Megacities and the Global Environment

The world's urban population has been increasing at an alarming speed in recent years, with the trend toward megacities getting stronger. This project examines the Jakarta metropolitan region, a classic example of a developing-world megacity. We attempt to develop an *urban sphere model* of megacity growth that can illuminate the negative environmental impacts associated with megacities while at the same time highlighting the real and potential benefits of urban life for citizens of the developing world.

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Research Background

It is predicted that more than twenty-seven megacities—cities with a population of 10 million or more—will exist in 2020. Most of these megacities will be located in developing countries where urban infrastructure and environmental regulation are already overwhelmed. The problems of urban sprawl, "heat island" effect, flooding, overcrowding and traffic are not just of local concern; they are also clearly linked to a number of global-scale environmental issues.

The problem of megacity growth has attracted the attention of urban administrators, academics, and those working in international aid and NPOs. Often their approaches to megacities, however, rely on those devised in the context of the climate, population size and historical development of 19th and 20th century Western Europe, the United States and Japan. Such approaches are not always applicable to megacities in developing countries, and can even be detrimental.

Research Methods and Target Regions

This study will be conducted in the following three phases:

Phase 1: Mechanism investigation

We will examine depletion of fisheries, degradation of urban amenities, and the negative impact of construction waste on the natural environment. Our analysis encompasses both causes and effects of these phenomena, which, when combined with urban inhabitants' value assessments, will identify and inform effective future urban regulation.

Phase 2: Database construction and utilization

We will create a system, content (a database of geographical space information and policies), and a structure of cooperation (consensus building) in order to allow various stakeholders—urban administrators, NGOs, citizens, and foreign institutions—to utilize the results of our research.

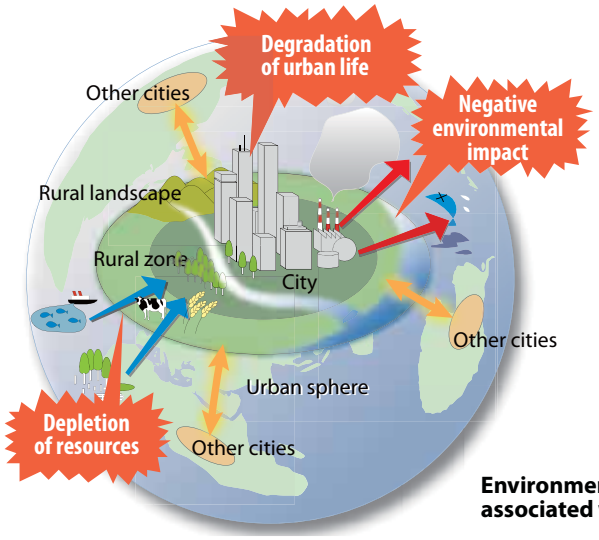
Phase 3: Urban sphere model and policy proposals

Based on the results gained in the first phase, we will present spatial placement plans and scenario-based forecasts that can be applied to existing or emerging megacities in developing countries.

Expected Results:

In 2009 we will:

1) Organize various study meetings regarding cities and the global environment, which will help us to further develop our research policy and methods;
2) Conduct preliminary research on Jakarta and other relevant cities;
3) Organize a conference together with the University of Indonesia in order to promote cooperative research;
4) Publicize the results of the above endeavors through websites and other English and Japanese language media.



Environmental problems associated with cities

An Environmental History of Nomads and Farmers in Central Asia

Central Asia is the crossroads of Eurasia. This project investigates the still unknown origins of Central Asian nomads and describes environmental change in the region over the last ten thousand years, with emphasis on the Syr Darya, Zeravshan, Amu Darya rivers, Aral Sea and the Pamir mountains. In clarifying the activities of and interactions between nomads and farmers, and their relation to the environmental changes of Central Asia we hope to compose a unique environmental history, and so to inform future interaction between humanity and nature in the region.

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Project Objectives

Central Asia is located at the center of the "yellow belt" of Eurasia, and it has long been a crossroads between Eastern and Western Asia and northern nomads and southern farmers. Our project will first investigate the origins of nomad peoples in this topography. Second, we will describe the water circulation systems that have sustained all life in the Pamirs, the three large rivers of the region and Aral Sea. Third, we will describe and compare the activities of nomads and farmers from their origins until modern times, and clarify the impact of these peoples on Central Asian environments. We will also explore possibilities for the future interaction between humankind and nature suggested by the research results.

Methodology

We research the origin of nomads by excavating their burial places and collecting bone fragments of livestock (Photo 1). Morphological and genetic analysis of livestock bones will allow us to determine whether nomads were involved in the domestication of wild animals or if their livestock species were originally domesticated by agricultural peoples. Core-sampling and proxy analysis at the Pamir Mountains and Aral Sea allow us to describe long-term environmental change in these areas. A Geographic Information System will allow us to reconstruct paleo-topography and attempt runoff analysis. Digital Elevation Models (Figure 2) will describe long-term environmental change of drainage basins. Comparing such environmental data with archaeological, anthropological and historical data of nomad and farmer activities will allow us to develop a rich description of Central Asian human and environmental history.

Photo 1 **Tombs of nomads in Kurgan, Sazagan cemetery, Uzbekistan**

Figure 1 **Runoff analysis in Central Asia. SRTM 3 data is used to create a base map**

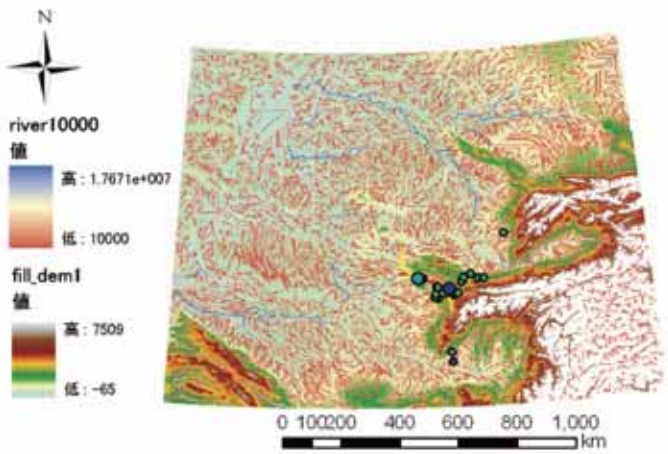
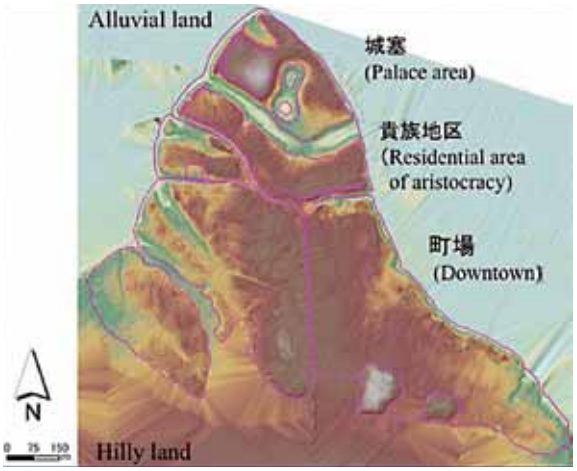


Figure 2 **A Digital Elevation Model of an urban settlement at Dabusya, Uzbekistan**



Agricultural and Hydrological Cycles in the Changjiang Basin

This study examines interactions between agricultural activities and hydrological environments in the rapidly changing Changjiang basin in south China. It will clarify the influence of recent socio-economic and climate change on the hydrologic cycle in the Changjiang basin, as well as the manner in which this change impacts basin residents and adjacent dry regions, and so improve human capability to mitigate and adapt to contemporary environmental change.

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Project overview

Water is essential to all life. It circulates in many forms throughout the biosphere. Even small fluctuations in the hydrologic cycle—small changes in the temporal and spatial distribution of water—may have significant impacts on human activities.

Economic development is rapidly changing land use in China. Urban and peri-urban areas have been transformed, but rural areas have also been affected, for example by improvements in rural livelihoods and change in rural industrial structure. Change in land use and land cover is now associated with local environmental problems in the basin as well as global climate change. This study investigates human-environmental interactions in the Changjiang basin, with emphasis on the environmental problems associated with interactions between agriculture and the hydrologic cycle.

Research methods and expected results

Analysis of statistical data, literature of socio-economic and land use activities, remotely sensed land cover data, and materials gathered in the field will allow us to compile a spatially explicit history and dataset of land use in the basin. We will describe the key social and natural factors contributing to changes in land use. Important social factors to be considered include changes in policy, economy, agriculture, society, industry, and water use, while natural factors include changes in climate and distribution of precipitation.

Field measurements of hydrometeorological properties, including river discharge and precipitation, will be made at several points in the basin. Changes in the water environment and in patterns of water- and land-use in each area will be represented quantitatively. Analysis of this data should describe the root causes of contemporary hydrologic problems, and illuminate interactions of different biophysical systems and their impacts on human societies, and so improve human capability to mitigate and adapt to contemporary environmental change.

Hilly terrain in the middle stream of Changjiang basin, southern Jiangxi Province, China, 1993.

Small-scale paddy fields, distributed over severely eroded hills, recharge the regional water table. What impact will rapid economic development, or the shift to a market economy, have on this landscape?

Ecosystems and Social Sustainability in Coastal Southeast Asia

The coastal areas of Southeast Asia contain great biodiversity, and livelihoods of the people of Southeast Asia directly and indirectly depend on this biodiversity. We use a holistic approach to give a full accounting of how people use coastal resources so that rational and sensible measures to for social and ecological sustainability can be established.

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Purpose of the project

This project will conduct interdisciplinary field surveys in the coastal areas of Southeast Asia in order to establish a consolidated database of livelihood and resource utilization. This database will stimulate exchange of ideas, opinions and information among local people, researchers, politicians and other interested stakeholders. The resulting dialogue will improve understanding of social and ecological interdependence in the region, so that rational and sensible countermeasures for social and ecological sustainability can be established.

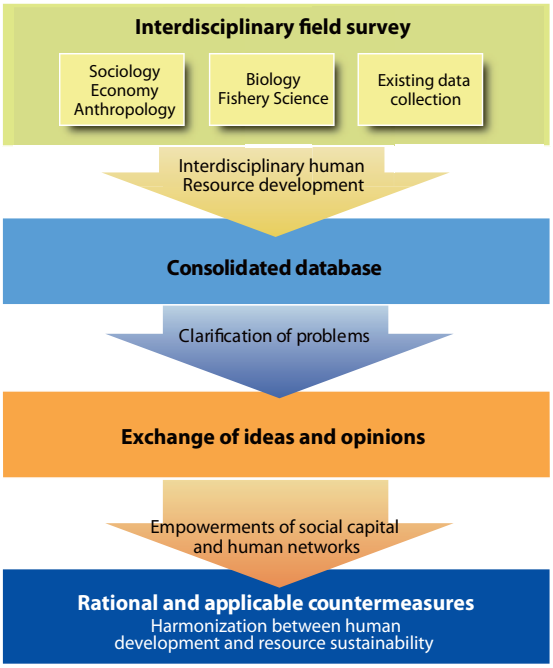
Research Approaches

1. Interdisciplinary field surveys
Data on biodiversity and resource utilization in coastal areas of Southeast Asia will be complied through collaborative field surveys conducted by biologists, economists, anthropologists and others. Some biological samples will be subject to molecular and stable isotope analysis in order to identify the stock and ecosystem structure.

2. Consolidated database
All information collected by the field surveys is compiled into databases that will be available through the World Wide Web. The results of scientific analysis, including DNA and stable isotope analysis, are also included the database.

3. Dialogue and exchange
Researchers examine principal patterns of resource utilization in relation to sustainable resource use. Research findings are provided to resource users and managers and other involved stakeholders. The project offers a series of workshops in order to facilitate the exchange of ideas and opinions about resource problems.

4. Establish countermeasures
The project solicits advice from local people, researchers, politicians and others regarding pressing resource and livelihood problems, and attempts to develop countermeasures to improve social and ecological interactions. Project researcher actions and monitoring systems are determined through popular discussions.



Project framework and approach

Expected outcomes

This project will establish a robust database of ecological and social data that can be subject to extensive scientific analysis. By facilitating public access to the database and to information regarding key resource problems in coastal Southeast Asia, many people directly involved in coastal resource management will be able to discuss their understanding of the problems, and exchange ideas of potential solutions. Project researchers will also monitor feedback mechanisms, once countermeasures are adopted. In addition, as continued field surveys will be required to update the database, this project will contribute to the formation of a new human network of social and ecological sustainability.

Development, Migration, Environmental Change and Human Health in Malaysia

Globalization is transforming lifestyles, livelihoods and environments around the world. People in search of economic advantage follow development, moving from one place to another. Development projects, such as infrastructure work, industry, and the associated changes in cultural landscapes, have dramatic, and sometimes dire, effect on biophysical environments. This project will evaluate change in natural and social environments associated with development and population flows in Malaysia, and quantitatively measure their impact on human health.

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Mohd Zahedi bin Daud	Malaysia Darul Iman University
Ramle bin Abdullah	Malaysia Darul Iman University

Project Background and Objectives

People adapt in different ways to the environmental effects of development. Some people may remain in their home regions to actively take part in the development, while the other may choose or be obliged to migrate to other regions or nations in an attempt to maintain or better their lifestyles. Such population flows may put additional pressure on local environments and social systems; intensified use of resource associated with development can lead to conflict between the original occupants of an area and newcomers. This project evaluates the effect of development and population flow on biophysical and social environments in Southeast Asia, especially by quantifying their impact on human health.

Research Method and Expected Results

Development in rural Malaysia has taken the form of palm oil production and dam construction, both of which encroach on tropical forests in Malaysia. This project examines the coping mechanisms and responses of the *Orang Asli* people, an aboriginal people in peninsular Malaysia, to such development. We will collect and analyze data in three spheres: 1) the human relation with environments, such as resource use, subsistence strategy and perception of environments, 2) natural and social environments, such as environmental assessment and legislation of land and resource use, 3) the influence of environments on humans, especially as new environments of development affect nutrition and health. With respect to population flow, we also study the national and international origins of migrant in order to examine regional developments in relation to new population flows.

A tropical forest submerged by a dam
This forest was formerly the subsistence area for the *Orang Asli* people.

Genetic Pollution, Farming Ecosystems and New Energy Crops in Tropical Asia

Rapidly expanding cultivation of new energy crops is reducing the area of rain forest in Tropical Asia. Biofuel crops require intensive application of chemical fertilizers and pesticides, which can pollute surrounding ecosystems and damage human health. Energy crops also displace cultivation of food for human consumption, endangering food security. This project examines the effect of energy crops on biodiversity and human health in Tropical Asia.

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MATO Tooru	Graduate School of Agriculture, Kyoto University
SATO Yo-Ichiro	RIHN
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Research purpose

This research project investigates the following themes: 1) the factors influencing conversion from traditional agriculture to modern agriculture in Tropical Asia; 2) the biodiversity in traditional and modern farming ecosystems, including microorganisms coexisting in the rhizosphere and plants; 3) genetic diversity of crops in different cultivation systems; 4) the sociocultural infrastructure, such as mythology and customary practices, related to traditional agriculture and foodstuffs. In combination, the above themes will describe the role of farm- and ecosystem-scale biodiversity in sustainable crop production. Further, we will determine to what degree genetic diversity is related to traditional social and agricultural systems. Based on this analysis, the research project should present proposals for sustainable food production in tropical Asia.

Research methods

Field research will take place in regions of tropical Asia where modern agriculture is displacing traditional agriculture. We have conducted several preliminary investigations, including: examination of genetic-diversity of crops and the dynamic state of nutrients such as nitrogen and phosphoric acid in distinct agricultural systems; examination of field biodiversity found in companion planting, soil microbes, and symbiotic microbes; ethnic and religious studies investigating traditional farming systems and food consumption. Molecular biological and stable isotope analysis will complement field observations. Social-scientific investigations entail interviews and field investigations as well as reviews of existing literature.

Future study

In this year of feasibility study, we emphasize: 1) clarification of physical and socio-cultural factors that most influence biodiversity and genetic-diversity in farming ecosystems; and 2) advancing our proposal concerning the key components of sustainable food production and consumption in tropical Asia.

Traditional farming field located in a valley of Northern Laos
Rice yields here reached 3 tons per hectare without chemical pesticides and fertilizers. Slash and burn fields are visible in the surrounding mountains.

In-field diversity in Northern Laos
Various rice cultivars have different colors and panicle sizes.

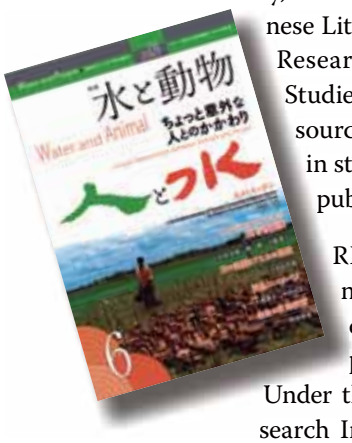
Rice and fish are harvested in paddy fields/ pond systems in Sulawesi, Indonesia
The circles visible within paddy fields are the banks of excavated fish ponds.

Completed Research

Research projects completed in the previous two years (2008/09) are assessed by the Project Evaluation Committee and so have been described in the program domain sections. The following projects were completed in years previous to 2008.

Domain	Year completed	Project leader	Project title	Present affiliation of project leaders
Circulation	2007	**HAYASAKA Tadahiro**	Emissions of Greenhouse Gases and Aerosols, and Human Activities in East Asia	Center for Atmospheric and Oceanic Studies, Graduate School of Science, Tohoku University
Circulation	2007	**KANAE Shinjiro**	Global Water Cycle Variation and the Current World Water Resources Issues and Their Perspectives	Institute of Industrial Science, University of Tokyo
Resources	2007	**WATANABE Tsugihiro**	Impact of Climate Changes on Agricultural Production System in the Arid Areas	RIHN
Ecohistory	2007	**NAKAWO Masayoshi**	Historical Evolution of the Adaptability in an Oasis Region to Water Resource Changes	National Institutes for the Humanities
Ecosophy	2007	**YACHI Shigeo**	Multi-Disciplinary Research for Understanding Interactions between Humans and Nature in the Lake Biwa-Yodo River Watershed	Center for Ecological Research, Kyoto University

RIHN within the National Institutes for the Humanities



The National Institutes for the Humanities was established on 1 April 2004. RIHN joined the National Museum of Japanese History, the National Institute of Japanese Literature, the International Research Center for Japanese Studies and the National Museum of Ethnology as a member institute. RIHN shares resources and contributes to joint research with other NIHU institutes, and collaborates in staging public lectures and symposia and other activities designed to generate broad public interest in intersections between the humanities and the environment.

RIHN coordinates two NIHU endeavors on topics of great regional and global significance: Water in Asia, and environmental transformation in China. RIHN is the core institution in the Integrated Study of Water and People in Humid Asia, and publishes themed issues of the journal Water and People for a specialist audience. Under the NIHU Center for the Promotion of Area Studies, RIHN established the Research Initiative for Chinese Environmental Issues. The RIHN-China Newsletter, published in Japanese and Chinese, and the Symposium Series on Chinese Environmental Issues, held at locations in both Japan and China, have established RIHN as a central node in the network of scholars concerned with environmental transformation in China.