Research Program 1

Societal Transformation under Environmental Change

This program aims at providing realistic perspectives and options to facilitate the transformation towards a society that can flexibly respond to environmental changes caused by human activities such as global warming and air pollution, as well as to natural disasters.

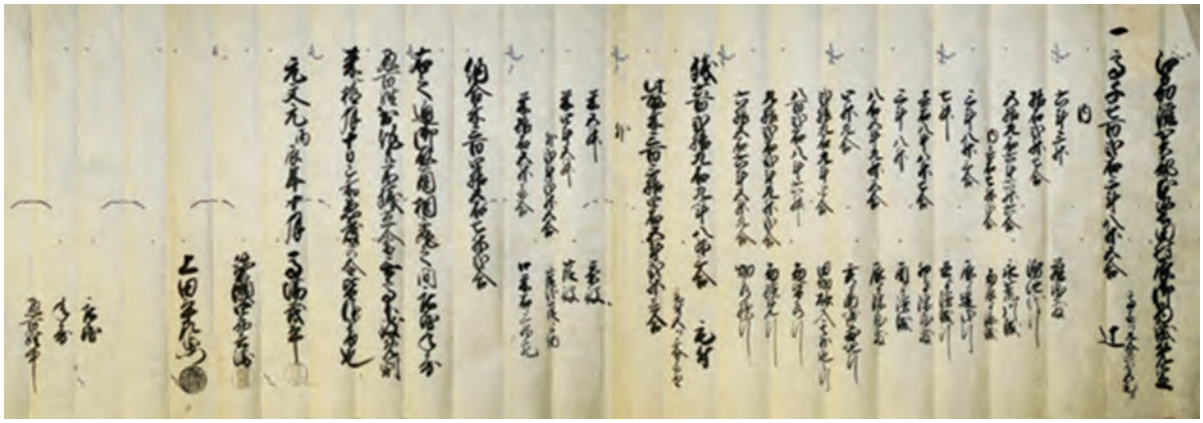
To demonstrate the fundamental significance of global environmental sustainability for human society, we need to make the links between environmental change and natural disasters, and social issues such as livelihood, inequality, social security and conflict, intellectually explicit, and reinforce them in the real world. RIHN's Societal Transformation under Environmental Change research program contributes to this task.

The Program follows two lines of inquiry. The first conducts research on Asia's long-term paths of social and economic development in relation to climate change and environmental history. Such studies offer historical understandings of the human-nature interface, and evaluate each region's political and economic conditions and cultural and social potentialities in comparative perspective. For example, postwar development of the industrial complex along Asia's Pacific coast was made possible by the combination of imported fossil fuels and utilization of rich local resources of land, water and biomass. Industrial development in the region produced both rapid economic growth and at times severe environmental pollution and degradation. It is important to recognize the causes and consequences of these historical processes in their own light, as well as for their significance to future societal change and policy deliberations.

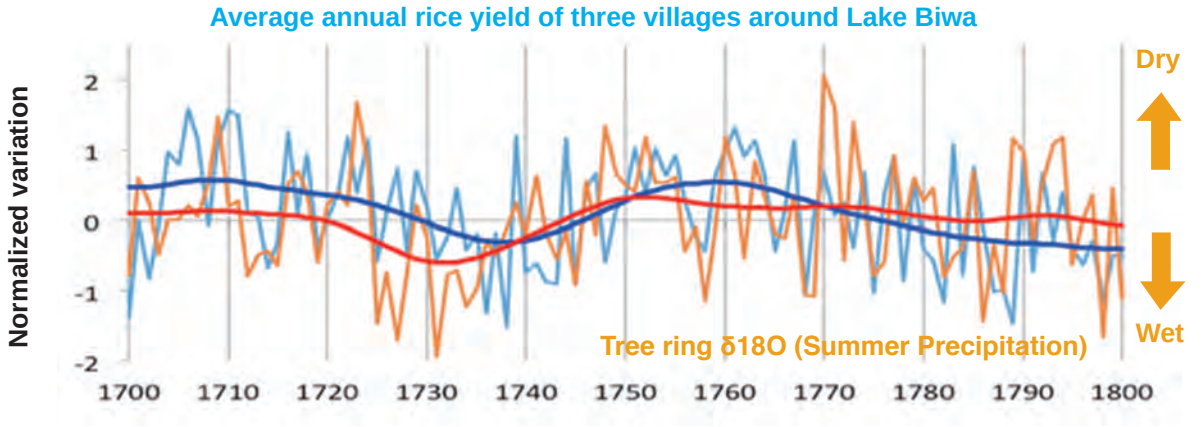
The Program's second line of inquiry examines the kinds of motivations that affect people's livelihood, by working closely with various stakeholders in local society in Asia. Our project based in Sumatra's tropical peat swamp forest, for example, has identified four principal kinds of motivations—local livelihood; profit of local farmers and agricultural and industrial enterprises; local and centrally-based governance; and conservation measures implemented by governments, NGOs and international institutions—and examines how they can best be coordinated to promote sustainability at the village level. Research also helps implement policies at local, national and international levels. This ongoing project, which cooperates with local universities, companies and officials, has already contributed to the development of regional and national policies to control peatland fires, which became a significant environmental issue in Indonesia and beyond.

This program coordinates a variety of research projects along these lines in order to develop a perspective that helps direct research and social transformation in Asia.

Recent land development activities in some parts of tropical peatlands have led to unpreceded scales of forest fire incidents, which are a serious health threat to people of local areas and neighboring countries. This photograph shows a peatland fire in Riau Province, Sumatra Island, Indonesia.



Village tax account in 1736 AD at Honkatada village, Shiga county, Ohmi state



A normalized account of estimated rice yields based on village tax accounts among three villages around Lake Biwa and tree-ring cellulose oxygen isotope ratios taken in central Japan during the 18th century. These data demonstrate that flooding was the most significant factor negatively affecting rice yields in the area at this time.

Program Director **SUGIHARA Kaoru** RIHN

Trained in Japan (Doctorate at the University of Tokyo), I have held positions at the History Department of the School of Oriental and African Studies, University of London, the Center for Southeast Asian Studies, Kyoto University, the Graduate School of Economics, University of Tokyo, and the National Graduate Institute for Policy Studies (Japan). My research concerns the history of intra-Asian trade and labor-intensive industrialization in the last two centuries. I am currently working on the economic and environmental history of Monsoon Asia in long-term perspective. I also act as Vice-Chair of the Future Earth Committee of the Science Council of Japan.

Program Researchers

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YAMAMOTO Aya	Program Research Associate
YANAKA Hiroko	Program Research Associate

Historical Climate Adaptation Project

Societal Adaptation to Climate Change: Integrating Palaeoclimatological Data with Historical and Archaeological Evidences

Project Leader **NAKATSUKA Takeshi** RIHN

Professor Nakatsuka's specialties are palaeoclimatology and isotope biogeochemistry. Since his early career as a graduate student, he has been using nitrogen isotopes to study long-term variations of climate and its impacts on oceanic biogeochemical cycles. Recently, he changed his main research area from oceans to land and focused on using tree-ring oxygen isotopes to examine the relationship between climate change and human history. Investigating periodicity of climate during the last two millennia in Japan and the world, he now hypothesizes that past human societies were often damaged by multi-decadal climate variations as they were caught in a cycle of over-adaptation and subsequent failure of adaptation.

Background and objectives

If global warming causes many societal difficulties, how can we adapt to the change? Remarkable recent progress in palaeoclimatology has elucidated the fact that large climate variations often underlay epochs of human history. How did our ancestors address such change in the past? Human history must include many examples from which we can extract common lessons relevant to contemporary global environmental change. The research target of this project is Japanese history from the prehistorical Jomon era to the present. First, we reconstruct past climate variations in Japan and Asia at annual or seasonal time resolutions for the last several millennia, using up-to-date palaeoclimatological methods to identify outstanding periods of climate variation. Then we use historical and archaeological approaches to investigate how local societies reacted to climate variation in order to clarify common sociocultural characteristics of societies that are tolerant or vulnerable to changes in climate.

Research methods

In this project, past climate variations are reconstructed based on various proxies, such as tree rings (Photo 1, 3), historical weather records, lake and marine sediments, coral rings and speleothem, and compared with human responses recorded in historical documents (Photo 2) and archaeological archives. There are three reasons why we have chosen Japan as the main research area in this project. First, Japan is located at northeastern rim of the Asian summer monsoon, where small changes in monsoon dynamics might have significantly affected rice paddy cultivation on which Japanese sustenance has historically depended. Second, due to the historically high literacy rate and long-lasting family system in Japan, innumerable historical documents dating back to the 8th century are preserved in both private and governmental sectors. Third, rapid land developments during last several decades have allowed for precise archaeological excavations at numerous sites all over Japan. In addition, a palaeoclimatological tool (tree-ring cellulose oxygen isotope ratio) particularly useful in the Asian monsoon region has recently been developed to reconstruct summer precipitation on which rice paddy cultivation in Japan depends, providing archaeologists with a reliable tool for annual dating of numerous excavated woods (Fig. 1).

Remarkable results

So far, we have been using many tree-ring samples from around Japan in order to analyze tree-ring oxygen isotope ratios during the last 4300 years in annual time resolution. We have also collected many tree-ring width datasets from all over Asia in the framework of an international palaeo-climatological project (PAGES) and reconstructed inter-annual variations of averaged summer temperature in East Asia. Comparison of annual records of past climate with paleographic information such as yearly tax accounts in early modern villages and administrative documents on water control in medieval manors, as well as archaeological information on prehistorical and ancient societies excavated from farmland and habitat remains, coupled with the newest isotopic dendrochronological data allow us to investigate how variations in temperature or precipitation influenced agricultural production, human livelihoods, and water management. As a result, we can understand how historical societies could or could not overcome serious climate changes in the past. In the Edo era, summer temperature changed cyclically with

Photo 1 Sampling a tree-ring core with an increment borer

Photo 2 Collection of photo images from old written documents

Photo 3 Analysis of giant tree ring disk

http://www.chikyu.ac.jp/rihn_e/project/H-05.html
http://www.chikyu.ac.jp/nenrin/index_e.html

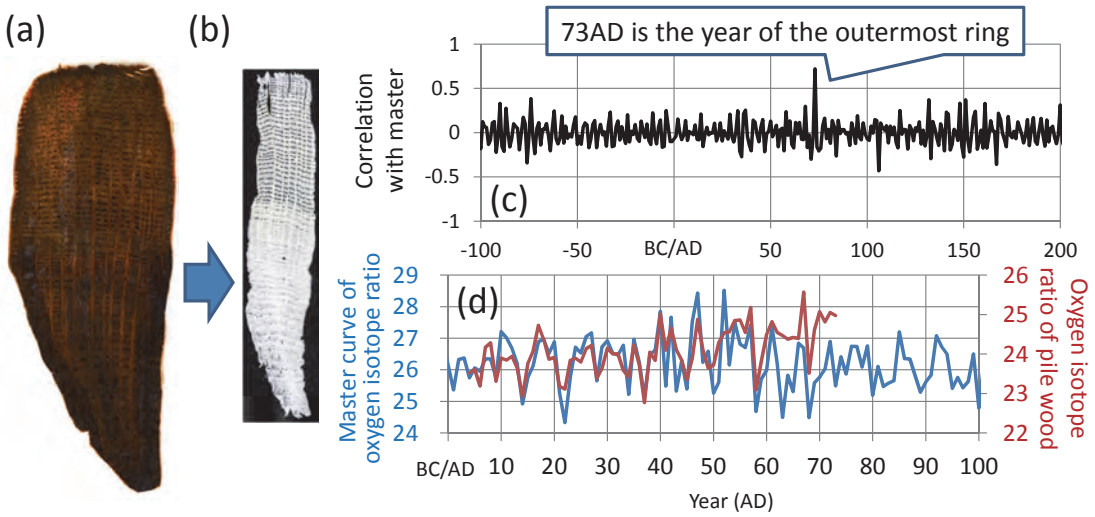

Figure 1 A thin wood plate (a) and its chemical treatment residue (cellulose) (b) from a pile wood at a rice paddy field in the Yayoi era. Variation in the tree-ring cellulose oxygen isotope ratio is compared with that in master chronology to determine the matching year (c & d).

about 40 years of periodicity and sudden temperature decreases often reduced rice yield drastically and caused serious famines in Northeast district of Japan (Fig. 2). In the medieval period, we find tight relationships between temperature and famine as well, but also that sudden increases in precipitation often caused water disasters and subsequent social conflicts and warfare (Fig. 3). Such relationships can be traced back to the early period of the Yayoi era about 2500 years ago.

Final goal

As our present concerns for global warming clearly illustrate, large climate variations in the past have always had serious impacts on our ancestors. As shown in Figs. 2 and 3, multi-decadal large climate variations had especially damaged historical societies. However, some past societies continued making efforts to overcome the influence of climate variations, while other societies collapsed. Comparative evaluation of historical climate adaptations may allow us to explain Japanese history since the Jomon era as a sequence of societal transformations designed to overcome large intermittent climate variations. The final goal of this project is to bring such historical insight into consideration of fundamental adaptation strategies in relation to contemporary global environmental problems.

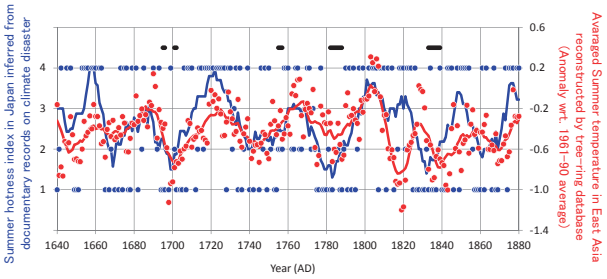

Figure 2 Variations of summer temperature in the Edo era. Two reconstructed time-series are based on Japanese historical documents of climate disasters (blue) and East Asia database of tree ring width (red), respectively. Upper black bars are corresponding to the year of giant famines in Northeast district. Dots and lines indicate yearly and 11 year running mean values, respectively.

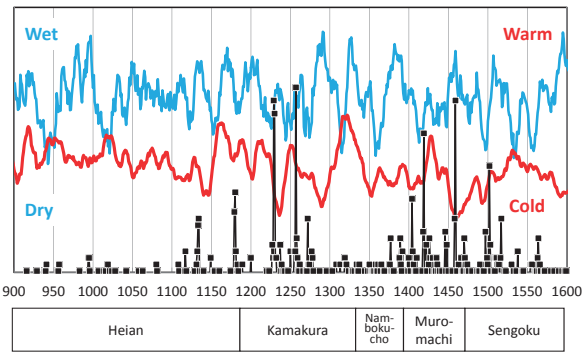

Figure 3 Variations in summer temperature (red: reconstructed from East Asia database on tree-ring width) and precipitation (blue: reversed tree-ring oxygen isotope ratio in central Japan) during 10-16th centuries, together with yearly number of famine reports (black) in Japan.

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Tropical Peatland Society Project

Toward the Regeneration of Tropical Peatland Societies:
Building International Research Network on Paludiculture and Sustainable Peatland Management

Project Leader **MIZUNO Kosuke** RIHN/Kyoto University

Kosuke Mizuno has been studying the economic changes unfolding in rural West Java, Indonesia, since 1978, putting special attention to land, capital, and labor relationships. Following the Indonesian democratization process and particularly the restoration of the right to organize in 1998, when former President Soeharto stepped down, he analyzed institutional change, economic development, and resource management by people's organizations across Indonesia. He became the leader of an integrated natural and social science study on peatland society in Riau province in 2008, and continues to conduct action research on peatland rehabilitation while also deepening understanding of the historical and social dimensions of peatland society.

Necessity of the study

Peat swamp forests are found throughout Southeast Asia, especially Indonesia, and contain massive stores of carbon and water. Over the last two decades, these swamps have been intensively exploited for commercial acacia and oil palm plantations. As these trees cannot grow in swamps, they have been drained, creating extensive areas of dried peatlands, which are extremely vulnerable to fire.

In 2015, peatland fires burned 2.1 million hectares of forest in Indonesia, affecting 45 million people. A half million people suffered from upper respiratory tract infections, and thousands of people, especially children, were afflicted with asthma.

The government responded to this disaster by mobilizing the army, punishing people who set fires, and refusing to issue new peatland development permits. These measures were urgently needed, but provided only short-term relief. The public has demanded longer-term and sustainable measures, such as rewetting and reforestation.

The Government of Indonesia established the Peatland Restoration Agency in January 2016, and declared that two million hectares of degraded peatlands will be restored by 2019. The objective of this research project is to generate solutions to the current crisis of peat degradation and related fire and haze in tropical regions, especially Southeast Asia. It seeks to identify and implement alternative practices in collaboration with local people, as well as academia, government, NGOs, and international organizations.

The project conducts multidisciplinary research in order to clarify the entire process of peatland degradation. We focus on: A) gathering social and ecological baseline data on peatlands and measuring the impacts of fire and haze; B) implementing paludiculture projects in wetland areas as a potential mitigation strategy to peatland degradation; and C) identifying governance structures and incentives, including environmental finance mechanisms, that can support sustainable peatland management. These projects engage local people, migrants, logging and plantation companies, and local and national governments.

Achievements to date

Project researchers introduced the practice of rewetting and reforestation in peatland areas in Bengkalis District, Riau Province in 2010. This experimental site has attracted significant attention, especially since 2015 when fire and haze became very serious. Along with project-led international seminars, the site has significantly enhanced public awareness of the potential for rewetting and forestation to regenerate peatland.

On August 10, 2016, the Research Institute of Humanity and Nature, Kyoto University, and Hokkaido University signed a Memorandum of Understanding with the Peatland Restoration Agency of Indonesia to conduct action research to restore degraded peatland. Our project has created action plans based on this MOU and has accordingly begun to implement a restoration program in Meranti District, Riau Province.

Research Targets

Peatland ecosystems are vulnerable: damage from human disturbance can be irreversible. In order to achieve long-lasting solutions to peatland degradation, we must also understand the vulnerability of tropical peatland societies. Communities within peatlands often have little social capital, and land is owned by the state and not well managed. In this context our research objective is to examining alternative livelihood strategies addressing the environmental and social vulnerability of tropical frontier societies. The project supports community-initiated paludiculture as a sustainable livelihood model in rewetted peatlands, and thus explores the potential transformation of tropical peatland societies.

This research thus demonstrates the future potential of peatland-based societies the phasing out of monoculture production activity, the development of paludiculture, and the enlargement of protected peatland areas.

Publications

The edited book *Catastrophe and Regeneration in Indonesia's Peatlands: Ecology, Economy and Society* was published by the National University of Singapore Press in 2016. This volume provides inter-disciplinary field-based and historical analyses of peatland degradation through examination of the survival motives of local people, profit motives of companies, and conservation motives of Government and NGOs. The book showcases the potential solution of rewetting and reforestation of "the people's forest". The book has been reviewed in multiple media, including leading international academic journals. Our project will continue to build on this research in order to develop new insights on tropical peatland management.

Photo 1 Burned sago and peatland forest in Kepau Baru village, Meranti, Riau

Photo 2 Rewetting with local people at Tanjung Leban Village, Bukit Batu Sub-district, Bengkalis District, Riau Province

Sub Leader

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Research Program 2

Fair Use and Management of Diverse Resources

Global environmental problems are related each other. Studies concentrating on single issue are not effective, and those consideration inter-linkage of multiple resources involving stakeholders are essential to approach the problems. Recently, nexus structure among energy, water and food became a hot issue, though we need more comprehensive understandings taking into account other issues such as ecological resources which provide ecosystem services and cultural resources to attain sustainable society. Production, circulation and consumption of resources should be discussed in wide range of special scales with involvement of various stakeholders. Sustainable use of resources require fair and wise systems and proper indices to manage these processes.

In particular, transformation from traditional socio-economic or human behaving systems to the new systems which pay more attentions on renewable natural resources which have been sometimes externalized from traditional economics is a key. Asian systems are experiencing rapid change in economics, urbanization and populations, though partly keeps traditions to manage resources in sustainable way, which associated with relatively rich humanospere and cultural background in this region. Thus, the studies on such Asian experience of resource use may give important suggestions on future sustainability in the world.

The RIHN projects up to now have accumulated information and suggestions necessary for this transformation, though there remains some parts with less information (ex. Resources such as energy, or enterprises as global stakeholders, etc.). In this program, we tries to explore wise and fair management system to cope with multiple-resource, by multiple-stakeholders, in multi-spatial scales by encouraging new projects including such new and lacking aspects with innovative ideas by young scientists. The conditions necessary for transforming values and human behavior will be discussed and we try to propose new appropriate indices and institutions for fair resource management.

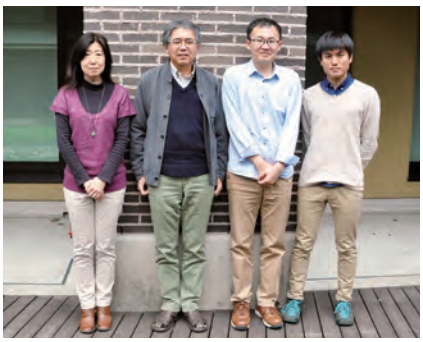
Agricultural land in India

Logging of tropical rain forest in Malaysia

Palm oil factory in Malaysia

Program Director **NAKASHIZUKA Tohru** RIHN

Tohru Nakashizuka has been studying forest ecology, biodiversity and ecosystem services at the Forestry and Forest Products Research Institute, Kyoto University, and Tohoku University. At RIHN, he is to study wise and fair use of diverse resources.



Program Researchers

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SHIBATA Rei	Program Researcher
KARATSU Fukiko	Program Research Associate

Human-Environmental Security in Asia-Pacific Ring of Fire: Water-Energy-Food Nexus

Project Leader **ENDO Aiko** RIHN

Associate professor Aiko Endo studies the economics of fisheries as well as coastal and marine policy. Her interdisciplinary and multi-sectoral approaches to Integrated Coastal Management (ICM) in Japan have generated national policy proposals. Her research seeks interdisciplinary and transdisciplinary approaches to the co-design and co-production of governance structures that can solve environmental issues by linking local, national, regional, and global policy spheres.

Research objectives and background

Climate change and social change, including accelerating development, urbanization, and globalization are increasing pressure on water, energy and food resources, increasing the number of tradeoffs and potential conflicts among these resources that have their complex interactions. The Global Risks Interconnections Map published by the World Economic Forum in early 2016 highlights the global risk posed by linked food and water crises and energy price shocks. In order to address these issues, the objectives of the project are to understand the complexity of the water-energy-food (WEF) nexus system and to create policy options to reduce trade-offs among resources and to alleviate conflicts of resource users using scientific evidence and under assumptions of uncertainty to maximize human-environmental security. The project also contributes solutions to local and global environmental problems by contributing to global research networks associated with the Future Earth platform and the U.N. Sustainable Development Goals.

Research methods and structures

The project involves 60 researchers from different disciplines and five countries, including Indonesia, the Philippines, Canada, Japan and the USA. Five research groups carry out the following tasks: 1) the Water-Energy Nexus Group conducts biophysical measurement and analysis using space satellites, geothermic, and hydrogeological techniques; 2) the Water-Food Nexus Group conducts biophysical measurements and analyses using geochemical, coastal oceanographic, geophysical, hydrologic, and ecological methods, including isotopic tracers; 3) the Stakeholder Analysis Group conducts stakeholder and social network analyses, community surveys, and scenario planning based on sociology, economics, and behavioral science approaches; 4) the Socio-culture of Resource Usage Group develops the science-policy interface based on its examination of the socio-cultural history of groundwater use; and 5) the Interdisciplinary Group conducts the research with a mission to: i) identify research problems; and ii) determine the methods and/or create new discipline-free methods based on synthesizing and harmonizing team-based production, collected from individual scientists in different disciplines from each team in order to assess human environmental security. In addition, the team further developed these approaches to incorporate non-scientific/-disciplinary views on the analyses; and iii) design a nexus system.

Figure 1 Target research sites

http://www.chikyu.ac.jp/rihn_e/project/R-08.html
http://www.chikyu.ac.jp/wefn/index.html

Research activities and findings

In order to analyze the water-energy nexus we are collecting groundwater samples from observation wells by depth for monitoring the groundwater level in Otsuchi. We also calculated the potential of using groundwater as a source of thermal energy in Obama. In Beppu, the subsurface environment, including flow of groundwater and hot springs, have been clarified by gravity measurement.

The Water-Food Nexus Group identified the location of submarine groundwater discharge at Obama and Beppu bays, and estimated the supply of nutrients conveyed from land to ocean by groundwater. Stakeholder analysis of hot spring resources also clarified key issues related to future scenarios and social change.

The Interdisciplinary Group will continue to develop integrated methods, including models of Beppu and Otsuchi, Japan, Pajaro Valley, California, and British Columbia, Canada. This group is also designing a nexus system at the local scale to understand the complexity of the nexus system and establish a clear definition of the nexus concept.

For collaborative scientific activities with society, we designed lectures open to local citizens, also conducted a participatory survey on hot springs with local residences and stakeholders in Beppu. We developed a web page, "spring map", in order to share the results of our groundwater survey. Such activities with local governments and private sector raised awareness of nexus issues.

Future research will improve scientific understanding of the complexity of the water-energy-food nexus, and attempt to ease social conflicts by promoting dialogue and cooperation with stakeholders. Finally, we will contribute to policy by suggesting ways to reduce trade-offs among the three nexus resources.

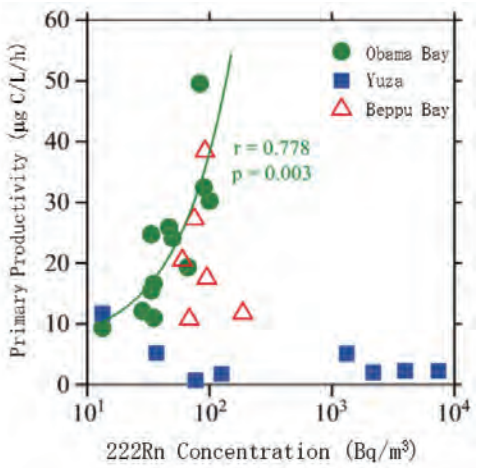

Figure 2 Relationship between submarine groundwater discharge and primary productivity (Sugimoto et al. 2017)

Photo 1 Participatory survey on hot springs in Beppu

Expected results

1. To define the academic nexus concept.
2. To understand the complexity of the water-food-energy nexus system, and create visualizations of the linkages between events using ontology-based systems; to identify trade-offs and efficient resource uses; to define the academic concept of nexus, contribute to scenario planning, and design a nexus system.
3. Preparation of policy-relevant future nexus issue scenarios through collaboration with stakeholders.
4. Development of localized studies that can be up-scaled and produce policy-relevant results; improvement of networking with stakeholders and researchers addressing nexus issue nationally and internationally.

Photo 2 The nexus project meeting in Otsuchi Town

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HONDA Hisami	Project Research Associate
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Biodiversity-driven Nutrient Cycling and Human Well-being in Social-Ecological Systems

Project Leader **OKUDA Noboru** RIHN

My specialty is ecology, the field of study concerned with the relationships between biodiversity and ecosystem functioning. One of ecology's central questions is why humankind should conserve biodiversity. As a member of the Center for Ecological Research at Kyoto University, I have approached this question by integrating different research fields related to biodiversity from gene to ecosystem. At present, I am developing methods for adaptive watershed governance which allow new environmental knowledge to reconcile global, regional, and local ecological issues. I also should say that I love nature and humanity and how they come together very much!

Research background and objectives

Technological innovations in the use of nutrients for food production, in particular nitrogen and phosphorus, have allowed global increases in population and economic prosperity in the twentieth century. Overexploitation of nutrient resources, however, affects biogeochemical cycles and can lead to nutrient imbalances, eutrophication and loss of biodiversity. It is now recognized that nutrient imbalances and biodiversity loss are prevalent in watersheds around the world, and pose a risk to sustainable human development.

In spite of such risk, most citizens are not so interested in global environmental issues but are rather concerned about local issues related to their lives and livelihoods. Considering this dissonance in environmental consciousness, we aim to develop a framework for adaptive governance of sustainable watershed systems (Fig. 1).

Research methods

We facilitate stakeholder engagement in multi-level and multi-scale governance in order to enhance biodiversity, nutrient cycling and human well-being, according to our hypothesis that these are the three primary components for sustainability of social-ecological system and, like gears, also interdependently linked in community activities (Fig. 2). We begin with action research to empower members of each community within a watershed to conserve indigenous environmental icon, defined as indigenous nature with special significance to local life and livelihood (Process A in Fig. 2). As the value of engaging in such conservation efforts is shared among community members, community-based well-being is altered and reinforced through bonding social capitals in a positive feedback of biodiversity conservation and biodiversity-driven nutrient cycling.

If such community activities enhance nutrient cycling at the watershed scale, they can stimulate strong collective public interest in ecosystem services. In disseminating our scientific understanding of the community dimensions of nutrient cycling in watershed-based societies, our project will facilitate social involvement in conservation activities as well as "green consumption" of local products by non-community members who appreciate the public interests. Such links accumulate bridging social capital and increase economic incentives (Process B in Fig. 2). With increased public interest in conservation activities, community members may also gain institutional support from local governments. Such integration of local and scientific knowledge further enhances community-based well-being, and leads to empowerment of community activities.

To test this hypothesis, we apply our governance approach to two extreme systems in Asia: the Lake Biwa Watershed (Japan) and the Laguna de Bay Watershed (Philippines). The former is an infrastructure-oriented society and the latter a high-nutrient loading society.

Research progress

For the Lake Biwa Watershed, we practiced action research in the mid-stream community of the Yasu River sub-watershed. Based on our exercises to explore the cultural

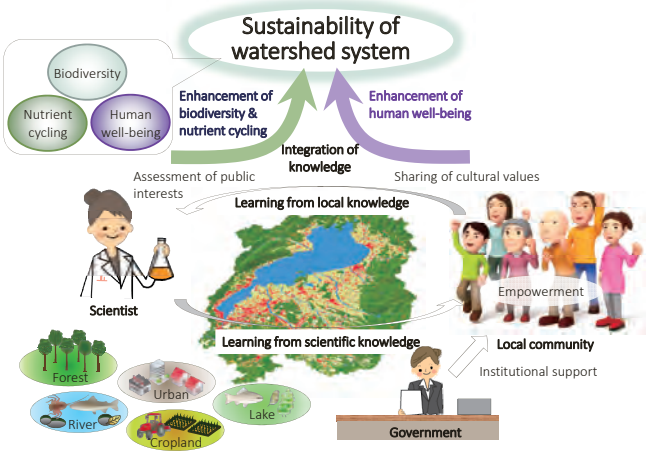

Figure 1 A conceptual schema of adaptive watershed governance

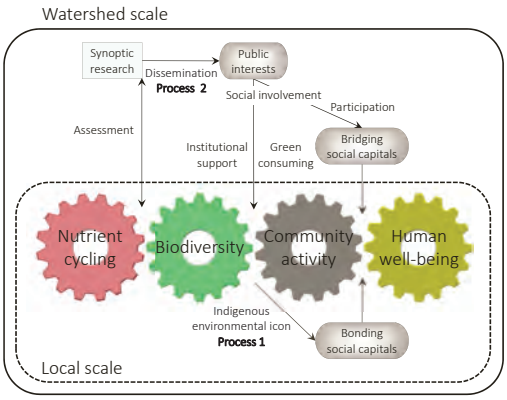

Figure 2 **A working hypothesis of how biodiversity, nutrient cycling and human well-being are enhanced through multi-level and multi-scale governance**

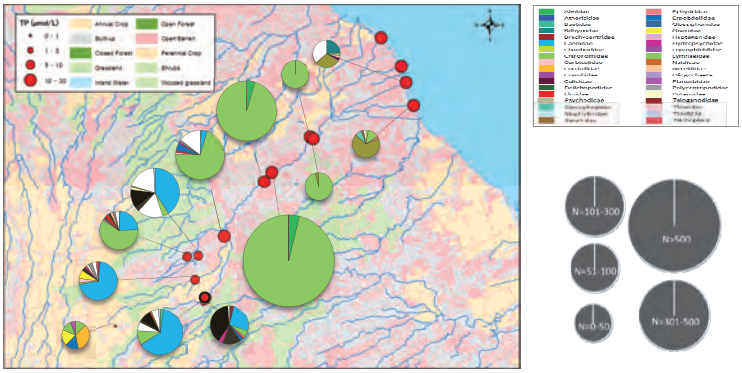

Figure 3 **A map of biodiversity in the Silang-Santa Rosa sub-watershed. Circle size and color pattern indicate abundance and species richness, respectively**

significance of indigenous nature, we identified a brown frog as an indigenous environmental icon and began to work to conserve its habitat. Monitoring revealed that the brown frog prefers to spawn in paddy fields with wetland biotopes (Photos 1). This observation facilitated farmer engagement in conservation activities, as they shifted from the modern to traditional paddy field irrigation system. We have been able to observe how farmer engagement in the conservation activities has altered environmental consciousness, improving their sense of how their well-being is closely linked to natural capitals. In FR3, we will conduct field experiments to demonstrate how traditional irrigation techniques are effective in reducing nutrient loadings from paddy fields.

In the Laguna de Bay Watershed, in contrast, recent economic development has led to expansion of residential areas into the mid-stream area of the Silan-Santa Rosa sub-watershed. In downstream urban areas, nutrient loadings and eutrophication have led to serious loss of biodiversity (Fig. 3). At present, people within the watershed are dependent on groundwater resources for drinking and irrigation and therefore highly concerned about groundwater overexploitation and pollution. In FR3, we will disseminate the results of our research to discuss the solution strategy for these groundwater issues with a variety of stakeholders within this watershed. We will also conduct the action research to empower the mid-stream community to conserve a communal spring as an indigenous environmental icon (Photos 2).

Perspectives

In developed societies, sewage treatment and tap water infrastructure systems have reduced eutrophication and led to greater comfort and convenience. Environmental consciousness, however, has receded from the nature of wetlands. What enhances our well-being? Is it enhanced by infrastructure? We want to seek answers to these questions together with a variety of stakeholders.

Photos 1 **Social engagement in biodiversity monitoring (left) and a map of indigenous environmental icons (right) in the mid-stream community Kosaji**

Photos 2 **Eco-tourism in a communal spring (left) and a women's association engaged in conservation (right) in the mid-stream community Carmen**

Project Researchers at RIHN

ASANO Satoshi	Project Researcher	**UEHARA Yoshitoshi**	Project Researcher
IKEYA Tohru	Project Researcher	**WATANABE Kirie**	Project Research Associate
ISHIDA Takuya	Project Researcher		

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IWATA Tomoya	University of Yamanashi	**WAKITA Kenichi**	Ryukoku University
BAN Syuhei	The University of Shiga Prefecture	**SANTOS-BORJA, Adelina C.**	Laguna Lake Development Authority, Philippines
OSONO Takashi	Doshisha University		

Research Program 3

Designing Lifeworlds of Sustainability and Wellbeing

More than 60% of the world's population resides in Asia and the regions surrounding it. Over a third of global economic activity occurs there. Within these places lies an incredible diversity of cultures, histories, societies, economies, livelihoods, and ecologies. Asia is also affected by myriad global and local environmental issues, such as population increase, air, water, soil, and coastal pollution, increasing greenhouse gas emissions, and biodiversity loss. At the same time, growing wealth disparity, social isolation, rising levels of poverty, and the disappearance of traditional culture and knowledges are emerging.

Within these processes, the combination of migration between the countryside and cities, and rural depopulation with urban concentration is accompanied by rapid socio-cultural change, resource over-use, and the deterioration of the natural environment. Both urban and rural lifeworlds are disintegrating rapidly. Consequently, by reconstructing the lifeworld concept and highlighting the reciprocal linkages between rural and urban spaces, Program 3 designs lifeworlds of sustainability and wellbeing and co-creates concrete pathways for their realization.

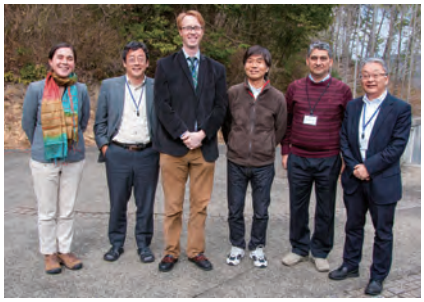
In these same places, diverse world-views and experiences of the ways in which humanity and nature can exist have accumulated. Pre-existing, yet latent, diverse socio-cultural elements, such as livelihood styles, lay knowledge, conflict resolution strategies, and the vitality of the people themselves can be called upon to address problems and help to chart a course toward possible future societies. Program 3 builds upon these experiences and knowledges of human-nature interaction to propose concrete changes needed to achieve a sustainable society.

Through the transformations and frameworks leading to sustainable urban and rural lifeworld design, the existing economic systems, markets, and political decision making systems will also require fundamental shifts in the way they are conceived. However, Program 3 will not investigate top-down approaches to system change, but will work with local residents, government officials, companies, citizen groups and other various stakeholders to propose sustainable alternatives and gauge their feasibility.

In order not to run the risk of developing proposals that are only applicable to specific regions or sites, Program 3 will aim for research results that are generalizable, but retain their diversity.

The varieties of fruits and vegetables for sale at the market in Kanchanaburi reflect Thailand's changing society

Socialization of composting type toilet in Burkina Faso. Photo by Dr. ITO Ryusei



Program Director **SAIJO Tatsuyoshi** RIHN

Tatsuyoshi Saijo (4th from left) specializes in designing social systems that promote sustainability and equity without inhibiting individual incentive. His interest is in developing the field of "Future Design", one that links the happiness and wellbeing of current generation to that of future generations.

FEAST Project

Lifeworlds of Sustainable Food Consumption and Production: Agrifood Systems in Transition

Project Leader **Steven R. McGREEVY** RIHN

Steven R. McGreevy is an environmental sociologist (Kyoto University Ph.D. 2012) and associate professor at RIHN. He has a background in agriculture, rural sustainable development, and environmental education. His research focuses on novel approaches to rural revitalization that utilize local natural resources, sustainable knowledge dynamics, sustainable agrifood and energy transition, and the relinking of patterns of food consumption and production in local communities.

Research Background

Agrifood systems in Asia face a myriad of sustainability challenges related to declining environmental health (GHG emissions, resource overuse, pollution, soil fertility), loss of diversity (biological, cultural, knowledge), and deterioration of small-scale farming due to globalizing market forces. At points of consumption, over-reliance on globalized food flows limits consumer agency and decreases food security and sovereignty. Diets increasingly composed of processed foods also negatively impact public health (rise in diabetes, obesity). The ways in which food is provided, consumed and governed need urgent change, but we lack real understanding of how agrifood transitions emerge and take root, or of the role of existing and alternative institutions, social practices, and economic arrangements to advance sustainable transitions.

Research Overview and Objectives

The FEAST project takes a transdisciplinary approach to explicate the reality of, and potential for, sustainable agrifood transition in Asia. Individual field sites are located Japan, Thailand, Bhutan, and China. Taking a lifeworld perspective, we analyze patterns of food consumption, the socio-cultural significance of food-practices, and the potential of consumer-based agency to change deeply held cultural notions and regional food systems. We also develop structural description of the food system, by mapping national, regional, and local production, distribution, and consumption contexts. In combining socio-cultural and structural descriptions of the relationships between production and consumption, we are able to conduct visioning workshops with stakeholders and initiate food citizenship-oriented experiments and actions.

FEAST's process of co-design and co-production of sustainable food systems seeks to challenge mainstream economic thinking on consumption and growth. In engaging the public in structured debate of societal relationships with food and nature, our project reorients consumers to consider themselves as citizens and co-producers of the foodscapes on which they depend. FEAST seeks knowledge and mechanisms that can redefine the notion of long-term food security.

FEAST Working Groups will produce four types of knowledge relevant to catalyzing agrifood transitions (Figure 1). These are: 1) contextual knowledge of contemporary national, regional, and local food systems (production, distribution, and consumption); 2) co-produced visions of alternative food consumption and production practices and corresponding municipal-level transition plans identifying research, education, and policy needs; 3) modeling- and scenario-based knowledge supporting deliberation and planning processes; and 4) knowledge of two intervention strategies: the social learning dynamics affecting execution and effectiveness of workshop-based consensus-building for collective food action; and the significance of new methods of market transparency (e.g. eco-labels, food impact smartphone apps) in food system change.

Photo 1 **Mother and daughter harvesting *daikon* in the Phobjikha valley, central Bhutan**

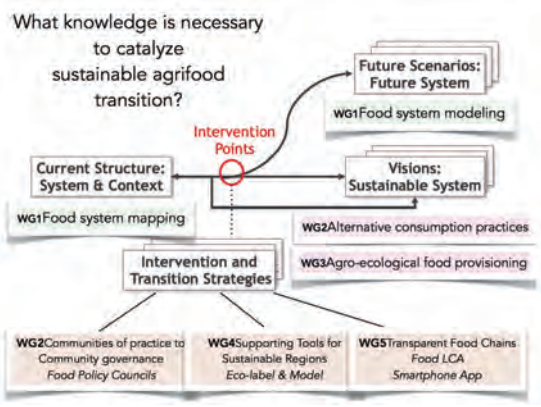


Figure **Diagram detailing how each FEAST working group is organized around the question of "What knowledge is necessary to catalyze sustainable agrifood transition?" Four kinds of knowledge are listed: 1) Current system and contextual knowledge; 2) Visions of sustainable future systems knowledge; 3) Future system scenario knowledge; and 4) Knowledge associated with intervention and transition strategies**

http://www.chikyu.ac.jp/rihn_e/project/2016-01.html
http://feastproject.org/?lang=en

Progress to Date

Investigations of the major drivers of, and environmental impacts from, the gaps between "potential foodshed" (ie. potential food systems) and "observed food flow" (ie. current food system) began at three sites in Japan (Kyoto, Akita, and Nagano). Methodologies used include extensive statistical and literature review of national and regional food distribution networks, compilation of food production data and GIS analysis of satellite imagery to determine food production potential, interviews of major food market actors and government regulators, and fieldwork in wholesale food markets.

Fieldwork was initiated at various sites in Asia examining production-led agrifood transitions toward agroecological rural development. Sites in Japan (Wakayama, Ishikawa, Gifu) and Bhutan will set the stage for further research on the viability of agroecological models such as GIAHS (Globally Important Agricultural Heritage Systems), organic farming in developing-world contexts, and the effectiveness of development policies emphasizing valorization. A comprehensive review of "support structures" aimed at encouraging new farmer entry into agriculture in Japan was accompanied by thorough fieldwork. Studies on the economic and ecological feasibility of carbon offsetting production practices with an accompanying branding scheme were initiated in Kameoka City.

Analysis also continued on the development of civic food networks (CFN) and their impact on regional food policy. Fieldwork in North America on food policy councils sought to determine the preconditions, possibilities, and restrictions for the emergence and success of such networks. Collaborating with local government and local food system actors in Noshiro, Akita Prefecture, a series of workshops to forecast and backcast possible and ideal food futures was held (Photo 2). A comparative study of consumer visions of sustainable food practices in Thailand, China, and Japan is scheduled for next year. Four teams composed of food-impact analysis experts from academia and the food industry (seafood, agriculture & meat, processed food, and app design/consumer behavior) began collaborating on data collection and structuring as initial steps toward the design of a smartphone app.

A research partnership was finalized with Kameoka City, Kyoto and partnerships with Bhutan Royal University, Chinese Academy of Sciences, and Noshiro City, Akita are expected in the near future.

Photo 2 Consumer workshops on visioning food futures, held in Noshiro City, Akita Prefecture. Drawings of an "ideal meal" 30 years in the future (inset)

Photo 3 Organic farmer and citizens workshop at the Kyoto Farmers' Market

Photo 4 FEAST Project Annual Assembly held January 7–8, 2017 at RIHN

Sub Leader

TAMURA Norie	RIHN Senior Project Researcher

Project Researchers at RIHN

KOBAYASHI Mai	Project Researcher	**SPIEGELBERG, Maximilian**	Project Researcher
RUPPRECHT, Christoph D. D.	Project Researcher	**MATSUOKA Yuko**	Project Research Associate
OTA Kazuhiko	Project Researcher		

Main Project Members

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TACHIKAWA Masashi	Ibaraki University	**NAKAMURA Mari**	Nagoya Bunri University
SUDO Shigeto	National Agriculture and Food Research Organization	**TANAKA Keiko**	University of Kentucky, USA
SHIBATA Akira	Ritsumeikan University	**KISHIMOTO-MO Ayaka**	National Agriculture and Food Research Organization
INABA Atsushi	Kogakuin University		

Sanitation Project

The Sanitation Value Chain: Designing Sanitation Systems as Eco-Community-Value System

Project Leader **FUNAMIZU Naoyuki** RIHN/Hokkaido University

Dr. Naoyuki Funamizu is professor in the Graduate School of Global Food Resources, Hokkaido University. He was professor in the Graduate School of Engineering from April 2002 to March 2017. He has B.S. in Sanitary Engineering and an M.S. and a Ph.D. in Environmental Engineering both from the Hokkaido University. His research topics are integrated water resources management, including wastewater reclamation and reuse, and resources-oriented sanitation. He is also working on an international collaboration program on sustainability education. He is a Fellow of the International Water Association (IWA) and is a member of the Management Committee of the specialist group on Wastewater Reclamation and Reuse, and Small Water and Wastewater Systems and is a committee member of Japan Society on Water Environment.

Sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and faeces. The word 'sanitation' also refers to the maintenance of hygienic conditions, through services such as garbage collection and wastewater disposal. In this proposal, the word "sanitation" is used to explore the provision of facilities and services for safe disposal and resources recovery of human urine, faeces and wastewater. The world's population is estimated to be approximately 10 billion in 2050, and this population growth will happen mostly in developing countries. UN Millennium Development Goals Report 2015 reported that 2.4 billion people are still using unimproved sanitation facilities, including 946 million people who are still practising open defecation. And the developing world has still high under 5 mortality and poverty rates. On the other hand, depopulation and aging are progressing especially in rural area of developed world, and the financial capability of local government—which is a key agent in the management of sanitation systems—is becoming weaker.

Sanitation systems are essential for promoting public health, preventing environmental pollution, conserving ecosystem functions, and recycling resources. The question of how to handle the waste of 10 billion people is therefore highly relevant to the global environment.

Working hypothesis of the research

The project has set the following hypothesises:
Hypothesis 1: Current sanitation problems are caused by the dissociation between the value which is provided by the sanitation system and the values of the individual people and/or the community of the people.
Hypothesis 2: Sanitation technologies can't work well without a social and institutional support system. The mismatch between prerequisites of technologies and local characteristics additionally complicates sanitation issues.

Key concept – Sanitation Value chain as a solution

The project proposes a new concept, the Sanitation Value Chain, which has the following dimensions:
1) Places the values of people and community in the center of discussion, and prepares the sanitation system to correspond to this value chain; 2) Designs the sanitation system by focusing on direct incentives for individual users and communities; 3) Recognizes a sanitation system as an integrated system with social and technical units; 4) Designs the sanitation system by making a good match between social characteristics and prerequisites of technologies.

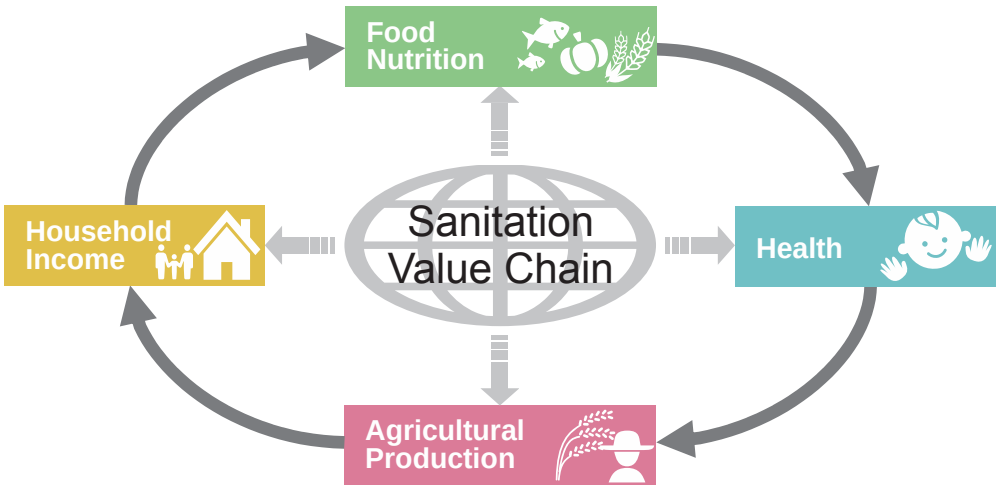

Figure The Sanitation Value Chain acts within and between other important social values

Goals of the project

The goals of this research project are to: 1) propose the concept of Sanitation Value Chain in relation to both developing and developed countries; 2) design several pilot studies demonstrating the significance of societal, academic,and professional involvement in the co-creation of this value chain; and 3) contribute to the establishment of a new interdisciplinary academic foundation regarding sanitation.

Research topics for achieving the goals

Topic–1: Life and Sanitation Field survey for analyzing values and happiness of people (1-1); Field and literature surveys on current and historical norms related to human excreta (1-2); Field and literature surveys analyzing examples of the mismatch between prerequisites of sanitation technologies and regional specific characteristics of human and community (1-3); Field and literature surveys on historical change of sanitation system in target areas (1-4); Matching the values of people, community and value provided by sanitation system (1-5).

Topic–2: Technology Literature survey on prerequisites of sanitation technologies (2-1); Field and literature survey on prerequisites of sanitation technologies in particularly successful cases (2-2); Field and literature surveys to re-evaluate the value of the sanitation system (2-3).

Topic–3: Co-creation of sanitation value chain
Identifying stake holders and understanding the value structures of people and communities (3-1); Analyzing hierarchy and structure of stakeholders' value chain and evaluation of their affinities (3-2); Demonstration of co-creation of the sanitation value chain (3-3).

Research sites

The project will perform field studies at: 1) the rural area in Ishikari River Basin, Hokkaido; 2) the rural area in Burkina Faso; 3) the urban area in Indonesia; and 4) the peri-urban area in Zambia.

Achievements in FS and PR studies

Two field surveys at Lusaka (Zambia) and Bandung (Indonesia), a researcher meeting at Hokkaido University, and a joint seminar with RIHN have been conducted in FS and PR phases. Based on these activities, we have clarified the current sanitation sistuations in our field survey sites. Photo shows the situation in in Kanyama district in Lusaka City, Zambia. The surveys also showed the possible stakeholders related to sanitation and tentative ideas on how to include sanitation systems into user value chains as shown in Figure (for Burkina Faso). Tentative results on the prerequisites of sanitation technologies have also been summarized.

Photo Toilet (red mark in the Photo) and open defecation zone (blue mark) in Kanyama district in Lusaka City, Zambia (Photo by Sikopo P Nyambe)

Project Researchers at RIHN

HAYASHI Koji	Project Researcher	**KIMURA Ayako**	Project Research Associate
NAKAO Seiji	Project Researcher		

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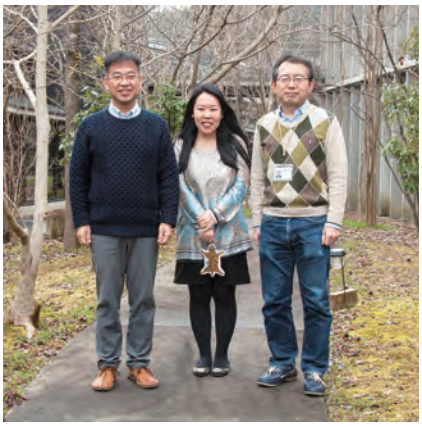
USHIJIMA Ken	Hokkaido Research Organization	**INOUE Takashi**	Hokkaido University
IKEMI Mayu	Hokkaido University	**SINTAWADANI, Neni**	Indonesian Institute of Science (LIPI), Indonesia
SANO Daisuke	Tohoku University	**NYAMBE, Imasiku Anayaw**	University of Zambia, Zambia
NAKATANI Tomoaki	Hokkaido University	**LOPEZ ZAVALA, Miguel Ange**	Instituto Tecnológico y de Estudios Superiores de Monterrey, Mexico
NABESHIMA Takako	Hokkaido University		

Core Program

The Core Program develops concepts and methodologies for transdisciplinary research to solve global environmental problems in collaboration with society. Core projects develop comprehensive and systematic concepts and methodologies for transdisciplinary research, which are widely applicable to global environmental issues, and accessible to related stakeholders.

Core projects produce conceptual and methodological frameworks together with RIHN Research Projects, based on individual methods, techniques, and tools from the divisions in the RIHN Center. Core projects collaborate with Research Projects, building on the case studies developed by these projects, and develop comprehensive and systematic methodologies beyond an individual Research Program or Project. Core projects also deliver completed concepts and methodology to Research Programs and Projects, the RIHN Center, and related stakeholders.

(See additional Core Program description on page 8.)

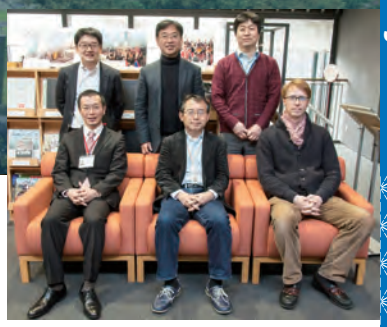


Program Director **TANIGUCHI Makoto** RIHN

Prof. Dr. Makoto Taniguchi is a hydrologist and a deputy Director-General at RIHN. He received a Ph.D. from The Tsukuba University, Japan in 1987. He is currently the vice president of the International Association of Hydrogeologists and the president of the Japanese Association of Groundwater Hydrology. He has been working on water-related projects around the world, in particular Asia, authoring or co-authoring over 170 peer reviewed articles and 8 books including "Groundwater and subsurface environment", "The Dilemma of Boundaries" and "Groundwater as a key for adaptation to the changing climate and society".

Environmental Traceability Project

Proposal and Verification of the Validity of Isotope Environmental Traceability Methodology in Environmental Studies



Project Leader **TAYASU Ichiro** RIHN

Dr. TAYASU was Assistant Professor at RIHN (2002), Associate Professor at Kyoto University (2003), and is currently a Professor at RIHN (2014). His research focuses on isotope ecology and isotope environmental science.

In this project, we hypothesize that environmental traceability is a key concept needed to solve environmental issues for various stakeholders. Stable isotope ratios of elements, together with concentrations of elements, can trace the flow of matter and chemicals through the environment, better describe ecosystem structure and conditions, and appraise food products' chemical profile. Spatio-temporal variation of multiple isotope ratios can be used for studying earth systems, ranging from local to global scales. The information may serve as a key decision-making factor for local people consider water, food and environmental security, all of which are fundamental for the sustainability of human society.

We seek to establish a methodology for how to use the concept of environmental traceability in this study. A combination of quantitative and qualitative tools, including "Multi-Isoscapes" (use of multiple elements and multiple isotope ratios, together with GIS-based mapping technique), social surveys, and workshops, are deployed to investigate the role of environmental traceability in confronting environmental issues. We hypothesize that the role and perception of traceability methods in transdisciplinary processes will differ among stakeholders and that the co-production of "Multi-Isoscapes" can act as an effective "bridging tool" for understanding and explaining variation in local environments. The ultimate objective of this research is to demonstrate the effectiveness of multi-isotopic information in solving global environmental issues.

In this project, we test (I) the effectiveness of the environmental traceability concept in environmental studies, by comparing study cases in which isotopic methods were initiated by (1) local government, (2) citizen groups, and (3) researchers; (II) to what extent the concepts of food traceability and environmental traceability are perceived to be different and how effective they are in communicating the linkages between food production and consumption to consumers?

Research will take place at sites in Ono City, Fukui; Otsuchi Town, Iwate; Saijo City, Ehime; the Chikusa river watershed, Hyogo; Lake Biwa and surrounding watershed in Shiga; and Laguna de Bay and surrounding watershed in the Philippines.

Photo 1 Hongan-Shozu pond in Ono City, Fukui, recharged by ground water

Photo 2 A meeting at Sayo, presenting results and making the next sampling design for Chikusa river watershed

Main Project Members

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http://www.chikyu.ac.jp/rihn_e/project/2017-03.html