

# Diversity Program

SATO Tetsu | 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-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
Full Research	Leader	Title
D-05	ISHIKAWA Satoshi	Coastal Area Capability Enhancement in Southeast Asia





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

Project Leader **OKUMIYA Kiyohito** RIHN

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

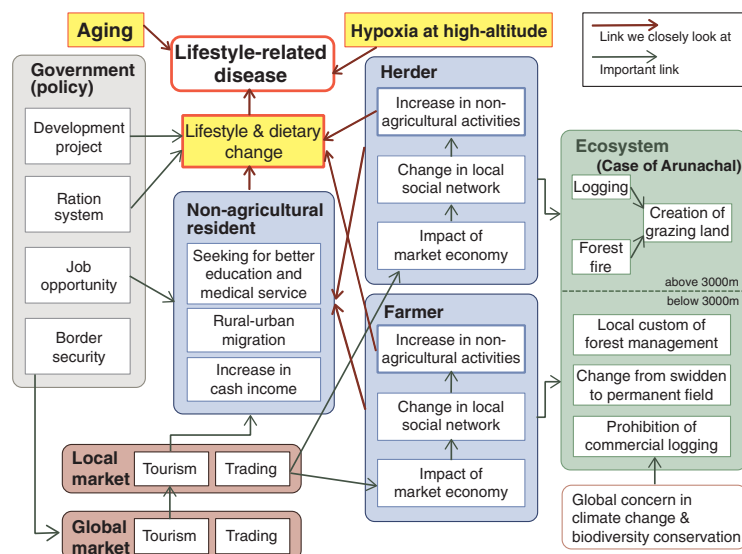
## Results

Ecological and cultural adaptation in highlands was characterized as maximal and sustainable utilization of limited but diversified natural resources, flexible management for disasters notwithstanding inherent social-ecological vulnerabilities, and a simple life with modest virtues. Human-environmental relationships were studied in three ecologically distinct zones in Himalaya-Tibet region: a forest in Arunachal Pradesh and Bhutan, the Ladakh oasis, and the grasslands of Qinghai. In Arunachal Pradesh, for example, the distribution of vegetation, ethnic groups, subsistence-related lifestyle patterns and recent change, and alien plant invasion were described from 200 to 4000 meters of altitude. Our survey of rural-urban migration suggested that local residents increasingly seek better education and medical service as well as the higher cash income provided by non-agricultural activities. This change in human-environment relationship, caused by various factors from local to global, uniformly resulted in the rise of lifestyle-related disease such as hypertension and diabetes (Figure). The “Himalaya model of lifestyle-related diseases” and “diabetes acceleration model” were developed to describe these trends. The background association of diabetes with high hemoglobin and oxidative stress was viewed as a trade-off with hypoxic adaptation associated with aging in highland environments.

## Research communication

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

The project has published extensively, including: “Ecology of life, aging and disease: Living in Tibet/ Himalaya”; (in Japanese) “Ecology of life, aging and disease Vol.2: Living in Himalaya / Andes” (in Japanese), “Mysterious Land: nature of Assam Himalaya and Tibetan society” (in Japanese), “Health in high-altitude environment: interaction between hypoxic adaptation and recent lifestyle change” (in Japanese), “Andes, Himalaya and Mongolia: People living with domestic animals”, “The Study of Mādhyamika Philosophy: Dar ma rin chen Bhāṣya and Busshitogan of Bodhicharyavataṛa” (6 volumes), “Report of heavy rain disaster in Ladakh”. Four additional books are currently in preparation. Project researchers have published 201 peer-reviewed scientific papers in Himalayan Study Monographs (No. 8-14) or other journals, and convened four international symposia or workshops.



Increased lifestyle-related disease caused by non agricultural activities, aging and trade off of hypoxic adaptation

# Collapse and Restoration of Ecosystem Networks with Human Activity

Project Leader **SAKAI Shoko** Kyoto University

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

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

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

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

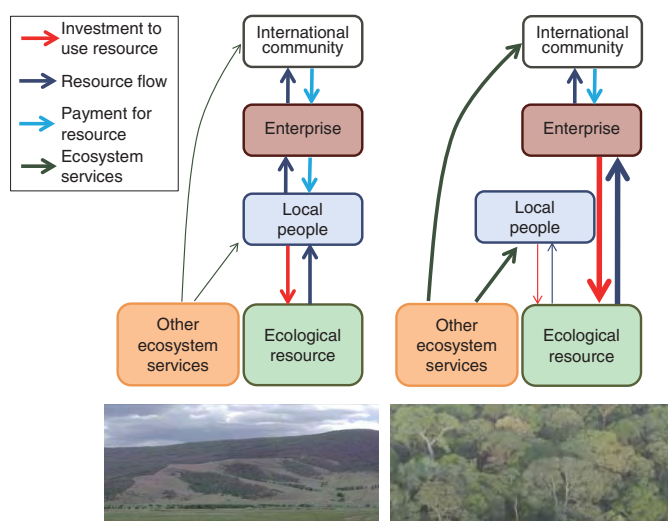
The results of the project showed that network structures that are likely to lead to environmental problems or ecosystem network restoration depend on the ecological characteristics of the specific system and resources.

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

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

Grasslands in Mongolia

Tropical forests in Sarawak



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

# 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.



## Background

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.

## Project Framework

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.

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 seminars in the Philippines of researchers from Kagoshima University, Research Institute for Humanity and Nature, UPV and SEAFDEC in 2011 and 2012. These 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.

This project is based on the joint research efforts of Southeast Asian Fisheries Development Center (SEAFDEC), Faculty of Fisheries of Kasetsart University, the University of the Philippines Visayas (UPV), and Japanese researchers who are members of the RIHN project. Aklan State University and Eastern Marine Fisheries Research and Development Center of Department Fishery, Thailand, are active participants as well. Through this collaboration, we can realize “area capability” and to generate a new approach toward rural development based on the harmonization between ecosystem health conservation and improvement of local people’s quality of life. .

## Future tasks

With full research underway since 2012, we will examine coastal area resources, ecosystem services and

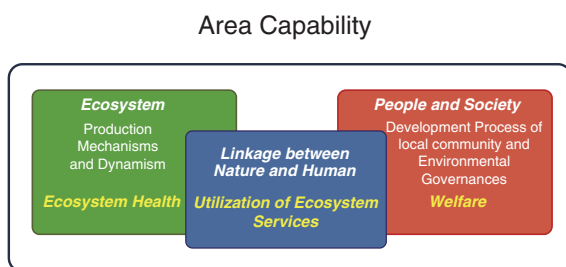


Figure 1 Conceptual Diagram of Area Capability

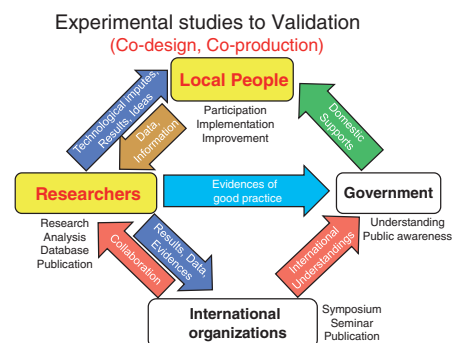


Figure 2 Framework of collaboration activities



Photo 1 Set-net in Rayong



Photo 2 Community market managed by set-net fishery group



Photo 3 Intensive fishery in Batan Bay in Philippines

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 4 Group photo at Joint Seminar held in Philippines 2012

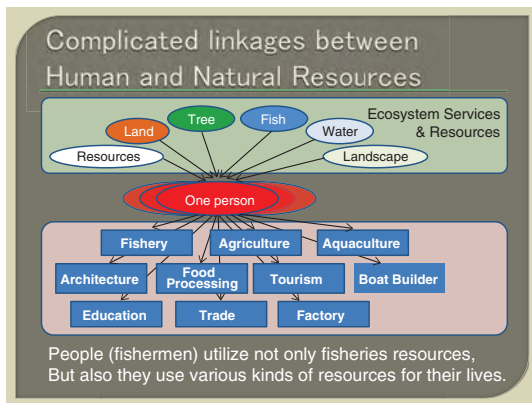


Figure3 Utilization situation of coastal resources in developing areas

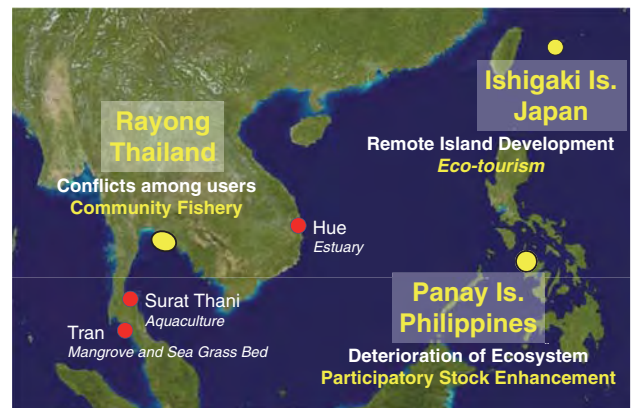


Figure 4 Main target areas

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