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 intellectually explicit the links between environmental change and natural disasters on the one hand, and social issues such as livelihood, inequality, social security and conflict on the other, and reinforce understanding of these links 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. 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. Urban and 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. The project based in Sumatra's tropical peat swamp forest, under this program, 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 be best 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 in recent years have become a significant environmental issue in Indonesia and beyond.

This program coordinates a variety of research projects along these lines, including another project on Eco-DRR under this program,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 unprecedented scales of forest fire incidents, which are a serious health threat to people in local areas and neighboring countries. This photograph shows a peatland fire in Tebing Tinggi Island, Riau Province, off the coast of Sumatra Island, Indonesia. It took approximately 10 days to extinguish the fire.

Program seminar at RIHN, January 18, 2019

Abandoned paddy fields located at the bottom of small valleys called "yatsu" in the Lake Inba area, Chiba Prefecture, Japan. Though rice farming was abandoned, they still have multiple functions including flood control, water purification and biodiversity conservation, which is the key feature of Eco-DRR (Ecosystem-based Disaster Risk Reduction).

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

Researchers

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

Project Leader **KOZAN Osamu** RIHN/Kyoto University

Osamu Kozan has conducted hydro-meteorological observation and hydrological modelling in Asia. Based on field observation data, he developed hydrological land surface models considering actual water management in the Huai River basin in China and the Aral Sea Basin in Central Asia and developed a forecasting model of snowmelt-flood in Lake Biwa basin. He has been promoting an integrated natural and social science study on peatland society in Riau province and conducting action research on peatland rehabilitation since 2008. He is continuing research on the effects of peatland fires and the accompanying air pollution on the local community.

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 in order to create commercial acacia and oil palm plantations. As these tree species cannot grow in swamps, peatlands have been drained, creating extensive areas of dried peatlands that 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 more sustainable measures, such as rewetting and reforestation of peatlands, activities also promoted by this project since 2012.

The government of Indonesia established the Peatland Restoration Agency in January 2016, and declared that two million hectares of degraded peatlands would 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 through action research. The project seeks to identify and implement alternative practices in collaboration with local people, academics, governmental offices and officials, NGOs, and international organizations.

The project conducts multidisciplinary research in order to clarify the entire process of peatland degradation. We are especially focusing on the three topics: A) History of development, B) Peat environment, and C) Climate change. Each topic sheds light on the cyclical series of social and environmental phenomena related to the process of peatland degradation. We study vulnerability and transformability of each topic in order to bring innovative peatland restoration activities to tropical peatland societies.

Research methods and objectives

Peatland ecosystems are vulnerable. We explore their vulnerability with scientific methods, analyzing the socio-economic history of the peatland societies, monitoring greenhouse-gas emissions in various types of peatlands, and tracking historical change in the amount of rainfall and significance of haze. Damage from human disturbance is not completely reversible, however, and it is also necessary to consider sustainable development of the local economy. In order to address this dilemma, we also explore the transformability of peatland societies with trans-disciplinary approaches, in which we promote participation by villages in peatland restoration activities and suggest effective policies to administrators, arrange effective applications of paludiculture and social forestry, and use weather radar to identify potential fire outbreaks.

This research thus supports the future potential of

Photo 1 Social forestry workshop held in the village of Tanjung Leban (August 2018)

Photo 2 Drained peatland and oil palms in Pelalawan District (September 2018)

peatland-based societies, the phasing out of monoculture production activity, the development of paludiculture, and the enlargement of protected peatland areas.

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.

We signed the Memoranda of Understanding with the Peatland Restoration Agency of Indonesia and Riau University to conduct action research to restore degraded peatland. Our project has created action plans based on these MOUs and has accordingly begun to implement a restoration program, in which we started the social forestry programs designed to strengthen the land rights of people on degraded state lands.

In addition, as a result of the continuous monitoring of green-house-gas emissions from peatlands, the influences of haze on atmosphere, and the seasonal changes of local rainfall, we are clarifying the influences on and processes of peatland degradation.

Publications

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, the profit motives of companies, and the conservation motives of Government and NGOs. The book showcases the potential solution of rewetting and reforesting "the people's forest". The book has been reviewed across various 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.

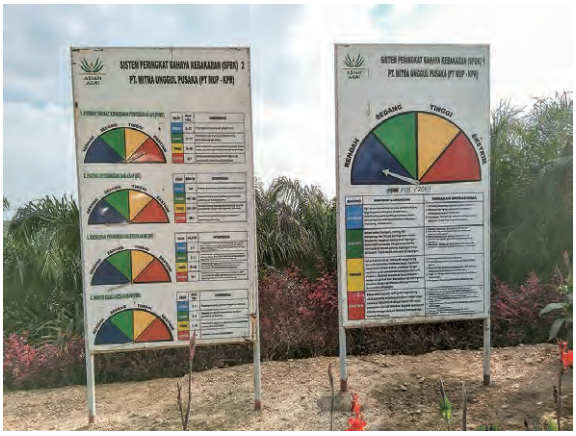

Photo 3 Signboards that show the degree of risk for peatland fire (September 2018)

Photo 4 Practice of planting indigenous trees for social forestry in the village of Tanjung Leban (August 2018)

Researchers at RIHN

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Research and Social Implementation of Ecosystem-based Disaster Risk Reduction as Climate Change Adaptation in Shrinking Societies

Project Leader **YOSHIDA Takehito** RIHN/The University of Tokyo

Takehito Yoshida is an ecologist and limnologist who studies diversity and complexity of organisms and ecosystems from the viewpoints of adaptation and system dynamics, and explores human-nature interactions and sustainability in local communities in Japan. Trained in Kyoto University (PhD) and Cornell University (postdoc), he was a member of the faculty at the University of Tokyo at Komaba before assuming joint appointments at RIHN and the University of Tokyo.

Outline of the project

Globally, the rate of natural disaster occurrence has been increasing, partly due to contemporary climate change, and adaptation to natural disaster risks is increasingly important to the sustainability of human societies. At the same time, many societies are experiencing shrinking populations. Ecosystem-based Disaster Risk Reduction (Eco-DRR) takes advantage of the multi-functionality of ecosystems and biodiversity, including their capacity to mitigate natural disasters while providing multiple ecosystem services, and population decline provides ample opportunity for implementing Eco-DRR. Our project will develop practical solutions for implementation of Eco-DRR by visualizing natural disaster risks, evaluating multi-functionality of Eco-DRR solutions, conducting transdisciplinary scenario analysis, examining traditional and local knowledge of disaster risk reduction, and collaborating with the insurance industry and other sectors.

Background and goals

Climate change impacts natural and human systems, and is projected to intensify in the future. Our project focuses on reducing risk and developing management strategies related to natural disasters. The risk of natural disasters results from the interaction between a climate-related hazard, and the exposure and vulnerability of human activities (Fig. 1), so that adaptation to natural disaster risk can be realized by reducing exposure (e.g. by improving land use) and vulnerability to hazards.

Hard-engineering natural disaster countermeasures have target safety levels, below which natural disasters can be prevented. Although these countermeasures are effective if the hazard level of natural disaster is below the target safety level, we are increasingly faced with situations in which hazard levels exceed safety levels, resulting in devastating natural disasters. Eco-DRR approaches focus on lowering the exposure of human activities to natural hazards, so reducing, if not preventing, associated losses and damages. Eco-DRR approaches, meanwhile, take advantage of the multi-functionality of ecosystems, so complementing conventional approaches to natural disaster management, although the effectiveness and multi-functionality of Eco-DRR is not yet clearly and quantitatively understood.

Japan's population is aging and shrinking, leading to the abandonment of farmlands, houses and decreases in other intensive land uses, a challenging circumstance that

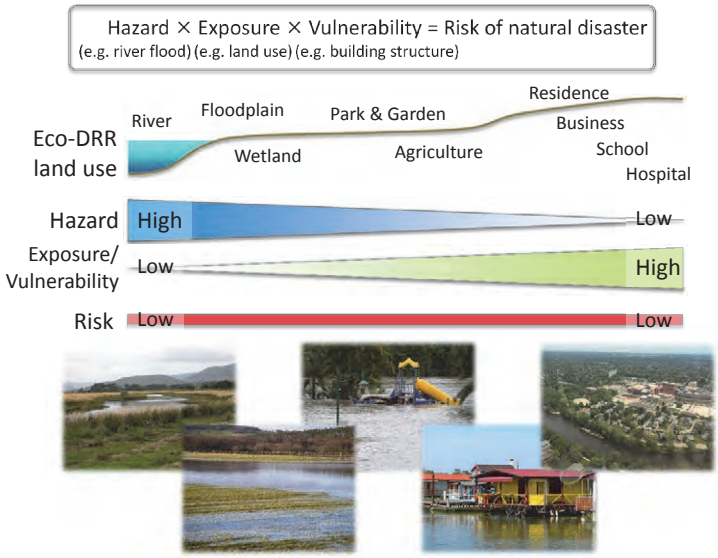

Figure 1 Ecosystem-based disaster risk reduction not only lowers disaster risks but also enhances benefits of ecosystem services by reducing the exposure of human activities in high-hazard locations and supporting human activities in low-hazard locations.

nevertheless provides an opportunity for improving land use. The population of Japan increased substantially over the last century, increasing the risk of and public exposure to natural disasters. Evaluating past natural disaster risks therefore provides valuable information of adaptation strategies considered in Japan as well as in other countries.

Given this background, the ECO-DRR project sets two main goals: first, it develops methodologies to evaluate Eco-DRR multi-functionality and assess Eco-DRR by comparing multi-functionality in the past, present and future. Secondly, the project supports Eco-DRR implementation through transdisciplinary collaborations with local communities, governments, insurance industry and other stakeholders.

Research objectives

Three research components contribute to achieve the above two goals.

(1) Visualizing the risks of natural disasters in the present and the past

The exposure and vulnerability associated with different natural disasters will be analyzed, and the risks evaluated and visualized as risk maps of the present and past. Modeling risk for the different exposure scenarios will contribute to future Eco-DRR assessments and plans.

(2) Evaluating and modeling multi-functionality of Eco-DRR

Provisioning, regulating and cultural ecosystem services will be evaluated, and their spatial distribution will be modeled in relation to population and land use. The model will be used to evaluate the ecosystem services for different land use scenarios.

(3) Transdisciplinary scenario analysis and developing social and economic incentives of Eco-DRR

Together with local communities and governments, transdisciplinary platforms will be formed at research sites to deepen understanding of, discuss future options of, and build consensus around Eco-DRR approaches. Transdisciplinary scenario analysis under the conditions of climate change and declining population will be conducted. In addition, traditional and local knowledge of disaster risk reduction will be inventoried and evaluated for multi-functionalities shared in the platform.

In collaboration with the insurance industry, a research forum will be formed to discuss the possibility and feasibility of industry-led contributions to and economic incentives for Eco-DRR. The research forum will also assess various laws and institutions in national and local governments related to disaster risk reduction and land use.

Recent results

The oriental white stork is an endangered bird species that once went extinct in Japan, and the reintroduction of this species has been progressed in Toyooka city and other places in Japan, emphasizing the need of conservation and restoration of its habitat. We explored the characteristics of the habitat by tracking individual birds by satellite, and found that paddy fields and adjacent forests are important component of the habitat. Comparing the habitat of oriental white stork with flood-prone areas demonstrated significant overlap between the two areas, suggesting that conservation and restoration of the habitat can lead to the reduction of flood disaster risk as well.

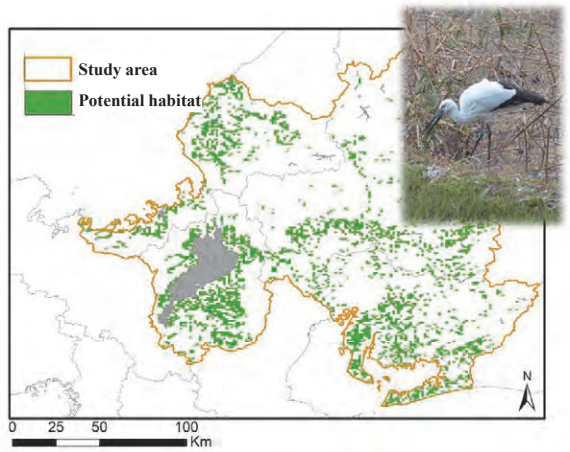

Figure 2 Map of the potential habitat of oriental white stork (green area) in central Japan.

Photo 1 Mikatagoko area in Fukui Prefecture, one of the research sites.

Photo 2 Hira mountains and their base area in Shiga Prefecture, one of the research sites. Photo courtesy of MATSUI Kimiaki.

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Research Program 2

Fair Use and Management of Diverse Resources

Global environmental problems are inter-related. Studies concentrating on single issues are therefore often not effective and consideration of the links between multiple resources involving stakeholders is essential. Recently, the nexus structure linking energy, water and food production has become a prominent area of study, but truly sustainable societies require more comprehensive understandings of the ecological resources that provide ecosystem services and cultural resources. The production, circulation and consumption of resources should be discussed in relation to a range of spatial scales, and stakeholders should be involved in these discussions. Sustainable use of resources requires fair and wise management systems as well as indices capable of managing these processes.

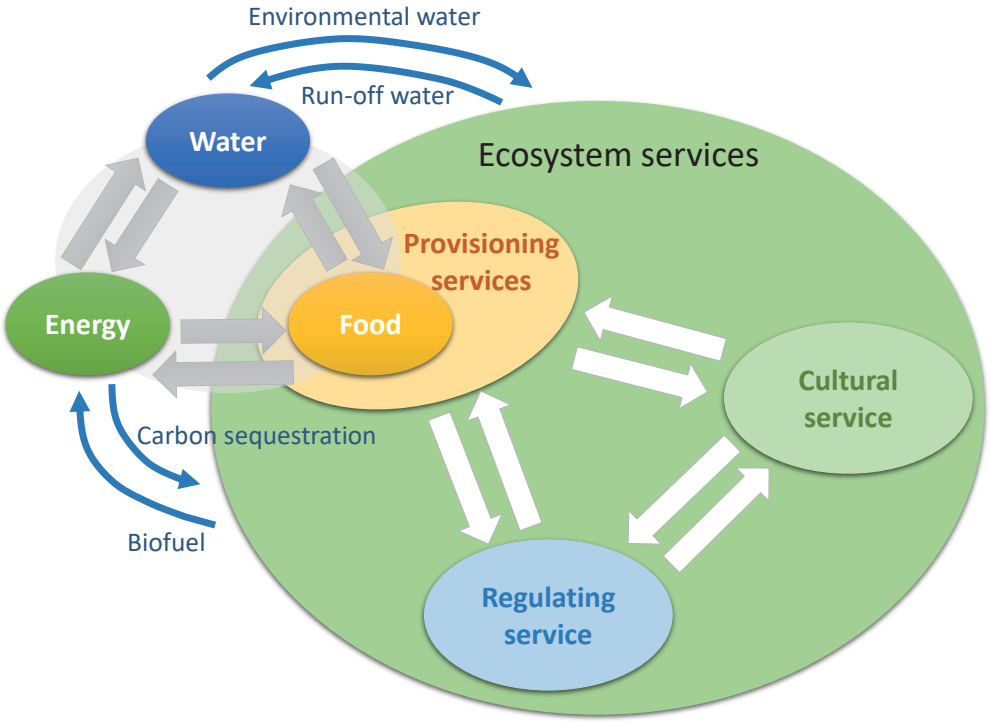
Many existing socio-economic or human behavioral systems must be converted or transformed into new systems capable of addressing the special qualities of renewable natural resources, as these qualities have sometimes been externalized from conventional economics. Asia is experiencing rapid change in economy, urbanization and population, though traditional techniques for sustainable resource management, associated with the relatively rich humanospere and cultural background in this region, also survive. Study of this long-standing Asian experience of resource use may offer important observations about sustainability in general.

RIHN research projects have accumulated information and suggestions necessary to this transformation in resource management, though gaps remain. Program Two therefore explores wise and fair management systems capable of addressing multiple resource-uses by multiple stakeholders, in multi-spatial scales. We encourage new project proposals including those by innovative young scientists addressing such novel and under-examined subjects. Internal Program discussions also address the social conditions that support transformation of values and human behavior, as they should also inform new indices and institutions for fair resource management.

In 2018, we initialized a database of resource supply and demand in every prefecture in Japan in order to assist comparative and integrative analyses of research sites. One initial analysis of this database indicated that prefectural sustainability is related to population density. We would like to enhance this database's relevance as a decision-support tool at all levels, from the municipality- to the national-scale, and expand its ability to assess multiple resources.

Traditional agricultural landscape in Hanamaki, Iwate Prefecture, Japan

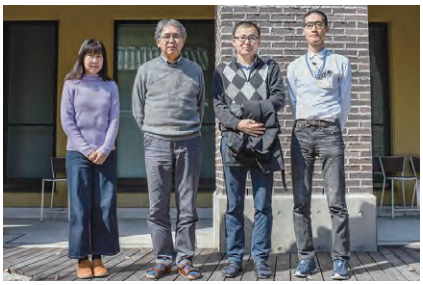
Land-use pattern in mountain area in Thailand



Nexus structure among water, energy, food, and ecosystem services

Program Director **NAKASHIZUKA Tohru** RIHN

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



Researchers

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KARATSU Fukiko Research Associate

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 a framework for adaptive watershed governance that allow new environmental knowledge to reconcile global, regional, and local ecological issues. I should also 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, in particular nitrogen and phosphorus, have allowed global increases in population and economic prosperity in the Anthropocene. Overexploitation of nutrient resources, however, affects biogeochemical cycles and can lead to nutrient imbalances, eutrophication and loss of biodiversity. It is now recognized that the nutrient imbalances and biodiversity loss are prevalent in watersheds around the world, resulting in deterioration of ecosystem services in quality and quantity. These are considered global environmental issues, while their causes and effects vary among watersheds, in which there exist a variety of social issues specific to local communities.

Here we aim to develop a framework for adaptive watershed governance with two approaches (Fig. 1): a macroscopic approach to recognize and address environmental issues at the watershed level based on scientific knowledge; a microscopic social-cultural approach to empower local communities to achieve solutions of local issues.

Research methods

In adaptive watershed governance, stakeholders are involved in enhancement of biodiversity, nutrient cycling and well-being, according to our hypothesis that these are essential to the social-ecological health of watershed system and, like gears, also interdependently linked into community activities (Fig.1). We begin with action research to empower the communities for conservation of "familiar" nature, that is, natural phenomena of special significance to local life and livelihood. As conservation activities promote community sharing of cultural values of familiar nature, community-based well-being is altered and reinforced by accumulation of bonding social capitals.

If such community activities enhance biodiversity and nutrient recycling, they may benefit stakeholders other than the community members in ways not easily registered by the local cultural values, but inspired by the social-ecological health of watershed. In disseminating such scientific knowledge to the public, our project will facilitate social involvement in conservation activities by non-community members who appreciate the value of social-ecological health. This shared awareness allows accumulation of bridging social capitals. As scientific knowledge is extensively shared among diverse stakeholders in the watershed, community members may gain institutional support from local governments. Integration of local and scientific knowledge further enhances community-based well-being, resulting in community empowerment.

To investigate this positive feedback process, we compare the consequences of watershed governance activities in two contrasting watersheds 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.

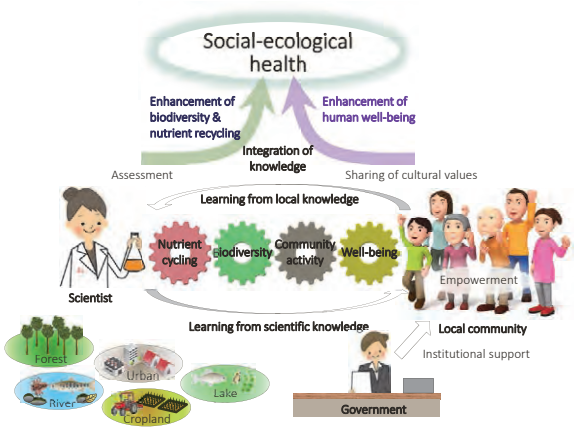

Figure 1 A conceptual schema of adaptive watershed governance

Research progress

We conducted synoptic research in order to visualize spatial patterns of biodiversity, nutrient cycling and subjective well-being in a whole catchment of Yasu River

Figure 2 Action research with five focal communities in the Lake Biwa Watershed. Tree planting in upstream forests of Oh-hara (a), conservation of wetland biodiversity in terraced rice paddies of Kosaji (b), rehabilitation of habitat networks between a lake basin and rice paddies to facilitate fish spawning migration in Suhara (c), Conservation of lagoon landscape and rehabilitation of habitat networks between the lake basin and lagoons in Shina (d), Formation of a new community to recycle overgrown macrophyte debris in urban coastal areas (e; photo by INOUE Yasuo)

tributary to Lake Biwa. In parallel, action research has been practiced in five focal communities within the watershed (Fig. 2). In some communities, our social-cultural approach was effective in enhancing biodiversity, community-based well-being, and nutrient cycling (Fig. 3), whereas our action research is still in the process of building trust with other communities.

In the Silang-Santa Rosa sub-watershed of Laguna de Bay, urbanization has caused serious eutrophication and biodiversity loss in downstream areas. In this situation, it is difficult to restore stream environments through community conservation activities alone, and institutional and technological approaches to these issues may be required. We focused on groundwater as a key issue of common interest because all stakeholders depend on groundwater resources for their lives and livelihoods and are therefore highly concerned about groundwater overexploitation and pollution. Following our assessment of groundwater pollution, stakeholder workshops were held to discuss sustainable and fair use of groundwater resources (Photos 1a-b). A stakeholder assembly was co-organized with the watershed management council as a step toward formation of a watershed forum as a platform for stakeholder involvement in watershed governance (Photos 1c-d).

We are also conducting action research to empower a mid-stream agricultural community to conserve a communal spring as an environmental icon of local groundwater. Its activities have been increasing with the organization of a conservation group. Comparison of watershed cases will allow us to summarize how social and ecological properties of watershed systems can affect applicability of our governance approach.

Perspectives

In developed societies, sewage treatment and tap water infrastructure systems have reduced eutrophication and improved comfort and convenience. Environmental consciousness of formerly familiar nature, however, has diminished. What kind of societal interactions with nature enhances human well-being? Is it enhanced by infrastructure? Our research seeks answers to these questions together with a variety of stakeholders.

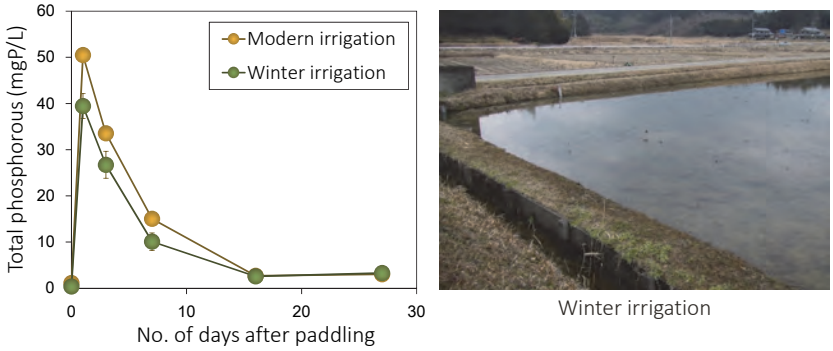

Figure 3 **A lab experiment to compare temporal changes in total phosphorous concentrations in rice paddy waters after paddling (pre-planting field preparations) between modern and traditional winter irrigations. Phosphorous loading was significantly lower in the winter irrigation.**

Photo 1 **Workshops for a local community (a) and National Water Resource Board (b), and roundtable discussion (c) of the 1st Stakeholder Assembly (d) in the Silang-Santa Rosa sub-watershed.**

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Mapping the Environmental Impact Footprint of Cities, Companies, and Household

Project Leader **KANEMOTO Keiichiro** RIHN

I was a Lecturer of Institute of Decision Science for a Sustainable Society at Kyushu University and Faculty of Economics and Law at Shinshu University. From 2009-2011, I was a Visiting Research Fellow at Integrated Sustainability Analysis, the University of Sydney. I received my Ph.D. in 2014 from Tohoku University. My main research interests are in Industrial Ecology, Environmental Economics, Input-Output Economics (multi-region, environment), and Networks. I developed Eora multi-region input-output database with Manfred Lenzen, Daniel Moran, and Arne Geschke. I am a member of the editorial board of Journal of Economic Structures. In 2018 I was named a Highly Cited Researcher in the field of Cross-Field by Clarivate Analytics.

A recent study in Nature showed that up to a third of biodiversity loss is driven by trade, and a body of other studies have identified the same pattern for GHG emissions, air pollution, and other environmental ills. Many environmental impacts worldwide are ultimately driven by consumption in developed countries. Considerations of remote responsibility, ecological footprint, and scope 3 emissions are now a standard part of the environmental policy discussion at many levels, from the UNFCC to individual businesses and households.

Providing better information to buyers and decision-makers can be a powerful way to reduce environmental pressures worldwide. The life-cycle analysis (LCA) and supply chain analysis tools (multi-regional input-output (MRIO) models) used to analyze these remote effects in detail have benefited from significant advances in the past years, with improving models and, more recently, the link of economic models to spatial (GIS) maps that locate more precisely how global supply chains link to particular emissions and biodiversity hotspots.

However, while existing work sketches out the broad picture, it still falls short of being detailed enough to help with many specific decisions. Existing supply chain analyses operate at the resolution of countries and broad economic sectors. In practice decision-makers at these levels often only have limited effective economic and judicial power. Many individuals, businesses, and local governments are seeking to reduce their total environmental footprint, but existing models are either too coarse resolution to be truly useful or require expensive and time-consuming modifications to be useful for informing specific decisions.

Unlike most studies, which focus on environmental emissions and international trade, this is the first study to clarify the effect of global supply chains on environmental impacts. Further, in addition to countries and regions, we will estimate the environmental footprint of cities, companies, and households. The proposed project would be a major contribution and can be expected to be of high interest to businesses, policymakers, NGOs, sustainability consultants, and researchers around the world. The project team has deep experience in supply chain analysis and environmental impact assessment.

Carbon footprint of cities

In 2018, we estimated the carbon footprint of 13,000 cities. Key findings are the following:

- Globally, carbon footprints are highly concentrated in a small number of dense, high-income cities and affluent suburbs
- 100 cities drive 18% of global emissions
- In most countries (98 of 187 assessed), the top three urban areas are responsible for more than one-quarter of national emissions
- We define cities as population clusters, but in practice mapping footprints to local jurisdictional bounds is complex
- 41 of the top 200 carbon-intensive cities are in countries where total and per capita emissions are low (e.g. Dhaka, Cairo, Lima). In these cities, population and affluence combine to drive footprints at a similar scale as the highest income cities
- For large and high-income cities, their total Scope 3 footprint is much larger than the city's direct emissions
- Radical decarbonization measures (limiting nonelectric vehicles; requiring 100% renewable electricity) can induce substantial emissions reductions beyond city boundaries. In wealthy, high-consumption, high-footprint localities such measures may require only a small investment relative to median income, yet accomplish large reductions in total footprint emissions
- Local action at the city and state level can meaningfully affect national and global emissions

Our findings are widely reported in the press, e.g. Scientific American, DailyMail, Newsweek, U.S. News, World Economic Forum, Kyodo News.

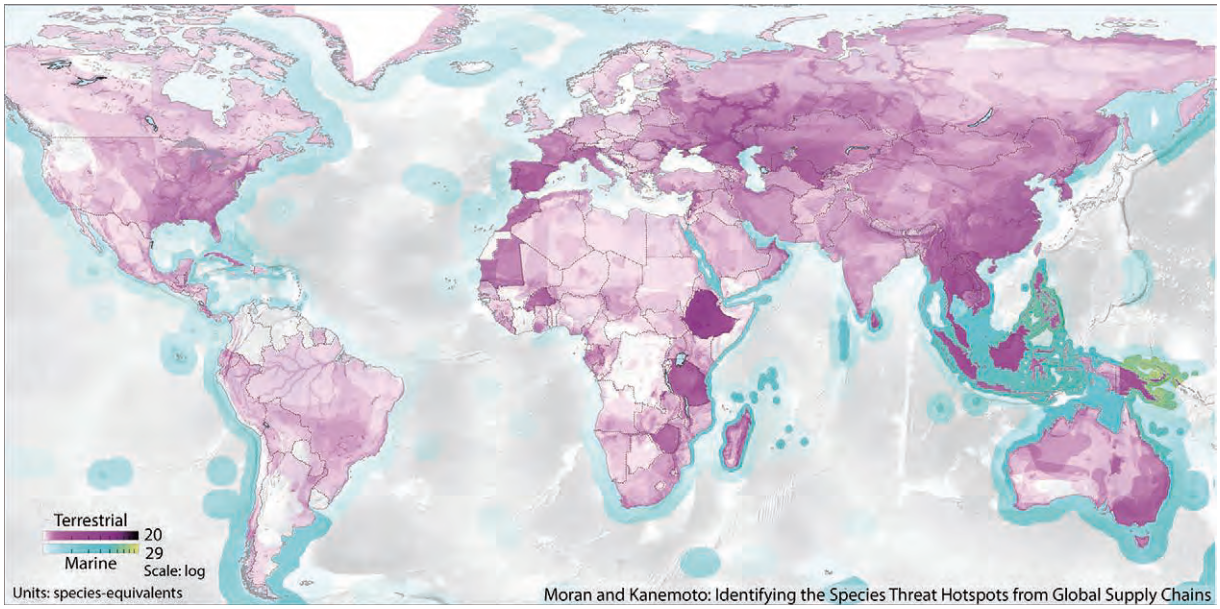

Figure 1 A map shows species-threat hot spots linked to consumption in Japan.

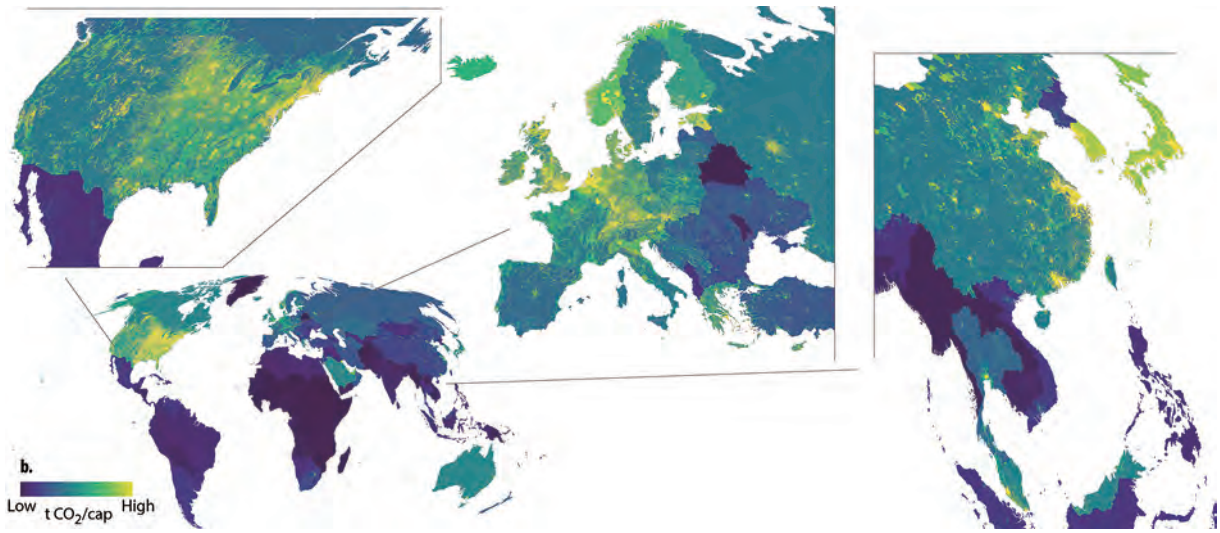

Figure 2 The carbon footprint of Asian cities.

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CHATANI Satoru	National Institute for Environmental Studies	**ASAYAMA Shinichiro**	Waseda University
MATSUBAE Kazuyo	Tohoku University	**YAMAMOTO Yuki**	Nagasaki University
OHNO Hajime	Tohoku Universitu	**SUH Sangwon**	University of California, Santa Barbara
MURAKAMI Shinsuke	The University of Tokyo	**ODA Tomohiro**	NASA Goddard Space Flight Center
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FUJII Hidemichi	Kyushu University	**VERONES, Francesca**	Norwegian University of Science and Technology
SHIGETOMI Yosuke	Nagasaki University	**GESCHKE, Arne**	The University of Sydney

Research Program 3

Designing Lifeworlds of Sustainability and Wellbeing

More than 60% of the world's population resides in Asia and over a third of global economic activity occurs there. Asia is comprised of 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. The region is also affected by growing wealth disparity, social isolation, rising levels of poverty, and the disappearance of traditional cultures and knowledge. The combination of migration between the countryside and cities, rural depopulation, and urban concentration is accompanied by rapid socio-cultural change, over-exploitation of resources, and deterioration of natural environments. Both urban and rural lifeworlds are disintegrating rapidly.

As a consequence, in 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. Program research is based on the diverse world-views and accumulation of experience of human-nature co-existence. These latent 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 contemporary problems and to help 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.

The transformations and frameworks leading to sustainable urban and rural lifeworld design, will also entail fundamental shifts in existing economic systems, markets, and political decision-making systems. Rather than investigating top-down approaches to system change, Program 3 will work with local residents, government officials, companies, citizen groups and other stakeholders to propose sustainable alternatives and gauge their feasibility.

In order to avoid the risk of developing proposals that are only applicable to specific regions or sites, Program 3 will aim for research results that are generalizable while also retain the diversity at the heart of local lifeworlds and wellbeing.

The highlight of this year was the Program's session in World Social Science Forum 2018 at Fukuoka (Lifeworlds of Sustainability and Well-being in a Shrinking Japan). Both the FEAST Project and the Sanitation Value Chain Project research the ways in which depopulation is affecting the sustainability and well-being of those in rural Japan. At the same time, Japan's shrinking society represents an opportunity to reduce overall ecological impacts, rethink the values associated with well-being, and restructure economic interrelationships to align with reduced resource consumption. Peter Matanle (University of Sheffield), Steven McGreevy, Ken Ushijima (Sanitation), Yui Takase (Ibaraki University), and Christoph Rupprecht (FEAST) reported their research results. The output of this session will be a book from Springer.

The diversity 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 ITO Ryusei

Program Director **SAIJO Tatsuyoshi** RIHN

Tatsuyoshi Saijo 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.

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. The ways in which food is provided, consumed and governed need urgent change, but we lack understanding of how agrifood transitions emerge and take root, or of the role of existing and alternative institutions and policy, social practices, future visions, and economic arrangements, in advancing 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 in 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 descriptions 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 **Visioning workshops with farmers, consumers, NPO, and government officials held in Kyoto City, February 2018 (bottom), backcasting group work output (upper left), and "food policy council simulator" game (upper right).**

Progress to Date

Over the past year, FEAST has made progress on several areas of research.

The Ecological Footprint of Japan's food consumption was analyzed for all 47 prefectures and showed that imported animal feed and ingredients for processed foods comprised a significant portion of the overall impact. Urban Japanese prefectures and cities had a much higher

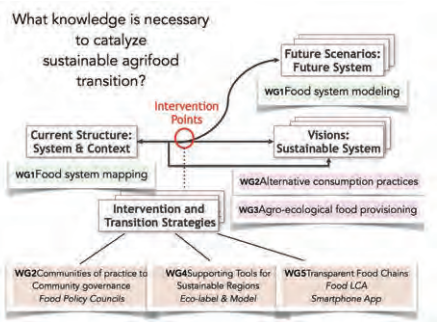

Figure 1 **Diagram detailing how each FEAST working group is organized around the question of "What knowledge is necessary to catalyze sustainable agrifood transition?" Four kinds of knowledge are listed: 1) Current system and contextual knowledge; 2) Visions of sustainable future systems knowledge;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

footprint than their rural counterparts (Figure 2). One way to reduce environmental impact from food consumption would be through increased local production via urban agriculture. Unfortunately, a study using satellite imagery to map both formal and informal urban agricultural land use change in Kyoto City found that agriculturally productive land decreased by 10% over the last 10 years to housing development (40% post-ag. use) and abandonment (28% post-ag. use), even though Kyoto is a shrinking city. These findings emphasize the need to intervene at the municipal level for policies that address food system sustainability.

Last year, six workshops were held across the four Japanese sites (Kyoto: 3, Kameoka: 1, Nagano: 1, Akita: 1) on a range of issues relevant to local food policy and the issues stakeholders felt were urgent and actionable, including rural futures and ideal future school lunches. These multi-method workshops utilized visioning, backcasting, role-playing, and gaming methods with local food-related actors and government officials and will be linked with future scenario modelling and local policy proposals and plans. (Photo 1)

FEAST is also investigating informal food practices (hobby gardening, seed sharing, urban foraging, gathering edible wild plants, etc.), how they form informal food systems and their relationship with well-being and sustainable lifestyles. Work on urban bee-keeping found that low social awareness (and not pesticide use) is the main obstacle to keep bees in cities. (Photo 2)

In Bhutan, a front-runner of sustainable development in Asia, extensive interviews and surveys in three rural districts revealed wide-ranging changes in on-farm practices and food consumption patterns. Follow-up studies are underway in urbanizing districts to capture how Bhutan might develop its food system in a sustainable way. (Photo 3)

FEAST maintains research partnerships with the University of California at Berkeley, Royal University of Bhutan, Mahidol University, Shanghai Academy of Agricultural Science, as well as Kameoka and Noshiro Cities (Japan) and plans to partner with University of Utrecht next year.

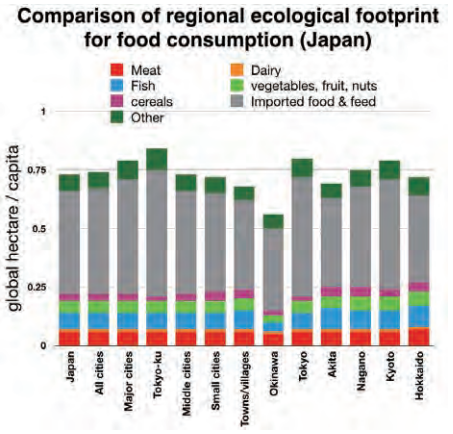

Figure 2 Comparison of regional ecological footprints for food consumption in Japan. Imported food and animal feed is most impactful, while regional differences in overall impact are evident.

Photo 2 Investigating informal food practices: fieldwork with urban hobby bee-keepers (upper left), seminar on bee-friendly cities (below)

Photo 3 Community and market fieldwork as well as household surveys in Bhutan.

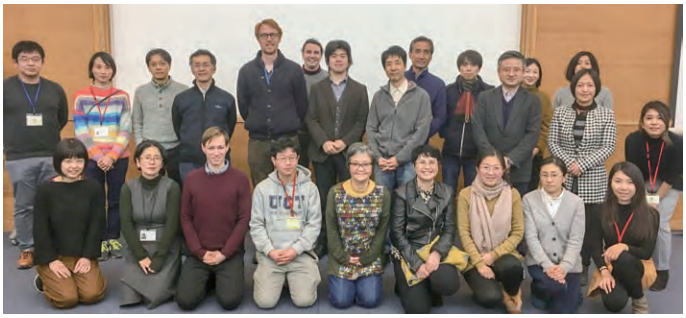

Photo 4 FEAST Project Annual Assembly held at RIHN 13-14 January 2019.

Sub Leader

TAMURA Norie	Senior Researcher

Researchers at RIHN

RUPPRECHT, Christoph D. D.	Senior Researcher	**SHINKAI Rika**	Researcher
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ODA Kimisato	Researcher	**MATSUOKA Yuko**	Research Associate
OTA Kazuhiko	Researcher	**KOBAYASHI Yuko**	Research Associate

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TANIGUCHI Yoshimitsu	Akita Prefectural University	**INABA Atsushi**	Kogakuin University
NAKAMURA Mari	Nagoya Bunri University		

Sanitation Project

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

Project Leader **YAMAUCHI Taro** RIHN/Hokkaido University

Prof. Taro Yamauchi is a professor at the Faculty of Health Sciences, Hokkaido University. He has a B.S., a M.S. and a Ph.D. in Health Sciences from the University of Tokyo. He does intensive fieldwork in hunter-gatherer society, rural villages, and urban slums in developing counties to understand the lifestyle and health of local populations and adaptation to living environments. His research interests also include sanitation and participatory action research involving local children, youth and adults. He is Vice-President of the International Association of Physiological Anthropology (IAPA) and an executive member of the International Society for the Study of Human Growth and Clinical Auxology (ISGA).

Sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and feces. 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 practicing open defecation. The developing world still has high under-five mortality and poverty rates. The world's population is estimated to reach approximately 10 billion in 2050, and this population growth will happen mostly in developing countries. At the same time, depopulation and aging are increasing, especially in the rural areas of the developed world, and the financial capability of many local governments—which are key agents in the management of sanitation systems—is getting 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 hypotheses of the research

The project investigates the following hypotheses:

Hypothesis 1: Current sanitation problems are caused by a 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 cannot 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.

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 on sanitation.

Research topics for achieving the goals

Topic–1 **Life**: By field survey, we learn about the values of people and the norm for human excreta, and reevaluate the sanitation system in relation to the residents lives.

Topic–2 **Technology**: We identify prerequisites of sanitation technologies and reevaluate the value that sanitation will give us. In addition, we develop new sanitization technology to make use of the value chain by understanding the values of people and local conditions.

Topic–3 **Co-creation**: We identify stakeholders and describe the value structures of people and communities, and analyze the hierarchy and structure of stakeholders' value chain and evaluate their affinities. We demonstrate the co-creation process of the sanitation value chain.

Topic–4 **Visualization**: In order to co-create the value chain, it is necessary to make efforts to communicate research results to actors and stakeholders. Utilizing resources and institutional collaborations of RIHN, we will develop a method to express and transmit outcomes using various media.

Research sites

The project is performing field studies at four sites: 1) Rural areas in Ishikari River Basin, Hokkaido; 2) Rural areas of Burkina Faso; 3) Urban areas in Indonesia; and 4) Peri-urban areas in Zambia.

How we think about sanitation

We involved multidisciplinary experts and have created a framework of understanding to capture sanitation problems as not only material cycling, but as a whole of the value of sanitation in health and wellbeing, materials, and socio-culture (Figure1). Based on the framework, we will uncover values embedded in societies and cultures, and

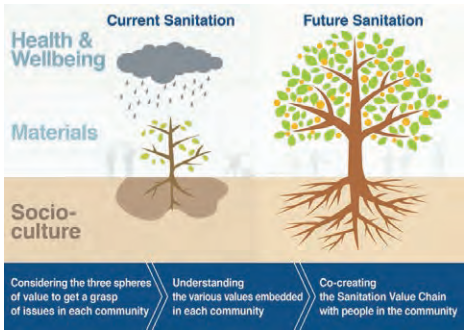

Figure 1 The concept of three values from the point of Co-creation (Figure by KATAOKA Yoshimi)

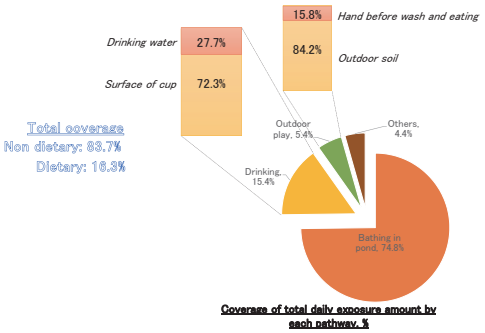

Figure 2 *E. coli* exposure pathways. Example of measurement in Bangladesh, From: Harada et al. (2017) Fecal exposure analysis and *E. coli* pathotyping: a case study of a Bangladeshi slum, International Symposium on Green Technology for Value Chains 23-24 October, 2017, Balai Kartini, Jakarta.

co-create the Sanitation Value Chain by cooperating with various actors related to the sanitation system. We envisage that Sanitation Value Chain system will improve the health and wellbeing within the community.

Achievements in FR studies

(1) Toilet for recycling resources. We have developed functioning toilet technologies necessary for the sanitation value chain by making urine in the urban area valuable as fertilizer. These are the "Toilet that can concentrate urine" and "Toilet that can make phosphorus fertilizer".

(2) Tracking propagation of pathogens. Pathogenic bacteria propagate through various routes. We have developed a molecular biological method of tracking this propagation. In the case of Bangladesh, we found that the most important route of pollution is bathing, and the contamination of drinking cups is more important than of the water itself (Figure 2).

(3) Establishment of "Children and Youth Club" and implementation of action research. In the peri-urban areas of Lusaka, the capital of Zambia, we established a group called *Dziko Langa* (My Community) and conducted action research. Children and youth drew pictures and took photographs of scenes considered as community problems related to sanitation, giving explanatory narratives of their work ("Arts-based" and "PhotoVoice" approaches). The groups then held open sanitation exhibitions in their communities. Through these activities, we were able to clarify community sanitation challenges and to discuss problems with community residents.

The notable achievements (New achievements in FY2018, special remarks)

Figure 3 International academic Journal *"Sanitation Value Chain"* Vol.2 No.1

1. We published the second volume of the international multi-disciplinary academic journal "Sanitation Value Chain", (Figure 3) and an academic book "*Resources Oriented Agro-Sanitation Systems: Concepts Business Model and Technologies*" (Funamizu (ed.) 2018, Springer).
2. In Zambia, we organized an exhibition to showcase the results of the action research which we had done with our local youth group based in 2 communities in Lusaka, the capital city of Zambia. The exhibition attracted many people including residents and Members of Parliament elected in the study area. We set up an exhibition booth at ZAWAFE 2018 held in Lusaka. The exhibition was well received, and we were honored to receive a visit from Vice President of Zambia (Photo 1) (visiting of exhibition booths was based on special selection). In addition, the project leader, project members, and *Dziko Langa* held a 3 day Sanitation Festival, with the first day being a march officially opened by the Mayor of Lusaka.
3. In Burkina Faso, we have researched private companies and workers who remove fecal sludge in the capital city (Ouagadougou). Demand for removal of fecal sludge has been increasing along with the rapid population growth in Ouagadougou. It is also noted that the workers have developed a unique method of removing fecal sludge in the rural area (Kongoussi).

Photo 1 Action research in Zambia: Vice President of Zambia visited the *Dziko Langa* Exhibition Booth at ZAWAFE 2018 (Photo by NYAMBE, Sikopo P.)

Sub Leader

FUNAMIZU Naoyuki	Muroran Institute of Technology

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HAYASHI Koji	Researcher	**HONMA Saki**	Research Associate
SHIMIZU Takao	Researcher		

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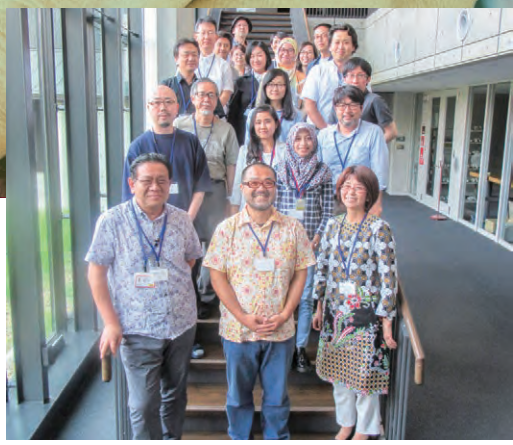
SRIREP Project

Co-creation of Sustainable Regional Innovation for Reducing Risk of High-impact Environmental Pollution



Project Leader **SAKAKIBARA Masayuki** Ehime University

Professor Masayuki Sakakibara is an earth scientist with multidisciplinary backgrounds of Geology, Petrology, Astrobiology, Geochemistry, Medical Geology, Geoengineering, and Remediation Engineering etc., currently working at Faculty of Collaborative Regional Innovation and Graduate School of Science and Engineering, Ehime University in Ehime Prefecture. His strong interest in environmental pollution led him to intensive fieldwork and activities to reduce mercury pollution and poverty problems in artisanal and small-scale gold mining (ASGM) areas in Indonesia for over eight years, work conducted with students, scientists, researchers, and various stakeholders from Indonesia, ASEAN countries, and Japan. Professor Sakakibara is also responsible for international conferences and seminars such as Transdisciplinary Research on Environmental Problems in Southeast Asia (TREPSEA) and Transdisciplinary Research and Practice for Reducing Environmental Problems (TRPNEP), which focus on transdisciplinary approaches to research and practice, as well as development of various regional innovations for the reduction of environmental pollutions in ASEAN countries.

Research Background

Mercury (Hg) is a toxic metal that seriously threatens the embryonic and early-childhood development of humans, and is extremely toxic to the human body. Mercury pollution is one of the most serious environmental issues and requires global action for its resolution. Recent investigation by the United Nations Environment Programme (UNEP) has highlighted the enormity of Hg pollution in developing countries and the associated harmful effects on human health and ecosystems. One of the main causes of Hg pollution is ASGM, in which Hg is used as the traditional method of amalgamation to extract gold from the ore rock. This activity is responsible for 37% of global anthropogenic Hg environmental emissions. This method of amalgamation is quicker, simpler, and more cost effective than alternative methods, and is widely used in many ASGM communities. According to data from the UNEP, ASGM produces 15-20 % of the global gold market. Almost 15 million people, including about 3 million women and children, participate in ASGM activities in more than 70 countries. The Hg pollution generated during ASGM indirectly affects more than 100 million people worldwide. ASGM activities are also sources of social problems, such as land tenure issues, social instability such as migration, and conflict between residents. The vicious cycle related to poverty and environmental degradation in developing countries has long been discussed. However, the behavioral patterns that make it difficult for those living under chronically impoverished conditions to escape from those conditions are still not well understood (Sen, 1999; Banerjee and Duflo, 2011). The Minamata Convention on Hg is a global treaty established to protect human health and the environment from the adverse effects of Hg. The Convention addresses ASGM and the development of national plans to manage ASGM.

Research Objects

The objectives of our research project are: 1) to understand the link between poverty reduction and environmental management in ASGM areas; 2) to establish a process for constructing sustainable societies through regional innovations in ASGM areas; and 3) to strengthen environmental governance in ASEAN countries.

Methodology and research process

Our project will conduct the following research in ASEAN countries:

a) Case studies on reduction of Hg pollution using a future scenario of ASGM in Indonesia and Myanmar

Project members will (1) undertake environmental impact assessments; (2) study living conditions, cultures, history, and regional sociology; (3) cultivate or organize transdisciplinary communities of practice (TDCOPs) used

Figure 1 The Hg amalgamation process for getting gold in ASGM

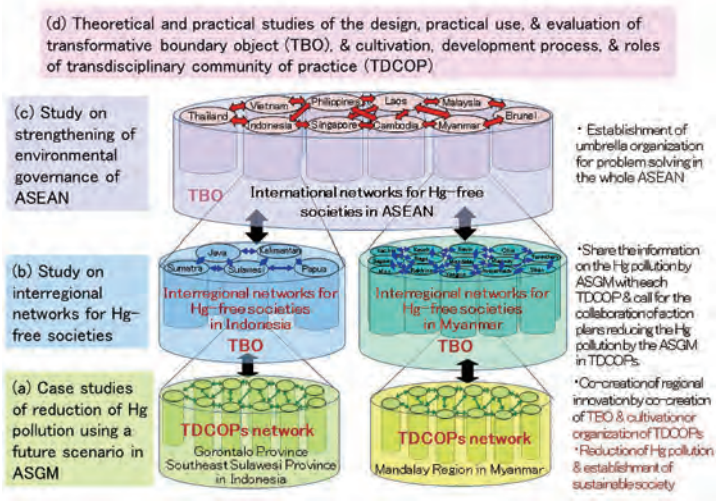


Figure 2 Whole structure of SRIREP project

by transdisciplinary boundary object (TBO); (4) co-create future scenarios; (5) co-design and co-produce with TDCOP members and other stakeholders; and (6) evaluate the progress of regional innovation through social and economic studies.

b) Study on interregional networks that aim to generate Hg-free societies in Indonesia and Myanmar

Study of interregional networks will be conducted in three steps: (1) construction of an exchange platform for information and collaboration on the management of Hg; (2) improvement of organizational and communication capacities; and (3) strengthening the communication policy with local and central governments.

c) Study on improvements in environmental governance in ASEAN countries

Project members will study the principles and processes used for multilayer and cooperative environmental governance. They will also investigate to strengthen environmental governance of the ASEAN countries.

d) Theoretical and practical studies of the design, practical use, and evaluation of TBO, and cultivation, the development process, and roles of TDCOP

Project members will design TBOs and then use and evaluate them in order to cultivate the development processes of TDCOPs with the collaboration of key stakeholders at the study areas.

Expected goals of the project

Regional innovation will arise as a consequence of environmental and industrial innovations introduced with a transdisciplinary approach, including the development of a future scenario for an Hg-free society, the co-creation and practical application of TBOs, and the mobilization of TDCOPs. By strengthening environmental governance, which consists of multiple layers of co-operative organizations, we will also develop a route via which the problem of global environmental Hg pollution can be resolved.

Photo1 The 3rd international conference of the Transdisciplinary Research on Environmental Problems in Southeast Asia (TREPSEA2018)

Photo2 A TDCOP meeting on the valuable agriculture in Indonesia

Sub Leader

TANAKA Katsuya	Research Center of Sustainability & Environment, Shiga University

Researchers at RIHN

KIMIJIMA Satomi	Researcher	**Myo Han Htun**	Research Associate
KUANG Xiaoxu	Researcher	**TAKEHARA Mari**	Research Associate
Win Thiri Kyaw	Researcher		

Main Members

MATSUDA Hiroyuki	Yokohama National University	**Fenty U. Puluhulawa**	State University of Gorontalo
KASAMATSU Hiroki	Ehime University	**Idham A. Kurniawan**	Institut Teknologi Bandung
SHIMAGAMI Motoko	Ehime University	**Basri**	College of Health Sciences Makassar
MIYAKITA Takashi	Kumamoto Gakuen University	**Bobby**	Network Activities Groups
MATSUMOTO Yuichi	Kwansei Gakuin University	**Zahra R. Intanasri**	Indonesian Public Health Association

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.

13th core program meeting

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 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".

Researcher

LEE, Sanghyun Researcher

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.

This project investigates environmental traceability as a key concept for solution of environmental problems. 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 the chemical profiles of food products. Spatio-temporal variation of multiple isotope ratios can be used to study Earth systems operating at local to global scales. This information can serve as an important decision-making tool for local people considering water, food and environmental security, all of which are fundamental for the sustainability of human society.

This study seeks to establish methodologies for the use of environmental traceability in environmental studies. A combination of quantitative and qualitative tools, including "Multi-Isoscapes", (the use of multiple elements and isotope ratios together with GIS-based mapping techniques), social surveys, and workshops are deployed to investigate the role of environmental traceability in addressing 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.

Project research tests: (I) the effectiveness of the environmental traceability concept in environmental studies by comparing case studies in which isotopic methods were initiated by local government, citizen groups, and researchers; (II) the extent to which these different stakeholders hold different views of the concepts of food traceability and environmental traceability and the effectiveness of these concepts in communicating links between food production and consumption. Field research is taking place in Japan at sites in Ono City, Fukui; Otsuchi Town, Iwate; Saijo City, Ehime; Oshino Village, Yamanashi; the Chikusa river watershed, Hyogo; Lake Biwa and surrounding watershed in Shiga; as well as in the Laguna de Bay and surrounding watershed in the Philippines.

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

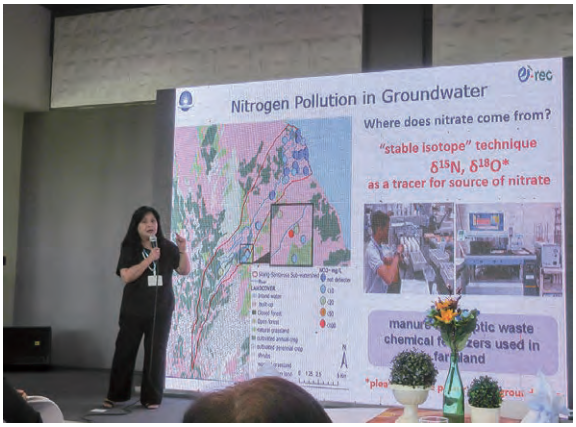


Photo 2 The multi-stakeholder workshop on the Silang-Santa Rosa Watershed in the Philippines, where we presented the results and used a questionnaire to study the effectiveness of our environmental traceability methodology

Researcher at RIHN
FUJIYOSHI Lei Researcher

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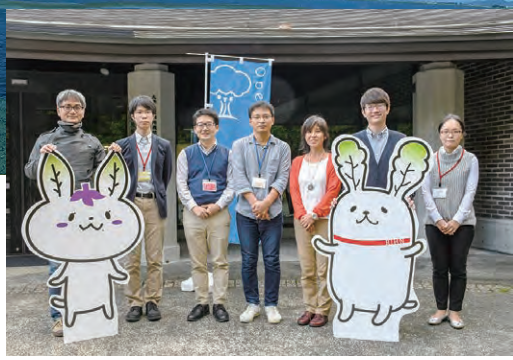
Open Team Science Project

Information Asymmetry Reduction in Open Team Science for Socio-environmental Cases



Project Leader **KONDO Yasuhisa** RIHN

Yasuhisa Kondo has worked for five years as an associate professor at the Information Resources Division of the RIHN Center. Originally, he studied archaeology and geographical information sciences (The University of Tokyo PhD 2010). He is currently interested in open science, participatory action research, and transdisciplinary research promotion for environmental archaeology and socioenvironmental cases. He is also coordinating an archaeological mission to Oman.

Backgrounds and Objectives

Social issues caused by environmental deterioration present complex and multidimensional problems for science. To approach them, solution-oriented research has involved research experts from different domains (interdisciplinarity) and also practitioners such as governments, funders, industries, non-profit organizations, and civil members (transdisciplinarity). However, such team science is often disrupted by asymmetric information, knowledge, wisdom, value, socio-economic status, and power among actors. This Core Project, also called the Open Team Science (hereafter OpenTS) Project, develops a methodology to reduce (rather than dissolve) such socio-psychological asymmetry for the sake of more efficient transdisciplinary (TD) collaboration.

Methodology

To develop the methodology, this project interlinks the concept of open science as an open scientific knowledge production system with a TD approach to boundary spanning by transforming in-between spaces into "our" epistemic living spaces. Technically, boundary spanning can be achieved by a combination of: (1) discovering and sharing the goals that actors with different interests can tackle together (transcending); (2) considering ethical equity, with special attention to empowering marginalized (or "small voice") actors; (3) developing fair data visualization based on the FAIR (findable, accessible, interoperable, and reusable) principles; and (4) facilitating dialogue. Civic Tech can be applied as a holistic approach. It is an open governance approach in which civic engineers develop a solution to local issues by using open governmental data and information and communication technologies.

As a working hypothesis, the proposed methodology is assessed and improved in an iterative process through practical case studies of community-based participatory research projects for socio-environmental issues (the hypothesis-practice-assessment cycle), with special interest in developing a method to measure participants' perceptual transformation.

Expected results

At the completion of the project, we expect to establish the OpenTS methodology by successfully interlinking open science and TD theories, with new knowledge about effective (and ineffective) combinations of visualization and dialogue tools, and with qualitative and quantitative methods to measure the effect of boundary spanning.

The project has two major interfaces of social outputs. The Research Group will make suggestions for national and international open science policies, while the Practice Group will contribute to community-based policymaking and social startups for the sustainable waterweed recycling in Lake Biwa and built heritage management in Oman.

A workshop held in the city on the shore of Lake Biwa with participation of research experts, civic engineers, municipality officers, local business people, and residents.

A graphic recording facilitates conversations during the workshop (graphic facilitator: Yuu Aruga).

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Above: UEHARA Yoshitoshi, Silang-Santa Rosa River, Philippines Bottom: IKEYA Tohru, Phenology at RIHN, Kyoto, Japan