Project Homepage ● http://www.chikyu.ac.jp/rihn/pro/2004_1-2.html & http://www.chikyu.ac.jp/yris/

Recent Rapid Change of Water Circulation in the Yellow River and Its Effects on Environment

The recent crisis that occurred in the Yellow River basin is complicated because factors like natural climate fluctuation, global warming and changes of land utilization may be affecting one another. We will evaluate how land use changes affect the water cycle throughout the Yellow River drainage basin and what kind of effect the decrease in groundwater storage downstream could have on marine conditions, through five years of research. This study may prove to be at the forefront of ecological studies of densely- populated coastal zones, and through studying the Bohai Sea and Yellow Sea we may also be able to evaluate the effects on marine products in the Sea of Japan through the Bohai Sea and Yellow Sea.

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Background and Objectives

Environmental problems related to the water resources and management have been occurring all over the world. Since 1990, the frequency with which river water in the Yellow River does not reach to the Bohai Sea has rapidly increased due to uptake of river water for irrigation in the upper- and midstream areas. In the lower reaches area of the Yellow River basin, people suffer water shortages for irrigation, industrial and drinking water. In addition to these, the shortage of river water induces a decrease of groundwater level and increase of water pollution. Due to the increase in population and food demand on the earth, such cases seem to be increasing and are likely to spread much further in the near future worldwide. How we can recognize and resolve this problem is one of the most important and urgent issues for humanity. The recent crisis that occurred in the Yellow River basin is complicated because natural climate fluctuation, global warming and change of land utilization may affect each another. This research will be made based on recently acquired knowledge of the effects of climate change and human impacts on the water cycle in the Yellow River Basin, and ancient Chinese ideas on water management.

Methods

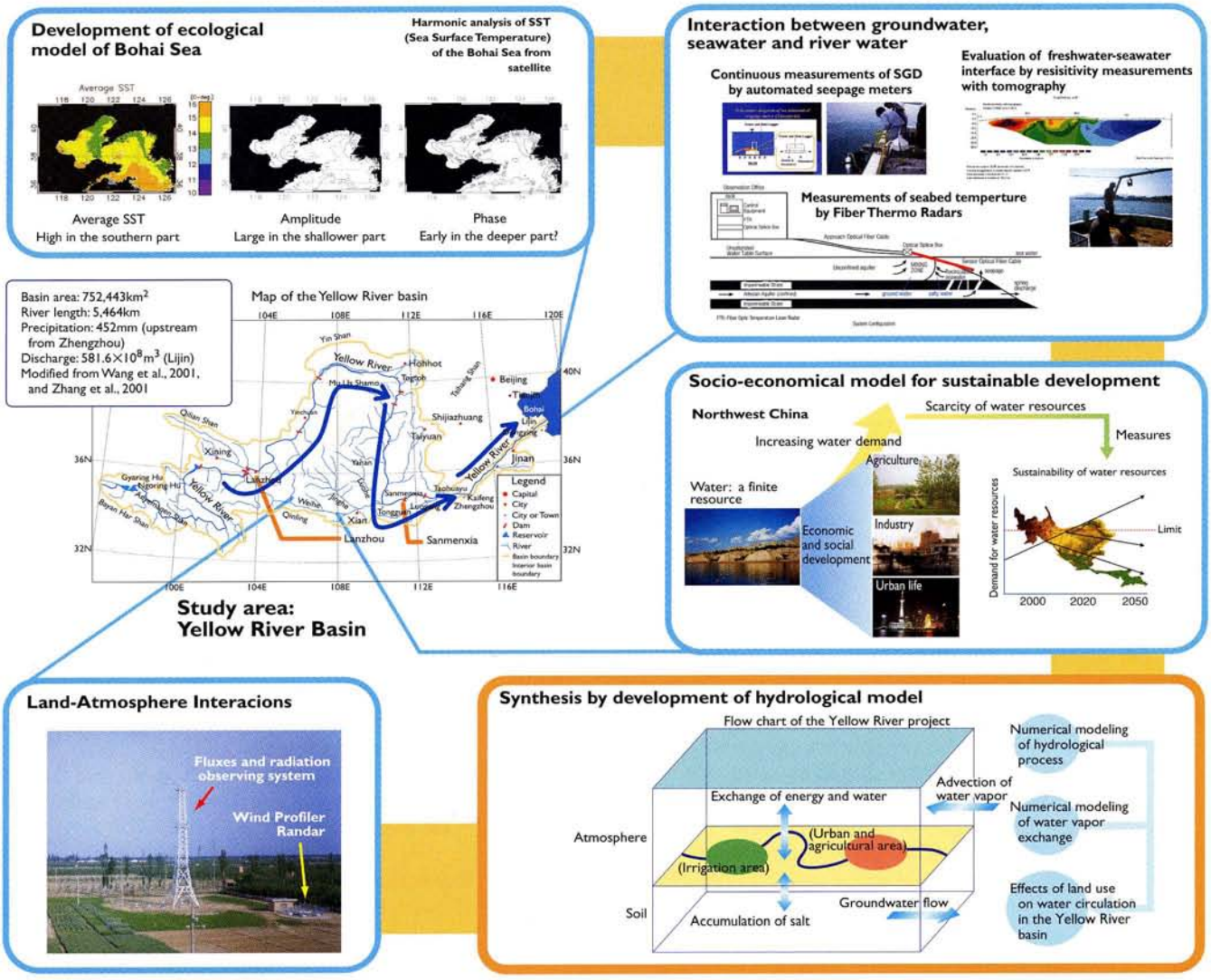
We plan to achieve this study through the following sub-studies;

(1) Field observations and analyses on land-atmosphere interactions in the Loess Plateau
(2) Field observations and analyses on interactions between river water, groundwater, and seawater in the Yellow River delta,
(3) Development of a socio-economical model for sustainable development,
(4) Development of an ecological model of the Bohai Sea,
(5) Development of an integrated model to evaluate the effects of land use change on the water circulation in the Yellow River basin, and
(6) Analyses of Chinese ideas and knowledge of water management.

Sub-study (6) has been started from 2005. And Sub-study (5) will integrate the results obtained by each sub-study team.

Expected Results

We aim to understand how land use changes affect the water cycle over the Yellow River drainage basin and what kind of effect relevant to the decrease of groundwater storage will have on the downstream to marine environment over the five year course of this research. This study may prove to be at the forefront of ecological studies in the coastal zones where many people live, and we may also be able to evaluate the effects on marine products in the Sea of Japan through studying the Bohai Sea and Yellow Sea. We will evaluate the problems under consideration, which if unchanged could cause worse environmental damage, by use of written documents more than 3000 years old and recent data from the Yellow River basin.



Attained Results

The dry-up of the Yellow River has mainly occurred during the 1990's due to over-use of river water from upstream to downstream for maintaining irrigated areas, coupled with a slight decrease of precipitation. Remarkable decreases of river discharge were not detected in the upstream area during the 40 years from 1960 to 2000. The reason why a severe dry-up occurred between 1970-1990, and particularly in 1997, was analyzed by the hydrological water budget method. With simulated discharge using land classifications from 2000, it became clear that almost 15 billion m^3 was lost between year of 1960 and 2000 in those 40 years in the midstream area, in spite of annual water budgets in the upstream area satisfying the observed discharge. It was an unexpected result, in the beginning. But, we became aware that previously the Loess Plateau might have been deforested. We experienced increased annual river discharge from deforested mountains in Japan, and the magazine "People's China" published on June 1973 described deforested slopes and reforestation work done on the Loess Plateau. If these considerations are true, high discharge in 1960-1980 and low discharge in 1980-2000 can be easily understood. Finally, it was conclusive against the dry-up of the Yellow River that low amount of precipitation has continued during 1990s.

Thanks to a new Water Law promulgated in 2002, dry-ups no longer occurr in the downstream region of the Yellow River. It is because the Yellow River Commission (YRC) became able to completely control water use from provincial matter. The YRC has asked each province to save water and has arranged intake periods in order to avoid drying up of the river. However, total water diversion from the Yellow River still seems not to have changed. Furthermore, sediment transportation energy seems to decrease as flood discharge is controlled in reservoirs. Therefore, the riverbed in the downstream region continues to rise up. It will increase the danger of disastrous floods downstream.

Meanwhile, recent satellite data and numerical simulation models show the decrease of water exchange between the Bohai Sea and the Yellow Sea. We will evaluate the relationship between the decrease of Yellow river discharge and the decrease of water exchange between the Bohai Sea and the Yellow Sea. The observed results of interaction between the land surface and atmosphere at the Loess Plateau show a drastic vertical exchange of air between the land surface and atmosphere. We will develop a model to explain this unexpected new phenomenon.

Project Homepage ● http://www.chikyu.ac.jp/ichikawa-pro/top/top.html

Sustainability and Biodiversity Assessment on Forest Utilization Options

Terrestrial biodiversity has decreased mainly because of the loss and/or deterioration of forest ecosystems. A system to utilize forest resources while conserving biodiversity should be developed. This project aims to elucidate the socio-economic background causing forest decrease, its effects on biodiversity, and ecological services that might be lost as a consequence of biodiversity loss. We also evaluate the forest-use options both from ecological and socio-economical aspects to develop a sustainable utilization system.

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Background

Decrease and deterioration of forest ecosystems is the major reason for drastic loss in terrestrial biodiversity.

A sustainable management system to conserve biodiversity should be developed.

Purposes of the Project

(i) To clarify historical change in forest utilization and its social- and economic backgrounds.
(ii) To assess impacts of forest utilization on biodiversity.
(iii) To evaluate function and ecosystem service provided by forest biodiversity.
(iv) To develop integrated evaluation systems for sustainable forest utilization.

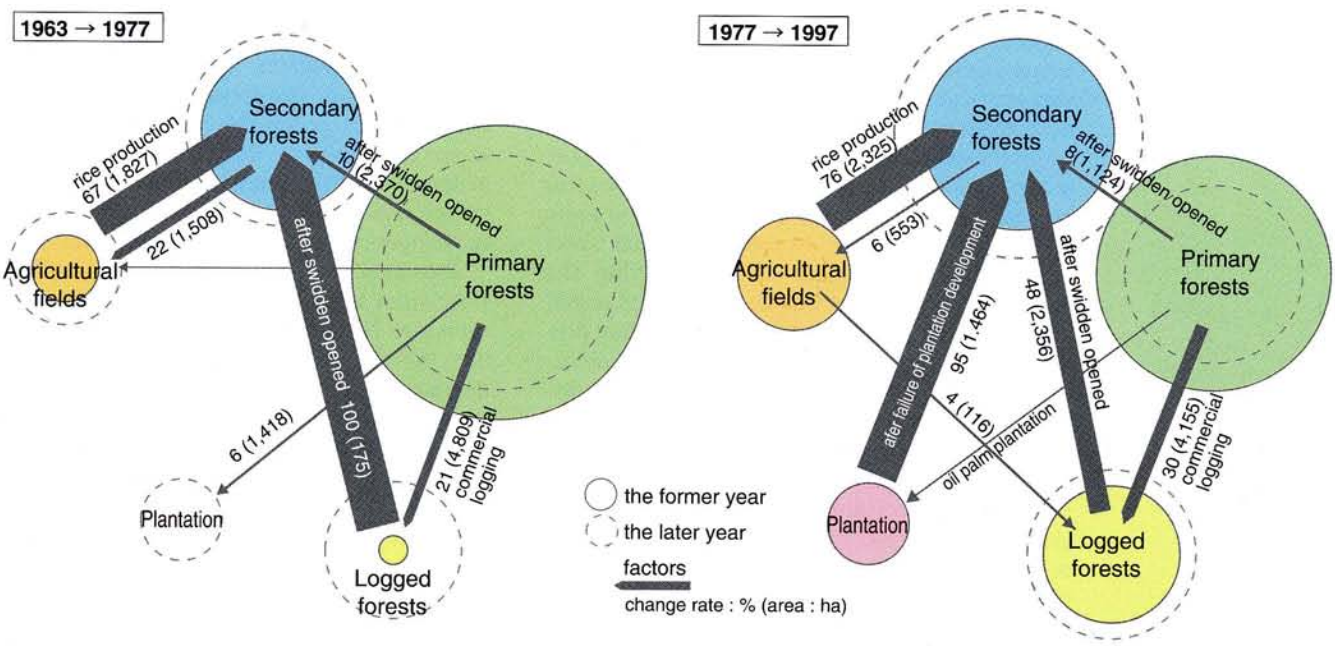
Research Sites

1) Lambir National Park, Malaysia (Tropical rain forest area)
2) Kinabalu National Park, Malaysia (Tropical montane forest area)
3) Yaku Island (Temperate evergreen forest area)
4) Abukuma Mountains (Temperate deciduous forest area)

Expected Results

1) Basic information applicable for criteria and indices of sustainable forest management.
2) Evaluation methodology for ecological services that will be lost by biodivesity decrease.
3) Elucidation of socio-economic causes that brought forest deterioration and their global comparison.

Figure 1 Factors of Changes in Land Use in Lambir



4) Models to predict the change in forest-use and biodiversity in the future and criteria to design spatial arrangement of forest-use.
5) A power-point slide set (11 volume, in Japanese) as education material for under graduate students will be developed (Fig. 3)

Outcome up to the present

1) The change in forest utilization and its driving factors have been analyzed for the past 40-100 years (Fig. 1).
2) Biodiversity assessment was conducted for various types of forest use, and tools for future projection of the biodiversity are being developed (Fig. 2).
3) Ecological services that are in crisis due to losses of biodiversity have been analyzed.
4) Biodiversity resource utilizations by local people have been elucidated in terms of forest use .
5) Models of relationship between sustainable land use and social-economic conditions were developed.

Figure 2 Spatial Assessment of Biodiversity Changes

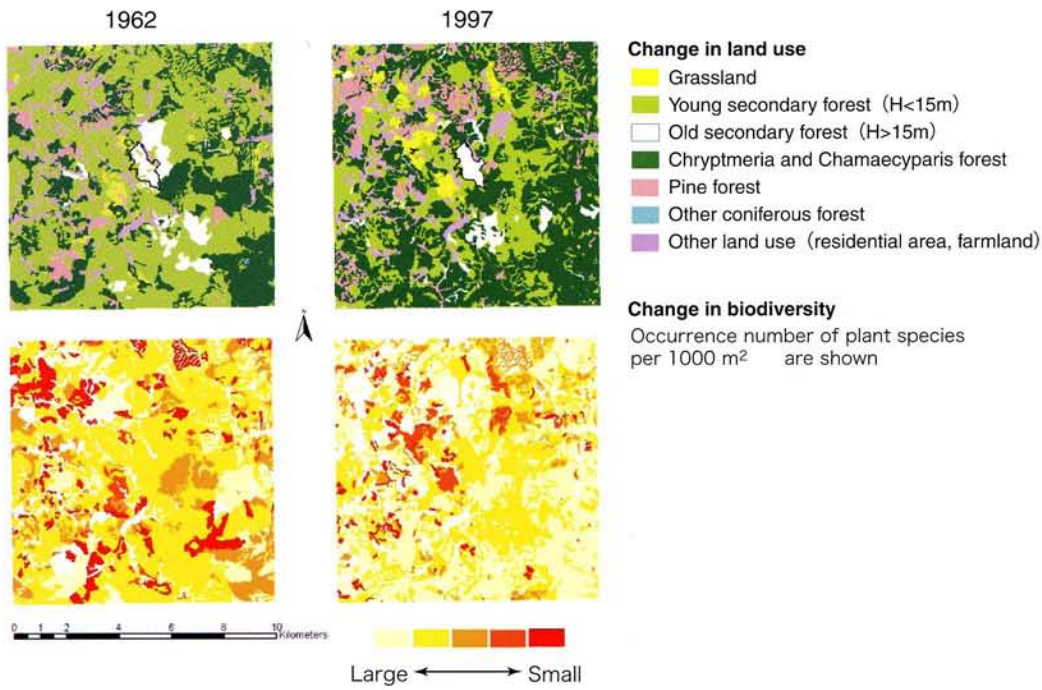
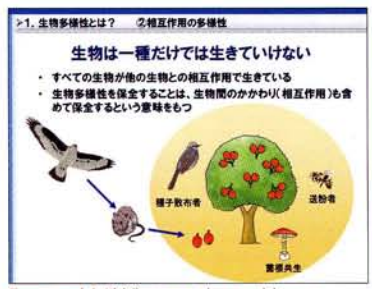
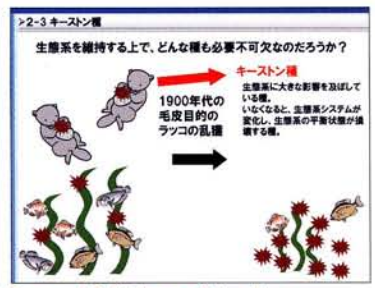


Figure 3 Some Slide Examples of the Slide Set as Teaching Material (11 volumes)

From vol.5

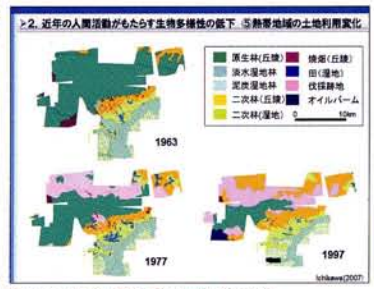


From vol.1 "What are the problems for biodiversity?"



From vol.2 "Why are living things so diverse?"

From vol.3 "Do human beings reduce biodiversity?"



From vol.4 "Biodiversity loss in forests"

From vol.6 "How do human beings use biodiversity?"

Project Homepage ● http://www.chikyu.ac.jp/ecohistory/top_jp.htm

A Trans-Disciplinary Study on the Regional Eco-History in Tropical Monsoon Asia: 1945-2005

This research project aims to study interactions between people who inhabit the tropical monsoon Asia region and their surrounding environments during the past several decades since WW II. The reforms in political regimes, devastating wars, infiltration of modernization, economic globalization, and population growth that swept this region, have had serious impacts upon both local environments and human populations. In this project, we examine how people have coped with these external impacts, how they have survived during these upheavals, and the eco-historical consequences.

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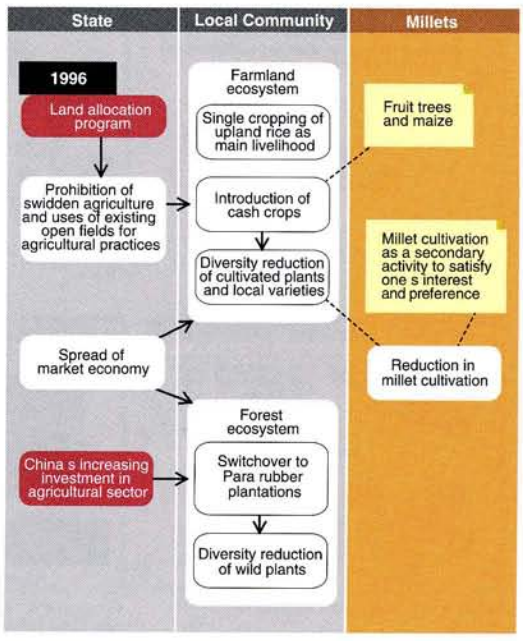
Aim of the Research Project

This project aims to study interactions between local populations and their surrounding environments, in the region of Yunnan of southwestern China, northern Thailand and Laos, focusing on the post-war period up until the present to form a regional eco-history. In this region, a large number of ethnic groups live in diverse ecological habitats such as wetlands, plains, valleys, and mountain slopes. Major historical events that have been witnessed there during the past 50-60 years, such as revolutions and reform in political regimes, the second Indo-China War, and the infiltration of the global market economy, have caused great upheaval in the region as a whole. Indeed, these external influences have overwhelmed not only people's health, subsistence, and social life, but also the surrounding environment. Our research focuses on how people have continuously struggled, coped with, and adapted to the changing environmental, economic, and socio-political conditions.

Figure 1 An Eco-history of Millet Cultivation in Northern Laos [Ochiai 2007]*



Methodology and Study Areas

In this project, we address three eco-sensitive domains: subsistence complex, nutrition and health, and resource management. To date, in order to demonstrate interactive consequences between the three analytical domains, we have conducted intensive fieldwork with collaboration between six project research groups. The study groups and their study areas are (1) Agro-Forestry Group (Northern Laos), (2) Plains Ecology Group (Central Laos), (3) Human Ecology Group (Central-South Laos), (4) Northern Thailand Group (North Thailand), (5) China Group (Yunnan Province, Southwestern China), (6) Material Culture and Information Retrieval Group. The China Group is further divided into three; (5-1) History Group, (5-2) Forestry Group, and (5-3) Eco-History Group, the last being lead by Chinese scholars at Yunnan University.

Present Status, Results and Future Prospects

We have already presented some of our research results as publications. First, *An Illustrated Eco-History in the Mekong Basin* (in Japanese) describes the particular eco-historical consequences regarding some sixty items that represent natural resources, subsistence complex, food, health, and resource management in tropical monsoon Asia.

For instance, in terms of cultivation of millet in Laos, the introduction of a land reform act in 1996 has induced a decline of shifting cultivation. The cropping pattern has also changed from a multi-species cultivation type to monocultures of upland rice, or cash crops. This change has lead to a loss of bio-diversity in local varieties of millet. Since around the 2000s, an economic boom in northern Laos, triggered by Chinese investors has drastical-

Figure 2 Rubber and Water Buffalo in a Tai Lue Village, Northern Laos [Theapkaysone 2007]*

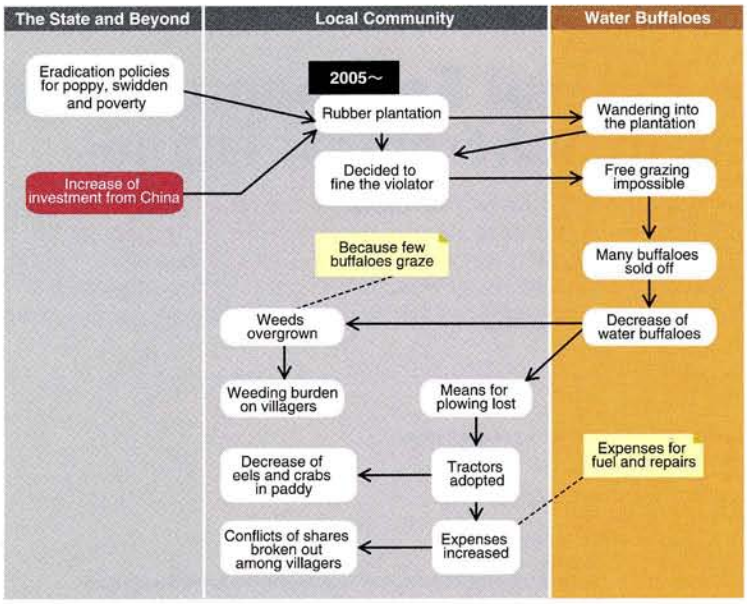
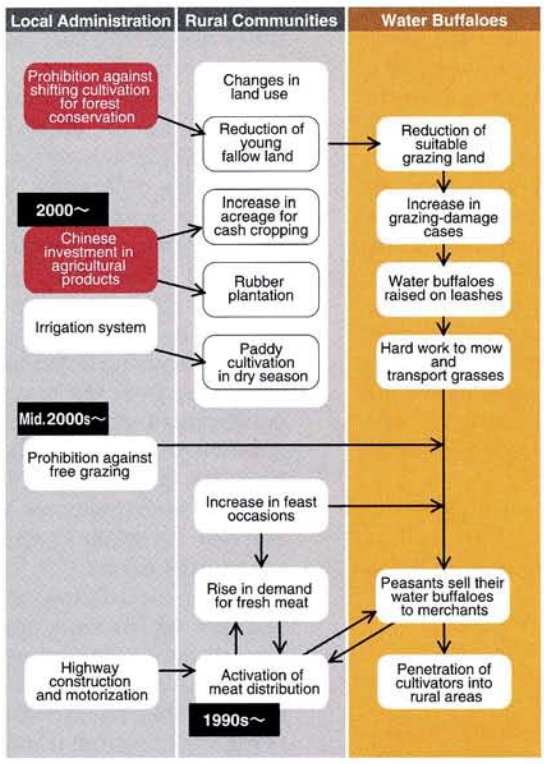
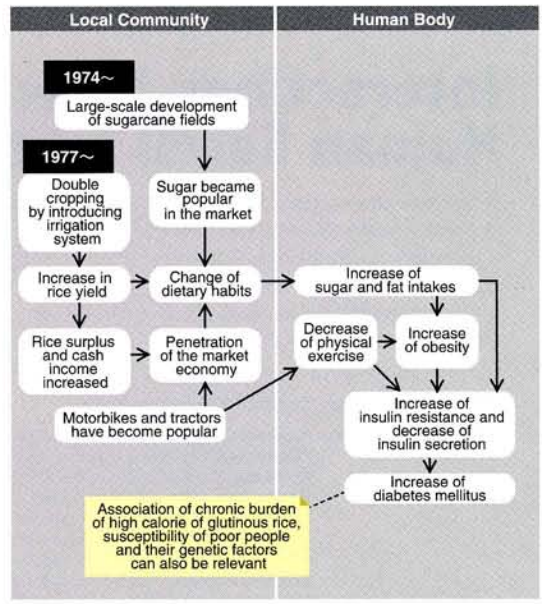


Figure 3 Water buffalo and People in Northern Laos [Takai 2007]*



ly changed the local landscape of monsoon forests into rubber plantations (Fig. 1). Introduction of rubber plantations has also brought about conflicts between Chinese investors and local farmers who raise water buffaloes as these animals often intrude into rubber gardens to feed on young rubber plants (Fig. 2). Since the introduction of farm tractors, the water buffalo has lost its role in local subsistence. Water buffalo have come to be butchered for meat consumption (Fig. 3). Agricultural reforms such as

Figure 4 Eco-history of Diabetes in Songkong, Central Laos [Okumiya 2007]*



* See T. Akimichi ed. 2007 *An Illustrated Eco-History in the Mekong Basin*, Kobundou.

the introduction of high yield rice, mechanization, and irrigation systems, have produced surplus rice stock, and subsequently altered labor patterns and eating habits. The change has critically been detected as a significant increase of diabetes even among local populations (Fig. 4).

By linking each set of flow charts together, showing the particular historical processes of millet, water buffalo, rubber, and diabetes, it is expected to obtain an overview of certain aspects of the eco-historical consequences in the region. The challenge is to combine various sets of flow charts and draw more extensive and detailed figures of the eco-historical consequences. An English version of this book will be published this year by the White Lotus publishing company in Thailand.

Other than this, *A Study of Eco-History in Anthropology* (in Chinese), consisting of eighteen articles submitted by Chinese co-researchers; *Lao Food Book for Dietary Assessment*, a field guide for nutritional and dietary analysts; and *The biodiversity of vegetables in Vientiane*, a booklet for the area around Vientiane, have been published. This year, we plan to publish a book of three volumes on *The Eco-history in the Asian Monsoon Region*, "Inscribed Eco-History", and "Vientiane Plains Eco-History". A special exhibition on life in the Lower Mekong Basin is planned in autumn at Oyasato Museum of Tenri University.

In September, we will have an international workshop in Vientiane on the future of health in Southeast Asia, and in November a workshop in Luang Nam Tha on the sustainable agriculture on the hillsides in Laos. In October, we will also participate in the 2nd International symposium on "the Asian Green Belt" organized by the RIHN. These efforts are expected to give a comprehensive aspect to the research project goal.

Project Homepage ● http://iriomote.chikyu.ac.jp

Interactions between Natural Environment and Human Social Systems in Subtropical Islands

A variety of environmental problems have arisen on islands around the world, leading to the deterioration of precious natural environments and the disappearance of local cultures. In order to resolve environmental issues on islands, it is necessary to thoroughly understand the interaction between natural environments unique to islands and the human social systems that are found on islands. Using Iriomote Island in Okinawa Prefecture as a model, we hope to find information that will help resolve these issues. We aim to provide guidelines for building island human social systems that are sustainable in the future.

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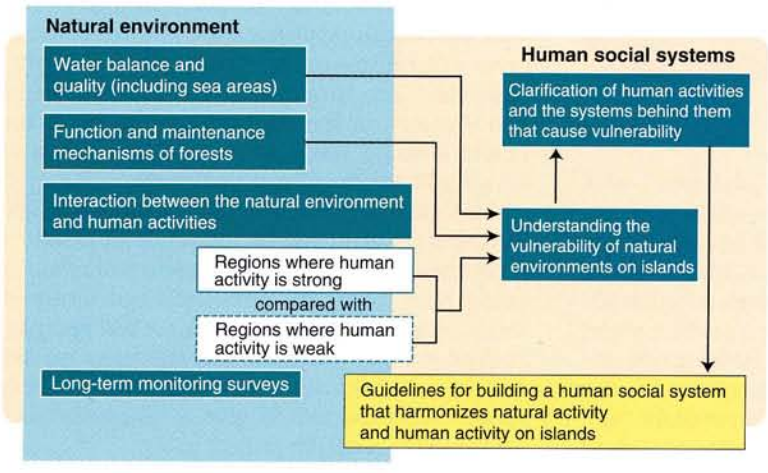
The Purpose of the Project

Islands throughout the world are faced with ongoing deterioration of their precious natural environments due to water shortages, industrial development and other factors. Along with this, local cultures are at risk of disappearing. To solve these problems, it is important to fully understand interaction between natural environments and human social systems on islands. As islands are geographically limited areas, their natural environments and human social systems tend to be different from others and vulnerable as well. The main subjects of project are the environmental issues related to the unique features of islands. Iriomote Island, a typical subtropical island located in Okinawa Prefecture, is an ideal model for studying island environments, as it is rich in natural resources such as water and virgin forests, as well as traditional art and culture.

Research Methods

1) We will build a water balance model of Iriomote Island based on the estimated amount of precipitation, river flow, and evapotranspiration. The model will be used as a standard for future water usage. We will also assess the human impact on rivers.
2) We will clarify functions and maintenance mechanisms of evergreen and mangrove forests, while studying biodiversity and interaction among organisms. We will take a closer look at the dynamism of forests and assess the human impact on forests. As for the research materials gathered, we will use them as references for global warming issues.
3) We will look into the background of human activities causing deterioration of natural environments, from the perspectives of industrial development, demographic structure and government policies. In particular, we will explore how the main industry of the island has changed from traditional agriculture to tourism and how the social system has changed during the transfer period.
4) Regarding the decision-making process in communities, we will study how local people should understand the impact of human activities on the natural environment and how local common rules should be modified according to changes in the use of natural resources.

Figure 1 Overview of the Project



Progress Status, Achievements, and Future Challenges

1) To clarify the water balance on Iriomote Island, we have installed a monitoring device on the island. A database is being built up to help us make more accurate predictions about the quantity and quality of water that will be available in the future. Our observations have indicated that rain on the island is acidic throughout the year. We will identify the origins of the substances that cause the acid rain, estimate the total amount of such substances falling on the

Iriomote Island, located in the southwest of the Ryukyu Islands, is a perfect place to study natural environments. It is typical of subtropical islands that have precious natural environments. The islanders have developed an original lifestyle, even though the island itself has been under the influence of neighboring districts.

Photo 1 Schichi Festival (Hoshidate Area)

Photo: Fumio Sakuma, Nature Image Inc.

Photo 2 Water Balance on Iriomote Island

Photo: Watanabe Suimon Kikaku

Photo 3 Industries as Bases of Life for the Islanders

Photo: Fumio Sakuma, Nature Image Inc.

island, and monitor the impact. We will also identify substances that are carried down rivers into the sea, especially to coral reef areas along coasts, and assess the impact.

2) Our studies have shown that typhoons affect turnover in broadleaved evergreen forests. In forests including those of mangroves, we have been keeping track of production/circulation of substances, while monitoring the impact of human activities. We will provide information on effective maintenance and management of forests in the near future.

3) We have gathered a variety of reference materials including demographic statistics, administration policies and information on local industries, and categorized them for further analysis. We will use these materials to develop measures to promote networking of small-scale industries from the viewpoint of island economics. In this process, we will focus on tourism, agriculture, health and education.

4) We have been in close contact with the islanders by participating in various local events and educational programs designed for schools and communities. As a result, we learned that community centers on the island play a large role in the communities' decision-making processes.

To solve environmental problems on Iriomote Island, local people need a solid economic infrastructure to build self-esteem and become independent. To achieve this, it is important to share useful information with the islanders. We will proceed with this project so that the findings can contribute to promoting local industries and growing new ones. We will take part in education at schools and in communities from the planning stage, and would like to help locals promote the island's traditional culture and smooth handover of its performing arts to younger generations.

※ http://www1.gifu-u.ac.jp/~kawakubo//iriomote/index01.html

Photo 4 Function and Maintenance Mechanism of Forests

Photo: Fumio Sakuma, Nature Image Inc.

Interaction between Environmental Quality of the Watershed and Environmental Consciousness:

With Reference to Environmental Changes Caused by the Use of Land and Water Resource

People's value judgment system on the environment, or the environmental consciousness, is explored through theoretical analyses and empirical surveys in order to identify the environmental elements and the human-sociological factors that are affecting the formation of this consciousness. Environmental changes caused by a virtual impact on a watershed environment are predicted and proposed to people. People's judgments on such environmental changes are analyzed to elucidate the relationship between people's environmental consciousness and the environmental quality. We will develop response-prediction models for a watershed environment and a methodology to clarify the changes in the people's value judgment on the environment.

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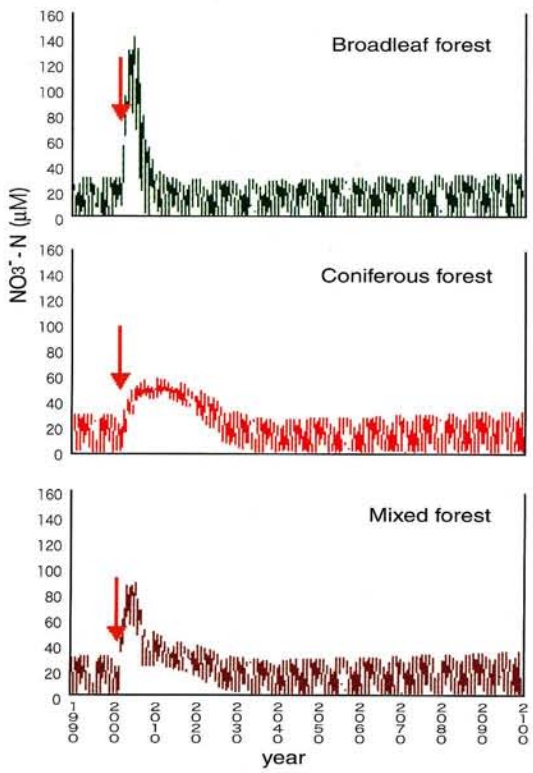
Purpose of the Project

How do we perceive the environment? People's attitudes toward the environment are based on their various value judgments on it. We define this value judgment system as "environmental consciousness." What kinds of changes in environmental qualities affect the formation of people's environmental consciousness? We need quantitative evaluation of the changes in the environment to understand its present status and to predict its future. On the other hand, clarifying the relationships between the environmental quality and the environmental consciousness is important for wiser use and conservation of the natural environment. In this project, we will develop a set of response-prediction models to simulate environmental changes as well as a methodology to analyze people's value judgments when they are presented with the predicted environmental changes. Although the project is conducted mainly in the Lake Shumarinai watershed, Hokkaido, Japan, the methodology will be developed to be applicable to other environments.

Figure 1 Calculation Results of Stream NO_3^--N Concentration after Forest Logging

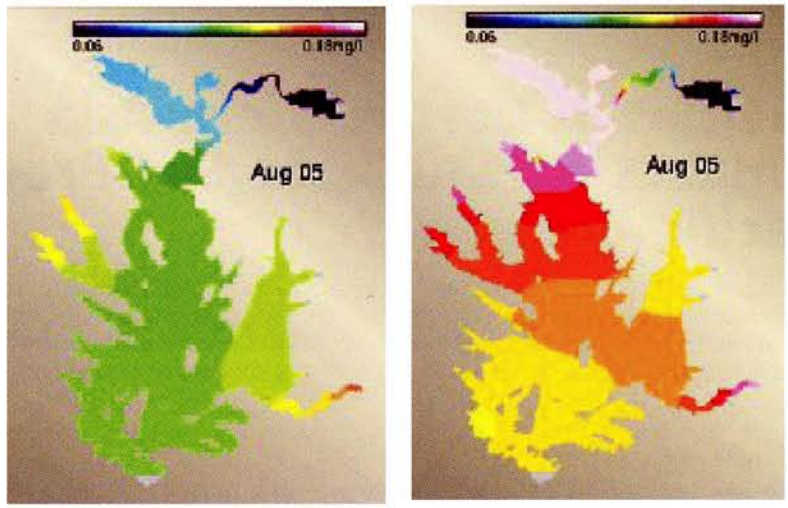


In calculation experiments, the year of forest logging is 2001 (red arrows). The stream NO_3^--N concentration remarkably increases 5 years after logging of broadleaf forest, then rapidly decreases to the original level (top panel). In the case of the logging in coniferous forest, though the peak concentration is low in comparison with the broadleaf forest, the effect of logging continues for about 30 years (middle panel). Mixed forest logging causes mixed effects (bottom panel). Oscillation indicates the seasonal variation in NO_3^--N concentration.

Methods and Research Area

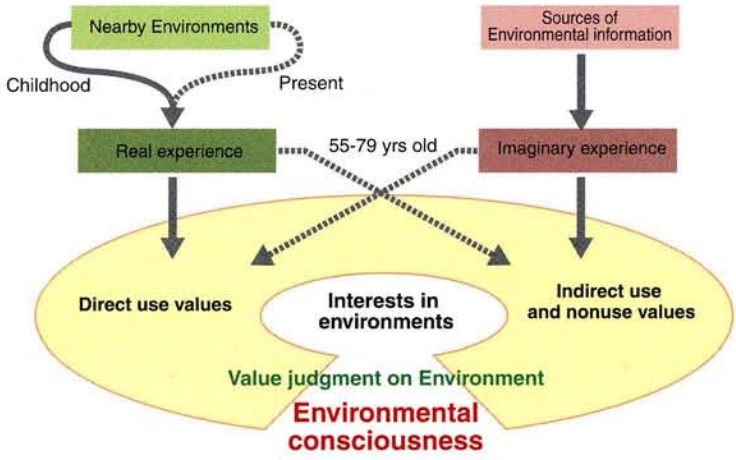
In this project, several virtual scenarios of environmental changes are assumed. People's value judgments on those changes will be elucidated. The method developed in this project requires three functions: (1) quantitative prediction of

Figure 2 Calculation Results of the Distribution of NO_3^--N Concentration at the Lake Surface



The left panel is the calculation result for the present state, the right panel is that for 5 years after logging in the watershed. Forest logging causes an increase in NO_3^--N concentration in the lake. Both panels show the distribution on August 5. The program can display the temporal changes as an animation.

Figure 3 Relationship between Individual Experience and Interest in Environment



changes in environmental elements caused by virtual environmental modifications, such as logging and dairy farming, (2) comprehensively informing people of the environmental changes and (3) analysis of the relationship between changes in the people's value judgments and in the environmental elements. The method is composed of a response-prediction model for the environment and tools to develop and analyze the attitude surveys. The main research area is the Lake Shumarinai watershed in northern Hokkaido, Japan. However, we are developing the method to be applicable not only to this particular watershed environment, but also to other environments. Attitude surveys are conducted through interest questionnaires and scenario questionnaires.

Progress to Date

The response-prediction model includes several sub-models that simulate the biogeochemical material cyclings in forest, river and lake environments, respectively. Reviews of those sub-models have been published in the Japanese Journal of Limnology (Vol. 67, 2006) and as a project report No.1 (ISBN-4-902325-07-1). The forest model can simulate effects of forest logging on stream hydrochemistry (**Fig. 1**). There are some difficulties when connecting these sub-models due to the differences in the scales of time and space that each of them assumes. These problems were solved by calculating the water input from the rivers to the lake using a forest hydrologic model. A detailed lake mesh model that simulates lake water movement, biogeochemical material (such as carbon and nitrogen) cycles, and plankton population dynamics was developed (**Fig. 2**). Since the execution of this detailed model takes a large amount of time, a simpler box model assuming 8 boxes in the lake has also been developed.

We conducted a survey to study people's interests in the watershed environment (**Fig. 3**). It indicates that those people who lived near forests in their childhood, show high interest in direct use values of the forest (forestry production), and those who collect information about the environment from a wide range of sources such as newspapers, TV, or the Internet, show high interest in indirect use values and nonuse values, such as places for recreations and CO_2 sinks. These findings suggest that real experience from the nearby environment and virtual experience from the information media may relate to people's interest in the environment. In the case of people who are more than 55 years old, both relationships - relationship between real experience and indirect use and nonuse values, and that between imaginary experience and direct use values - have been elucidated.

Plan Hereafter

A nation-wide questionnaire survey on forest management for the next generation was conducted in February 2007. People's preferences on the methods of forest logging were surveyed in this questionnaire. Analyses of differences among the respondents' preferences are currently in progress. We will use the people's interests elucidated from the results of this survey to select the type of virtual impacts to apply to the watershed environment. Scenario questionnaires will be conducted using environmental changes simulated by the response-prediction model, in order to estimate environmental qualities that affect people's value judgments on the environment.

Project Homepage ● http://www.chikyu.ac.jp/AMORE/

Human Activities in Northeastern Asia and Their Impact on the Biological Productivity in North Pacific Ocean

Recently, we have recognized a possible function of continental forests breeding fish in oceans. In this study, we will investigate how the Amur River transports dissolved iron from forests to the Sea of Okhotsk and the Oyashio area and supports primary production. We will also clarify to what extent the human activities on the Amur basin may disturb this material linkage, in order to create an ideal relationship between land and ocean ecosystems including humankind.

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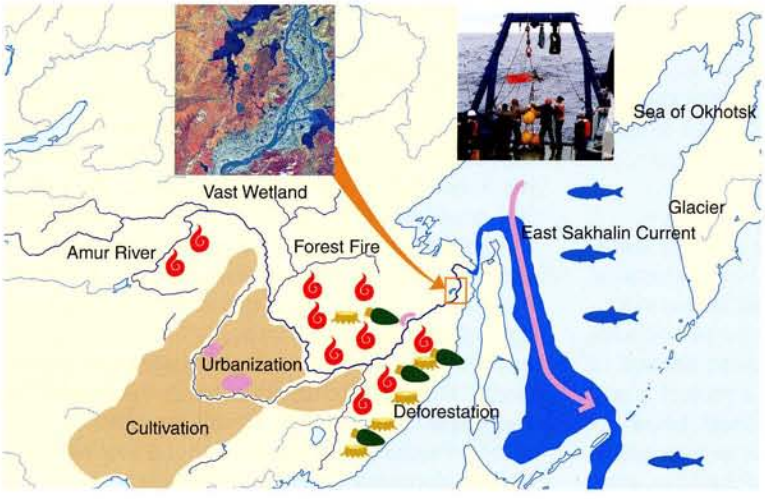
Background and Objectives

Recent oceanological studies have revealed that biomass productivity was limited by iron availability in the northern North Pacific. Because iron can hardly dissolve in water, phytoplankton largely relies on the iron supply from land via the atmosphere and/or rivers. In contrast to the central region of the northern North Pacific, the phytoplankton productivity is very high in the Sea of Okhotsk and the Oyashio area, probably due to the sufficient supply of iron from the Amur River. Riverine iron cannot remain dissolved in the seawater without forming a complex with humic substances created in forest and wetland. Therefore, changes in land uses on the Amur River basin such as deforestation, forest fires, cultivation, urbanization and/or reduction of wetland may reduce the primary productivity in the Sea of Okhotsk and the Oyashio area.

In this study, we try to answer the following four questions; 1) How large is the discharged flux of materials such as iron from the Amur River, how far the iron is transported offshore and to what extent the iron is contributing to the primary production in the Sea of Okhotsk and the Oyashio area; 2) What are the factors controlling the release of materials such as iron from the land to the Amur River in the natural and/or artificially altered land surface conditions in the Amur basin; 3) To what extent the economic and social systems around Northeast China and Far Eastern Russia change the land uses in the Amur basin in the past, present and future; 4) How can we conserve the system? The system is now named "Kyodai Uotsukirin (Giant Fish-Breeding Forest)" which includes both physical and human processes. We will try to establish this concept and find ways for the conservation of the system.

Figure 1 Study Area. Human Activities in the Amur River Basin and the Transport of Dissolved Iron to the Sea of Okhotsk and the Oyashio Area



Progress and Tasks

We succeeded in conducting a Russian-Japanese joint research cruise in the Sea of Okhotsk in the summer of 2006. The cruise clarified distribution of iron concentrations from the mouth of the Amur river to the Kuril islands. It was found that the dissolved iron from the Amur river was deposited in the estuary area and then transported offshore by thermohaline circulation and tidal movement. The iron was then transported in the intermediate layer to the south by the East Sakhalin current and mixed vertically at the straits of the Kuril islands becoming available at the surface of the ocean. Our hypothesis is thus more or

Figure 2 Oceanological Observation by R/V Khromov in the Sea of Okhotsk

Figure 3 Ice Core Drilling on the Summit of Mount Ichinsky, Kamchatka, Russia

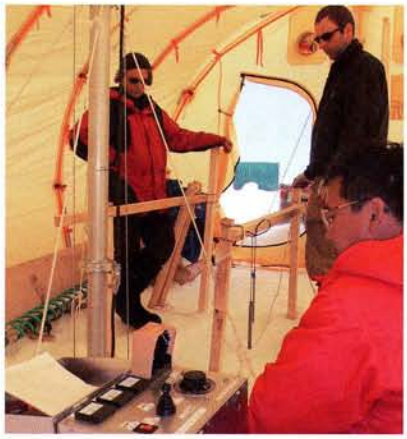


Figure 4 Sampling of Interstitial Soil Water at Sanjiang Plain, China

Figure 5 Seasonal Changes in Dissolved Iron Concentration for Different Land-use Types at Sanjiang Plain, China

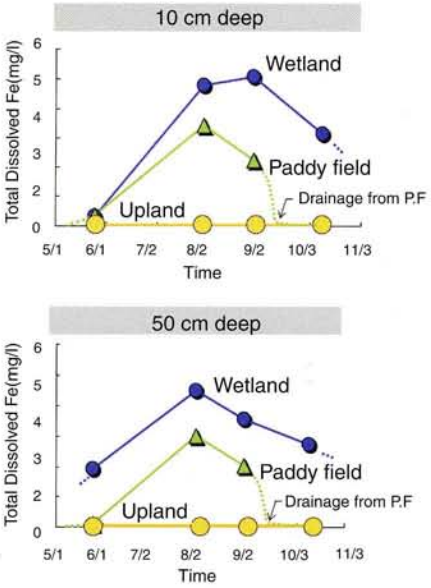
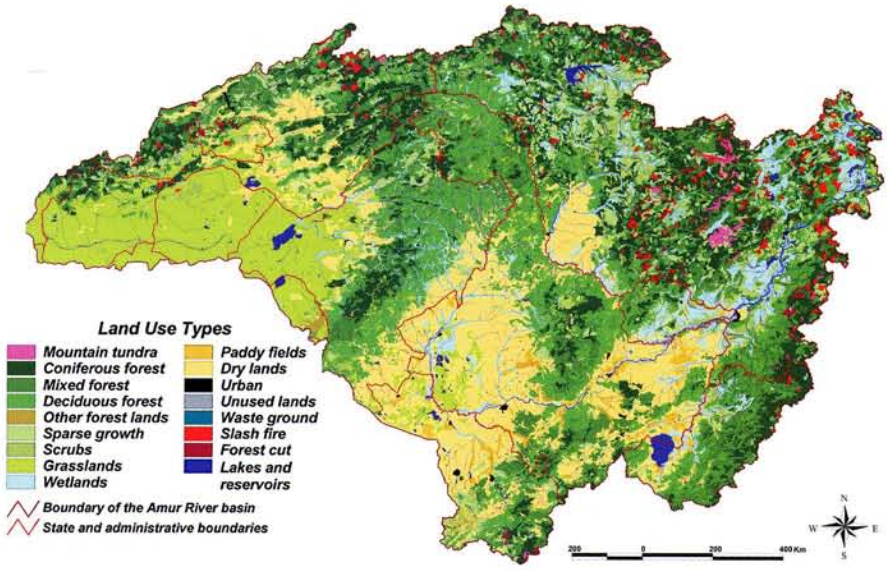


Figure 6 Present-day Land-uses in the Whole Amur River Basin



less validated by the cruise.

Atmospheric transport of the iron was monitored by an automatic high-volume aerosol sampler installed at Oktyabrisky, Kamchatka Peninsula. Reconstruction of the time-series of iron deposition was also attempted by drilling ice cores in a summit glacier of Mount Ichinsky, Kamchatka. The samples are currently being analyzed in various laboratories and atmospheric contribution to the primary production of the study area will be clarified in the near future.

Do human activities in the Amur river basin really affect the iron flux to the Sea of Okhotsk? We have not obtained any definite answer yet. Our 2006 field investigation in the Sanjiang plain revealed, however, that the concentration of dissolved iron in the soil pore water was the highest in natural wetlands, depleted in paddy fields and almost negligible in upland areas. This indicates that land-use changes will surely affect the concentration of iron in the Amur river basin. Our GIS data indicates that 7% of the Amur river basin is currently occupied by natural wetland and that portion has been reduced by farming in the later half of the 20th century. We will quantify the impact of land use changes on the flux of iron by numerical model in the latter half of this project.

The Giant Fish-Breeding Forest system is much larger than what we call the "Uotsukirin (Fish-Breeding Forest)". The proposed system spans international boundaries such as Russia, China, Mongolia and Japan. People living in and depending on the system have different perspectives on their natural environment. It is an asymmetrical system having two independent stakeholders: farmers and foresters in the upstream and fishermen in the downstream. There seems to be no direct connection between the stakeholders. Our project will seek a way in which we can conserve this vast linkage by studying the various flows in the system, which include economic exports and imports, cultural interactions, information, and governmental regulations.