

Completed Research

When a project moves to CR (Completed Research) 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 post-evaluation, 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	C-01	Emissions of Greenhouse Gases and Aerosols, and Human Activities in East Asia
	KANAE Shinjiro	C-02	Global Water Cycle Variation and the Current World Water Resources Issues and Their Perspectives
	WATANABE Tsugihiro	R-01	Impact of Climate Changes on Agricultural Production System in the Arid Areas
	NAKAWO Masayoshi	H-01	Historical Evolution of the Adaptability in an Oasis Region to Water Resource Changes
	YACHI Shigeo	E-01	Multi-Disciplinary Research for Understanding Interactions between Humans and Nature in the Lake Biwa-Yodo River Watershed
2007	FUKUSHIMA Yoshihiro	C-03	Recent Rapid Change of Water Circulation in the Yellow River and Its Effects on Environment
	ICHIKAWA Masahiro	D-01	Sustainability and Biodiversity Assessment on Forest Utilization Options
	AKIMICHI Tomoya	R-02	A Trans-Disciplinary Study on Regional Eco-History in Tropical Monsoon Asia: 1945-2005
2008	SEKINO Tatsuki	E-02	Interaction between Environmental Quality of the Watershed and Environmental Consciousness
	TAKASO Tokushiro	E-03	Interactions between Natural Environment and Human Social Systems in Subtropical Islands
2009	SHIRAIWA Takayuki	C-04	Human Activities in Northeastern Asia and their Impact on Biological Productivity in the North Pacific Ocean
2010	TANIGUCHI Makoto	C-05	Human Impacts on Urban Subsurface Environments
	YUMOTO Takakazu	D-02	A New Cultural and Historical Exploration into Human-Nature Relationships in the Japanese Archipelago
	SATO Yo-ichiro	H-02	Agriculture and Environment Interactions in Eurasia: Past, Present and Future
2011	KAWABATA Zen'ichiro	C-06	Effects of Environmental Change on the Interactions between Pathogens and Humans
	KUBOTA Jumpei	R-03	Historical Interactions between Multi-Cultural Societies and the Natural Environment in a Semi-Arid Region in Central Eurasia
	OSADA Toshiki	H-03	Environmental Change and the Indus Civilization
	UCHIYAMA Junzo	H-04	Neolithisation and Modernisation: Landscape History on East Asian Inland Seas
	UMETSU Chieko	E-04	Vulnerability and Resilience of Social-Ecological Systems
2012	OKUMIYA Kiyohito	D-03	Human Life, Aging and Disease in High-Altitude Environments: Physio-Medical, Ecological and Cultural Adaptation in "Highland Civilizations"
	SAKAI Shoko	D-04	Collapse and Restoration of Ecosystem Networks with Human Activity
	MOJI Kazuhiko	R-04	Environmental Change and Infectious Disease in Tropical Asia
2013	HIYAMA Tetsuya	C-07	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	R-05	A Study of Human Subsistence Ecosystems in Arab Societies: To Combat Livelihood Degradation for the Post-oil Era
	KADA Ryohei	R-06	Managing Environmental Risks to Food and Health Security in Asian Watersheds

Human Life, Aging and Disease in High-Altitude Environments: Physio-Medical, Ecological and Cultural Adaptation in “Highland Civilizations”

Project Leader **OKUMIYA Kiyohito** RIHN

This project explored new perspectives regarding how people live in high-altitude environments where oxygen levels are low and natural resources are limited. We focused on aging problems and lifestyle-related diseases because we regard these as manifestations of global environmental issues in the human body. Project research also aimed to clarify the meaning of “highland civilization”, defined by human ecological, physiological, and cultural adaptations to high-altitude environments, and to describe how recent changes in lifestyle have affected quality of life (QOL) among the elderly. Based on these observations, we also proposed a model of human-nature interactions appropriate for highland civilizations. Study sites were selected from four areas in the Himalaya-Tibet region: the Ladakh region in India, the Arunachal Pradesh State in India, Khaling in Bhutan, and the Qinghai Province in China, each of which has distinct ecological and socioeconomic conditions.

Results

Human ecological and cultural adaptations in highland environments were characterized as maximal and sustainable utilization of limited but diversified natural resources, flexible management for disasters notwithstanding inherent social-ecological vulnerabilities, and a simple life with modest virtues. Human-environmental relationships were studied in three ecologically distinct zones in Himalaya-Tibet region: a forest in Arunachal Pradesh and Bhutan, the Ladakh oasis, and the grasslands of Qinghai. In Arunachal Pradesh, for example, the distribution of vegetation, ethnic groups, subsistence-related lifestyle patterns and recent change, and alien plant invasion were described from 200 to 4000 meters of altitude. Our survey of rural-to-urban migration suggested that local residents increasingly seek better education and medical service as well as the higher

cash income provided by non-agricultural activities. This change in human-environment relationships, caused by various factors from local to global, uniformly resulted in the rise of lifestyle-related disease such as hypertension and diabetes. The “Himalaya model of lifestyle-related diseases” and “diabetes acceleration model” were developed to describe these trends. The background association of diabetes with high hemoglobin and oxidative stress was viewed as a trade-off with hypoxic adaptation associated with aging in highland environments.

Research communication

In Ladakh and Bhutan, we contributed to the design of health care systems for elderly people and described the negative effects of new lifestyle-related diseases. Grassroots international workshops involving local residents, researchers, and medical officers were conducted in Arunachal Pradesh and Bhutan in order to discuss regionally appropriate development pathways in relation to QOL of elderly highlanders.

The project has published extensively, including: “Aging, diseases and health in the Himalayas and Tibet from medical, ecological and cultural viewpoints: studies on Arunachal Pradesh, Ladakh, and Qinghai”; “Pastoral nomadism, pastoral transhumance, and sedentary pastoralism-from the fields of Mongolia, Tibet, the Himalayas and the Andes” (in Japanese); “Himalayan Study Monographs (No. 15)” (in Japanese); “Ladakh: Ecology, Disaster, and Health”; and several chapters in a forthcoming volume on Ecohealth in the RIHN Book Series and two additional books are currently in preparation. Seminars were held every month by the project while in CR phase on the theme “The wisdom of the aged: Learning from the high-altitude elderly”; and publication of a series on field-practices are also currently in preparation (see Photo).



Nomads on Changthang plateau in Ladakh (4700 m alt).

This elderly pastoralist had recently suffered the loss of his wife, but his mental health was maintained because of his important role of looking after his livestock every day, including shifting location ten times/year, along with other pastoralists of his village. Comparative analysis with elderly of Japan indicated that the prevalence of depression in high-altitude people was relatively low in spite of severe livelihood conditions (Ishikawa 2010, 2013).

Collapse and Restoration of Ecosystem Networks with Human Activity

Project Leader **SAKAI Shoko** Kyoto University

Most ecosystems on the planet have been seriously degraded by human activities and are now in critical condition. We still do not have a clear perspective on solving these problems, however, owing to the complexity of ecosystems and human societies and their interactions (what we refer to as the Ecosystem Network). The goals of this project are to promote understanding of the environmental problems associated with managing ecological resources and to contribute to their solution using the concept of the Ecosystem Network.

In this project, we address two tangible environmental problems under contrasting ecological settings: grasslands in Central Asia (Mongolia), and tropical rainforests in Southeast Asia (Sarawak, Malaysia). In Mongolia, we focus on the degradation of pastures. For thousands of years, many people in Mongolia have lived by nomadic herding on the grasslands. In recent decades, however, the number of livestock—especially goats for the export of cashmere—has increased rapidly, causing degradation of pastures and hindering sustainable nomadism.

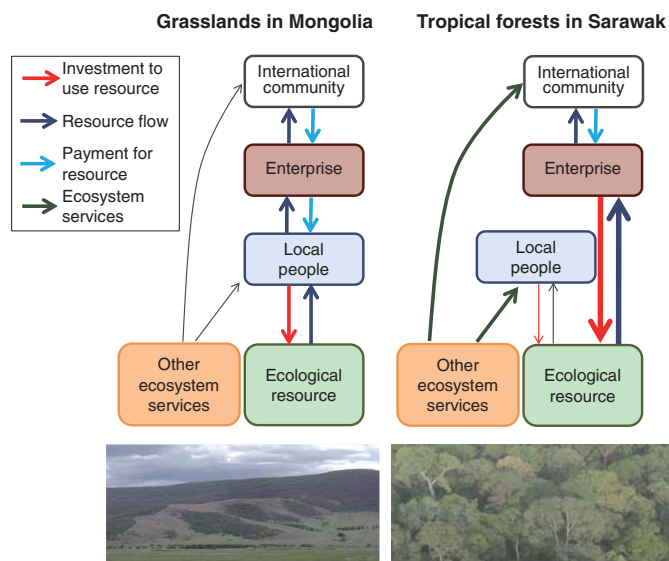
In Sarawak, we focus on the loss and degradation of forests. Local ecosystems have undergone dramatic changes during the last 100 years: land use has shifted from small-scale agriculture by indigenous people to logging of natural forests as a source of timber for export, and then to the development of oil-palm plantations. The expansion of these plantations has brought about a sharp decline in biodiversity and ecosystem components essential to indigenous people.

We identified differences between the Ecosystem Networks in Mongolia and Sarawak, which stem from different ecological characteristics of the ecosystems and ecological resources. Because of these differences, the appropriate policies and institutions would also differ. In Mongolia, there is potential for sustainable management via a negative feedback mechanism to suppress the overuse of pastures, since the degradation of ecological resources and other ecosystem services directly affects the users. For sustainable management, it is therefore essential to identify factors that weaken feedback mechanisms and to implement policies and institutions that enhance such feedback. In contrast, feedback does not act to suppress overuse in Sarawak, where the main users are enterprises. In this case, sustainable management requires policies to introduce feedbacks or restrict the intensity of resource use.

The results of the project showed that network structures that are likely to lead to environmental problems or ecosystem network restoration depend on the ecological characteristics of the specific system and resources.

Research in both Sarawak and Mongolia is comprised of three core stages:

- (1) Identification of Ecosystem Network structures underlying the problems. We first propose hypothetical ecosystem network structures and then confirm and evaluate these links through field surveys, remote sensing, literature surveys, and modeling. This stage will provide insight into the factors that cause and accelerate environmental problems and the barriers to their resolution;
- (2) Scenario analyses. We construct multiple scenarios for each case study and estimate land cover and network structures for each scenario based on the results obtained from (1). We then evaluate the predicted ecosystem and social status using various indices;
- (3) Implications for ecosystem conservation from the ecosystem network perspective. By comparing the case studies of Mongolia and Sarawak, we correlate the ecological characteristics of the ecosystems or ecological resources with the structure of the ecosystem network and the associated environmental problems.



Ecosystem networks of Mongolia and Sarawak simplified for comparison. Mongolian herders use pastures to feed livestock, and their products are sold to the market through companies and enterprises. In Sarawak, timber is harvested and palm oil is produced directly by enterprises. Ecosystem services provided by tropical forests are more highly valued by international markets than those of grasslands are.

Environmental Change and Infectious Disease in Tropical Asia

Project Leader **MOJI Kazuhiko** Nagasaki University

The RIHN Ecohealth Project examined the relation between endemic infectious diseases of significance to public health and ecosystem and societal transformation. Project research was guided by the hypothesis that the health profile of a human population is a product of the social ecological system, and as a consequence, environment and health (and society more broadly) should not be studied in isolation from one another. Instead, the idea of ecohealth recognizes their interactions. From this viewpoint, the ecohealth of each social ecological system is unique, and strategies to promote good health and its supportive environment should be unique for each locality. This integrative, transdisciplinary perspective is very different from the conventional model of universal health.

Lao P.D.R.

In Lao P.D.R., the project collaborated with the Ministry of Health, Ministry of Education, National Institute of Public Health (NIOPH), Savannakhet Provincial Health Department, District Health Offices, as well as numerous health centers and communities. We studied liver fluke infection in the lowland area of Savannakhet Province in relation to development of wet rice field and irrigation systems. In the mountainous area of the same province, where ethnic minority peoples cultivate upland rice paddies, we studied malaria in relation to forest degradation. A trans-border malaria study was conducted among villages on both sides of the Laos-Vietnam border, where we found a large difference in malaria incidence. The project established two Health and Demographic Surveillance Systems (HDSS) and one mobile-phone network in the province, both of which will continue to produce ecohealth data after conclusion of the project and so to elucidate the relation between social-ecological transformation and a population's health profile.

Progress in 2013-2014

The 7th Laos National Health Research Forum (NHRF) was held in Vientiane in October 2013 as a part of the project's first year of CR activity. The results of the project were presented and further study plans for achieving the Millennium Development Goals (MDGs) and preparing for Sustainable Development Goals (SDGs) were discussed. We emphasized the importance of community-based ecohealth promotion and education to reduce the environmental and behavioral risk exposures to pathogens as well as harmful non-communicable factors, such as indoor pollution. We find that capacity building of village health volunteers is a critical element for the success of such endeavors. At the national level, strengthening health service systems should lead to universal health coverage, especially in the areas of curative medicine, immunization, and child delivery. Here there are two important factors. Providers must build the

capacity of their health center and district staff, as well as provide good governance and management of the health system. Second, social registration of residents is essential for universal health care. A Health and Demographic Surveillance System (HDSS) is a kind of social experiments for social registration and personal identification, and the continuing improvement of HDSS data collection, protection, and analysis is important. We continue to work in these areas in the CR period.

Following the NHRF, the opening ceremony of the Sepon Village Health Volunteer Training Center was conducted at Sepon Inter-District Hospital, Savannakhet Province. The center was constructed with support from the Japanese Government's Official Development Grant Assistance for Grassroots Human Security Projects and also benefited from the corporate social responsibility activity of Hitachi Ltd. working in collaboration with the Savannakhet Provincial Health Office. Our project members will continue to promote ecohealth capacity building of local health workers and volunteers at the training center, while also collaborating in ecohealth research activities for which we recently received the Laos Friendship Medal.

Vietnam, Bangladesh, and Yunnan, China

In Vietnam, Bangladesh, and Yunnan, China, RIHN Ecohealth Project research activities continue by new sources of funding. We are maintaining the network and good relations in the field of ecohealth both nationally and internationally. The RIHN EcoHealth Learning Group was established in 2013 in order to identify new research projects. The J-EcoHealth (Japanese Association for Ecology and Health) was established in Hue, Vietnam at the meeting of the DIAS-GRENEei EcoHealth Project in December 2013. Progress in ecohealth research will be presented at the EcoHealth 2014 conference to be held in Montreal, Canada.



The 7th Laos National Health Research Forum (NHRF), at the National Institute of Public Health (NIOPH), Vientiane, October 2013

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, especially in the Eurasian continent side, has been decreasing. 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 Lena River Basin from 2005 to 2008 and in 2012.

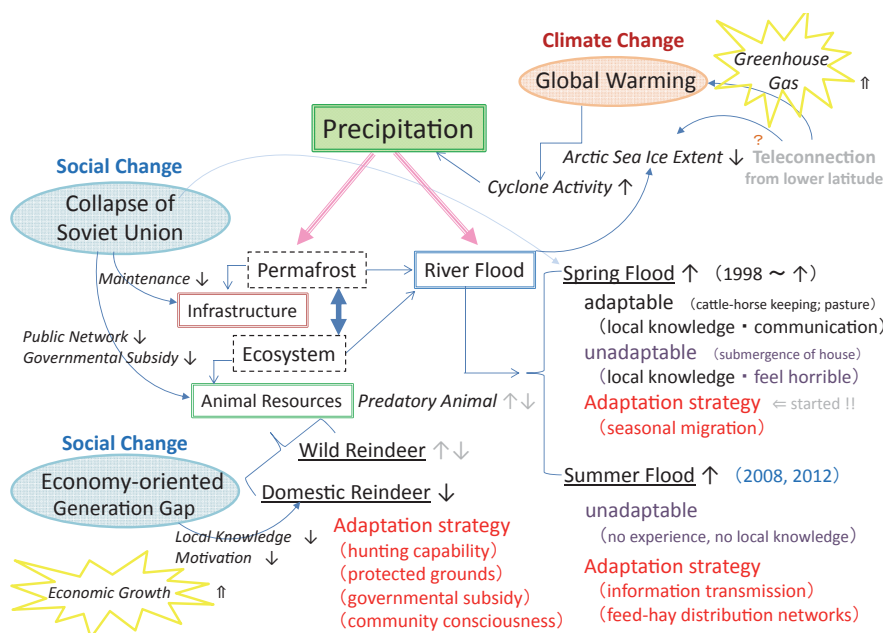
Summer river flooding around Yakutsk, capital city of the Sakha Republic of the Russian Federation, has become a problem, severely damaging local agriculture and pastoralism. On the contrary, the spring thaw along the Lena River typically causes river ice flooding, which can be severe when low winter 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 people's 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 getting of hay for cattle and horses. Village relocations were adopted as 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 domestic reindeer revealed that current climate change has not severely damaged their operations. Careful management of the microhabitats of domesticated reindeers has allowed them to successfully adapt to climate change even though they were severely affected by social changes follow 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 reindeers 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 peoples.



Human - nature interactions in Siberia. The left-hand side shows reindeer-related subsistence activities and 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

Project Leader **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 Publication

Managing Environmental Risks to Food and Health Security in Asian Watersheds

Project Leader **KADA Ryohei** Shijonawate Gakuen University

This research project examines the impact of ecological hazards, such as flood, soil erosion, and water pollution, on the inter-relationships of food production and public health in Southeast Asian watersheds. Field research is 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 has four principal objectives. First, it documents the current levels and pathways of heavy metal, chemical, and organic pollution of Laguna Lake. Second, it investigates the health profile of local residents, the quality of their diet, as well as their perception of food risks. Third, it analyzes 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 prepares alternative policy options with the potential to improve environmental quality for sustainable development in the region.

Transdisciplinary Approach

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



Laguna de Bay stakeholders and Community Forum 2013

Development Authorities (LLDA), local government units, fishermen's unions, and health workers. Our studies have not just investigated environment and human behavior in the region but also have engaged stakeholders more broadly in the question of how best to coexist with the environment.

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) Payment for ecosystem services, when appropriate, should involve a flexible payment mechanism to ensure the cost-effectiveness of resource conservation programs. In response to such findings, the "Yaman ng Lawa" ("Blessings of the Lake") Program, a community-based social action research program 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 by LLDA, the Philippine Government.

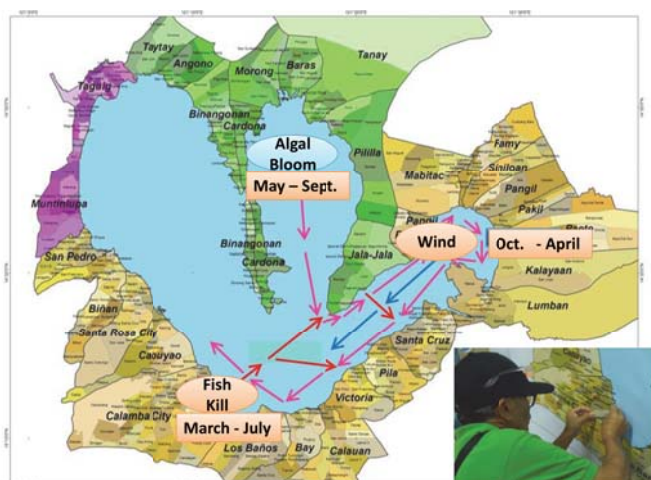


Figure Community-drawn Bio-Signal Map: seasonal changes in algal bloom, fish kill and wind directions