

# Resources Program



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Program Director ● **WATANABE Tsugihiro**

The Resources Program investigates problems deriving from humankind's use or conservation of renewable and non-renewable resources. Humans have always made use of plants and animal species, and have succeeded in domesticating some of these wild resources. Through time, humans were able to increase the amount of food available to them, and to increase their own numbers. At the same time, however, the exploitation of land for agricultural production and for pasture has dramatically decreased forest cover and wild biodiversity.

Formerly, most food was produced and consumed locally; gradually transportation technologies have enabled long-distance trade. At the same time, energy consumption has increased along with "food miles," and imposed serious environmental loads through the emission of CO<sub>2</sub>.

Such facts raise the question of how much of a certain resource exists, how much is consumed, what is involved in its extraction, processing, transport, and consumption, what rates of resource "throughput" are ecologically sensible and best promote human wellbeing, and what alternatives may exist. The Resources Program takes an integrated, transdisciplinary approach to such questions.

Full Research	Leader	Title
<b>R-03</b>	<b>KUBOTA Jumpei</b>	Historical Interactions between Multi-Cultural Societies and the Natural Environment in a Semi-Arid Region in Central Eurasia
<b>R-04</b>	<b>MOJI Kazuhiko</b>	Environmental Change and Infectious Disease in Tropical Asia
<b>R-05</b>	<b>NAWATA Hiroshi</b>	A Study of Human Subsistence Ecosystems in Arab Societies

# Historical Interactions between Multi-Cultural Societies and the Natural Environment in a Semi-Arid Region in Central Eurasia

This project examines the historical interactions of humanity and nature in the semi-arid region of Central Eurasia. Textual, archaeological and biophysical evidence is used to examine the effect of human boundaries on environments, ethnic groups, dominant patterns of subsistence, and relations between cities and their surrounding areas. The findings of this project will improve understanding of how past human activities cumulatively affected ecosystems in Central Eurasia, and how semi-arid regions can best be managed in the future.



**Project Leader**  
**KUBOTA Jumpei**  
RIHN

Professor Kubota earned a doctorate in forest hydrology from Kyoto University (1987). He was previously Assistant Professor at Kyoto University (1987-1989), Assistant Professor (1989-1996) and Associate Professor (1997-2002) at Tokyo University of Agriculture and Technology. He joined RIHN in 2002 and now directs the RIHN-China initiative. His major research fields are hydrology, water issues in arid regions and human impacts on the hydrological cycle.

**Core Members**

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- MATSUYAMA Hiroshi**
- TAKEUCHI Nozomu**
- FUJITA Koji**
- SUGIYAMA Masaaki**
- FUNAKAWA Shinya**
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- Graduate School of Science, Chiba Univ.
- Graduate School of Environmental Studies, Nagoya Univ.
- Graduate School of Letters, Kyoto Univ.
- Graduate school of Agriculture, Kyoto Univ.
- Faculty of Letters, Nara Women's Univ.
- National Museum of Ethnology
- Graduate School of Environmental Science, Okayama Univ.
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## Background and objectives

Nomads were once the principal inhabitants of semi-arid Central Eurasia. Following the rise and fall of various ethnic groups and empires, the Yuan Dynasty took nominal control of much of Eurasia in the 13<sup>th</sup> and 14<sup>th</sup> centuries. In the 18th century, however, a national border was drawn across the region, definitely distinguishing Russia from Qing China. The inhabitants of the area subsequently experienced a great change of lifestyle, as the border and national settlement policies forced nomadic peoples out of their traditional patterns of livelihood.

This project combines analysis of historical documents, archaeological remains and natural proxies such as ice cores, lake sediment samples, tree rings and wind-blown deposits in order to describe how nomadic peoples and nation-states affected the natural resources and climatic conditions in the Ili River watershed in Central Eurasia. Project researchers also investigate human activities on both sides of the Russia/China border in order to describe its potential effect on contemporary environmental conditions.

## Research area and groups

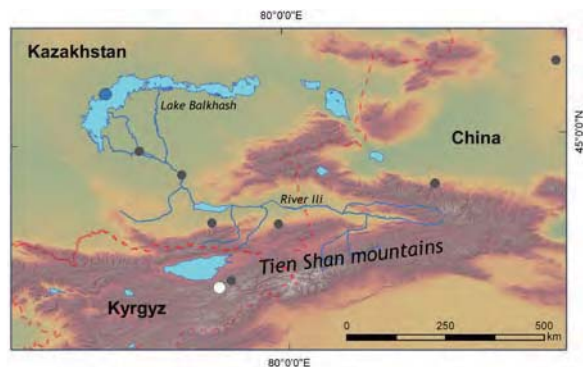
Research centers on the Ili River watershed area, which extends from China to Kazakhstan, and surrounding

areas, including Kyrgyzstan and Uzbekistan. Throughout human history, Central Eurasia has been a key site of interaction between individual ethnic groups inhabiting or passing through the area, and a longtime crossroads for the civilizations of East and West. In more recent times, the development policies of modern states have led to severe environmental degradation.

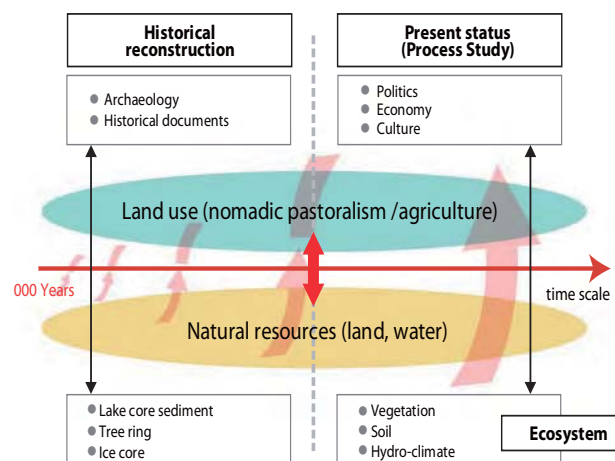
This project consists of two research groups. The first group uses historical documents and natural proxies to describe historical changes in both human and natural systems. The second group investigates current human activities and natural systems in order to interpret the long term significance of past human and environmental change.

## Progress to date

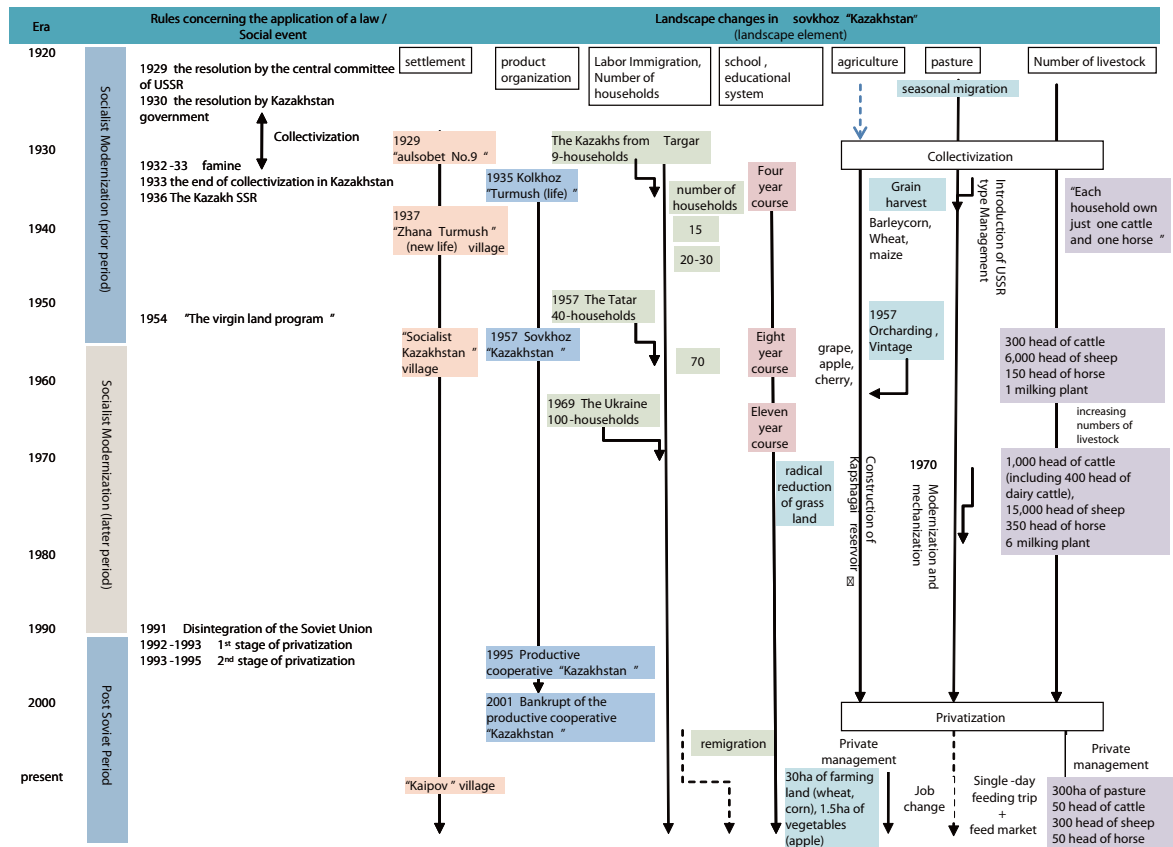
Initial analysis of data from Lake Balkash indicates that lake level began to decrease in the 10<sup>th</sup> century, and at the turn of the 13<sup>th</sup> century reached its lowest level in the past 2000 years. After this regression, the lake level showed rapid recovery, and remained relatively high until the modern regression beginning in the 1960s. Other lakes in Central Eurasia, such as the Aral Sea and Lake Issyk-Kul,



**Figure 1 The Tian Shan Mountains and Ili River**  
● Lake sediment core ○ Ice core ● Other study sites



**Figure 2 Outline of the project**



**Figure 3** Transition of social systems and subsidence in Kazakhstan

experienced a similar regression in medieval times, suggesting the climate then was cooler and drier. Increased human reliance on lake waters in this period could also be associated with their lower levels.

We find evidence that the establishment of a clear border between Russia and the Chinese Qing Dynasty shifted patterns of human-environmental interaction in the region. The border exposed certain areas to concentrated human activity, which, along with increasing tech-

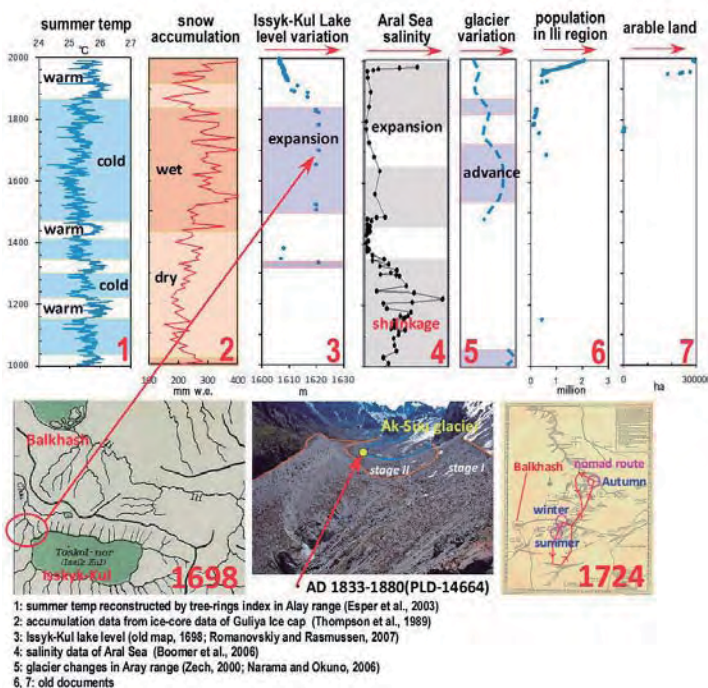
nological capacity, clearly demonstrate human potential to cause dramatic environmental change.

The most dramatic change in long-term patterns of human and environmental interaction in semi-arid Eurasia was the shift from nomadic to sedentary societies accompanying the establishment of modern agriculture. Russia's expansion into Kazakhstan in the late 19<sup>th</sup> century, agricultural collectivization in 1929, and Khrushchev's Virgin Lands Program gradually converted Kazakhstan into a major agricultural zone. Agricultural production was pursued with little regard for environmental capacity or impact. With the collapse of the Soviet Union many farms were abandoned, reducing pressure on natural resources, and allowing some ecosystem recovery.

In China, modern development did not begin in earnest until the 1950s. China's dramatic recent growth, however, is increasing demand for natural resources and the western provinces may again be subject to centrally planned development.

Cooperation with research institutions in Kazakhstan, China and Russia has facilitated collection of a number of unusual historical documents, maps and images of the region. Several documents describe the locations and populations of different nomadic groups, and the number of animals kept by each. Of these documents and maps, those written in Manchurian have not been previously investigated because few researchers can understand the Manchurian script; we are currently engaged in their translation and analysis.

We are also compiling information obtained from historical texts, archaeological sites and images into a chronological GIS database that will demonstrate in graphic manner the long-term human and environmental transformations in Central Eurasia.



**Figure 4** Long-term reconstruction of climate and environmental change in Central Eurasia

# Environmental Change and Infectious Disease in Tropical Asia

The RIHN Ecohealth Project examines the effects of social and environmental change on the ecology of human disease in tropical monsoon Asia. Key drivers of ecological change in this area include population increase, deforestation, resettlement, urbanization, expansion of wet rice cultivation, changes in water management, economic development and lifestyle changes. Prevalent diseases associated with such ecological change include malaria and liver fluke infection. Project researchers also investigate the relation between climatic change (e.g. temperature, rainfall, and flood) and infectious disease, mainly in Bangladesh. The study will offer new ecologically-based insights for the evaluation and control of infectious disease in relation to both local and global environmental changes.



Project Leader  
**MOJI Kazuhiko**  
RIHN

Kazuhiko Moji has been at RIHN since 2007. He received his MA (1978) and Ph.D. (1987) in Health Sciences at the University of Tokyo. He was Research Associate at the Department of Human Ecology at the University of Tokyo (1983-1987). In 1987 he moved to Nagasaki University, where he served as Associate Professor in the Department of Public Health (1987-1999) and Professor in the School of Allied Medical Sciences (1999-2001), Faculty of Health Sciences (2001-2002), and Research Centre for Tropical Infectious Diseases of Institute of Tropical Medicine (2002-2007). He was a visiting Takemi Fellow of International Health at Harvard School of Public Health (1991-1992) and a visiting researcher in the Department of Bio-anthropology, Cambridge University (1998-2000).

## Core Members

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<b>ASAKURA Takashi</b>	Tokyo Gakugei University
<b>YAMAMOTO Taro</b>	Nagasaki University
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## Project background

The health profile of a human population can be seen as a product of the human ecosystem—an ecosystem comprised of both biophysical and human elements. The construction and conservation of sound human ecosystems, therefore, is essential to the health and survival of human populations. The field of ecohealth considers human health and disease in relation to environmental conditions; it can improve attempts to address disease and local and global environmental problems.

## Research objectives

Several research groups comprise our project. The Lahanam Study Group's research in Savannakhet Prov-

ince, Laos, examines patterns of liver fluke infection, a parasitic infection associated with consumption of raw freshwater fish. In 2010 the principal objectives of this group are to:

- 1) Introduce an appropriate IT-based communication system in order to improve the Lahanam Health and Demographic Surveillance System (HDSS) and build a database allowing longitudinal health study;
- 2) Study the relation between modern irrigation/wet-rice cultivation and liver fluke infection;
- 3) Study fish and snail ecology, fishery ecology, and consumption of fish, and;
- 4) Determine feasible educational, behavioral, and/or environmental control of liver fluke infection.

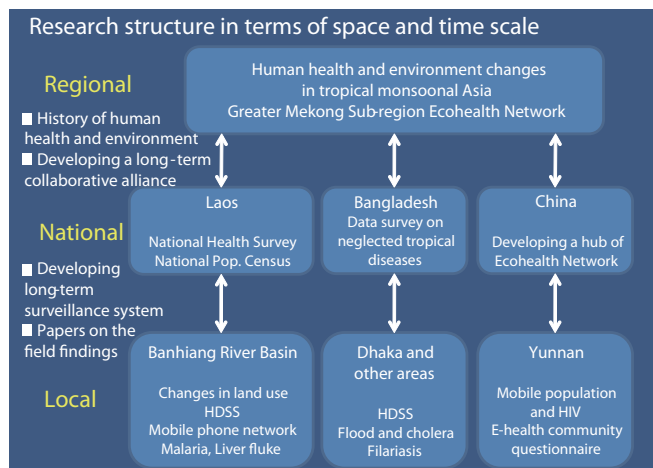


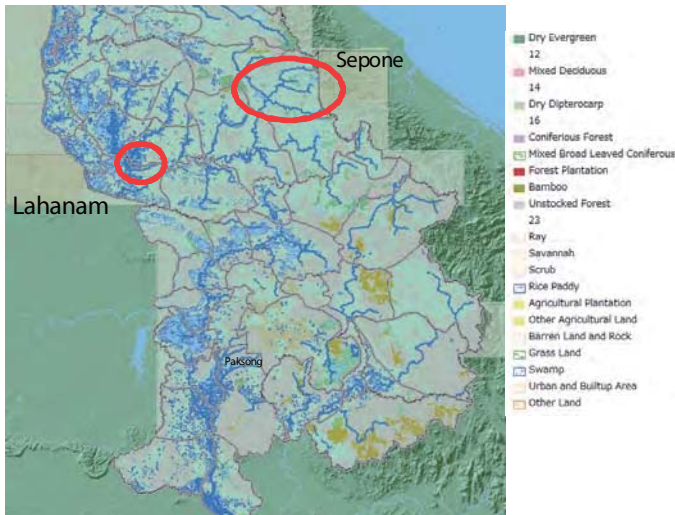
Figure 1 Research Framework of the Ecohealth Project

Studies on child and school health and nutrition are also under way. Project researchers found a decrease in the prevalence of liver fluke infection among school children since beginning our surveillance.

The Sepone Study Group's work in Savannakhet Province, Laos, is developing an integrated ecological and medical approach to malaria control and elimination in Southeast Asia. Their work focuses on malaria in the border regions of Vietnam and on new human malaria, *Plasmodium knowlesi*. In 2009 this group established a mobile phone-based health information network system covering all 158 villages in Sepone. Land-cover studies and satellite image analysis (ALOS) were conducted in Lahanam and Sepone.

## Further goals of the group are to:

- 1) Strengthen the Sepone Health Information Network in



**Figure 2** Location of Lahanam and Sepone in Lao (GIS Base Map Data for Lao PDR, 1998-2003)

### Variables associated with reporting

Variables	N	Uni-variate		Multi-variate *	
		Odds	95%CIs	Odds	95%CIs
Distance (km)	<5	52	1.00	1.00	
	5-10	48	1.01	0.43-2.37	0.72 0.27-1.91
	>10	38	0.33	0.14-0.81	0.21 0.07-0.63
Education (yrs)	<3	48	1.00	1.00	
	3-5	69	2.45	1.09-5.49	2.89 1.12-7.48
	>5	21	3.30	1.12-9.69	3.23 0.90-11.61
Number of received training	<3	74	1.00	1.00	
	3-5	38	3.00	1.32-6.80	2.85 1.13-7.14
	>5	26	3.15	1.25-7.95	3.81 1.30-11.15

\*: adjusted by age, VHV experience years, possession of vehicle, and satisfaction on incentive

**Figure 3** Variables associated with reporting by village health volunteers to the health center in Sepone (Pongvonsa, Nonaka, Kobayashi et al., 2009)



**Photos 1 and 2** Flood-prone areas of Matlab, Bangladesh

- order to better monitor monthly incidence of malaria and other diseases;
- Analyze the relation of forest cover change, settlement, subsistence, mosquito population/ecology with malaria epidemiology/epidemiology;
  - Analyze the environmental and societal changes within the Banhiang River catchment area (a tributary of the Mekong River), including rainfall, flood, land- cover/ use, and water quantity and quality.

The Lao and Great Mekong Subregion (GMS) Study Group analyses the changes of environment, society, culture, subsistence, wellbeing and health of specific communities in the GMS, especially in Laos and Yunnan. It employs both intensive village study and extensive group interviews and ecohealth questionnaire. Its objectives are to:

- Conduct multivariate analysis of national level census data, including the Lao National Health Survey of 2000 and 2005, and National Census of 2005;
- Analyze current health and environmental education in Laos in order to design appropriate ecohealth campaigns;
- Study the history of health systems in the area since the colonial period;
- Make a Laos (or GMS) water map of minerals and stable isotopes.

The Bangladesh Study Group is primarily dedicated to improving the disease knowledge base on which sensible ecohealth campaigns—especially those related to flood and health—can be based. Its efforts include:

- Developing a database for meteorological, hydrological and health data in Bangladesh;
- Quantification of the relationship between climate and disease, including the long-term effects of flood on morbidity and mortality (in collaboration with the International Centre for Diarrhoeal Disease Research, Bangladesh), and the effect of the Indian Ocean Dipole on the incidence of cholera in Matlab and Dhaka;
- Conducting a pilot study in order to improve national statistics on neglected tropical diseases such as filaria, leishmaniasis, and rabies (also, in Sri Lanka, rota virus induced diarrhoea). Data on the effects of the 2004 flood were collected in Matlab.

The China Study Group investigates how social and environmental change affects vulnerability to HIV in the GMS. It conducts interviews among vulnerable populations, including male and female commercial sex workers, IV drug users, truck drivers and international migrants in Yunnan and Laos. It also:

- Conducts molecular biological analyses to understand HIV transmission routes and evolution of pathogens in relation to specific human behaviors;
- Considers relevant measures to improve ecohealth and community development (it is collaborating with the ecological anthropology group at Kunming Medical College/Yunnan Health and Development Research Association/Yunnan University);
- Constructs a historical database of malaria, schistosomiasis, liver fluke and other diseases in East and Southeast Asia.

# A Study of Human Subsistence Ecosystems in Arab Societies: To Combat Livelihood Degradation for the Post-oil Era

This project examines life support mechanisms and self-sufficient modes of production among Arab peoples who have survived in dryland environments for more than a millennium. Research results will be used to propose a scientific framework to strengthen subsistence productivity and combat livelihood degradation in local Arab communities as they face the post-oil era.



Project Leader

**NAWATA Hiroshi**  
RIHN

Hiroshi Nawata received his Ph.D. in Human and Environmental Studies (Cultural Anthropology) at Kyoto University (2003). He was assistant professor at Division of Comprehensive Measures to Combat Desertification, Arid Land Research Center, Tottori University (2004-2007). His major fields of interests are camel pastoral systems,

Muslim trading networks, and indigenous (traditional) knowledge for rural development in the Middle East and Africa.

Core Members

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**SUGIMOTO Yukihiko**  
**MIYAMOTO Chiharu**  
**SAKATA Takashi**  
**YOSHIKAWA Ken**  
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Research Institute for Islamic Archaeology and Culture  
Graduate School of Agricultural Science, Kobe University  
Action for Mangrove Reforestation  
Faculty of Science and Engineering, Ishinomaki Senshu University  
Graduate School of Environmental Science, Okayama University  
Faculty of Environment Systems, Rakuno Gakuen University  
Sudan University of Science and Technology  
Gezira University  
Traditional Knowledge World Bank  
Centure National de Développement des Ressources Biologiques, Algeria

## Background and objectives of the project

Japan and the oil-rich countries of the Middle East have put excessive pressures on the earth's energy, water, and food resources. In prioritizing their own economic prosperity, these countries have exploited irreplaceable resources, such as fossil fuel and fossil water. Schemes to plant alien species have also placed stress on local ecosystems. Such practices have increased social and economic differences between the peoples of the Middle East at a time when the region faces a turning point in modern oil-based industrialization. The current fossil fuel-based interdependencies must be transformed into new relations that can support viable future societies.

Our project focuses on human subsistence ecosystems, namely the life-support mechanisms and self-sufficient modes of production (such as hunting, gathering, fishing, herding, farming, and forestry) based on low energy resource consumption. We will also re-examine the potential of advanced technology, economic develop-

ment, and comprehensive measures to combat desertification. Based on our research results, we will propose a scientific framework for strengthening subsistence productivity and rehabilitating daily life in Arab societies in the post-oil era.

## Field survey of mangrove forest along the Egyptian Red Sea coast

We collaborated with the Nature Conservation Sector, Egyptian Environmental Affairs Agency, in order to conduct eco-physiological field research of mangrove forest dynamics, including stomatal conductance and transpiration rate, and to assess recent methods of mangrove afforestation. We also assessed the impact of human activity, including the influence of human livestock and managed fisheries, on mangrove ecosystems. Upon receiving permission to remove samples from the site, DNA analysis (using CTAB and RAPD techniques) was

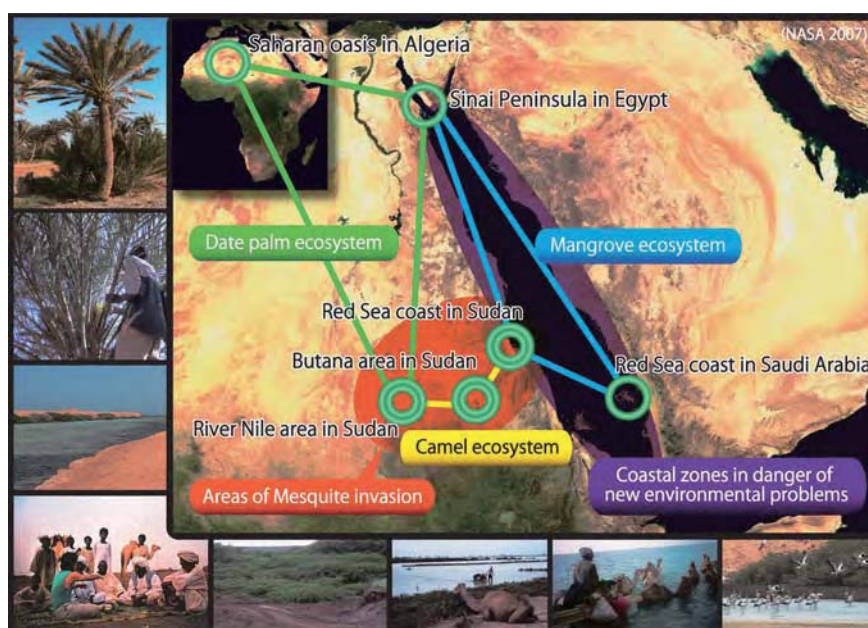


Figure 1 Area of field surveys



**Photo 1**  
RS/GIS research on the alien invasive species mesquite to make its distribution map in eastern Sudan.



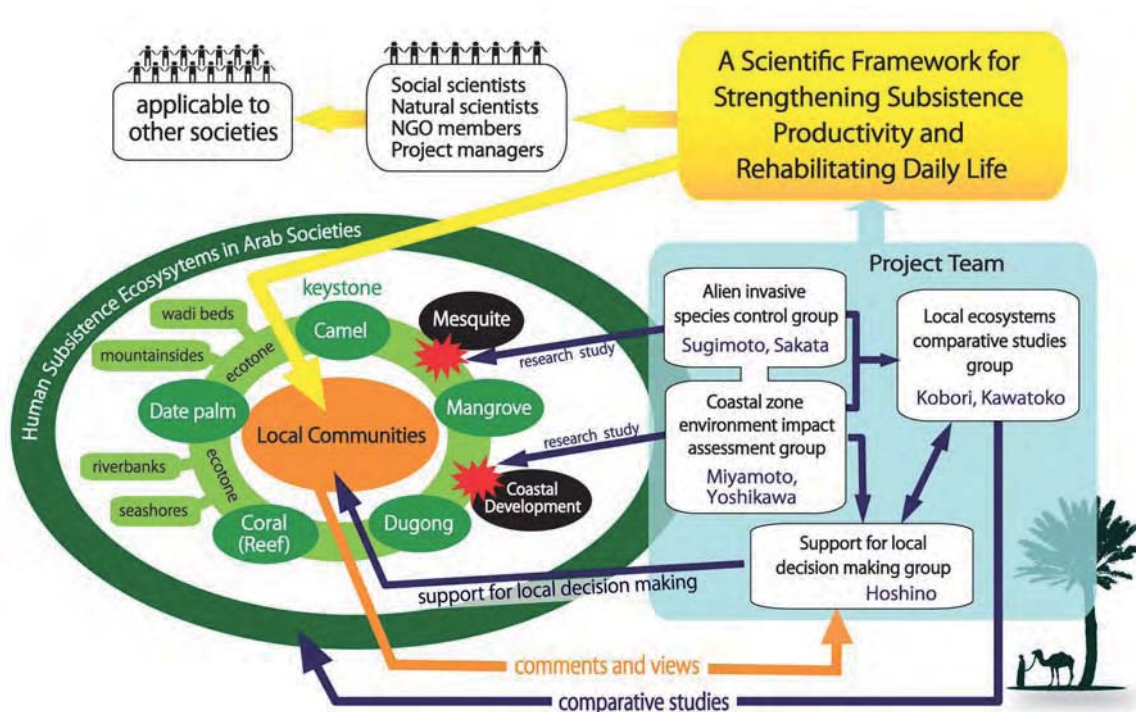
**Photo 2**  
Research on the architecture and restoration of coral buildings in the Sinai Peninsula, Egypt.



**Photo 3**  
Collecting leaf samples for eco-physiological study of mangroves in southern Red Sea, Egypt.



**Photo 4**  
Field survey of traditional water use and oasis agriculture in Algerian Saharan oases.



**Figure 2** Research methods, approaches, and organization

used to determine the genetic diversity and mass of *Avicennia marina* and to quantitatively analyze the relationship between geographical and genetic diversity.

### Conservation of traditional coral buildings in the Sinai peninsula, Egypt

At the request of the office of Islamic-Coptic Antiquities in the Supreme Council of Antiquities, Ministry of Culture, Egypt, we are now engaged in the conservation of traditional coral buildings in the Sinai Peninsula. Based on several archival sources of data concerning the architectural structure and foundation of the buildings and in collaboration with the Research Institute for Islamic Archaeology and Culture, we have drawn up a five year plan for the buildings' restoration and maintenance. This restoration project can serve as a future model of coral building cultural heritage conservation areas in the future.

### Preparation for field survey in Algeria

Project members from RIHN and the Centre National de Développement des Ressources Biologiques (CNDRB) in Algeria met on 15 December, 2009, and agreed to a Memorandum of Understanding. The main objective of this collaboration is to improve description of oasis date palm ecosystems in the Algerian Sahara.

### Further issues

We continue with full-scale field surveys in each research area. Further issues of our project in the second year (FR2) are described below.

In Sudan, according to an implementation agreement concluded with Sudan University of Science and Technology in 2008, we will initiate full-scale field survey on the alien invasive species mesquite (*Prosopis* spp.) especially on possible biological, chemical, manual and mechanical methods for its control. We will investigate how this species may impact pastoral ecologies and will monitor its root systems and water uptake, the nutritional status of ruminants and the metabolites of their gut bacteria, and how mesquite pods and leaves may be used as human food and supplemental livestock feed.

Along the Red Sea coast of Saudi Arabia and Egypt, we will start to integrate the eco-physiological study of mangroves, architectural study of coral buildings, and anthropological studies on camel herding, fishing, and hunting dugongs, in order to unveil the characteristic of human subsistence ecosystems in coastal zones of the arid tropics.

In the Saharan oases in Algeria, studies will be conducted on the human subsistence date palm ecosystems in the oasis, including their history and change, and related ecological footprints.



Zyndan Glacial lake outburst flood  
in the Tian Shan mountains, Kyrgyzstan  
Photo by NARAMA Chiyuki

Water for humans and animals, Mongolia  
Photo by MAEKAWA Ai (National Museum of Ethnology)

