We also investigated how animal keepers and hunters have adapted to social-environmental changes in the region. Interviews with keepers of domesticated reindeer revealed that current climate change has not severely damaged their operations. Careful management of the microhabitats of domesticated reindeer has allowed them to successfully adapt to climate change even though they were severely affected by social changes following the collapse of the Soviet Union. We also documented the migration routes of wild reindeer, tracking them with an ARGOS satellite system, in order to understand their seasonal behavior. Similar to reindeer populations in North America and North Europe, Siberian reindeer have a summer breeding season, winter hibernating season, and other migration seasons. Because recent climate changes degrade reindeer moss in winter, the birthrate and weight of reindeer in the spring has tended to decline. Establishment of protected winter hibernating grounds would therefore help to protect wild reindeer populations. In order to preserve the practice of keeping reindeer, one of the very important subsistence activities in Siberia, governmental subsidies should be provided to keepers of reindeers and to hunters of carnivores.

We intend to inform our Russia counterparts of our analysis and recommended adaptation strategies so that they can be considered by local governments and people.



**Human - nature interactions in Siberia**  
The left-hand side shows reindeer-related subsistence activities and the right-hand side indicates river flood impacts to the local residents. In the lower part of the figure, adaptation strategies are proposed for both issues.

# A Study of Human Subsistence Ecosystems in Arab Societies: To Combat Livelihood Degradation for the Post-oil Era

NAWATA Hiroshi Akita University

## Research objectives and background

Japan and the oil-rich countries of the Middle East have put excessive pressures on the Earth's energy, water, and food resources. In prioritizing their own economic prosperity, these countries have exploited irreplaceable resources, such as fossil fuel and fossil water. Schemes to plant alien species have also placed stress on local ecosystems. Such practices have increased social and economic differences among the peoples of the Middle East at a time when the region faces a turning point in modern oil-based industrialization. The current fossil fuel-based interdependencies must be transformed into new relations that can support viable future societies.

Our project was focused on human subsistence ecosystems, namely life-support mechanisms and self-sufficient modes of production (hunting, gathering, fishing, herding, farming, and forestry) with low energy resource consumption. Based on our results, we proposed a scientific framework for strengthening subsistence productivity and rehabilitating daily life in Arab societies in the post-oil era.

## Study outcomes

### 1) Publication of ten volumes of Arab Subsistence Ecosystems in Japanese

Camels, date palms, dugongs, mangroves, and coral (reefs) are believed to be the keystone species of Arab human subsistence ecosystems (social ecosystems). These species support diverse communities and their extinction could lead to the disappearance of other species and human communities. The survival of these species is likely to depend on the wise use of ecotones, socio-ecological niches in the arid Middle East environment (Nawata 2010). The ten volumes of Arab Subsistence Ecosystems were published to describe our results on the following: 1) interrelationships between humanity and nature; 2) date palms, 3) mangroves, 4) the alien species mesquite, 5) camels, 6) coral reefs, 7) dugongs, 8) sorghum and millet, 9) motivated practitioners and local communities, and 10) is the modern human really a keystone species?

### 2) The Surviving in the Desert exhibit at the National Museum of Nature and Science

The exhibition *Surviving in the Desert: Strategies of Humans, Plants, & Animals* ran at the National Museum of Nature and Science, Tokyo, from November 2013 to February 2014. Research results and materials collected in this project were on display. The exhibition organized twenty-seven gallery talks, symposia and lectures to communicate with Japanese citizens. More than one hundred thousand visitors visited the exhibit, demonstrating a significant public interest in the project's findings on contemporary environmental problems.

### 3) Feedback from Japanese citizens regarding the post-oil era

A RIHN book series volume titled *Human Resources and Engineering in the Post-Oil Era: A Search for Viable Future Societies in Japan and Oil-Rich Countries of the Middle East* was edited by the Project Leader and Project Researcher, based on feedback from Japanese citizens on the post-oil era, after attending three RIHN Open Seminars for the public on "How will you live without oil?" presented between 2009 and 2011 (Ishiyama & Nawata eds. 2013). One book review said: "This book took the initiative in examining renewable human resources and engineering to get ready for the post-oil era" (June 5, 2013, Environment Newspaper).

### 4) Publication of the Arab Subsistence Monograph series in multiple languages

In order to increase the availability of scientific knowledge and provide universal and equitable access to scientific data and documents, we made our results accessible to local and national decision-makers by reporting the results in English, the common language of the scientific community, and in Arabic, French, English, and Kiswahili, the languages of the communities in the study region, in the first volume *Exploitation and Conservation of Middle East Tree Resources in the Oil Era* (Nawata, Ishiyama & Nakamura, 2013).

### 5) Research implementation through development projects in Arab societies

The results of the study were applied as part of the Japan International Cooperation Agency project "Capacity Development Project for the Provision of Services of Basic Human Needs in Kassala" (2011–2013) in cooperation with the Sudan University of Science and Technology. Based on joint Japanese and Sudanese research, we organized a training course on mesquite management and utilization for outreach workers. The results were immediately presented at an international conference and published in an academic book (Mendez-Vilas ed. 2012).



Project Publications

# Managing Environmental Risks to Food and Health Security in Asian Watersheds

Project Leader **KADA Ryohei** Shijonawate Gakuen University

This research project examined the impact of ecological hazards, such as flood, soil erosion, and water pollution, on the inter-relations of food production and public health in Southeast Asian watersheds. Field research was conducted in the Santa Rosa sub-watershed of the Laguna Lake region of the Philippines. Laguna de Bay is one of the largest fresh-water lake in Asia, and its water resources are utilized for agriculture, manufacture, aquaculture, potable water, water transport, and leisure. The region is highly populated and variegated, containing rich ecological resources that are threatened by rapid land use changes, urbanization and industrialization. In many dimensions it is therefore representative of the challenges facing other watersheds in Southeast Asia.

The project had four principal objectives. First, it documented the current levels and pathways of heavy metal, chemical, and organic pollution of Laguna Lake. Second, it investigated the health profile of local residents, the quality of their diet, as well as their perception of food risks. Third, it analyzed the impacts of land use change in the Laguna Lake area on water and material cycles, including sedimentation and groundwater level and quality. Finally, it prepared alternative policy options with the potential to improve environmental quality for sustainable development in the region.

## Transdisciplinary approach

Project research teams were comprised mainly of researchers from RIHN, University of the Philippines, Yokohama National University, Shiga University, University of the Ryukyus, and Ehime University. These researchers worked in collaboration with stakeholders such as the



Laguna de Bay stakeholders and Community Forum 2013

Laguna Lake Development Authorities (LLDA), local government units, fishermen's unions, and health workers.

Major project findings include the following: 1) Urban development and industry in the western region and upstream open garbage disposal could be sources of pollutants, indicating the close linkage of environmental degradation and food-health security; 2) Lead (Pb) was identified as prevalent pollutant causing chronic poisoning of local children, as it is known to negatively affect brain and bodily functions; and, 3) A community-based social action research program, called the "Yaman ng Lawa" Program (*Blessings of the Lake*, in Tagalog), was established in 2012 in order to assess how stakeholder participation improves fishery and water resource management, waste control, and public health.

## Toward collective action in resource management

The *Yaman ng Lawa* Program follows the common resource management idea promoted by E. Ostrom. Such participatory, community-based watershed social action can combat environmental degradation and protect local fish habitat and health of fisheries. Through this participatory approach, we could collect and arrange local knowledge (see Figure). For our transdisciplinary study and activities, RIHN was awarded "Diwa ng Lawa" (*Spirit of the Lake*) honors in 2013 by LLDA, the Philippine Government.

In the CR phase of research, we attempt to examine and evaluate how this transformative social experiment may enable environmental conservation and sustainable livelihoods for local fishing folk. Key research questions include: (1) the processes by which major stakeholders participate; (2) how such activities resulted in environmental improvement, and; (3) the major socioeconomic outcomes of this social experiment.

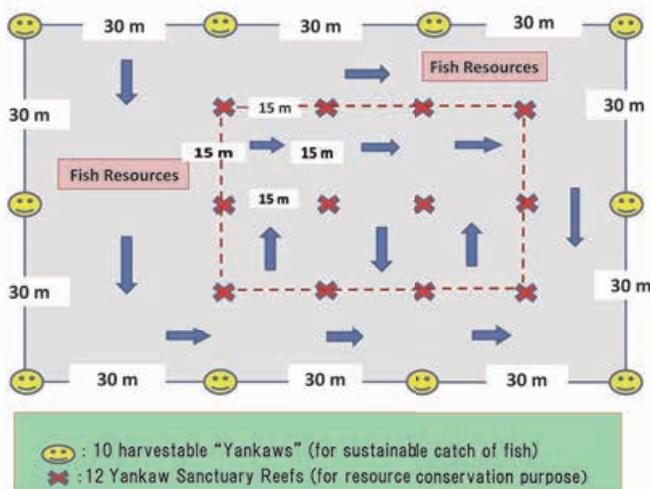


Figure Design of Yankaw Sanctuary System for Recovery of Fishery Resources

# Megacities and the Global Environment

MURAMATSU Shin The University of Tokyo

## 1. What, and how much, have we learned?

The seven findings presented below represent the accomplishments of the Megacity Project over the past five years.

(1) We identified the principle underlying the ideal organization of megacities from the standpoint of sustainability of human society. That is to say, we delineated constraints for cities so that the burden they place on the global environment does not exceed planetary boundaries. In order to enable this, it is necessary to mobilize humanity in a direction that maximizes the economic and social potential of cities. In doing so, it is critically important that we simultaneously pursue optimal benefits in the three areas of global environment, society, and economy (the *triple benefit principle*)

(2) We developed the City Sustainability Index (CSI) as a means of assessing megacities. Using this index, we assessed 18 megacities and found that none can be considered sustainable at present (Figure). What policies and measures, then, are needed to respond to this situation? In reply to this question we proposed a fundamental approach to achieving the ideal organization of megacities (3), which we coined “radical incrementalism with long-term vision.” Megacities are extremely large and complex. At present, it is not possible to find an optimal solution for all aspects of megacities. Radical incrementalism entails (a) repeatedly choosing actions from among the feasible options that are locally optimal in the short-term while (b) maintaining a long-term vision for pursuing sustainability for humankind and (c) emphasizing a city’s history.

Similarly, in order to deal with the size and complexity of megacities, it is necessary to deliberate on the ideal organization of cities with a wide range of experts and variety of stakeholders. We proposed a “megacity scenario-based approach” (4) as a means for realizing such co-design. Furthermore, as a prerequisite to achieving the ideal organization of megacities, we pointed out the importance of taking the local ecosystem into consideration while also paying attention to the geographic

characteristics and history of a given city (5). Each megacity is influenced by the climate, livelihood patterns, and topography of the particular ecosystem in which it is located, whether it be in the Monsoon Asia or mid-latitude arid region. Each megacity is further constrained, in both positive sense and negative senses, by events that occur on the time axis.

We also pointed out that in order to realize the ideal organization of megacities, we should focus on “residential environment” (6), which is the most important space in which humans live. The Megacity Project identified two means of intervening in the residential environment based on an inclusive urbanism approach focusing on the triple benefit society. Furthermore, we pointed out that in order to achieve the ideal organization of megacities, we should pay close attention to the economic development of the middle class (7). This focus on the economic component of the triplet benefit stems from the belief that people begin to consider the sustainability of human society only after they feel a certain degree of economic affluence.

## 2. Our vision of global environmental studies

Global environmental studies integrates a wide range of disciplines in order to think about the means necessary “for humankind to continue existing on the planet called Earth while enjoying a certain degree of affluence.” There are a number of possible approaches to creating such a field of study. In our project, we focused on cities, which are home to half of the world’s population, and, especially among these, on 18 megacities with a population of 10 million or greater.

## 3. New connections

The identification and development of the seven concepts and approaches presented above represent the accomplishments of our Megacity Project. Detailed content of each can be found in *Shirizu: Megatoshi to Sasutenabiriri* (Series: Megacities and Sustainability) a complete set of 6 volumes scheduled to be published by the University of Tokyo Press in 2015.



Figure City sustainability index (CSI)

A model constructed to investigate the sustainability of 18 megacities (Tokyo, Jakarta, Seoul, Mumbai, Sao Paulo, Mexico City, Manila, New Delhi, Cairo, Kolkata, Osaka-Kobe, Shanghai, Buenos Aires, New York, Los Angeles, Karachi, Dhaka, and Moscow).



Above: SASAKI Yuko, Researchers talking about their dream on the sand dune, Niger

Left below: KONDO Yasuhisa, Waiting for the good light from the top of a ladder, India

Right middle: SEKINO Nobuyuki, Interviewing fishermen, Senegal

Right below: MIMURA Yutaka, Looking at a precious post-1950 map from Indonesia at Cornell University, USA