

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.

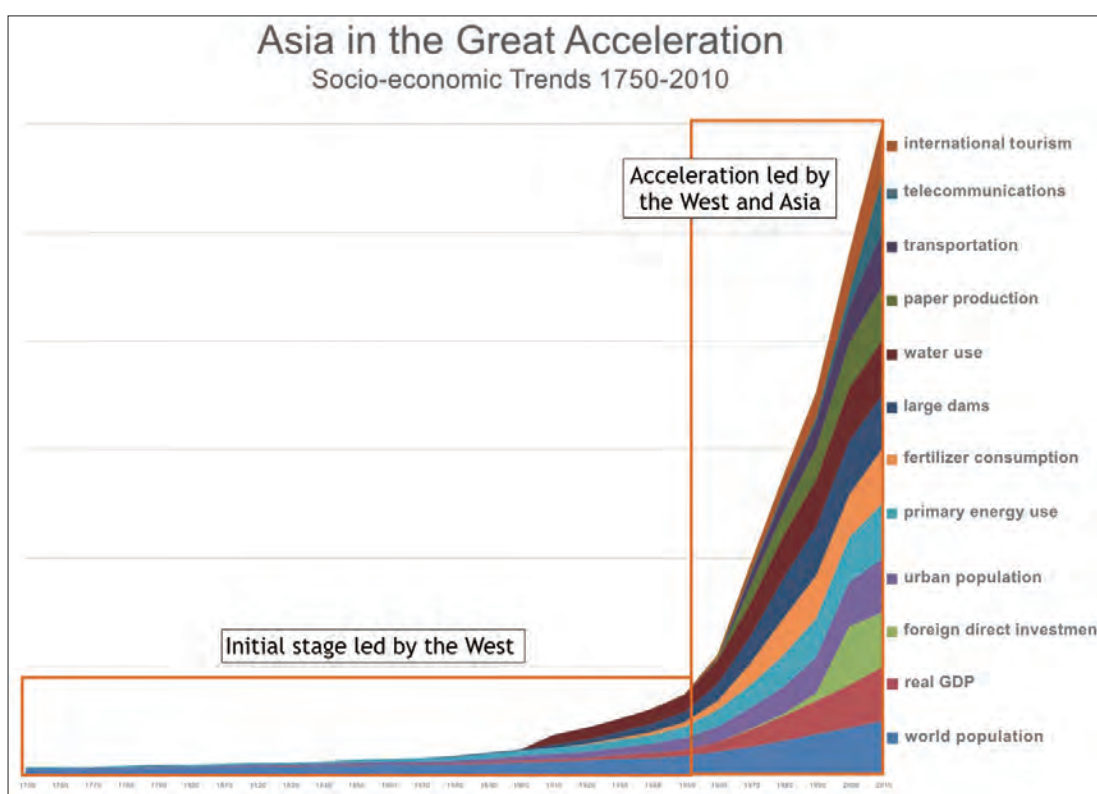
The Program's second line of inquiry examines the kinds of motivations that affect peoples' livelihoods and seeks social transformation of norms and institutions by working closely with various stakeholders in local society. The project on Sumatra's tropical peatlands identified four principal kinds 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. Another project on Punjab, India, studies how to prevent stubble burning accompanying the introduction of a compressed double cropping calendar after the Green Revolution, causing pressure on water and land, as well as air pollution and health hazards. Meanwhile, the ecosystem-based disaster risk reduction project investigates the potential of various ecosystem services to address natural disaster risks in Japan, where population decline creates additional dimensions to this issue, which is or could become relevant in many other Asian countries.



'Hyakken-tsutsumi', located at Otsu City, Shiga Prefecture. An approximately 180m-long stone-built prevention wall, which was constructed in the Tokugawa period, taking five years and eight months.



International Workshop on Resource Nexus and Asia's Great Transformation, 11th March 2019



Program Director **SUGIHARA Kaoru** RIHN

Trained in Japan (Doctorate at the University of Tokyo), I have held positions at the Faculty of Economics of Osaka City University, the History Department of the School of Oriental and African Studies, University of London, the Graduate School of Economics of Osaka University, the Center for Southeast Asian Studies, Kyoto University, the Graduate School of Economics of the 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.



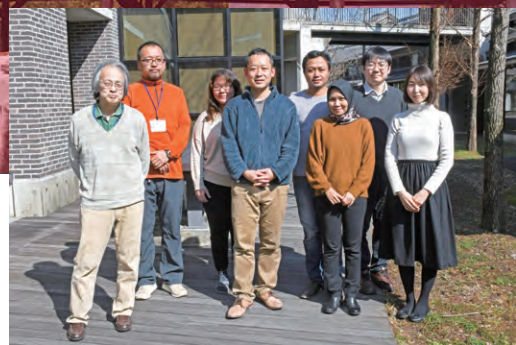
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Toward the Regeneration of Tropical Peatland Societies: Building International Research Network on Paludiculture and Sustainable Peatland Management

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

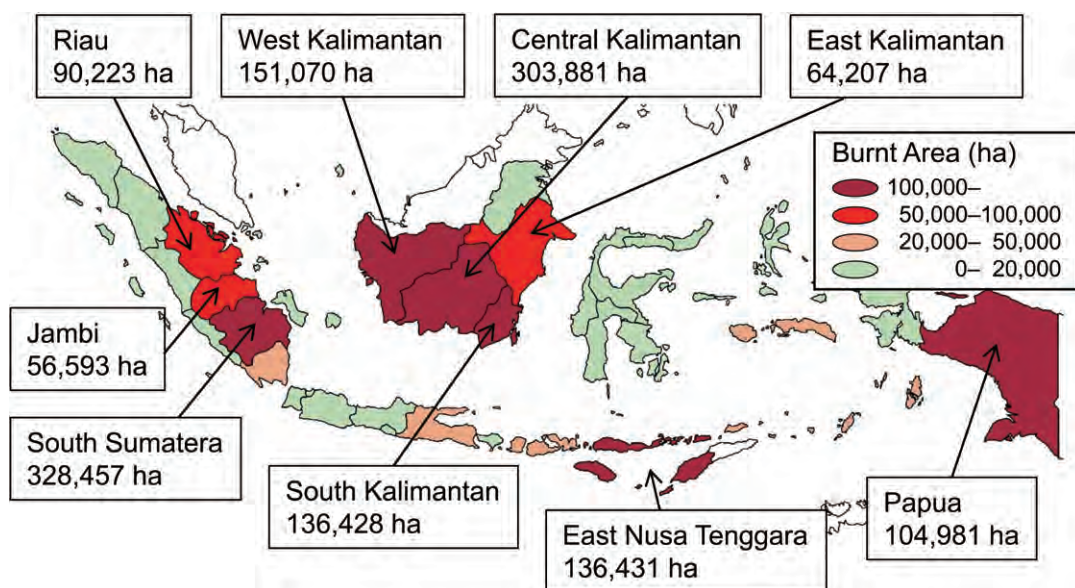
solutions to the current crisis of peat degradation and related fire and haze in tropical regions through action research. The project seeks to identify and implement alternative practices in collaboration with local people, academics, governmental offices and officials, NGOs, and international organizations.

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 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.



Total burnt area in Indonesia in 2019. Source: Ministry of Environment and Forestry website (SiPongi-KLHK). Data retrieved on 7 January 2020.



Questionnaire survey on peatland use and awareness in Lantau Baru village (Pelalawan District, 18 November 2019)

In order to address this dilemma, we also use trans-disciplinary approaches to explore the transformability of peatland societies. We promote village participation 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 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 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 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 influence



Weather radar installation (Bengkalis District, 12 February 2020)



Cooperation in shooting for NKH TV program "Magafire" at the Giam Siak Kecil-Bukit Batu Bioserve (Bengkalis District, 14 October 2019)

of haze on atmosphere, and 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 in 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.

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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, societies increasingly face 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 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

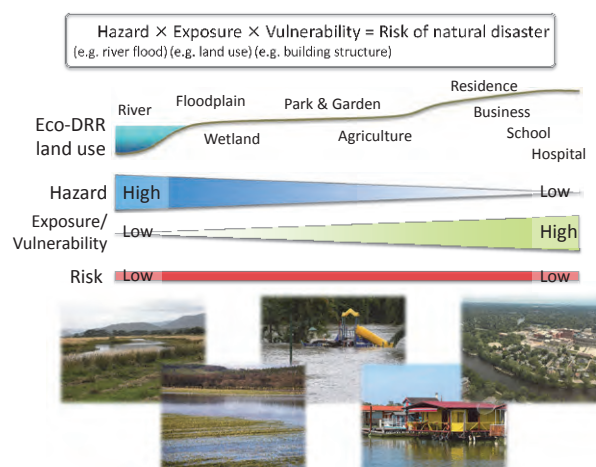


Figure 1 Ecosystem-based disaster risk reduction not only lowers disaster risks but also enhances benefits of ecosystem services by reducing the exposure of human activities in high-hazard locations and supporting human activities in low-hazard locations.

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 risks of natural disasters in present and 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 approaches for implementing Eco-DRR in society

Together with local stakeholders, transdisciplinary platforms will be formed at each of the local research sites by taking advantage of existing platforms. This transdisciplinary platform will deepen mutual understanding, promote discussion of future options, and build consensus regarding the use of Eco-DRR. Multi-functionality of Eco-DRR at each local site will be evaluated and research outcomes will be shared with

local stakeholders using our transdisciplinary platform. In addition, traditional and local knowledge of Eco-DRR will be inventoried and evaluated for the multi-functionality so that the benefits of the traditional and local knowledge can be shared with the general public.

In collaboration with insurance industry, a research forum will be formed to discuss the possibility and feasibility of insurance industry contributions to economic incentives of Eco-DRR. Various laws and institutions in national and local governments related to disaster risk reduction and land use will be assessed in the research forum as well.

Recent results

At several local research sites, the traditional and local knowledge of Eco-DRR,

including the history of land use management, flood and landslide control measures built during the Edo period, management of shelter woods around houses, etc. have been collected. This traditional and local knowledge of Eco-DRR will be made accessible to the general public by publishing a series of booklets in Japanese. The first of the series was published in the summer of 2019 in print as well as e-book which is freely available at the RIHN website, and an English version is forthcoming.



Figure 2 The first book of the series "Traditional and local knowledge of Eco-DRR in Japan", available for free from the RIHN website (in Japanese).



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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An Interdisciplinary Study toward Clean Air, Public Health and Sustainable Agriculture: The Case of Crop Residue Burning in North India

Project Leader **HAYASHIDA Sachiko** RIHN/Nara Women's University

Dr. Sachiko Hayashida is an atmospheric scientist who has long history of research on stratospheric ozone depletion, air pollution and greenhouse gases. She received the Horiuchi Award from the Japan Meteorological Society in 2002. From 2005-2008 she was a member of the Science Steering Group of the Stratospheric Processes And their Role in Climate (SPARC) within the World Climate Research Programme (WCRP). From 2010-2018 she was a committee member of the International Commission on Atmospheric Chemistry and Global Pollution (ICACGP), a special commission within the International Association of Meteorology and Atmospheric Sciences (IAMAS). She is currently a president of the Remote Sensing Society Japan (RSSJ).



Problem

This study addresses air pollution caused by large-scale post-harvest burning of rice-straw in October and November in the states of Punjab and Haryana in North-West India. The burning causes severe air pollution in the surrounding areas, most notably in the Delhi-National Capital Region. Some evidence suggests that crop-residue burning negatively affects air quality over the entire Indo-Gangetic Plain (IGP), demonstrating the potential negative impact of changing agricultural practices on regional air quality, affecting public health and well-being of hundreds of millions of people.

Background

Historically the Indian Punjab region, a semi-arid zone with insufficient precipitation, was not suitable for intensive cultivation. Traditional agriculture in the region consisted of a combination of cultivating wheat and raising livestock (cattle). Development of irrigation canals during the British colonial period transformed the region into a granary. In the 1960s, the area became the seat of the so-called "Green Revolution", and played a central role in producing food for the populous nation. In the 1970s, most of the region adopted a double-cropping system of wheat and rice. However, this cultivation practice required farmers to sow wheat seeds immediately after the rice harvest. While traditional hand-harvest allowed cropping of rice stalks near ground-level, increasing use of combine harvesters leaves large quantities of stubble in field. Farmers are forced to quickly burn this crop residue (stubble and stalk) in order to prepare for wheat seeding in the short period between late October and early November.

Winds in this season shift to the northwest, often blowing smoke from stubble burning to Delhi-NCR, markedly affecting air quality in Delhi. Actually, however, the cause and effect relationship between stubble burning in the Punjab region and worsening air pollution in Delhi has not yet been established quantitatively. This lack of definitive quantitative evaluation is due to the poor state of the air pollution monitoring network in India compared to those in developed nations. Unfortunately, many farmers of the Punjab region are reluctant to acknowledge their own actions as the cause of air pollution in Delhi, and there is also some disagreement among academic researchers as well.

Project Structure & Research Plan

This project will utilize observation data and model simulations in order to provide a scientific examination of the connection between stubble burning in Punjab and severe air pollution in Delhi. Based on this scientific understanding, we will pursue a pathway of social transformation toward clean air, public health and sustainable agriculture. We will organize three working groups to approach stakeholders; all working groups will examine various measures to raise awareness regarding farmer/community behavior, and as well as that of stakeholders and government (Figure 1).

Working Group 1: Agro-Economics, Human Geography, Cultural Anthropology, and Agricultural Science

Working Group 1 will examine incentives promoting farmers' behavioral changes and various alternative uses

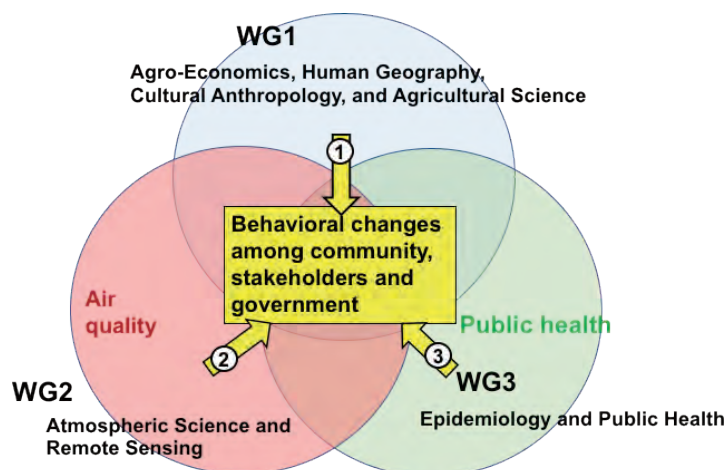


Figure 1 Structure of the project

of straw. In the first year of the project, we will conduct a survey across the entire state of Punjab based on voter lists. The results of the survey will allow to conduct intensive interviews assessing the traditional cultural background of farming, labor availability and impact of subsidies on farmer and community decision making. In parallel, we will examine both technical and socioeconomic advantages/disadvantages for straw management. We will examine several options for use of straw and suggest how they may lead to new agricultural practices, products and markets.

Working Group 2: Atmospheric Science and Remote Sensing

The mission of Working Group 2 is to utilize observations and model simulations in order to quantify the effects of stubble burning in Punjab on air quality of Delhi-NCR. As monitoring data are sparse in Punjab, we will set up

a network of several hundred compact instruments to monitor ambient PM2.5 and prepare refined estimate of inventory emissions from stubble burning. This data, combined with satellite measurements covering wider part of the IGP, will allow model simulations for extended analysis. In the later years of the project, PM2.5 distribution will be transmitted on smartphones via newly developed apps.

Working Group 3: Epidemiology and Public Health

Working Group 3 will conduct a health education class on "Air and Health" to increase awareness of local residents' health. In parallel, members will examine children and women's symptoms and test their pulmonary function. The advantage of our research plan is that we can estimate individual PM2.5 exposure using compact PM2.5 monitoring instruments. Figure 2 is an example of PM2.5 exposure taken in Punjab on Nov. 2, 2018.

PM2.5 Diary, Nov. 2, 2018 in Punjab

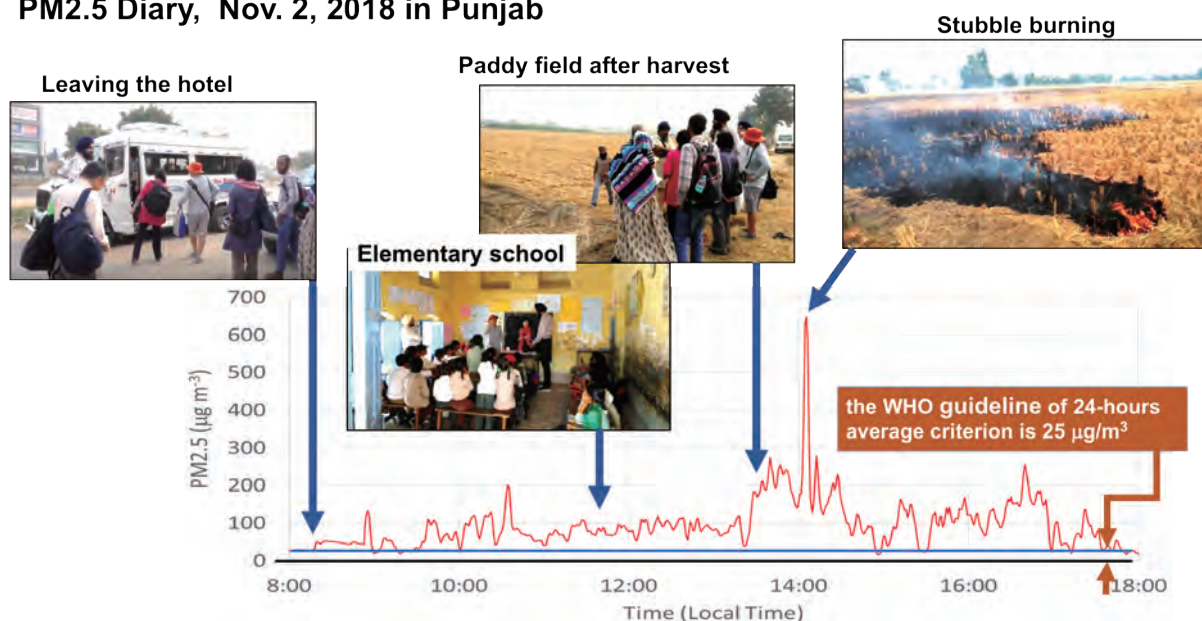


Figure 2 Time series of PM2.5 values that were exposed to the project PI when visiting Punjab on November 2, 2018. The sudden increase of PM2.5 at 14:00 is corresponding to her encounter with a straw burning shown in the figure. Note that the WHO guideline of 24-hours average criterion is 25 µg/m³.

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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 human sphere 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. Program research should 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 2019, we enlarged our database of resource supply and demand in Japan to the municipality level, with particular emphasis on ecosystem services. The database could be utilized to assist comparative and integrative analyses of research sites. One initial analysis of this database indicated that prefectural sustainability is related to population density. It is also useful to consider the inter linkages among the resource use sustainability, which could be developed to address SDG targets.



Traditional agricultural landscape in Hanamaki, Iwate Prefecture, Japan



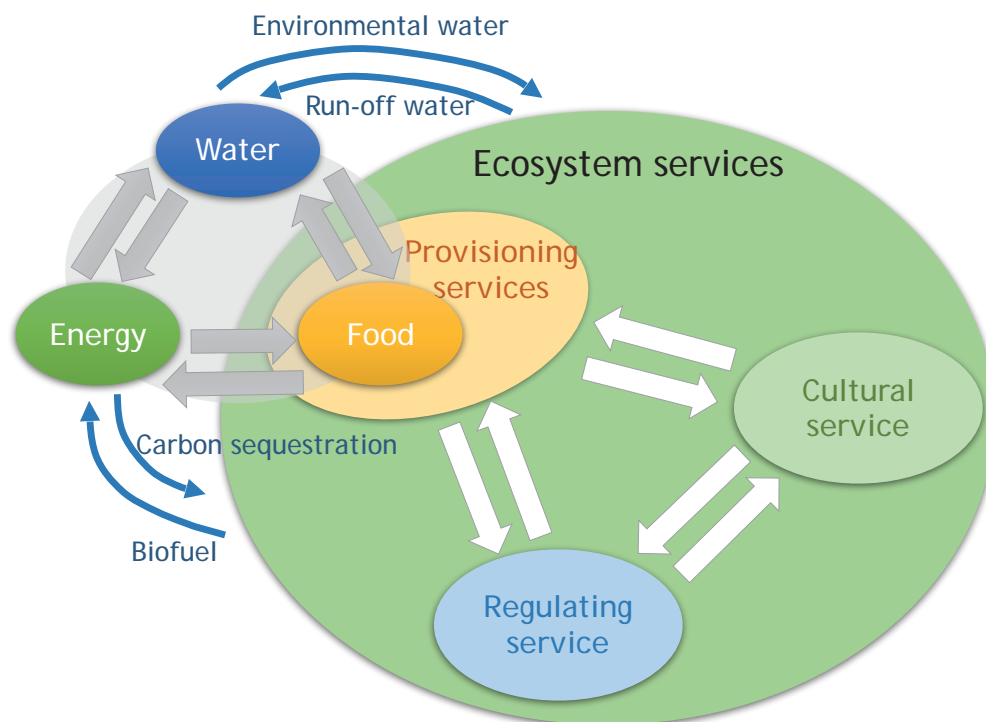
Land-use pattern in mountain area in Thailand



Water flow in upstream of Iwaki River, Japan



Solar power generation in Chiba Prefecture, Japan



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

Acting Program Director **Hein MALLEE** RIHN

Hein MALLEE is a social scientist with a Ph.D. from Leiden University, the Netherlands. His work was initially concerned with migration and related policies in China, but as he started working in international development, he became involved in projects on rural development, natural resources management and poverty alleviation both in China and in Southeast Asia. The dominant theme in this was local people's involvement in and rights to resources. He has been a Professor at RIHN since March 2013 and a Deputy Director- General since April 2018. He is also the Director of the Regional Center for Future Earth in Asia.

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

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 and 2019, 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 UNFCCC to individual businesses and households.

Providing better information to buyers and decisionmakers 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

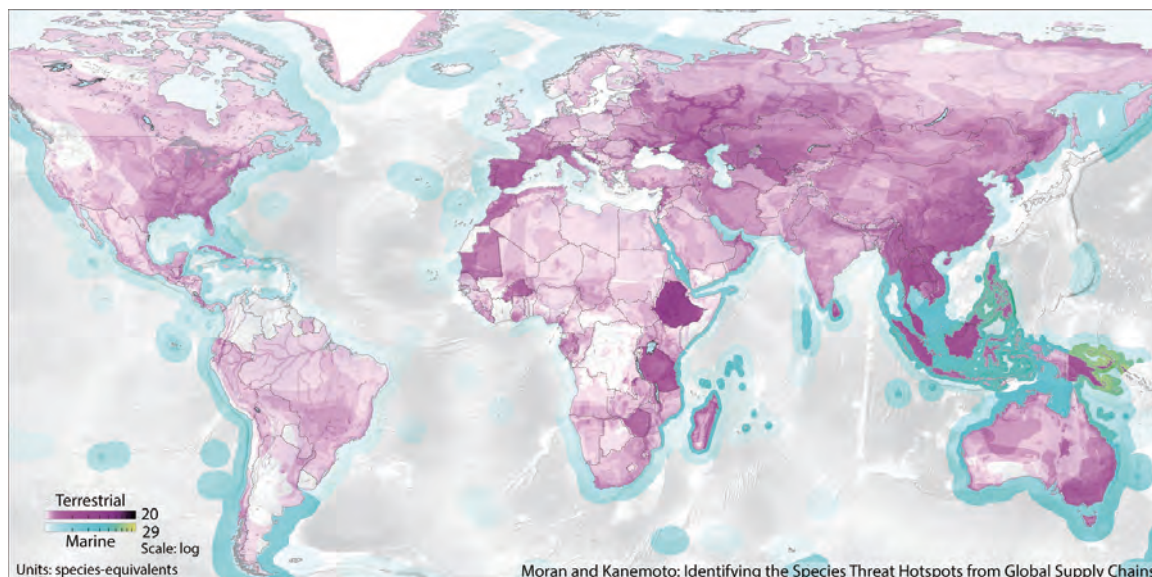
In 2018, we estimated the carbon footprint of 13,000 cities.

Key findings are the following:

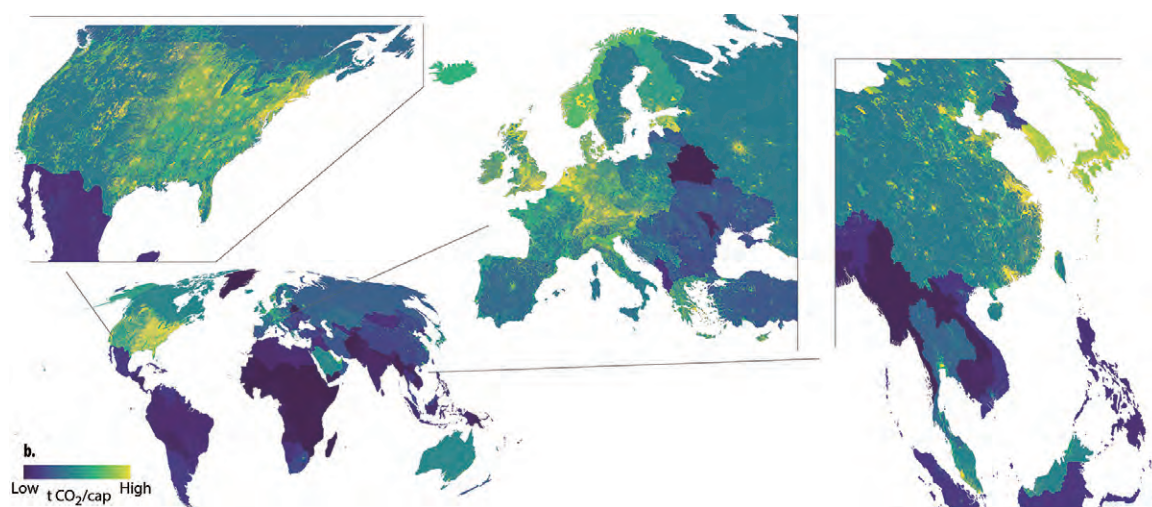
- Globally, carbon footprints are highly concentrated in a small number of dense, high-income cities and affluent suburbs
- 100 cities drive 18% of global emissions
- In most countries (98 of 187 assessed), the top three urban areas are responsible for more than one-quarter of national emissions
- We 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

Carbon footprint of households: The case of food diet

We identified five key results. First, differences in household demographics (age and sex) do not explain variation in household food CF. Second, regional differences in food-related CF exist, but these are not the main explanatory factor of household differences. Third, household income and savings are weakly correlated with food-related CF. Fourth, there is 1.9 times higher in food CF between the mean household in the lowest and highest quartile. Finally, meat consumption is almost identical across the four quartiles, and it is rather consumption of fish, vegetables, confectionary, alcohol, and restaurants that differentiates high and low CF households.



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



The carbon footprint of Asian cities.

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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.

How we engage with our stakeholders is very important in promoting transdisciplinary research. It seems that there are many abstract principles, but when applying them to the field, it is difficult to connect them to a concrete way of doing things. For this reason, we have started the "How to Engage Citizens in Practice Discussion" Meeting with people who have relations with stakeholders. This discussion has allowed us to slowly see the "rules" of concrete practices. One of the goals of our practice is to shift the way citizens think about and live towards sustainability, and we are slowly learning how to design such systems. At the same time, we are conducting an ecological footprint project to measure energy consumption and greenhouse gas emissions in our research buildings and travel.



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



An activities of transdisciplinary community of practice in Hayahaya village of Gorontalo Province, Indonesia



Action research in Zambia: The Vice-President of Zambia has visited the Sanitation project's booth of the Zambia Water Forum and Exhibition (ZAWAFE) 2018. (Photo by NYMBE, Sikopo P.)

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.

Researchers

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Researcher



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, loss of food diversity, and the deterioration of small-scale farming. On the consumption side, over-reliance on globalized food flows limits consumer agency, decreases food security, and impacts health. How do we respond to these challenges? Rather than furthering efforts to maintain existing food systems, FEAST research is line with complete food system transformation, and aims for re-imagining and re-creating regional, small-scale food systems designed for a post-growth world and food lifeworlds that re-value food as a commons.

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. 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. Finally, FEAST seeks knowledge and mechanisms that can redefine the notion of long-term food security at the regional scale.

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) and knowledge related to intervention strategies— such as niche incubation, social learning and market transparency— on the execution and effectiveness of workshop-based consensus building toward collective action and market-oriented information- providing tools (eco-labels, food LCA smartphone app)

Progress to Date

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

FEAST partnered with WWF Japan and the Global Footprint Network to feature research on prefectural and municipal level Ecological Footprints in Japan—an informational booklet aimed at municipal officers shows that urban cities and prefectures have a much larger footprint than their rural counterparts. Imported animal feed and ingredients for processed foods comprised

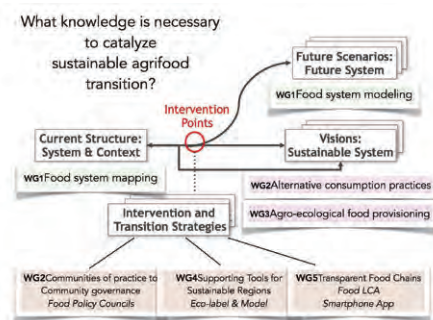


Figure 1 Diagram detailing how each FEAST working group is organized around the question of “What knowledge is necessary to catalyze sustainable agrifood transition?” Four kinds of knowledge are listed: 1) Current system and contextual knowledge; 2) Visions of sustainable future systems knowledge; 3)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

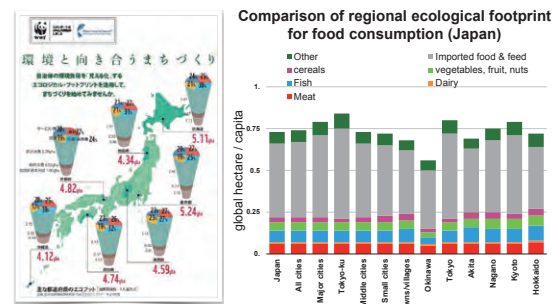


Figure 2 WWF Japan and Global Footprint Network booklet <https://www.wwf.or.jp/activities/data/20190726sustainable01.pdf> (left). Comparison of regional ecological footprints for food consumption in Japan. Imported food and animal feed is most impactful, while regional differences in overall impact are evident (right).

a significant portion of the overall impact, further strengthening the need for region-based production and municipal level interventions and policies that address food system sustainability (Figure 2).

Expanding sustainable food production will require scaling up successful models and new farmers. The potential for scaling up agroecological production in Japan was investigated with colleagues from UC-Berkeley to evaluate how “lighthouse farms” act as models for territorial development (Photo 1). An assessment tool is being developed for wide-spread use.

Over 20 meetings, workshops, and events were held in Kyoto, Kameoka, and Nagano to catalyze civic food networking and co-design food policy measures. In Kyoto, a new food policy council is active through these efforts. In Nagano, ideal future school lunches were envisioned in Obuse Town and plans are being made to input results from the visioning process into the general policy planning process. The need for culturally-specific approaches to civic food policy development that center on concepts of social



Photo 1 Fieldwork with Prof. Miguel Altieri and Dr. Clara Nicholls from UC-Berkeley.



Photo 2 Visioning workshops with farmers, consumers, NPO, and government officials held in Obuse Town, March 2019 (bottom), school lunch vision graphic recording (upper left), and Food Policy Council Kyoto logo (upper right).

expectation and “side-to-side” pressure are unique to Japan (Photo 2).

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. This work will be featured in a book scheduled to be released next year (Figure 3).

In Thailand, urban food futures are being explored through envisioning future food practices with stakeholders in Bangkok. Ideal ways of eating out, home cooking, and purchasing food were developed and policy-action plans were created in backcasting workshops (Photo 3).

FEAST maintains research partnerships with the Copernicus Institute of Sustainable Development at Utrecht University, University of California- Berkeley, Royal University of Bhutan, Mahidol University, Shanghai Academy of Agricultural Science, as well as Kameoka and Noshiro Cities (Japan).

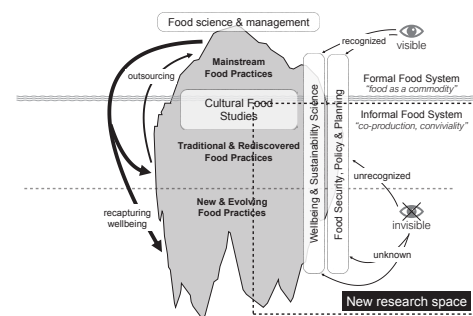


Figure 3 Conceptual framework to investigate the definition and interaction of formal and informal food system and practices represented as an iceberg.

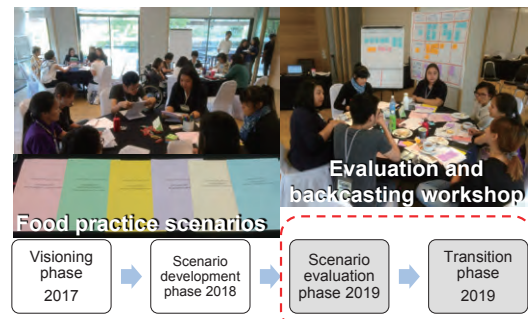


Photo 3 Urban food future workshops held in Bangkok, December 2019. Six future scenarios were evaluated and policy & action plans were backcasted as a means to initiate transitions.



Photo 4 FEAST Project Annual Assembly held at RIHN January 12-13, 2020.

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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 countries 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) Periurban 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 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) Detecting the risk factors relating to WASH. We surveyed the handwashing and health of the elementary school students in the “slum” area of Bandung, Indonesia. Risk factors of stunting and diarrhea are

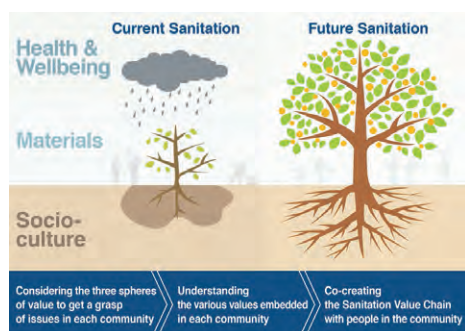


Figure 1 The concept of three values from the point of Co-creation (figure by KATAOKA Yoshimi)

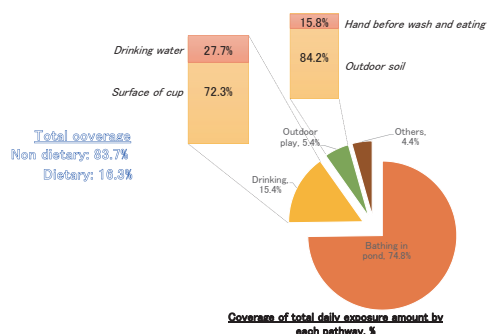


Figure 2 *E. coli* exposure pathways. Example of measurement in Bangladesh from Harada et al. (2017) Fecal exposure analysis and *E. coli* pathotyping: a case study of a Bangladeshi slum, International Symposium on Green Technology for Value Chains 23-24 October, 2017, Balai Kartini, Jakarta.

boy's behavior, drinking tap water rather than tank water, using an open storage container of drinking water, low household income, and not using towels after hand washing. The risk factors for fecal *E. coli* attached to children's hands are boy's behavior, inadequate hand-washing and using soap, and the practice based on inadequate hygiene knowledge.

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

1. We published the third and fourth volumes of the international journal *Sanitation Value Chain* (Figure 3).
2. In Zambia, we organized two workshops with local children and youth groups to promote good sanitation and hygiene. First, group members measured fecal contamination around their living environments. In creating visualizations of this invisible contamination they became aware of the problem and were able to discuss ways for its improvement (Photo 1). Second, they took pictures of the places thought to be a problem for community sanitation. These images were recomposed into videos that facilitated community communication.
3. Meta-studies of our project were conducted. We published a paper describing and analyzing the embarrassment and trial of a cultural anthropologist who entered our inter-disciplinary project. We also recorded and analyzed how interdisciplinary communication is performed at the fusion of humanities and sciences, such as the discussions of the meetings of our project. We use these recordings for promoting interdisciplinary communication in our project.



Figure 3 International academic Journal *Sanitation Value Chain*, 3(1).



Photo 1 Workshop in Zambia: Collecting samples and processing (photo by KATAOKA Yoshimi)

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

Project Leader **SAKAKIBARA Masayuki** RIHN/Ehime University

Professor Masayuki Sakakibara is an earth scientist with multidisciplinary backgrounds of Geology, Petrology, Astrobiology, Geochemistry, Medical Geology, Geoengineering, and Remediation Engineering. He currently works at the Faculty of Collaborative Regional Innovation and Graduate School of Science and Engineering, Ehime University. His 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 human embryonic and early-childhood development, and is extremely toxic to the human body. Mercury pollution is a serious environmental issue requiring global action. 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 4-5 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 is well known. Even though the Minamata Convention was established to protect human health and the environment from the adverse effects of Hg, mercury emissions are still increasing rather than decreasing. The global mercury related environmental pollution from ASGM, which is caused by poverty, cannot be solved by ratification of international treaties or NGO activities alone.

Research Objects

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

Methodology and research process

Our project members have been conducting transdisciplinary research and practice in collaboration with mining communities, local residents, key stakeholders

of public and private organizations and associations such as senior officials and staff of local and central government, key persons of companies, researchers of local universities, members of NGO, NPO, and others. This work emphasizes:

- Case studies on reduction of Hg pollution using a future scenario of ASGM in Indonesia and Myanmar which includes: (1) environmental impact assessments; (2) studies of living conditions, culture, history, and regional sociology; (3) cultivation or organization of transdisciplinary communities of practice (TDCOPs) used by transdisciplinary boundary object (TBO); (4) co-creation of future scenarios; (5) co-design and co-production with TDCOP members and other stakeholders; and (6) evaluation of the progress of regional innovation through social and economic studies.
- Research on interregional networks that aim to generate Hg-free societies in Indonesia and Myanmar which include: (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.
- Research on improvements in environmental governance of ASEAN countries through the principles and processes used for multilayer and cooperative environmental governance for solving global mercury pollution.
- Theoretical and practical studies of the design, practical use, and evaluation of TBO, as well as the promotion, development, and roles of TDCOP in study areas. (Figure 1)

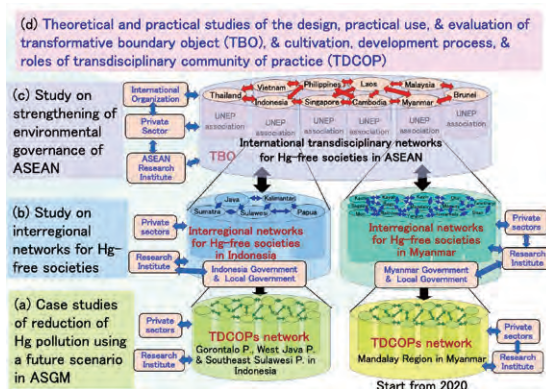


Figure 1 Whole structure of SRIREP project

FS①	PR	FR①	FR②	FR③	FR④	FR⑤
			2020			

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.

Progress and Achievements

During FR1, members of SRIREP project carried out several dialogs, fieldworks, and research activities with various stakeholders and key stakeholders in mining communities, local universities, and public and private organizations in both Indonesia and Myanmar.

Case studies have been completed largely in Gorontalo province. The resulting data show that air and water have been contaminated due to mercury exposure related to waste water from ASGM in the region. Further studies regarding mining community livelihood and value-added composite agriculture in non-polluted areas, as well as workshops are being conducted as transdisciplinary practice research for poverty reduction for the next fiscal year, especially in both Gorontalo, Sulawesi and Bandung, West Java (Figure 2). Some villages of the southern Bandung region of West Java have voluntarily discontinued their ASGM activities as a result of two TBO-based dialogues. (Photo 1)

In Indonesia, to study the establishment of interregional networks for a mercury-free society, two medical seminars on human health impact of heavy metals were held in May 2019. They included approximately 210 participants, including health care professionals, scientists, and researchers, including medical scientists from Japan and local universities and medical-related associations of Makassar City and Gorontalo City. Medical workshops were conducted, including information on Minamata disease, and the local experience of and concerns related to the current challenges of heavy metals intoxication was discussed.

In order to study improvements in environmental governance in ASEAN countries, dialogs meetings between SRIREP members and key stakeholders were conducted in 2019. In December 2019, the UNEP Global Environment Information Exhibition was co-organized with the Japan Association for UNEP in Yangon, Myanmar, in collaboration with some private sector actors. The 2nd ASEAN - Japan Meeting Point of Collaboration by Stakeholders and Researchers for Reducing Environmental Problems in ASEAN Countries was held in Nay Pyi Taw,

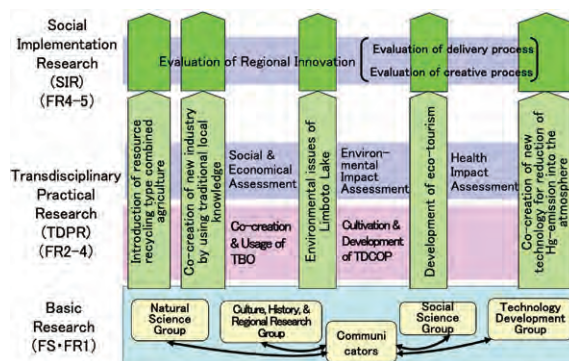


Figure 2 Whole schedule of the case study in Gorontalo Province, Indonesia



Photo 1 Workshop and fieldwork activities with local researchers at some ASGM areas



Photo 2 Attendees Union Minister of MONREC, officials, researchers and scientists, students, NGO and NPO members from Myanmar, Japan, Nepal, and ASEAN countries at TRPNP2019 Nay Pyi Taw Seminar.

the capital of Myanmar, in collaboration with universities of Japan and six ASEAN countries (Brunei Darussalam, Indonesia, Malaysia, Myanmar, Thailand, Vietnam, Nepal, and Ministry of Natural Resources and Environmental Conservation (MONREC). About 280 attendees, including researchers and scientists, senior officials and key stakeholders from Myanmar ministries, universities, NGO, and private companies attended the seminar. (Photo 2)

Dialog meetings, workshops, and stakeholder seminars are intended to establish future collaborations, multi-tier environmental governance for making the future scenarios with key-stakeholders based on the back-casting method, creating TBOs, TDCOPs, and policies, strengthening of environmental governance of ASEAN, and constructing mercury-free society networks and sustainable societies through regional innovations.

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MYO HAN HTUN

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ISOMONO, Hanung

Lampung University

BASRI

College of Health Sciences Makassar

BOBBY

Network Activities Groups

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.



Core Program online meeting (Apr. 2, 2020)

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 a Steering Committee member of Future Earth Nexus KAN. 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

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Assistant Professor



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

Project Leader **KONDO Yasuhisa** RIHN

Yasuhisa Kondo has worked for six years as an associate professor at the Information Resources Division of the RIHN Center. His academic background is archaeology and geographical information sciences (Ph.D. 2010 The University of Tokyo). 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 address such wicked problems, 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 above-mentioned actors. This Core 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) considering ethical equity with special attention to empowering marginalized (or “small voice”) actors; (2) building trust by securing transparency in the research process, by applying the FAIR (findable, accessible, interoperable, and reusable)

Principles for research data and information for instance; (3) facilitating dialogue; and (4) discovering and sharing the goals that actors with different interests can tackle together (transcend) where necessary. Civic Tech can be applied as a holistic approach, in which civic engineers develop a solution to local issues by using disclosed data and information and communication technologies. This proposed methodology is cyclically assessed and improved through practical case studies, with special interest in developing a method to measure participants’ perceptual transformation through interventions.

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 such as graphic recording, 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.



Graphic recording during the workshop in Otsu, Shiga (February 2020).



On-site experiment of the *Biwapoint* local electric acknowledgement system at the occasion of waterweed cleaning on the shore of Lake Biwa.

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Methods and Tactics to Foster Knowledge Co-creation: A Practical Framework for Implementing Transdisciplinary Research

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It is increasingly acknowledged that transdisciplinary research methods (TD) are useful in research projects on global environmental problems for which science alone cannot provide a definite solution. However, many researchers have pointed out that the theoretical concepts on ideal TD processes are extremely difficult to apply in practice. This project aims to identify a practical framework for TD research. The practical framework consists of methods and tactics for fostering knowledge co-creation, identified from the current TD practices implemented throughout the world, as well as from knowledge and perspectives of experienced TD researchers and stakeholders. In order to make sure that the proposed framework is useful, the project uses the above results for capacity building and will revise our framework as necessary.

The project consists of the following four components:

- 1) Research design
- 2) Tips and tactics (Researcher experiences)
- 3) Project Reflection (Stakeholder experiences)
- 4) Capacity building

Under a component of research design, this project analyses the international research landscape surrounding TD research. It examines similar research approaches, such as participatory approach and action research, and seeks to establish a new definition of TD research and project design (methods, tools and approaches) for fostering knowledge co-creation in relation to different types of environmental issues.

In addition to this survey of international TD literature, the project carries out in-depth studies with researchers and stakeholders in TD projects at RIHN and other institutes. The project carries out in-house workshops as well as interviews and workshops at existing project field sites. Focused study with researchers seeks to develop a novel and unique methodology for knowledge generation based on personal experiences and to identify tips and tactics to enhance stakeholder engagement in TD research. Investigation with stakeholders seeks to reveal the effects of TD projects on stakeholders and communities, which are the premise of TD projects, but largely overlooked in current project evaluation. With this combination of global and focused investigations, the project seeks to synthesize RIHN's TD research experiences and describe its relation to international trends.



TERRA School 2019 (TD School Co-organized by RIHN and Regional Centre for Future Earth in Asia)

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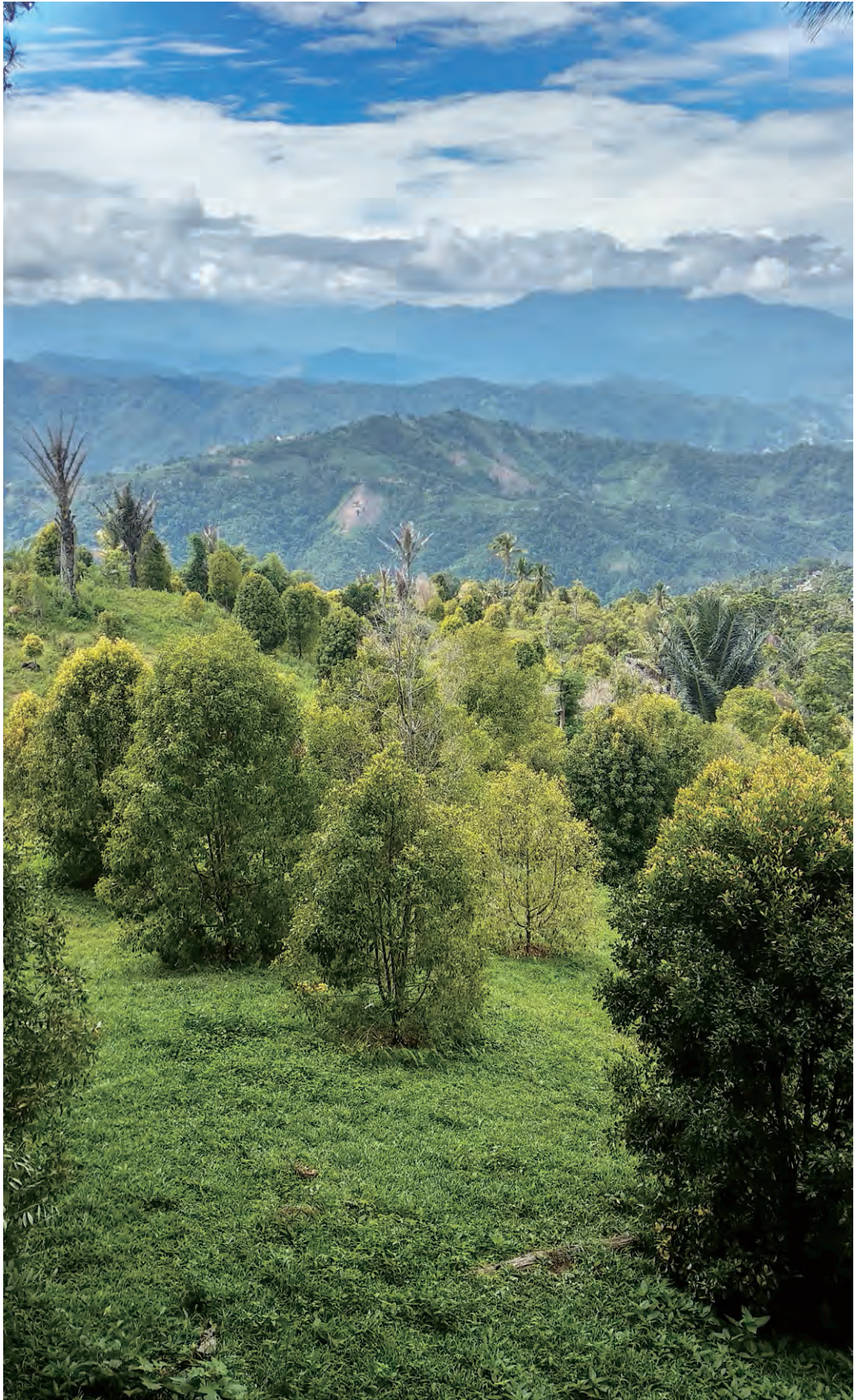
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