Diversity Program

KADA Ryohei | Program Director

Humanity and nature have evolved together. Nature is the source material of human perception and culture, and nature's rich diversity—both biotic and abiotic—has nurtured cultural diversity. Yet nature has been transformed through human activity: it is both source and subject.

Biological diversity composes the planet as we know it; it is the foundation of all society and human reliance on it is unquantifiable. Meanwhile, cultural diversity, including ideas, languages, technologies, ways of living and systems of belief, has been passed through the generations, and has enriched human quality of life and understanding of the biosphere. In acknowledging this role of cultural diversity we recognize the basic human rights to safe, healthy, fulfilling lives, peace of mind and just social systems, for these are the essential conditions in which people can live with hope and pride.

In historical context, the current loss of cultural diversity can be seen as part of a large-scale process that threatens biological diversity on Earth, and as an expression of humankind's relationship with nature since the last century. Humanity faces a situation in which the cultures responsible for today's global environmental problems are excluding from the world those that have historically embraced 'wise use' of, and harmony with, nature.

The RIHN Diversity Program describes and analyzes the formation, maintenance and functions of biological and cultural diversity in various environments. It seeks to identify ways to re-vitalize the idea and practice of 'wise use' of nature—to prevent exhaustion of resources and preserve ecosystem services—in order to enhance human well-being and ecological integrity.

Completed Research	Leader	Title
D-02	YUMOTO Takakazu	A New Cultural and Historical Exploration into Human-Nature Relationships in the Japanese Archipelago

Full Research	Leader	Title
D-03	OKUMIYA Kiyohito	Human Life, Aging and Disease in High-Altitude Environments
D-04	SAKAI Shoko	Collapse and Restoration of Ecosystem Networks with Human Activity
D-05	ISHIKAWA Satoshi	Coastal Area Capability Enhancement in Southeast Asia

A New Cultural and Historical Exploration into Human-Nature Relationships in the Japanese Archipelago

Project Leader **YUMOTO Takakazu** Kyoto University

The Japanese Archipelago has been densely populated since the Neolithic Age, and its natural environment has been greatly influenced by human activities. In spite of intensive human intervention in the natural environment, the area is still rich in biota. More recent patterns of interaction between humanity and nature, however, have placed many plants and animals in danger of extinction.

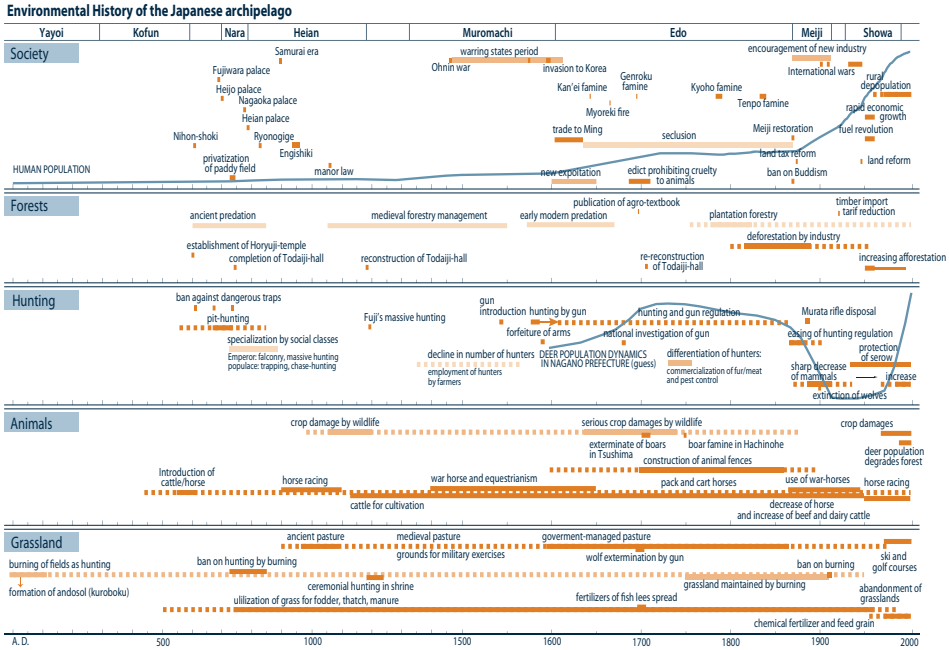
The main objective of the project was to describe the history of human-nature relationships in the Japanese Archipelago. Project researchers examined how the area's physical environment and biota have changed since the late Paleolithic Age, when human presence was first established. Archaeological, historical and folkloric materials were used to indicate past human perception, knowledge and skills regarding nature in general, and the human effect on key plant and animal species. This combination of biophysical and human cultural history will enrich appreciation of human-environmental history in the archipelago.

Results

In the history of the Japanese Archipelago, there are examples of both long-term sustainability and collapse. The common view that pre-modern or indigenous humans lived in harmony with nature, a harmony disturbed by modern science and technology, is partially true. Human ability to modify nature increased dramatically through time, and the earlier incentives to utilize local bio-resources in a sustainable way were displaced by growing access to global economies and trade. Traditional knowledge does not guarantee sustainable resource utilization, however; traditional systems sometimes have led to over-exploitation of resources. Project research found that the level of community governance plays a critical role in sustainable use of ecosystem services: non-local systems of governance frequently led to collapse. Such findings strengthen the case for enhanced support of community or local governance, especially by the people suffering most from current and future ecosystem service degradation. In some cases, long-term sustainability or recovery from collapse was achieved through collaboration of actors sharing both traditional and scientific knowledge, including, for example, that allowing alignment between local and non-local layers of governance.

Research communication

Project results have been published as Japanese books *35,000 Year History of the Japanese Archipelago* (in Japanese, six volumes). Important conclusions and messages were contributed to the report "Satoyama–Satoumi Ecosystem and Human Well-Being: Socio-ecological Production Landscapes of Japan (Summary for Decision Makers)" for the Convention of Biodiversity (COP10), held in Nagoya, October 2010.



Chronological chart showing 2000 years of human-nature relations in the Japanese Archipelago

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

Project Leader **OKUMIYA Kiyohito** RIHN

Dr. Okumiya is a medical doctor with a degree from Kochi Medical College. He has adopted a novel approach to field medicine, including cultural and environmental factors in the study of community-dwelling. He has published on field medicine, geriatrics, and neurology.

This project examines how humans have adapted to high-altitude environments physiologically, ecologically and culturally. Project researchers document the health status of elderly highlanders, and explore possible factors associated with lifestyle-related diseases in this population. Finally, we investigate the impact of modern development over the past 50 years on high altitude lifestyles and environments, and assess how these changes affect the quality of life of elderly highlanders. Study sites have been selected from four areas in the Himalaya-Tibet region, the Ladakh region in India, the Arunachal Pradesh State in India, Khaling in Bhutan, and the Qinghai Province in China, and each of which has distinct ecological and socioeconomic conditions.

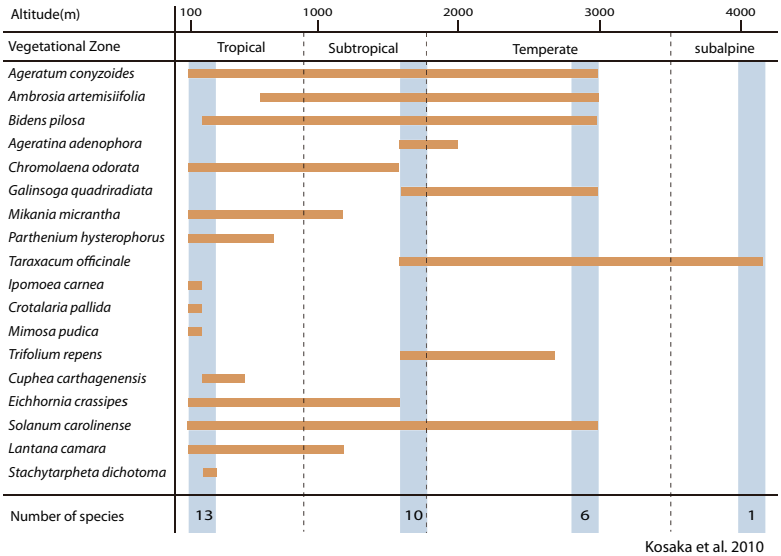
Ecological and cultural adaptation to the high-altitude environment and recent lifestyle change

In Arunachal Pradesh, project research described subsistence livelihood strategies of ethnic groups, patterns of alien plant invasion (Fig. 1), and wisdom of the aged and community support for its conservation (Photo 1). Locally perceived mountain sickness, or 'laduk,' which often occurs in association with aging, influenced highlanders' daily activities. In Ladakh, detailed household interviews and analysis of satellite images revealed a recent decrease in the number of livestock, increasing use of chemical fertilizers, and increasing land abandonment in the village. Decline in agriculture and village hollowing will probably weaken social cohesion. Risk assessment of glacial lake collapse, risk of flood to newly inhabited areas, and flood damage restoration have been reported.

The Highland model of lifestyle-related diseases

The relationship between long-term physiological hypoxic adaptation and lifestyle-related diseases was clarified. An association between diabetes mellitus and hemoglobin levels was documented in Tibet and the Andes, suggesting that poor hypoxic adaptation increases vulnerability to diabetes

Lifestyle changes may accelerate the development of such diseases in hypoxia-adapted people who are also culturally adapted to resource scarcities and have lifestyles that have traditionally been preventive of diabetes (the 'diabetes acceleration hypothesis'). In Tibet, genetic adaptation to hypoxia often leads to excessive hemoglobin levels and appears to increase the risk of diabetes (Fig. 2). Studies clarified the role of the chemoreceptor reflex



Kosaka et al. 2010

Figure 1 Altitudinal range of invasive alien plants in Arunachal Pradesh
The number of invasive alien plants decreased along with the altitudinal range. Low temperature and snowfall in the highland filtered nonadapted species from tropical region.

Photo 1 Chanting contest among Apatani shamans in Arunachal Pradesh
The shamans of Apatani community, who live in the mountain valley at the altitude of 1600m, have their special language and knowledge for rituals. Since 2000, a chanting contest has been held during the annual festival to conserve their cultural heritage.

Photo 2 The First Biennial Health Conference in Bhutan
The forum evaluated the impact of the pilot project in Khaling on elderly care and recommended integrating elderly care into the primary health care system during the 11th Five-Year Plan.

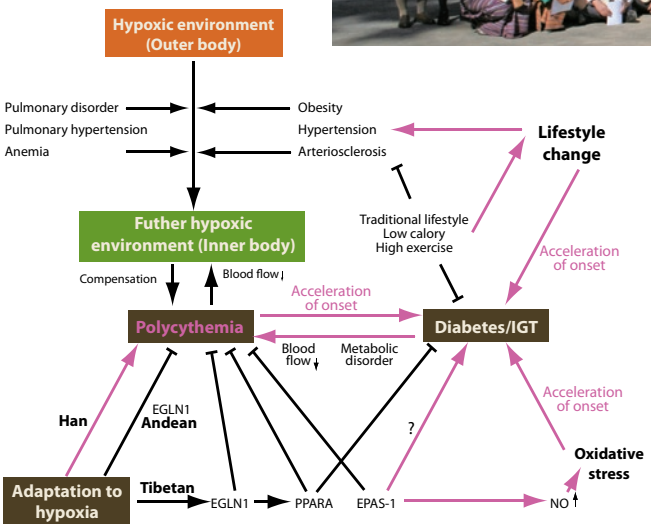


Figure 2 Trade-off of hypoxic adaptation with high oxidative stress and diabetes
With a background condition of high oxidative stress by hypoxic adaptation in Tibetan people, lifestyle change may accelerate diabetes.

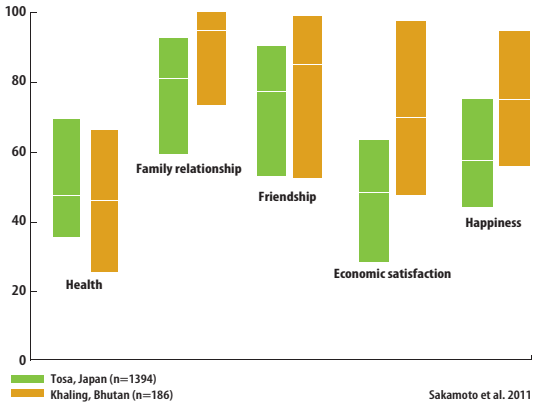


Figure 3 Subjective quality of life (QOL) in the elderly in Bhutan
High subjective QOL was shown despite low subjective health. Deep devotion to religion and tight interpersonal network may be related.

(linking the heart and the brain's cardioregulatory center) in adaptation to hypoxia, as well as the beneficial effects of highland peoples' preserved circadian rhythm.

We examined urban-rural differences on food diversity in relation to health status. Initial analysis indicates that diversity of diet is closely related to daily activities, and subjective QOL and depression. The association between high altitudes and depression was clarified in the Himalaya and the Andes. Despite the high altitude, the prevalence of depression was low in elderly highlander. Deep devotion to religion and tight interpersonal network may be related to this fact.

Health care design for elderly people in highlands: optimal aging with high QOL

Health care designed to provide high QOL among elderly highland peoples is conducted in collaboration with local health and community workers. Blood pressure, body weight, and amount of exercise were monitored by local health staffs in Ladakh for 2 years, and improvements in hypertension and diabetes were shown. We also conducted an international workshop in Arunachal Pradesh, including local residents, researchers and medical officers, in order to generate grassroots discussion of a region-specific kind of development for high QOL to the elderly.

Medical checkups were conducted for 186 community-dwelling elderly (96% of eligible people) in Khaling, Bhutan, in cooperation with the Ministry of Health (Photo 2). QOL was assessed on a visual analogue scale. Notably, the medians of all subjective QOL, including self-rated happiness, but excluding subjective health, were significantly higher in the elderly in Khaling than in a rural town in Japan (Fig. 3) to study environmental disease and promoted activities that can help alleviate infectious disease worldwide.

Schedule in 2012/2013

Global environmental changes associated with socioeconomic globalization and climate warming are manifest in the human bodies of highland peoples. In the coming period of research, we will examine the difference between adaptation and maladaptation in relation to our hypotheses of Highland lifestyle-related diseases and diabetes acceleration. In this task, we will continue to integrate the research and findings of the medical and cultural/ecological teams. In describing a model of health care that is culturally and ecologically suited to the challenges of highland civilizations, and that is based in the wisdom of the elderly concerning quality of life, aging, and death, we will reflect on present lifestyles and the future not only of highlands but also of modern civilization.

Sub-Leader

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Collapse and Restoration of Ecosystem Networks with Human Activity

Project Leader **SAKAI Shoko** RIHN

I started my academic career in botany and ecology. I have conducted several research projects on plant reproduction and plant-animal interactions the tropical forests of Borneo and Panama. In recent years, my interests have broadened to include interactions between ecosystems and human societies. I was an associate professor at Center for Ecological Research, Kyoto University from 2004 to 2008, and have been at RIHN since 2008.

Many ecosystems on the planet have been seriously degraded by human activity and are in critical condition. There are no simple solutions to this problem, as countermeasures must address both the internal complexity of, and interactions between, ecosystems and human societies. This project utilizes the concept of ecosystem network—a nested pattern of interactions among and within ecological subsystems, including human subsystems—to address tropical rainforest decrease in Sarawak, Malaysia and grassland degradation in Mongolia.

Research is conducted in three core phases:

(1) Identification of the network structure in which the problem occurs: Here we use field surveys, remote sensing, literature surveys, and modeling to propose and evaluate hypothetical ecosystem network structures.

(2) Scenario analysis: In this phase we estimate land cover and network structures based on the results obtained in (1) and evaluate ecosystem and social status predictions according to several key indices.

(3) Theorization of ecosystem network conservation: We evaluate the relationships between ecosystem or resource characteristics, network structure, and key environmental problems in both Sarawak and Mongolia. Our explanations can build theories indicating why certain network structures are likely to lead to environmental problems, or how they can be resolved or avoided.

Identification of ecosystem network structures and problems

Mongolia

Although an increase in the number of goats raised to produce cashmere for export has been considered the primary cause of pasture degradation, the distribution of livestock on the landscape and decrease of mobility in nomadic herding are also important causes. The high price of meat has enticed many herders to move their flocks into areas surrounding the capital, overburdening grasslands there. Meanwhile, land privatization and settlement policies are promoted by the government for development. Nevertheless, our simulation model demonstrated that in unpredictable environments, nomadic pastoralism is more sustainable and profitable than settled pastoralism (Fig. 2). Illegal logging and forest fires also negatively affect grassland productivity as forests maintain soil moisture on which grasslands depend (Fig. 3).

Sarawak

Drastic changes in land cover are affecting biodiversity and indigenous peoples. We conducted interview surveys at more than 90 villages in the Baram and Rajang river basins (Fig. 4) where large-scale timber extraction is occurring. Our data indicate that while decreasing forest area is not a direct cause of population decline, it does reduce opportunities for group activities such as hunting and swidden agriculture, and the overall social capital of the

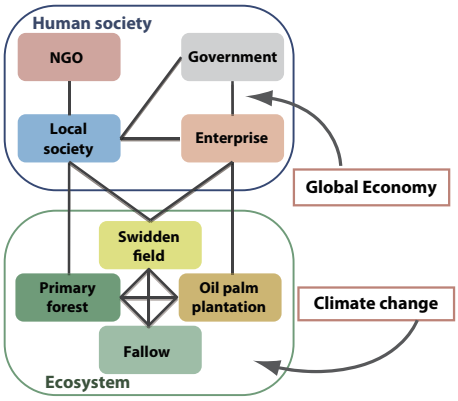
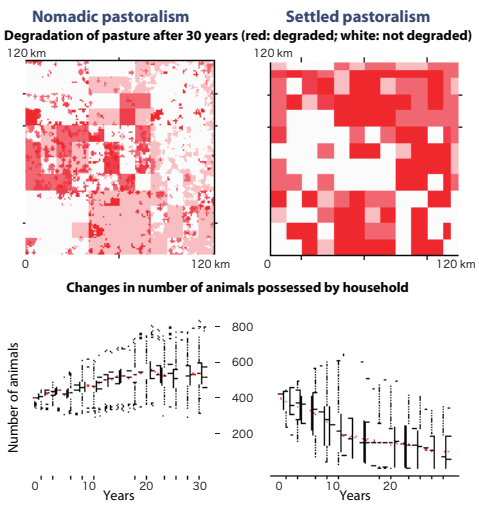


Figure 1 An example of ecosystem network
Within the ecosystem, there are subsystems, such as a primary forest and an oil palm plantation, modified or managed by different human activities. Within the human society, some actors interact with some subsystems, while others indirectly affect ecosystem through other actors.

Figure 2 An example of output of the simulation model
In the model, each household keeps and breeds animals. In the settled pastoralism option, each household is assigned a land of 100km^2 for each task, while in the nomadic option, each household can move to a better site within a certain range. The latter causes considerable degradation of grassland compared with the former.



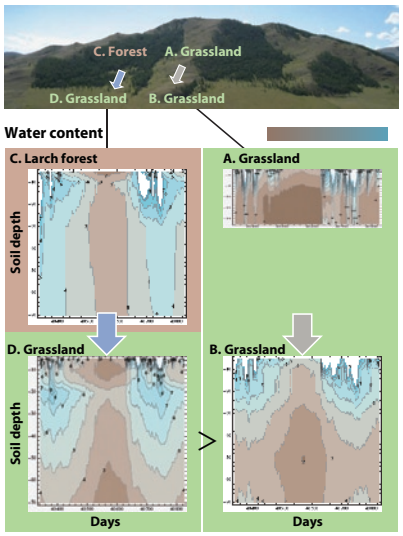


Figure 3 Changes in the water content of soil in a Mongolian steppe
The four graphs show water content in the soil along its depth at different sites on a slope; white and bluish shades indicate higher water content, and dark brown, lower. Water content is directly related to rainfall in both contexts, while water penetrates deeper into the soil and is retained for a longer time in the forest (upper left) than in the steppe (upper right). On the lower part of the slope, the water content is affected by the vegetation. The water content is generally higher in the slope with a forest in the upper part (lower left) than that in the slope without forests (lower right).

Photos Environmental problems in Mongolia and Sarawak
The number of livestock, especially goats, is increasing rapidly, leading to degradation of pastures (left). Oil-palm plantations are rapidly replacing natural forests in Sarawak (above).

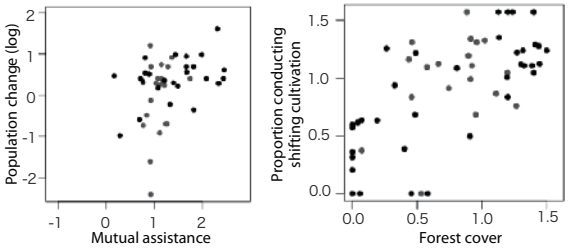


Figure 4 Questionnaire survey conducted in Baram and Rajan River Basins
In this survey, surveyors visited village leaders and representatives of 20 households in numerous villages. Data obtained show positive correlation between population changes and mutual assistance (left) and between proportion of households conducting shifting cultivation and forest areas surrounding the village (right).

village. Our data on biodiversity show that primary forests are irreplaceable in terms of species diversity conservation, however. In addition, we found that land cover conversion affects biodiversity not just at the site of deforestation but also in surrounding areas.

Comparison of ecosystem networks of Mongolia and Sarawak

Enterprises and local people have different mobility and dependence on local ecosystems in Mongolia and Sarawak. Ecosystem deterioration in Sarawak affects local people more significantly than does enterprise activity, since enterprises can move on to new territory in a way that people usually cannot. In Mongolia key ecological resources are generally used by local people and then sold to enterprises as product: local people and enterprises are mutually dependent. In Sarawak, enterprises directly exploit ecological resources; they therefore compete directly with local people for resources.

Scenario analyses

In order to communicate our analysis in an understandable way, we constructed three parallel scenarios for Mongolia and Sarawak, each of which focused on either economic, environmental or local community outcomes. A set of policies and institutions was used to base estimates of land cover and a range of environmental, social, and economic conditions over 30 years. Analysis shows that local communities are not sustainable in either environmental or economic scenarios. Furthermore, land use in the economically-focused scenario is not expected to produce significantly higher economic returns in 30 years. In economic terms, development is therefore sub-optimal: it is delivering short-term returns at the expense of greater income in the longer-term.

Theory of ecosystem network conservation

Ecosystem network structures are so different in Mongolia and Sarawak that they require distinct policies and institutions. In Mongolia, where local people are the primary land managers, there is potential that negative feedback (decreasing pastures decreasing income) may reduce grazing livestock and lead to grassland recovery. Sustainable management will entail design of policies that observe and support such feedbacks, while also balancing local economic needs. In Sarawak, where enterprises are not immediately damaged by forest overexploitation, policies that introduce feedbacks or restrict intensity of resource use are necessary for sustainable management.

What is the cause of the differences in ecosystem structure in Mongolia and Sarawak? We consider that ecosystem productivity and biomass (or resource) distribution is a main factor. Historical differences, such as status of land ownership, also affect the networks differently.

Activities in the final year

In the final year project researchers turn to develop the theory of ecosystem network conservation. Comparison of the Mongolia and Sarawak ecosystem networks suggests that enterprises' direct or indirect use of ecological resources depends on history and the ecological characteristics of these resources and ecosystems. During the final year, we will evaluate this idea by examining network structures of various ecological resources, including wild animals, non-timber forest products, and fisheries.

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Coastal Area Capability Enhancement in Southeast Asia

Project Leader **ISHIKAWA Satoshi** RIHN

Satoshi Ishikawa has researched population genetics of aquatic animals and conservation, and rural development through fisheries improvements and human capacity building in Asia and Pacific areas. He conducted surveys at Southeast Asian countries, PNG and Pacific Islands. He got bachelorship on Fisheries Science from National Fisheries University Japan, Master of Arts and Science from Hiroshima University, and Dr. of Agriculture from the University of Tokyo.

There is growing concern for marine ecosystems and resources. Coastal area ecosystems in particular have been deteriorating rapidly, as they are often affected by environmental change and intensive human activity both on land and at sea. This interdisciplinary project investigates the complexity of coastal ecosystem health in relation to human use in tropical Southeast Asia.

Coastal area ecosystem services are indispensable for rural people, but also easily damaged by human use. Many coastal areas with high biodiversity and biological production are located in tropical zones of developing countries, as is the case in Southeast Asia. In such areas, ecosystem services, local livelihood and culture are closely related, but no clear research methods have been established to evaluate coastal ecosystem health in relation to human uses and needs. Resource management methods commonly used in temperate regions tend to target single ecologies and commercial resources with little consideration of how multiple ecologies and livelihood strategies overlap in culturally diverse contexts, and so cannot be easily applied to tropical coastal areas.

This project develops a holistic concept of area capability to permit consideration of the socio-ecological dynamics and tradeoffs in rural coastal area development. Natural science methods identify key factors maintaining ecosystem health and services, or what we call ecosystem capability. Social and anthropological methods are used to describe patterns of resource use and how they may be linked to improvements in local livelihoods, or social and human capability. Field research is based on collaboration with local people and governmental institutions. In combination, such considerations can serve as a guide for sustaining biocultural diversity in tropical coastal area development.

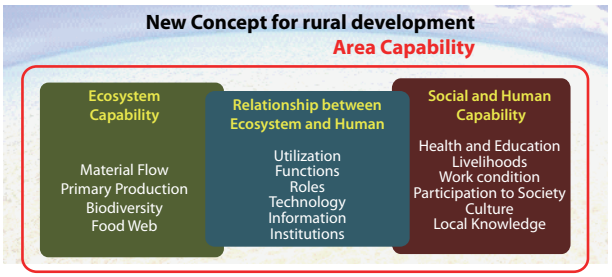

Figure 1 Conceptual Diagram

The period of Feasibility Study allowed us to develop our thinking in Japan and to contact many local researchers and people in order to discuss the concept and design a plan for Full Research. The concept of area capability was presented at the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 (June 2011, Bangkok), and at a seminar in the Philippines of researchers from Kagoshima University, Research Institute for Humanity and Nature, UPV and SEAFDEC. Both events have allowed us to develop the concept in dialogue with members of local institutions and fishery departments in ASEAN countries, as well as in the Food and Agriculture Organization, World Wildlife Federation, among others.

Joint research is now planned in Thailand with the Secretariat and Training Departments of South East Asian Fisheries Development Center (SEAFDEC), as well as the Faculty of Fisheries of Kasetsart University. In the Philippines, the Aquaculture Department of SEAFDEC in Panay and the University of the Philippines Visayas (UPV) will collaborate with the project team. Collaborations have also begun with local set-net fishery and marketing groups

Photo 1 Community market managed by set-net fishery group
Photo 2 Community based oyster aquaculture
Photo 3 Intensive fishery in Batan Bay in Philippines
Photo 4 Set-net in Rayong

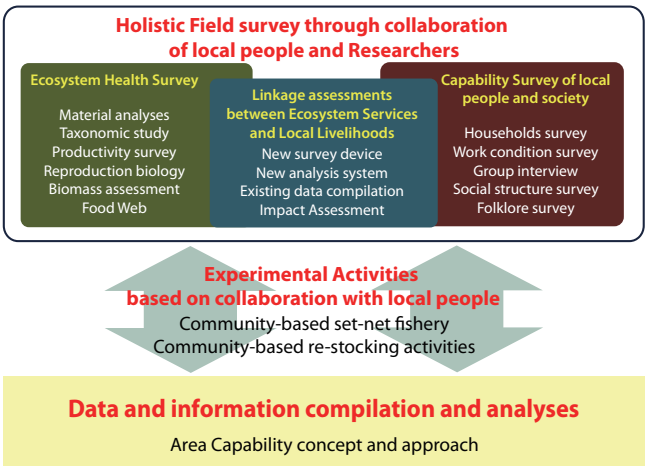

Figure 2 Flow of project activities

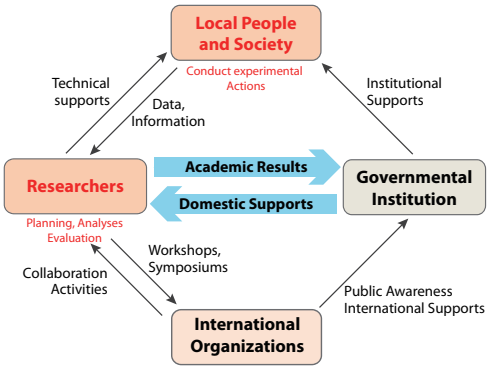

Figure 3 Framework of collaboration activities

in the Rayong area of Thailand, and aquaculture groups in Batan Bay, Philippines.

Future tasks

Full research will examine coastal area resources, ecosystem services and communities in the Rayong area of Thailand, Panay Island in Philippines, and in Ishigaki Island and Mikawa Bay, Japan. Local ecosystem primary productivity, material cycles, and food webs will be analyzed. The project will also examine the present state, fluctuation and migration of important biotic resources, and will develop equipment for such measurement as necessary.

Social research will investigate economic activities, including distribution and pricing mechanisms, working conditions, local culture and customs as they inform livelihood strategies, and health and disaster measures and resilience. A set-net fishery and the sale of seafood by local fishery groups will be researched in the Rayong area of Thailand, as will a fish farming enterprise in Batan Bay, Philippines, in order to describe the full effect of such endeavors on local environments and livelihoods, and to better inform effective resource management in these areas.

In total, this project aims to clarify the most salient local issues, constraints and opportunities that define the area capability of coastal tropical regions. A process of continual feedback of such data will deepen dialogue with local people and governmental institutions and is expected both to improve project research and support ecologically sound local and regional development.

Photo 5 Group photo at Joint Seminar held in Philippines 2011

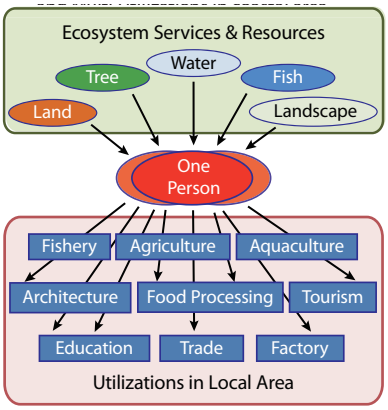

Figure 4 Utilization situation of coastal resources in developing areas

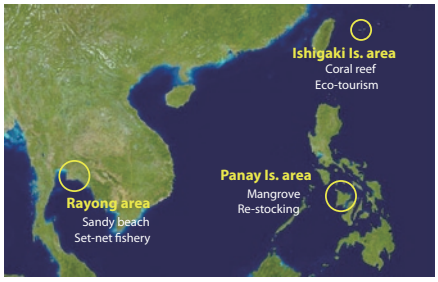

Figure 5 Main target areas

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