

Environmental Changes and Infectious Diseases in Tropical Asia

This project is to clarify the relationship between various environmental changes and the rise and fall of infectious diseases in tropical Asia. The project studies the effects of human societal and natural environmental changes on the ecology, epidemiology, and endemiology of infectious diseases such as malaria, dengue fever, opisthorchiasis (liver fluke infection), and water-borne diseases. Population increase, urbanization, deforestation, spread of wet rice cultivation, economic development, changes in lifestyle or so-called modernization, and population migration are the factors changing the ecological relationships among human beings, pathogens, and vectors. The project also investigates the relationship between climate changes and some infectious diseases.

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Background and Objectives

The study aims at offering new disease-ecological insights for evaluating the relation of infectious diseases with local and global environmental changes. Unlike conventional medical control programs/projects, which usually aim at short-term problem-solving approaches towards infectious diseases, this project tries to understand the fundamental relationships between human life and the ecology of pathogens and vectors, through a trans-disciplinary and integrated approach (Figure 1).

Methods

The project will clarify the impacts of changes in societies and the environment on infectious diseases, through the following five approaches (Figure 2):

- 1) Collecting and analyzing existing regional information on changes in climate, environment and infectious diseases (in selected countries in tropical Asia)
- 2) Field studies and observation in Laos, Vietnam, and Bangladesh
- 3) Historical studies of regional development and health/disease transition
- 4) Theoretical epidemiological studies using mathematical models
- 5) Integration of studies on global environmental changes and infectious diseases

International collaborations and networking are of great importance for this kind of study. The project will involve international researchers in the full-research stage.

Implications for Mitigating Global Environmental Issues

This project will provide us with deeper understanding of the relation between environmental changes and occurrence of tropical infectious diseases. This project will show that there are no magic bullets to eradicate all the infectious diseases from this world. We can learn through this study that the most of the infectious diseases can't be eradicated, that human beings must cope with these diseases by keeping a good balance with the environment, and that the "good balance" differs disease by disease and area by area. The project leader believes that this kind of understanding is the key for the betterment of the long-term health of the population.

Figure 1 Scheme of the Occurrence of Vector-borne Infectious Diseases by Interactions between Environments and Populations of Hosts (human beings), Vectors, and Pathogens

Incidence of vector-borne diseases such as malaria is related to the ecology of pathogens, vectors, and humans.

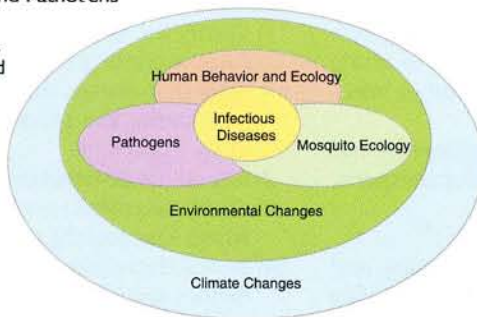
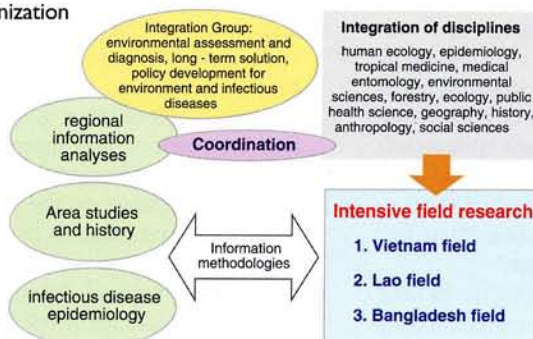


Figure 2 Project organization



Human Life, Aging, and Disease in High-Altitude Environments: Physio-medical, Ecological and Cultural Adaptation in the Three Great “Highland Civilizations”

Human life in highlands and its association with natural and socio-economic environments will be clarified through the comparative study of the three major highland zones: the Andes, the Himalaya and Tibet, and the Ethiopian Highlands. With the new perspective of “Highland Civilizations”, the human-environmental relationship will be verified by studying human life, aging, and disease in local life and the effects of globalization on highlands.

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Objectives

The four great ancient civilizations of the world arose on the banks of great rivers and are thus called the “Great River Civilizations”. The viewpoint

of “Highland Civilizations”, sustained by both common characteristics and local inherence, was realized by comparison of the three major highlands. The objective of the project is to understand the relationship between people and the highland environment. This will be accomplished by verification of the extent and limitations of local knowledge regarding adaptation to high-altitude environments. Furthermore, we intend to find new perspectives on the study of global environmental issues.

environmental exploitation such as agriculture and animal husbandry in the livelihoods of the three major highland zones. Those common features are probably what enabled inhabitants of the highlands to establish the highly cultured “Highland Civilizations”. Sustainable ways to exploit environments will be clarified so they can be applied towards the solution of global environmental issues.

The theme of how the “Sub-Systems” have supported the “Highland Civilization” will be discussed from the viewpoint of agro-ecosystems, transition of environmental exploitation and “highland-lowland interaction”. It is known that, not only self-sufficiency but also complicated “highland-lowland interaction” is needed in order to maintain isolated highland communities and lifestyles for more than a few hundreds years.

Nature and ecology in “Highland Civilizations”

The relationship, and the change of the relationship, between human activities and livelihoods and land and forest use will be disclosed. Environmental issues in fragile upper mountain forests and the area along the timberline will be also discussed. High altitude environments, especially the association of climate and its change with the development of “Highland Civilizations” will be clarified.

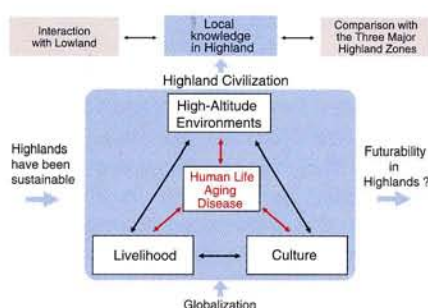
Culture in highlands

“Highland Civilizations” will be understood through the perspective of “Study of Nature”. Human ageing and diseases will also be discussed in association with high spiritual religion and traditional medicine.

Expected Outcomes

The common characteristics and unique local factors in the highlands will be understood. The “futurability” of “Highland Civilizations” will be proposed, after evaluating the effects of globalization and the problems it causes. It is expected that unique models and wisdom will come to light from local highland knowledge. This knowledge can be applied toward the solution of global environmental issues caused by the, mainly lowland, modern civilizations.

Figure Outline of the Project



Human life, aging, and disease in high-altitude environments will be studied by the verification of physiological, ecological and cultural adaptation of peoples in the three great “Highland Civilizations”. “Futurability of the highlands” will be discussed in terms of the influence of such factors as socio-economic globalization and global warming.

Methods

Human life, aging, and disease in highland people

Diseases specific to high altitudes, those that are closely associated with a hypoxic environment, are one of the environmental issues that affect the human body. Highland peoples have escaped from infections, such as malaria; however, lifestyle-related diseases increasing quickly, with extended life spans and changes in lifestyle, and are regarded as diseases related to modern civilization. The actual features of the disease and human aging phenomena among highland peoples will be clarified with special reference to high-altitude ecology and its socio-economic backgrounds.

Environmental exploitation and livelihood in “Highland Civilizations”

There are common features of

Photo A village on the Tibetan Plateau



In the highlands, not only crops for the people but also feed for the domesticated animals are important for the existence of life.

Collapse and Restoration of Ecosystem Networks with Human Activity

Most ecosystems on the planet have been seriously degraded by human activities and are now in a critical situation. Nevertheless, most research on the problem has focused only on the direct consequences. The project aims to clarify the mechanisms resulting in the collapse and deterioration of ecosystems, and then pave the way to restore and maintain healthier ecosystems with high biodiversity and ecological functions while minimizing instability and uncertainty in the long term over a wide area.

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Objectives

Degradation of ecosystems, which has led to the loss of biodiversity and ecosystem function, is widely accepted as one of the most serious global environmental problems. Nevertheless, most research on the problem has focused only on the direct consequences. The collapse and deterioration of ecosystems caused by human activities via interactions within the ecosystem network, including indirect and cascade effects, have rarely been considered. In addition, few studies take a social science perspective, although environmental problems are one of the consequences of the interactions between nature and human society.

The recent boom in theoretical studies on complex networks (complex system sciences, complex adaptive systems) and the remarkable progress in computer performance have dramatically increased our capacity to deal with complex systems such as ecosystems and social interactions. Complex system sciences are now a practical and important tool in various fields of sociology, economics, and ecology.

This project takes advantage of the interdisciplinary nature of network sciences to consider environmental problems, especially the problem of

ecosystem deterioration, by linking sociology, economics, and ecology. The project aims to clarify the mechanisms resulting in the collapse and deterioration of ecosystems, and then pave the way to restore and maintain healthier ecosystems with high biodiversity and ecological functions while minimizing instability and uncertainty in the long term over a wide area.

Research Sites

The research sites for this project are a tropical rainforest in Southeast Asia and grassland in Central Asia. At both sites, the terrestrial ecosystems are being devastated by the surge in the Asian economy associated with the recent dramatic economic growth of China. Nevertheless, the lives of many people depend on natural ecosystems and the destruction of these ecosystems directly results in dramatic changes in their lives.

Expected Achievements

This project is expected to achieve the following three main points:

1. Clarification of the relationships between human activities and ecosystem networks at two research sites that have common characteristics and marked differences. At the two research sites we will investigate the extant ecological networks and their transitions over the past 100 years as human activity intensified dramatically.
2. Development of models for projecting and evaluating future ecological networks based on different scenarios. We will construct simulation models for both regions based on the structure of the observed ecological networks and present a set of assumed conditions and projections as scenarios.
3. Provision of new approaches for investigating global environmental problems by introducing network sciences. We will generalize the analysis from case studies at the two sites to investigate which network structures are likely to lead to environmental problems and how we can restore ecological networks to solve the problems.

Photo Top: Mongolia, Healthy Grassland (left) and Degraded Pasture (right)
Bottom: Sarawak, Rainforest (left) and Plantation (right)

In Mongolia, livestock have grazed the grasslands extensively for the long time. In recent years, overgrazing by livestock, especially by the increased number of goats for the production of cashmere for export, has caused a serious problem in the region. In Sarawak, the ecosystem has changed dramatically over the last 100 years; land use has shifted from extensive agriculture in forests by aboriginal people to logging in natural forests as a source of timber for export, and then to oil-palm plantations.



Relationships between Human Activities and Atmospheric Changes, Possibilities of Harmonious Society for Environmental Issues in the East Asia

Amid atmospheric deteriorations with rapid economic growth in East Asia, a new environmental cooperation system that emphasizes not political or economic but environmental and cultural contexts is becoming more and more significant. This project tries to explore the theory of fostering a harmonious society for environmental issues synthetically based on results derived from analysis of the relationships between human activities and emissions of man-made substances, quantitative evaluation of social perception of environmental issues, and identification of social capacity for environmental management.

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Objectives

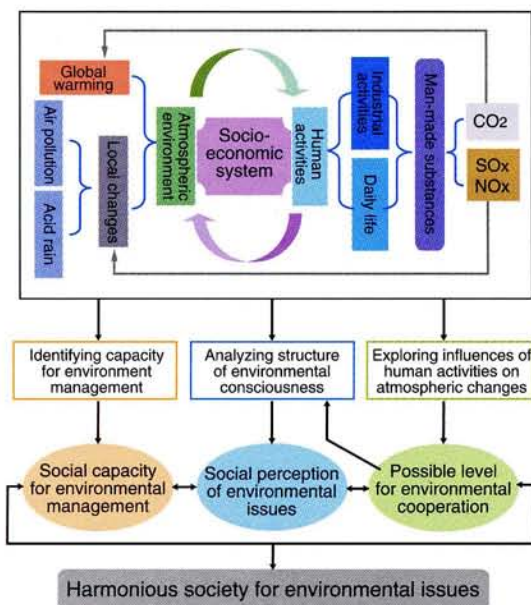
A new framework for the international environmental community to improve atmospheric quality is indispensable to overcome the limitations of the current environmental cooperation system that is driven by political and economic profits. This project aims to analyze how various human activities affect the emissions of man-made substances such as CO_2 , NO_x and SO_x . It also tries to probe the possibility of a harmonious society for environmental issues (HOSEI) defined by a diversity of environments and cultural links, as well as the foundations of environmental harmony study (See Figure).

Methodology

This project selected East Asia as the research area and will proceed with the three main approaches below:

- 1) One of the approaches is to analyze the influences of human activities, including energy consumption and land use etc., on emissions of CO_2 , NO_x and SO_x , and to predict the possible level for environmental cooperation (PLEC) for each research area by means of investigating the emission inventories at both national and regional scales.
- 2) The second approach is a quantitative evaluation of social perception of environmental issues (SPEI), which will be accomplished by extracting the essence of environmental consciousness of citizens, firms and governments, and thereby develop multidimensional indicators.
- 3) Finally, the framework of a harmonious society for environmental issues will be explored based on three essential factors, which are: the possible level for environmental cooperation, the social perception of environmental issues, and the social capacity for environmental management (SCEM).

Figure Conceptual Flowchart of Research Project



Expected Outcome

This project will contribute to developing methodologies and essential models for analyzing the influences of human activities on emissions of man-made substances in time series, within the structural consistency between a whole country and its regions. Furthermore, it is expected that this project will provide necessary information concerning the social roots of environmental issues and concrete solutions for decision-making.

Sustainable Food Production Concept Based on Evaluation of Traditional Agricultural Practices

After the Second World War, using chemical fertilizers, agrichemicals and high yield varieties increased the yield of cereals such as rice and wheat. The dramatic increase of cereal yield is termed the “Green Revolution”, despite the fact that the “Green Revolution” caused serious global environmental problems such as ground pollution, air pollution, eutrophied lakes and rivers, and shortages in irrigation water.

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Purpose of Research

This research is intended to investigate the following. Merits of traditional agriculture are evaluated from various viewpoints such as biology, agronomics, ethnicity, religious studies, and economics in managed cultivated fields and surrounding regions. Sustainable futuristic modes of agriculture are proposed under conditions in which the environment shall be preserved and a certain productivity level shall be secured. This research was undertaken based on the viewpoint that global environmental problems associated with agricultural practices that have spread since the “Green Revolution” are caused by: the use of large volumes of chemical fertilizer and agrichemicals; the use of crop species and varieties that depend on those chemicals; the socioeconomic structure of advanced countries, which provide such breeds of crops; and popular consciousness. Therefore, to solve problems of the global environment attributable to modern agriculture, it is necessary to build up cultivated fields in which a certain level of productivity can be secured without using large

amounts of fertilizer and agrichemicals and to revolutionize the socioeconomic structure and people’s consciousness. This research is intended to elucidate a route by which a future mode of agriculture can be realized for sustainable food production, based on clarification of “an interactive cyclical system including humans and nature” related to agriculture and food.

Method for Research

The investigation targets of this study are fields, mainly in Japan and tropical Asian regions, in which traditional agriculture and advanced agriculture are managed. The following preliminary investigations have preceded planning of this research: agricultural investigations concerning genetic diversity of crops and the dynamic state of elemental nutrients such as carbon, nitrogen, and phosphoric acid; biological examination of biodiversity such as companion planting, insects, soil microbes, and symbiotic microbes; ethnic and religious studies investigating consciousness of traditional farming systems and diet; and socioeconomic investigation of productivity and economic efficiency. For agricultural and biological studies, not only field observations but also analytical technologies have been applied using molecular biology and examination of stable isotopic elements. Social-scientific investigations have included not only studies based on the scientific literature, but also interviews and field investigations.

Expected Subjects

Expected subjects based on the research described above are given as follows: (1) clarification of environmental pollution of a cultivated field and the ecosystem surrounding it attributable to the use of large amounts of agrichemicals and chemical fertilizer in advanced agriculture and its implied “vicious circle”; (2) the structure of sustainable agriculture through preservation of biodiversity and genetic diversity of crops used for traditional agriculture; and (3) studies of natural perspectives related to production and consumption of food in developed and less-developed countries.

Photo 1 Traditional Farming Systems in Slash and Burn Fields of Northern Laos



Various kinds of crops including upland rice are cultivated in slash and burn fields. After cultivation for 2 or 3 years, the farmland is left for 10 or 20 years.

Photo 2 Advanced Farming Systems in Paddy Fields



Mono-cultivar of rice requiring a lot of chemical fertilizer and agrichemicals is cropped in paddy fields, which are irrigated and arranged in an orderly pattern.

Migration, Sojourn, and Possibilities in Cities

Currently, more than half the human activities on earth occur in cities. We propose to observe the migration and sojourn phenomena of people, commodities, capital, and information, analyzing such transformational processes while adopting different academic methods with their various time-space measures. We thus would like to propose a model for sustainable urban regeneration.

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The Background and the Purpose of the Research

Currently, more than half the human activities on earth occur in cities. The urban concentration of people, commodities, capital, and information has been accelerating. This phenomenon is not only a result of global-scale mobility but also of migration from rural and suburban areas to the urban centers. People, commodities, capital, and information, once concentrated in a city, are amplified, consuming and wasting natural resources — water, wood, farmland, and air — and as a result, rubbish, discarded lumber, carbon dioxide, and waste water are discharged.

Many of the environmental problems on this earth are caused by such urban consumption and discharge, which in turn should adversely affect the environment of the city itself. However, urban activities consist of so many different elements, and these various phenomena, while being bound by historical and civilization related factors, travel across urban and national borders, making it

difficult for us to grasp them, let alone control them. This study is an attempt to grasp and analyze such phenomena of urban migration and sojourn, which have been too complicated for any investigation so far, by means of various academic approaches.

The Research Methods and the Expected Tasks

We have chosen Southeast Asia as the focus of our study — particularly Jakarta, Bangkok, Manila, and their respective migration spheres — as this is the area where the struggling forces of globalization converge and whose urban environments are being heavily degraded. We are planning to investigate the urban migration mechanism of people, commodities, capital, and information during the period from the end of the eighteenth century, when a great change was caused by the British Empire's making inroads into the region, to the present. We will study our subjects over the long-term (across a span of about 100 years), mid-

term (across a span of about 30 years), short-term (across a span of about 10 years), and very short-term (within a span of one year). We will conduct these studies cross-disciplinarily, including various academic fields such as economic history, urban history, transportation engineering, religious studies, and the history of ideas. Finally, we will also examine which elements are responsible for the degradation of the earth's environment. Based on our results, we would like to contribute to the improvement of such problems by constructing an environmentally friendly model for sustainable urban regeneration that will lead to future-oriented and practical urban policies.

Photo Urban Landscape, Jakarta, 2006



Here, people, commodities, capital, and information flow in from all over the world and transform the city, these factors will be historically investigated.

Environmental Problems and Human Security for Children as Our Future: Asia-Pacific Children and the Environment (ACE) Project

Children are the most vulnerable sector of the human population within the environment. There is no doubt that understanding the effects of environmental dangers on children is crucial when considering environmental problems. Nevertheless, insufficient effort is being made to assess the relationships between children and their environment. This project seeks to determine the actual conditions relating to child security in local environments in the Asia-Pacific region, to support children's participation in community development and environmental care, and to open up new perspectives on future human capabilities.

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Objectives

We focus on the risk of environmental chemicals (e.g., environment disrupting chemicals, agricultural pesticides and food additives) and aim to assess their health impact on children comprehensively in terms of biological, socioeconomic, and cultural-psychological aspects. In addition, we support participation of the children in local environmental protection and aim to reveal how children recognize their surrounding environment and hold environmental protection awareness not only on a local scale but also in terms of the global environment.

shed were selected as intensive research sites. The field sites include diverse environmental problems such as eutrophication due to the influx of domestic and industrial wastewater, dam reservoirs, and agricultural pesticides.

Methods

1. Exposure to chemicals and health risk

To assess the exposure to chemicals and risk to children's health, measurements of anthropometric indices (body weight, height, etc), dietary surveys, direct observation of daily behavior, collection of satellite data, and measurement of physical activity using accelerometers are conducted.

2. Children's participation in the community

Detailed observations and analyses are performed in the following sequence: finding problems, research of the environment, presentation, alteration of awareness and behavior, influence of the results on the community. The whole process, from understanding the environmental problems to carrying out some sort of action, is compiled as a unit for analysis.

Expected Outcomes

Further understanding of the process by which children understand both local and global environmental problems and carry out actions related to them. How and to what extent adults and the local society will change due to influence by children's actions. We try to extract generally applicable theories and possible scenarios from accumulated case studies and observing and recording the process in detail.

This project seeks to determine the actual conditions relating to child security in local environments in the Asia-Pacific region, to support children's participation in community development and environmental care, and to open up new perspectives on future human capabilities.

Photo 1 Spraying with Pesticide



Neither gloves nor mask are worn and the sprayer is unprotected

Fieldwork Area

Four rural villages and one small town in Citarum River water-

Photo 2 Landscape of a Village



Located in Citarum River watershed, West Java, Indonesia

A Study of Human Subsistence Ecosystems among Arab Societies: To Combat Livelihood Degradation

Japan and oil-rich countries of the Middle East have excessively promoted exploitation of irreplaceable resources such as fossil fuel and fossil water, because they put first priority on economic prosperity for their own benefit. Their attitude also furthers social differences among the people of the Middle East. Therefore, we need to break the existing framework of scientific understanding and deadlock of social systems, by building a direct relationship between Japanese and international scientists and the common people in Arab societies. These efforts would open up a road to solve problems both scholarly and social.

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Objectives

This research project aims to promote basic studies to examine the interactions between human and nature in dryland areas, for the purpose of ensuring sustainability of subsistence activities and combating livelihood degradation in local communities of the Arab people.

How have the Arab people survived more than a thousand years in the uncertainty in ecological systems of drylands, which are determined by non-linearities in the system of variability in time and heterogeneity in space (ex. a high fluctuation of annual precipitation and an uneven distribution of rich rainfall)? What was the basis of their livelihood and survival strategies, and what were the characteristics of its sustainability and weakness? We clarify human subsistence ecosystems by focusing attention on human life support mechanisms and self-sufficient modes of production (hunting, gathering, fishing, herding, farming, and forestry). Based on these research results, we intend to propose a scientific framework to strengthen their subsistence productivity and to rehabilitate the daily life of the common people in Arab societies.

on keystone species, (2) inspection of sustainability and fragility of Arab societies, (3) examination of the futurability of traditional knowledge. Field surveys will be conducted in four countries such as Algeria, Sudan, Egypt and Saudi Arabia, so that we can compare a combination of keystone species, ecotones and traditional knowledge, and examine differences in sustainability of subsistence economies particularly under site-specific conditions.

The exact targets of keystone species, ecotones and traditional knowledge are as follows: (1) Algerian Sahara oasis/ date-palms/ wadi-beds/ rehabilitation of a wise traditional way of water use, *foggara*, and redevelopment of oasis agriculture in Sahara; (2) Butana area in the Sudan/ camels/ river-sides/ building comprehensive measures to control exotic invasive species, mesquites, *Prosopis* and strengthening a stable food production system centering on pastoralism; (3) Sinai peninsula in Egypt/ coral reefs/ mountain-sides/ elucidation of material culture and promotion of studies on relationships between Arabs and nature, focusing on the dynamic systems of their social and complex networks; (4) Red Sea coasts in Saudi Arabia/ mangroves/ sea shores/ integrated land management applying traditional natural resource management, *hema*, and conservation of biodiversity.

Expected Results

In the 1980s, international organizations promoted planting exotic species of mesquites. However, this invasion not only changed regional ecosystems, but also caused livelihood degradation among local communities. Nowadays, the IUCN has put mesquites on the list of "100 of the World's Worst Invasive Alien Species". We will submit comprehensive measures to control this invasive species, by constructing research teams connecting various backgrounds, specializations and crossing different fields of science: scientists in universities and institutions, representatives of NGOs and consulting companies, project managers of international organizations and development institutions, and local people playing various social roles such as tribal leaders, technicians and villagers.

Photo 1 Assessment of Environmental Affects by Development Programs in Coastal Zones of the Arid Tropics



The coastal zones, in which fresh water can be converted from seawater, became a big development frontier and may cause environmental degradation by releasing highly concentrated saline water into the sea. On the other hand, this area is rich in biodiversity, so it has high potential for seafood and pastoral food production through reforestation of mangroves as fish nurseries and forage safekeeping. We are compiling scientific knowledge to prevent a new outbreak of environmental problems in coastal area development.

Photo 2 Supporting Local Peoples' Decision Making by Sharing Information from Research Results



We are conscious of the necessity to provide universal and equitable access to scientific data, making use of these for local peoples' decision making as well as nations' policy making, by information dispatch through printing and digital devices in Japanese (bridge between Japanese and Arab societies), English (scientific language for scientists communities) and Arabic (local common language for local communities).

Research Methods and Areas

Our research methods consist of three main pillars: (1) analysis of subsistence ecosystems focusing

The Effects of Economic Activities on the Ecosystem in the Caspian Sea and Cooperative Environmental Protection System

It is feared that a large-scale development of sea resources such as oil and natural gas has negative impacts on the ecosystem in the Caspian Sea. An environmental protection system should be enforced with cooperation between the circum-Caspian countries. In this project, in order to create an environmental protection system a future Caspian ecosystem will be demonstrated by analyzing the relationship between the history of economic activities and the unique ecosystem.

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Objectives

The Caspian Sea is a closed sea with no outflow of water through rivers and a unique ecosystem has formed over a hundred thousand years. Recently the development of oil and natural gas resources has been proceeding rapidly as they rise in cost. All the pollutants from the development are accumulated in the water or in the sediment since the Caspian Sea is closed. It is therefore feared that such pollutants have negative impacts on the unique ecosystem, which includes several endemic species such as seals and sturgeon. An environmental protection system should be enforced with cooperation between the circum-Caspian countries, whose nationalities, social systems, and economic conditions are quite different from each other. In this project, the future Caspian ecosystem will be demonstrated by analyzing the relationship between the history of economic activities and the unique ecosystem. Then an environmental protection system will be proposed, taking into account the differences in the nationalities, social systems, and economic conditions among the surrounding countries.

Methodology

In order to propose the environmental protection system, this project integrates: 1) field investigations of the Caspian ecosystem, 2) model analysis for prediction of the future ecosystem, and 3) investigation of the environmental consciousness of citizens and governments.

One example of field investigation of the Caspian environment is examination of transportation of pollutants and their concentrations in marine organisms to reveal the environmental impacts across borders. The future ecosystem will be predicted by numerical simulation of oil and natural gas development at a more accelerated pace than the present. Furthermore, investigation will reveal the differences in environmental consciousness of citizens and governments of the surrounding countries. These results will be integrated to propose a total system of environmental protection in the Caspian Sea.

Expected Outcome

In the future, the offshore development of renewable energy and resources will accelerate as demand for energy increases. It is therefore very important to protect the common environment of the countries surrounding the Caspian Sea. This project will contribute to illustrating how the environment can be protected by cooperation between the surrounding countries if their nationalities, social systems, and economic conditions are quite different from each other.

Figure Conceptual Flowchart of the Project

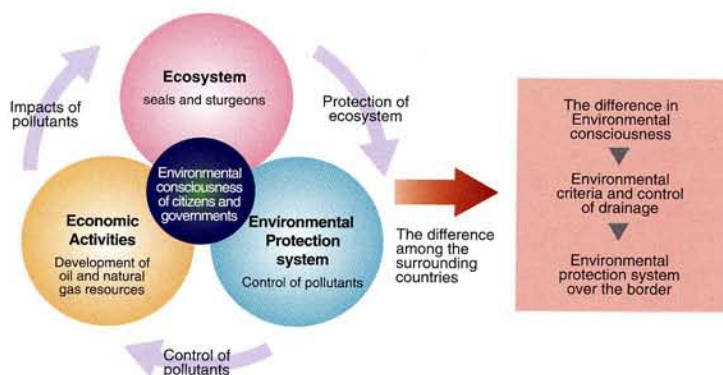


Photo Oil wells off Baku in the Republic of Azerbaijan

