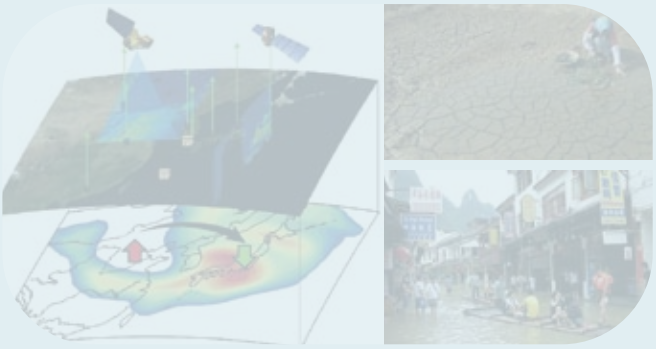
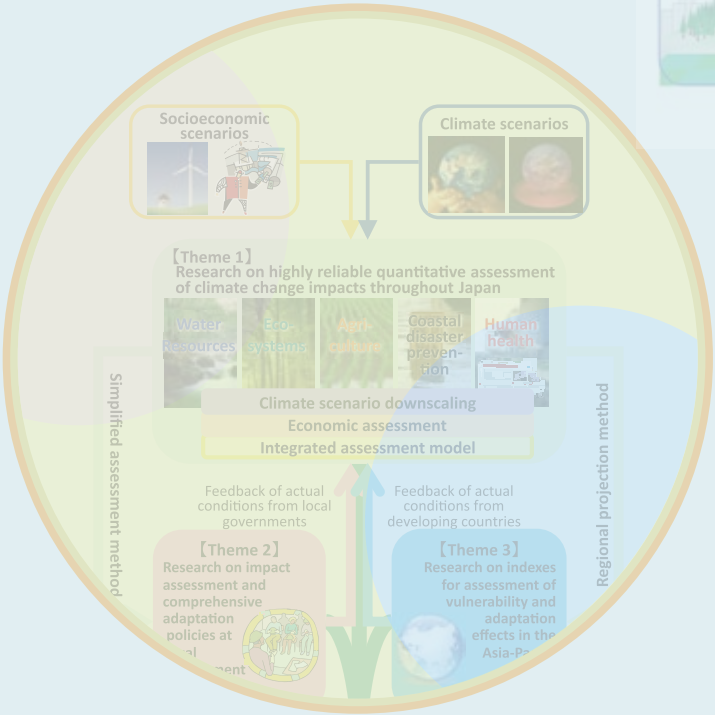
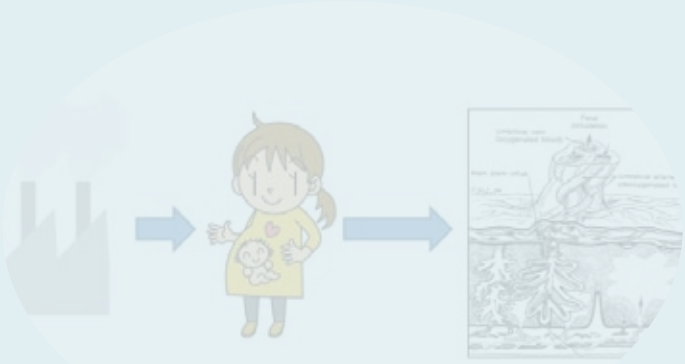


ENVIRONMENT RESEARCH AND TECHNOLOGY DEVELOPMENT FUND

FY2010





Ministry of the Environment

CONTENTS

Environment Research and Technology Development Fund in FY2010

Outline

Features:

- The Environment Research and Technology Development Fund (ERTDF) enhanced in 2010 through integration with the Global Environment Research Fund (GERF) and the Environment Technology Development Fund (ETDF), is a competitive grant scheme for environmental research with calls for proposals. The ERTDF has been playing a role as a core fund in Japan for promoting environmental studies through interdisciplinary interaction among natural, social and political sciences. The recent integration allows the ERTDF to accommodate more research studies and technology development with an interdisciplinary perspective.
- Each year, the Ministry of the Environment (MOE) formulates an "Environmental Research Program" through consultation with external reviewers. Based on the program, research projects are conducted in a timely fashion in accordance with the international situation, reflecting domestic/international trends in environmental research.
- Researchers belonging to Japanese research institutions may apply.
- The research projects will be evaluated in collaboration with external reviewers, weighing in such factors as degree of contribution (in terms of either policy or science) and feasibility, taking into consideration domestic/international trends in the environment.

Research Priorities:

- In order to obtain scientific evidence necessary for drafting and implementing policies to protect the environment, the administration indicates desirable themes for research.
- In order to contribute to international environmental policies, research projects with a focus on environmental policies in the Asia-Pacific regions have priority to a certain degree.
- Some research projects are promoted to facilitate cooperation with international organizations such as the IPCC, IGBP, WCRP, IHDP, etc.
- In addition to bottom-up type research projects, top-down type research projects, for which the MOE provides the project leader and an outline of the project theme and selects the researchers' roles, are also promoted as "Strategic Research and Development Types I & II".

System

Research Fields:

1. Global System Change

Global-scale problems, including destruction of the ozone layer, global warming and the impacts of global environmental changes through water circulation

2. Environmental Pollution

The domestic/overseas atmospheric environment, urban environment, water environment and soil environment, and transboundary pollution in those environments

3. Health and Ecological Risks

Environmental risks and health risks associated with chemical substances, global environmental changes, etc.

4. Protection/Restoration of Nature and Ecosystems

Protection and restoration of ecosystems in view of problems of ecosystem disruption, reduction of biodiversity, reduction of tropical forests and desertification with an aim for harmonious coexistence with nature

5. Research on Sustainable Society/Policy

Integrated research with environmental, economic and societal perspectives related to protection of the environment and establishment of a sustainable society

Classes of Projects:

Research Areas	Conditions	Duration	Average Annual Budget per Project (US$1=Yen120)
Strategic Research and Development area (Top-down) Type I	Large-scale projects for which MOE provides a research framework in advance	5 years (3 years for Period I and 2 years for Period II)	Several million dollars
Strategic Research and Development area (Top-down) Type II	Projects in areas which MOE designates in advance	4 years (may be extended to 6 years)	Up to $333,000
Environmental Problem Research Area (Bottom-up)	Research to contribute to solving individual or combined environmental issues	3 years (may be extended to 5 years)	Up to $833,000
Innovative Research and Development Area	(1) For Young Researchers Researchers 40 years old or younger	1 or 2 years	Up to $83,000
	(2) For Integrated Evaluation Research projects integrating or evaluating the latest outcomes of specified research themes	1 year	Up to $83,000
Strategic Feasibility Studies	Prospective projects for Strategic Research and Development Types I & II	1 year	Up to $83,000

Projects of Strategic Research and Development Type I:

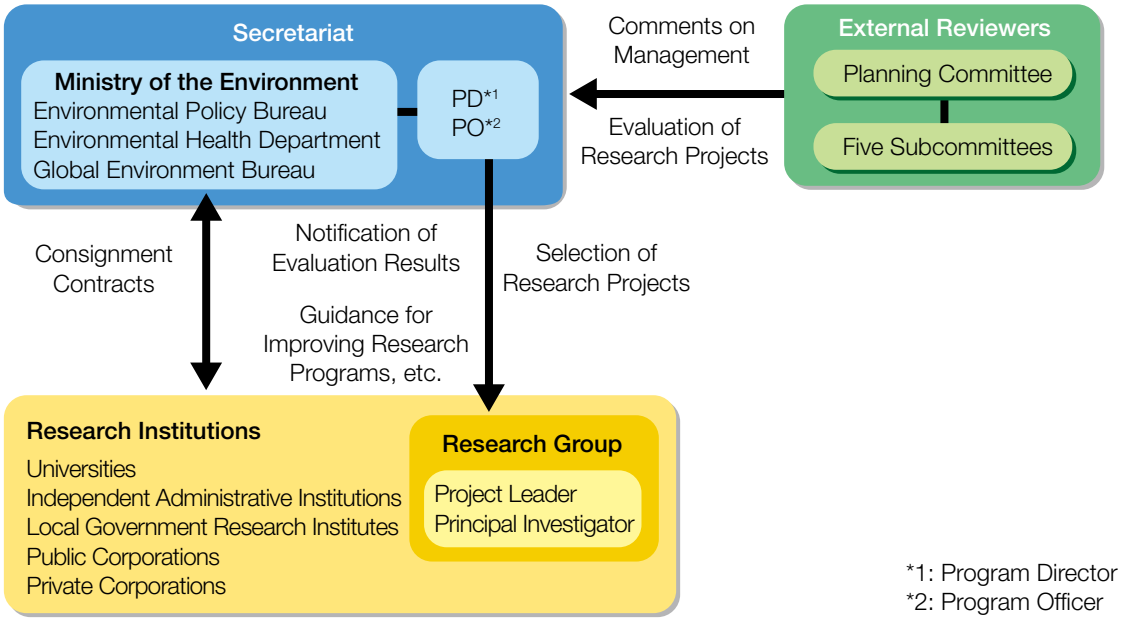
S-5: Integrated Research on Climate Change Scenarios to Increase Public Awareness and Contribute to the Policy Process (FY2007-2011)

S-6: Research Project on Establishing of Methodology to Evaluate Middle to Long Term Environmental Policy Options toward Asian Low-Carbon Society (Low-Carbon Asia Research Project) (FY2009-2013)

S-7: Scientific Analysis of Regional Air Pollution and Promotion of Air Pollution Management in East Asia Considering Co-benefits (FY2009-2013)

S-8: Comprehensive Research on Climate Change Impact Assessment and Adaptation Policies (FY2010-2014)

Implementation Structure:

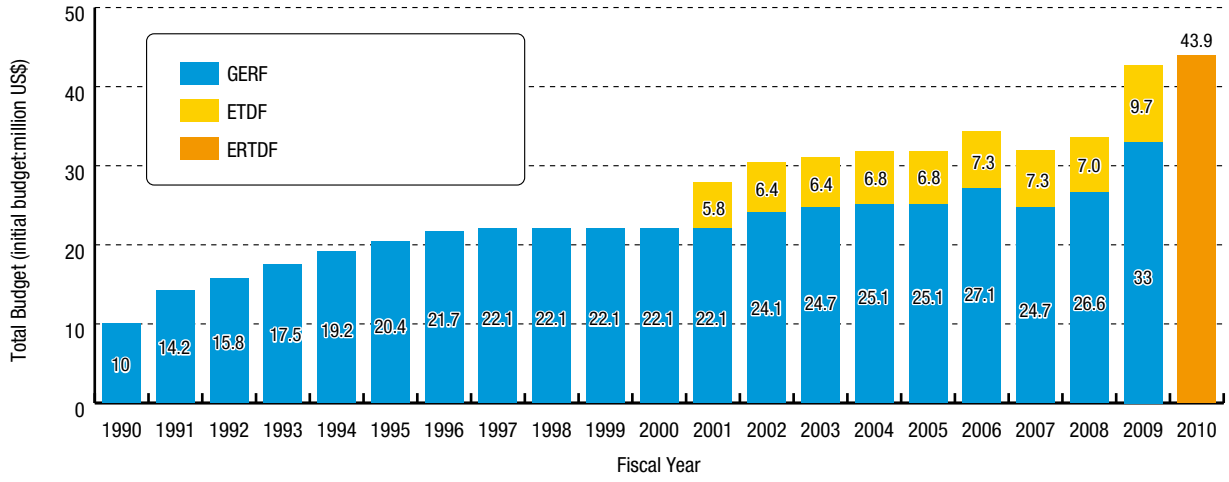


Intermediate Evaluation:

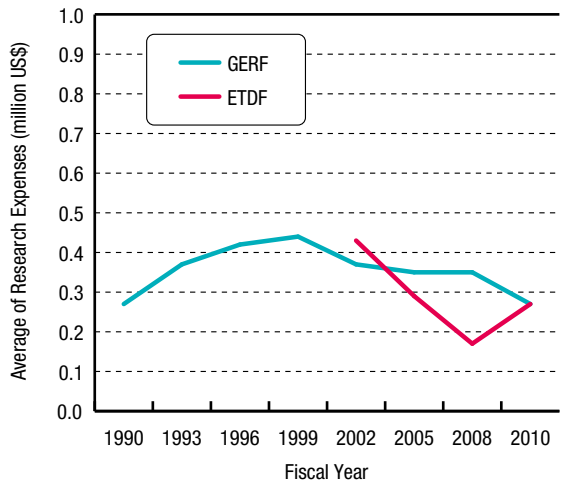
- Research projects in Strategic Research and Development Type I (for which the research period is five years) and Type II (for which the research period is four years) will undergo intermediate evaluation in their third year.
- Research projects in Strategic Research and Development Type II (for which the research period is four years) rated highly in the evaluation will be considered for an extension of two years (bringing the total to six years).
- Research projects in the Environmental Problem Research Area (for which the research period is three years) will undergo intermediate evaluation in their second year. Research projects rated highly in the evaluation will be considered for an extension of two years (bringing the total to five years).

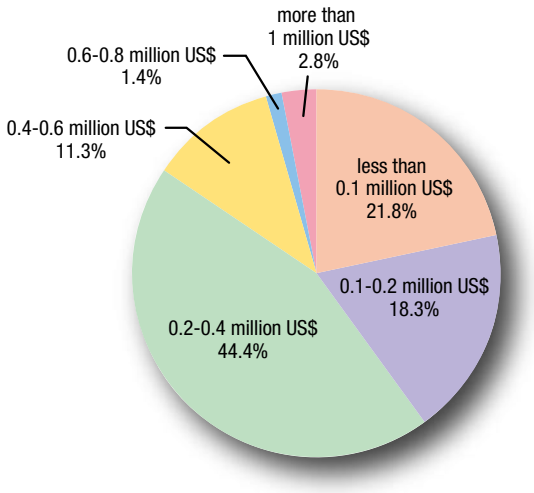
Management Performance

Trends in the Total Budget (1US$=120yen)

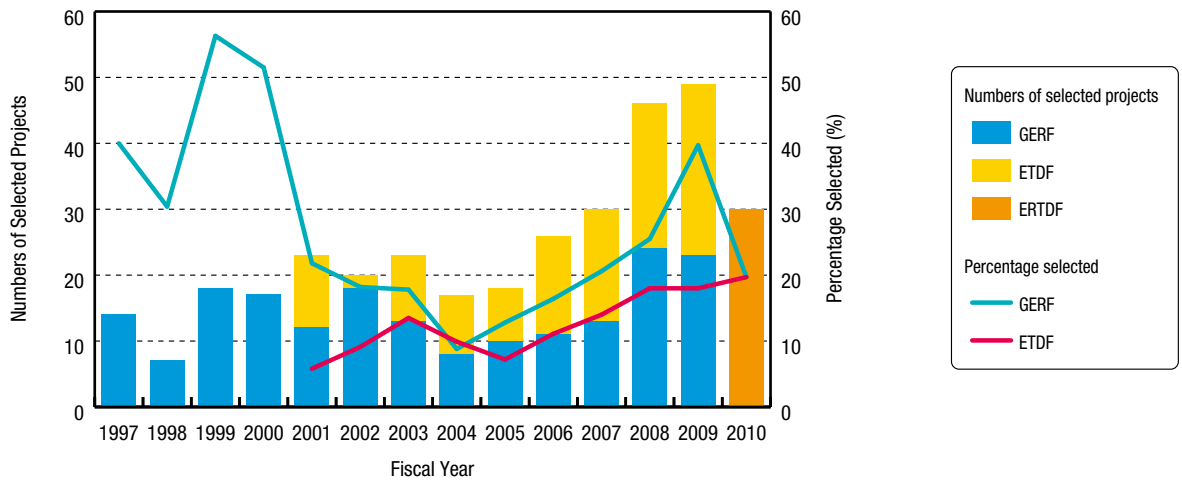


Trends in Annual Research Expenses per Project (1US$=120 yen) (Environmental Problem Research Area) & Ratios of Research Expenses

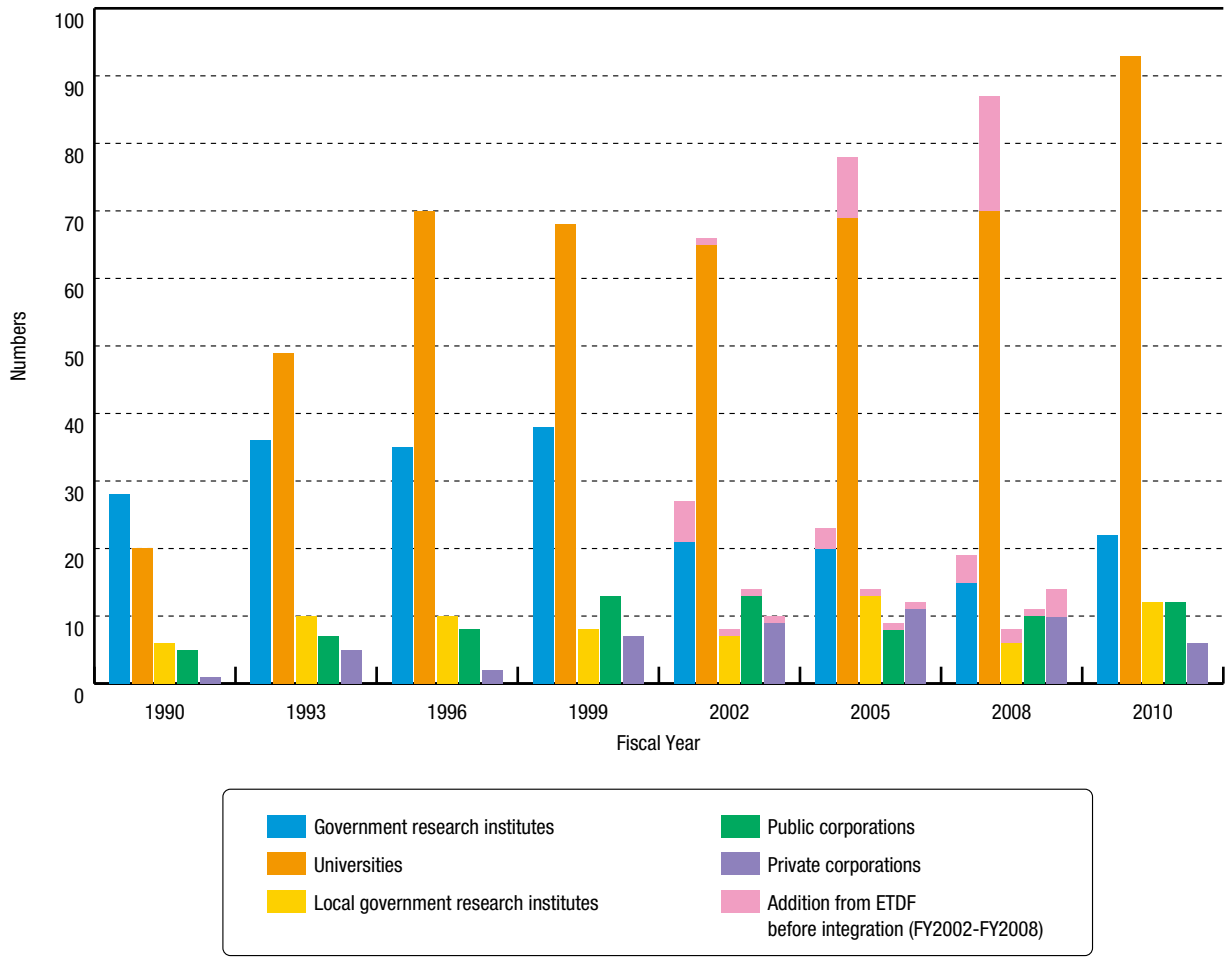




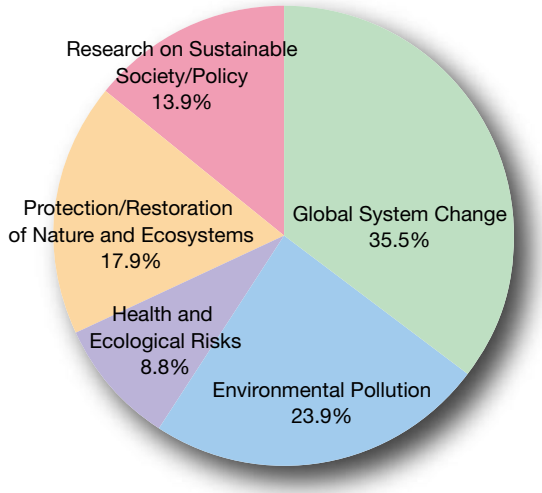
Percentages of Research Projects Selected



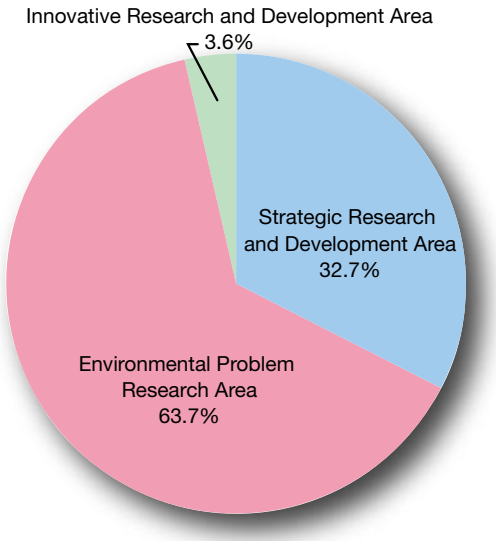
Numbers of Participating Institutions



Ratios of Research Categories Conducted in FY2010



Ratios of Research Areas Conducted in FY2010



Strategic Research and Development Area

Global System Change

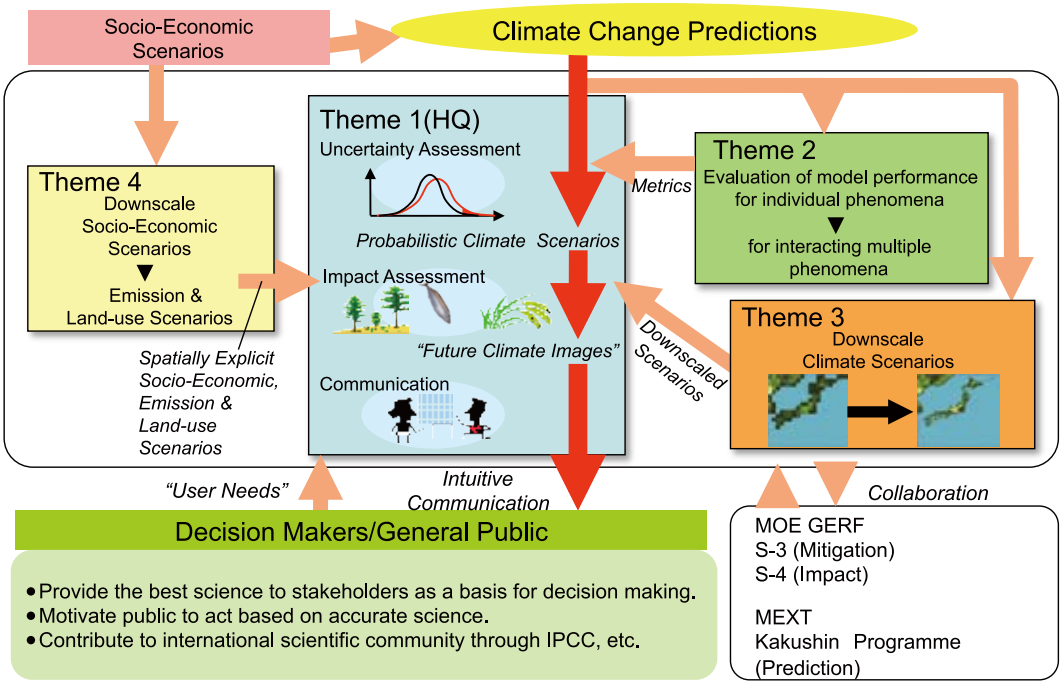
Integrated Research on Climate Change Scenarios to Increase Public Awareness and Contribute to the Policy Process

(Period I : FY2007-2009)
(Period II : FY2010-2011)

Project Leader : **Akimasa SUMI,** The University of Tokyo <S-5>

The University of Tokyo, National Institute for Environmental Studies, Japan Agency for Marine-Earth Science and Technology, Hokkaido University, National Institute for Agro-Environmental Sciences, Nomura Research Institute, Ltd., Kanagawa University, Toho University, Meteorological Research Institute, University of Tsukuba, Nagoya University, National Research Institute for Earth Science and Disaster Prevention, Kyoto University, Tokyo Institute of Technology

In this research project, present-day simulations and future projections by domestic and international climate models are comprehensively analyzed to assign indices quantifying uncertainties embedded in future projections. In addition, we use regional climate models to generate spatially-specific projections for Japan and its environs. We are also working on downscaling socioeconomic scenarios and the projections of land-use change. Through these efforts, we aim to construct comprehensive climate change scenarios that give detailed information about the impact of climate change on our society, and to find methodologies that win ensure that these scenarios can be presented in a manner that can be received intuitively by the public.



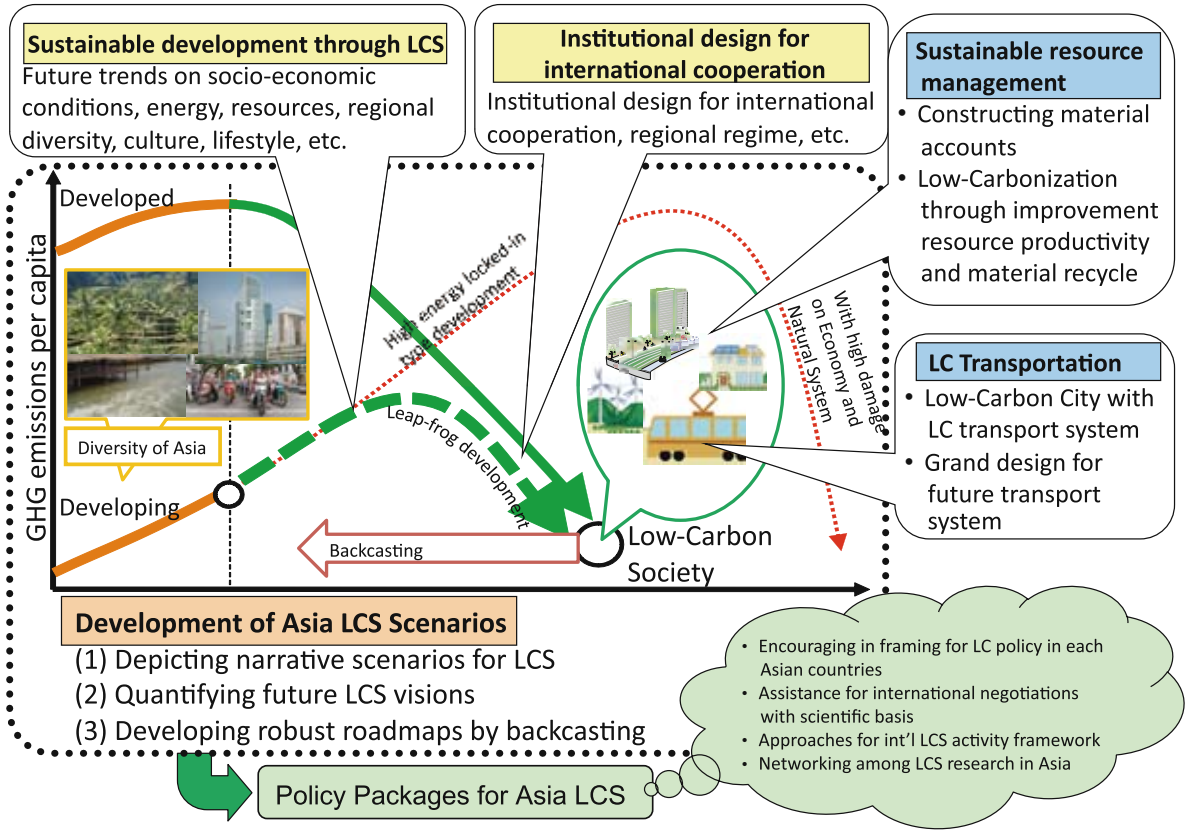
Research Project on Establishing of Methodology to Evaluate Middle to Long Term Environmental Policy Options toward Asian Low-Carbon Society (Low-Carbon Asia Research Project)

(Period I : FY2009-2011)
(Period II : FY2012-2013)

Project Leader : **Mikiko KAINUMA,** National Institute for Environmental Studies (NIES) <S-6>

NIES, Kyoto University, Mizuho Information & Research Institute, Inc., The Institute of Energy Economics, Japan, The Institute for Global Environmental Strategies, Hiroshima University, Tokyo Institute of Technology, International University of Japan, The University of Tokyo, Nagoya University, Nihon University, Yokohama National University

In order to achieve Asian Low-Carbon Societies (LCSs), we focus on some domestic and international factors which control the possibility to realize LCS by applying the modeling tools to the whole of Asia and various regions in Asia. We will design positive Asian LCSs in each country with a backcasting methodology, and also roadmaps toward the societies that cooperated with the policy options for other important problems in the Asian region in the first half of the 21st century.



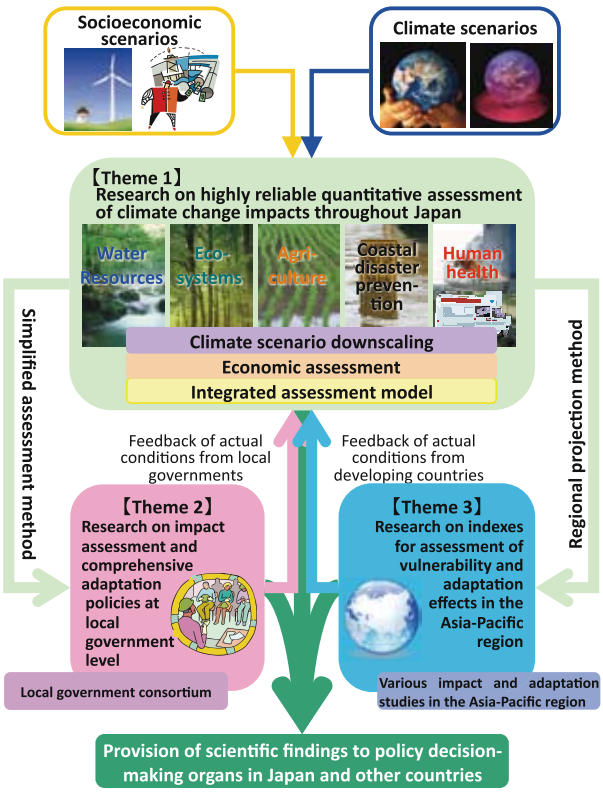
Comprehensive Research on Climate Change Impact Assessment and Adaptation Policies

(Period Ⅰ : FY2010-2012)
(Period Ⅱ : FY2013-2014)

Project Leader : **Nobuo MIMURA,** Ibaraki University <S-8>

Ibaraki University, National Institute for Environmental Studies, Japan Agency for Marine-Earth Science and Technology, Hokkaido University, The University of Tokyo, Tohoku University, Toyo University, National Institute for Public Health, Fukushima University, Shizuoka University, National Institute for Land and Infrastructure Management, Forestry and Forest Products Research Institute, National Institute for Agro-Environmental Sciences, National Institute of Fruit Tree Science, Center for Environmental Science in Saitama, University of Tsukuba, National Institute of Infectious Diseases, Meijo University, University of Hyogo, Japan Research Institute, Tohoku Bunka Gakuen University, Hosei University, Central Research Institute of Electric Power Industry, Tokyo University of Agriculture and Technology, The Tokyo Metropolitan Research Institute for Environmental Protection, Kanagawa Environmental Research Center, Nagano Environmental Conservation Research Institute, Kyushu University, Institute for Global Environmental Strategies, United Nations University

The S-8 Project will serve as a foundation for the formulation of adaptation in Japan and policy assessment of the feasibility of realizing a safe and secure climate change-adaptive society. Moreover, the development of a simplified method for making quantitative impact assessments will facilitate the presentation of comprehensive policy development plans for social implementation of more concrete adaptation measures at the local government level. The assessment of vulnerability, impacts, and adaptive capacity in the developing countries is also of great importance from the standpoint of contributing to promotion of international adaptation strategies.



Environmental Pollution

Scientific Analysis of Regional Air Pollution and Promotion of Air Pollution Management in East Asia Considering Co-benefits

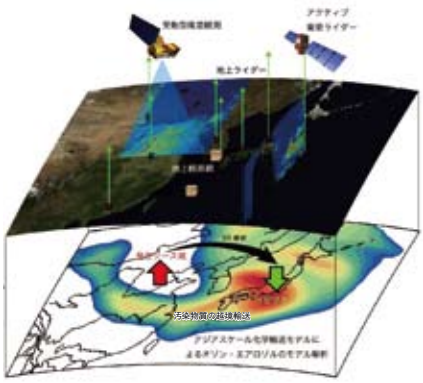
(Period Ⅰ : FY2009-2011)
(Period Ⅱ : FY2012-2013)

Project Leader : **Hajime AKIMOTO,** Asia Center for Air Pollution Research <S-7>

ACAP, Japan Agency for Marine-Earth Science and Technology, National Institute for Environmental Studies, Nagoya University, Kanazawa University, Institute for Global Environmental Strategies, Tokyo Institute of Technology, Tohoku University

Emissions of air pollutants such as nitrogen oxide (NOx) and Volatile Organic Compounds (VOCs) as well as greenhouse gases such as carbon dioxide have rapidly been increasing in East Asia, which contribute significantly to transboundary transport of ozone and aerosol to Japan, hemispherical scale background air pollution, and global scale increase of greenhouse gases. In this project, contributions of East Asian regional air pollution and hemispherical transport to ozone and aerosol pollution in Japan are quantified. Based on the scientific knowledge, reduction scenario of East Asian regional air pollutants will be developed considering co-benefit between mitigation of transboundary air pollution and global warming, and a pathway to international agreement will be discussed.

Analysis of transboundary air pollution synthesizing ground/satellite observations and chemical transport models and evaluation of global warming impact of air pollutants by a chemical climate model



Clarify the cause of the increase of exceedance of oxidant warning levels

Evaluation of global warming impact of air pollutants such as aerosols and ozone

Proposal of co-benefit approach between the regional air pollution and global warming measures

The first step to solve the problem is international sharing of scientific knowledge on regional air pollution

Theme 1 :
Elucidation of ozone and aerosol pollution synthesizing numerical model and observation

Grasp of the actual conditions of emissions is necessary for the air pollutants reduction scenario

Theme 2 :
Improvement of emission inventories of air pollutants and presentationof air pollutants reduction scenario

Theme 3 :
Research on international framework toward promotion of air pollution measures and co-benefit approach

International framework of atmospheric management in East Asia is studied considering simultaneous control of global warming

Environmental Problem Research Area
Innovative Research and Development Area

Global System Change

Asian Precipitation-Highly-Resolved Observational Data Integration towards Evaluation of the Water Resources (APHRODITE's Water Resources)

(FY2006-2010)

Principal Investigator: **Akiyo YATAGAI,** Research Institute for Humanity and Nature (RIHN) <A−0601>

RIHN, Meteorological Research Institute

The recent high-resolution General Circulation Models (GCMs) have allowed us to improve our understanding of the regional impacts of global warming on water resources. However observational datasets to validate such GCMs have not been developed. We propose to develop state-of-the-art daily grid precipitation datasets based on long-term rain-gauge observations over Asia, and to assess the performance of GCMs. Our project will also highlight the importance of orographically enhanced precipitation to the water resources. The gridded precipitation products developed by this project are provided on the following web-page.
http://www.chikyu.ac.jp/precip/

Research on the Global Forest Carbon Monitoring System

(FY2008-2010)

Principal Investigator: **Yoshiki YAMAGATA,** National Institute for Environmental Studies (NIES) <A−0801>

NIES, Japan Aerospace Exploration Agency, Mitsubishi Research Institute, Inc., The University of Tokyo

The aim of this research project is to develop a system for mapping and monitoring of forest carbon stocks and of changes therein, through the synergetic use of in-situ networks and Earth observation data. In particular, the project aims to assess the utility of using ALOS/PALSAR data to derive information about the status of the forest cover mapping and for identification and spatial quantification of changes in the forest cover as a result of deforestation, forest degradation and regeneration. The project also contributes to GEOSS (Global Earth Observation System of Systems) task.

Development of the Forest Degradation Index and the Carbon Emission Estimation Method Using PALSAR Data

(FY2008-2010)

Principal Investigator: **Yoshiyuki KIYONO,** Forestry and Forest Products Research Institute (FFPRI) <A−0802>

FFPRI, Gifu University, Japan Aerospace Exploration Agency, Hokkaido University

REDD (Reducing Emissions from Deforestation and forest degradation in Developing countries) and REDD+ have been drawing international attention in Post-Kyoto climate negotiations as a new mechanism to foster reduction of deforestation in those countries. PALSAR is an active microwave sensor in the Japanese satellite "ALOS" and expected to monitor tropical forest with overcoming the cloud problem. Because feasibility of operational application of PALSAR data for detecting deforestation and degradation and estimating GHG emissions is still unclear, we will improve a technique using PALSAR and GHG modeling to give a new tool to monitor changes in GHG emissions in tropical forests including peat swamp forests.

Investigation of Physical and Chemical Properties of Aerosol by Advanced Technologies for Improvement of Prediction of Climate Change

(FY2008-2010)

Principal Investigator: **Yutaka KONDO,** The University of Tokyo <A−0803>

The University of Tokyo, National Institute for Environmental Studies, Chiba University

This study is aimed to investigate impacts of aerosol on climate by combining observations using advanced technologies and climate models. Micro-physical processes of scattering and absorption of solar radiation by aerosol is to be fully understood by ground-based and aircraft observations of aerosol and radiation. Greatly updated knowledge on aerosol optical properties is included in climate prediction models and estimation and prediction of aerosol radiative effects on global and Asian scales will be greatly improved. Changes in radiation, cloud cover, and precipitation is predicted by performing numerical experiments using improved models. These results will be included in the IPCC 5th Assessment Report.

Experimental Study of Ocean Acidification Impact on Benthic Calcifies

(FY2008-2010)

Principal Investigator: **Yukihiro NOJIRI,** National Institute for Environmental Studies (NIES) <A−0804>

NIES, Kyoto University, Fisheries Research Agency, Advanced Industrial Science and Technology, University of the Ryukyus

Ocean acidification has been started as the increasing atmospheric CO_2 dissolution into surface seawater. Its impact is expected to be serious for marine calcifies, because they produce carbonate shell or skeleton. In this study, a precise CO_2 controlling system for culture of benthic calcifies has been developed and has been operated to experiment the near future impact of CO_2 increase on the coastal marine animals. Growth of sea urchin larvae and coral primary polyp increased under low pCO_2 condition simulating the environment of the pre-industrial era. It suggests that calcification of larvae and juveniles of calcifiers may have been already stressed by the present atmospheric CO_2 level.

Adaptive Measures to Changes in Geomorphology and Water Resources on Atoll Island Countries

(FY2008-2010)

Principal Investigator: **Hiroya YAMANO,** National Institute for Environmental Studies (NIES) <A−0805>

NIES, The University of Tokyo, Keio University, Ochanomizu University, Ibaraki University, Research Institute for Humanity and Nature

Small island countries established on coral atoll are vulnerable to climate change and sea-level rise caused by global warming. In this study, carrying capacity of the countries will be estimated by analyzing the history of geomorphic development, precipitation variability and human settlement. The vulnerability to climate change, sea-level rise and changes in social structure will be assessed based on the changes in the carrying capacity. Based on these results, adaptive measures to both coastal erosion and degradation of water resources in response to global warming will be proposed from the viewpoint of both scientific and social perspectives.

Assessment of Combined Effects of Rising Temperature and Ozone Concentration on Rice Production and Quality, and its Application for Mitigation of Food Supply Risk in Asian Countries

(FY2008-2010)

Principal Investigator: **Yoshihisa KOHNO,** Central Research Institute of Electric Power Industry (CRIEPI) <A−0806>

CRIEPI, National Institute for Environmental Studies, Center for Environmental Science in Saitama

Temperature rising accompanied by recent global warming may have potential to affect plant productivity through the increase in toxicity of tropospheric ozone. Rice plants are the most important crop for food supply in Asian countries. We will identify sensitivities of Asian rice varieties to combined effect of temperature and ozone. Proteome and transcriptome analysis will be performed to identify stress-induced proteins and/or genes for developing a novel diagnostic tool. These activities will support to propose a sustainable and feasible adaptation for reducing a risk of Asian food security.

Evaluating the Vulnerability of Agro-environment in a Cold Region to Climate Change and Developing Adaptation Practices by Snow and Soil Frost Control

(FY2008-2010)

Principal Investigator: **Tomoyoshi HIROTA,** National Agricultural Research Center for Hokkaido Region (NARCH) <A−0807>

NARCH, Hokkaido University

In eastern Hokkaido, one of Japan's primary arable farming regions, the depth of soil freezing in winter has decreased in recent years. To assess the impacts of such changes in soil frost depth on the global climate, i.e. greenhouse gas emissions, for the agricultural lands of northern Japan, emissions of nitrous oxide (N_2O), which is a key of greenhouse gas, were measured for different soil frost depths from winter to early spring. Consequently, a positive correlation between soil frost depth and N_2O emissions in early spring was found for agricultural soils in Hokkaido. Therefore, recent shallow soil frost depths in winter may reduce N_2O emissions in early spring. However, shallow soil frost depths adversely affect volunteer potatoes (or weed potatoes) by not killing unharvested potatoes, unlike deep soil freezing. We intend to develop new field management techniques utilizing soil frost depth control by managing snow cover both to reduce the impact on global warming and to protect to ensure sustainable crop production.

Research on Development of Integrated Scenarios on Climate Change and Assessment of Climate Policies Using Asia-Pacific Integrated Model (FY2008-2010)

Principal Investigator: **Toshihiko MASUI,** National Institute for Environmental Studies (NIES) <A−0808>

NIES, Kyoto University, Mizuho Information & Research Institute, Inc.

This study develops the global and national scale integrated scenarios describing future socioeconomic activities, greenhouse gas emissions, climate change, and climate change impacts by using the improved Asia-Pacific Integrated Model. The long term global scenarios reflect the Asian developing countries' perspectives. The outcomes contribute to promotion of the climate policy in Japan and other Asian countries.

Quantification of Above- and Below-ground Forest Carbon Budget Using Airborne Laser Altimetry (FY2009-2011)

Principal Investigator: **Tatsuo SWEDA,** Ehime University <A−0901>

Ehime University, Waseda University

The objectives of this research are to quantify the forest carbon budget using Airborne Laser Altimetry (ALA) and to apply the results to forest carbon management. The high-frequency and precise measurement of three-dimensional forest structure by ALA enables us an accurate estimation of forest timber and carbon stock, the multi-temporal measurement of which results in forest carbon budget. The target study areas are degraded tropical swamp forest of Borneo and boreal forest of northwestern Canada, where massive carbon emission not only from the above-ground biomass but also from peat is either considered underway or suspected in near future due respectively to devastation by aborted paddy development and warming-induced thawing of permafrost. Its exact quantification and early detection are much sought after.

Impact of Integrated Effect of Land Cover/Use Change and Aerosol Forcings on Climate Change in Asia (FY2009-2011)

Principal Investigator: **Tetsuzo YASUNARI,** Nagoya University <A−0902>

Nagoya University, Japan Agency for Marine-Earth Science and Technology, Tokyo Metropolitan University

Impacts of agriculture-induced nitrate aerosols and secondary organic aerosols (SOA) are important for Asian monsoon climate. In addition, Volatile Organic Compounds (VOCs) from vegetation are likely to have large impact on aerosol production and related cloud/precipitation processes over Asian monsoon region. This study focuses on unraveling these integrated vegetation-aerosol processes using a full-aerosol process model coupled with CHASER, an atmospheric chemistry climate model, and to validate these effects using high-resolution climate data analysis in the past several decades or longer.

Development of a Next Generation System for Monitoring the Atmospheric Environment and Estimating the Emission Inventory of Related Species

(FY2009-2011)

Principal Investigator: **Toshiki IWASAKI,** Tohoku University <A−0903>

Tohoku University, Meteorological Research Institute, Japan Agency for Marine-Earth Science and Technology, National Institute for Environmental Studies

This research project aims at developing a four Dimensional Data Assimilation (4DDA) system based on the chemical transport models for monitoring minor constituents, such as O_3, CO_2 and aerosols. 4DDA techniques, widely used for weather prediction, make optimal use of observation data for estimating the actual state of the atmosphere.

The project adopts an advanced data assimilation method of Ensemble Kalman Filter, so that complicated diffusive transports and chemical reactions can be easily represented. Through the day-to-day data assimilation, the system enables more accurate environmental monitoring and prediction. Its final goal is to analyze concentrations of O_3, CO_2 and aerosols, and surface fluxes of CO_2 and aerosols.

Quantitative Studies on the Cycles of Some Global Warming Gases and Related Materials through their Isotopomers

(FY2009-2011)

Principal Investigator: **Naohiro YOSHIDA,** Tokyo Institute of Technology <A−0904>

Tokyo Institute of Technology, National Institute for Environmental Studies, Sophia University, Japan Agency for Marine-earth Science and Technology

The aim of our research is to refine scientific understanding concerning global warming to be employed in the IPCC 5th Assessment Report. Researchers in atmospheric observation, isotopomer analysis, isotopic fractionation theory and 3D chemical transport modeling in joint collaboration will apply isotopomer information to reveal the gas cycle linked to global warming with high accuracy and precision.

Comparative Verification of Co-benefit Feature between Mitigation Technologies for Landfill Gas Emission

(FY2010-2012)

Principal Investigator: **Masato YAMADA,** National Institute for Environmental Studies (NIES) <A−1001>

NIES, Fukuoka University

Mitigation and adaptation on the climate change become main scientific target under the Kyoto protocol. Solid Waste Disposal Site (SWDS), which is one of major methane emission source, is also requisite to reduce both impacts on global and local environment. This study will validate several manners of the SWDS management including semi-aerobic that was originated in Japan, and co-benefit of semi-aerobic management on GHG reduction and prevention of aquatic pollution must be disseminated internationally. This study will contribute to show the strong will of Japan to achieve the target of emission reduction and to take an initiative to lead the environmental policy in Asian developing countries.

Mechanism Elucidation and Future Forecast on the Decreasing Trend of Dissolved Oxygen Concentrations in Deep Water of the Japan Sea (FY2010-2012)

Principal Investigator: **Takafumi ARAMAKI,** National Institute for Environmental Studies (NIES) <A−1002>

NIES, Japan Agency for Marine-earth Science and Technology, Kyushu University, Hokkaido University

In the Japan Sea, rising temperatures and decreasing dissolved oxygen concentrations in the deep water have been reported over the last several decades. Using the Japan Sea wide-range expedition, we obtain the spatial and temporal distributions of oxygen and water properties such as temperature and salinity in deep water. We also elucidate relationship between the decreasing trend of oxygen and the deep circulation. Applying these observational results to a model computation, temporal change of dissolved oxygen in deep water over the last several decades is simulated. These results are implemented to the simulation model in order to determine the impact of marine environment by global warming.

Observational Arctic Terrestrial Carbon Dynamics Research and their Modeling for Predicting Global Climate Change (FY2010-2012)

Principal Investigator: **Masao UCHIDA,** National Institute for Environmental Studies (NIES) <A−1003>

NIES, Kitami Institute of Technology, University of Tsukuba, Japan Agency for Marine-Earth Science and Technology

In this study, we conduct model simulation of soil carbon dynamics in permafrost in boreal and Arctic ecosystems based on meteorological and biogeochemical observations. Permafrost thaw and the microbial decomposition of previously frozen organic carbon are considered one of the most likely positive climate feedbacks from terrestrial ecosystems to the atmosphere in a warmer world. We will measure the radiocarbon age of ecosystem respiration in Alaska Taiga and Tundra ecosystems to determine the influence of old carbon loss on ecosystem carbon balance. Our study would provide useful information to predict the climate change in the high latitude soil carbon reservoir.

Estimation of Climate Effect by Global Aerosol Model with 4-Dimensional Data Assimilation (FY2009-2010)

Principal Investigator: **Toshihiko TAKEMURA,** Kyushu University <RF−0901>

Kyushu University

Spatial and temporal distributions of suspended particle matters in the atmosphere, that is aerosols, are derived with high precision 4-dimensional data assimilation method harmonizing a numerical model with observed data.

Effects of Forest Floor Mosses on Growth of Fine Roots and Emissions of Greenhouse Gases in Boreal Forests after Wildfire (FY2009-2010)

Principal Investigator: **Kyotaro NOGUCHI,** Forestry and Forest Products Research Institute (FFPRI) <RF−0902>

FFPRI

This study aims to elucidate effects of forest floor mosses on growth of fine roots and emissions of greenhouse gases in boreal forests along fire chronosequence. This study will contribute to prediction of long-term effects of wildfire on carbon dynamics in boreal forests.

Development of High Accuracy CH_4 and Total Hydro Carbon Flux Monitoring System for a Broad-leaved Deciduous Forest in Japan (FY2009-2010)

Principal Investigator: **Takafumi MIYAMA,** Forestry and Forest Products Research Institute (FFPRI) <RF−0903>

FFPRI

To clarify the effective control techniques of CH_4 flux in the forest, this study aims to develop a newly CH_4 and total hydro carbon flux monitoring system for long-term measurement using the tunable diode laser spectrometer and the micrometeorological method.

Quantifying the Change in Aboveground Carbon Stocks by Forest Management Using Airborne LiDAR and PALSAR (FY2010-2011)

Principal Investigator: **Akira KATO,** Chiba University <RF−1006>

Chiba University

Although 69% of the total area of Japan is forest, local woody biomass has not been utilized effectively. Only recently, the importance of appropriate forest management activities has been recognized as carbon reduction activities as defined by Kyoto Protocol. To quantify the effects of these activities, highly reliable monitoring system is required. Towards this goal, monitoring methods need to be developed using active remote sensing technologies such as airborne LiDAR and PALSAR, which can capture the data without being influenced by weather condition. The future goal of this study is to develop the technique utilizing only PALSAR as a standard method for estimating the amount of carbon stocks.

Refinement of Terrestrial Biosphere Models and its Downscaling Using GOSAT Satellite Data

(FY2010-2011)

Principal Investigator: **Kazuhito ICHII,** Fukushima University <RF−1007>

Fukushima University, Nagoya University, Osaka Prefecture University

Future projection of global environmental changes due to global warming shows large uncertainties. One of the causes is considered as uncertainties in terrestrial carbon cycles. Therefore, its understanding is urgent issue. Goals of this project are (1) significant improvement of terrestrial carbon cycle models using surface CO_2 flux products from GOSAT (Ibuki) satellite, and (2) more reliable estimation of terrestrial carbon cycles at global and regional scales. First, using GOSAT products (Level 4 surface CO_2 flux) as constrains, we will refine multiple terrestrial models. Second, using the refined models, we will estimate regional carbon cycles at higher spatial resolutions.

Studies of Optical Properties of Secondary Organic Aerosols: Impact on Earth's Radiation Balance

(FY2010-2011)

Principal Investigator: **Tomoki NAKAYAMA,** Nagoya University <RF−1008>

Nagoya University

Aerosol particles play an important role in radiation balance in the atmosphere by scattering and absorbing incident light. Although accurate determination of the optical properties of atmospheric aerosols is essential, optical properties for secondary organic aerosol (SOA) have not been studied in detail.

In this study, laboratory and field observation studies on the optical properties of SOAs will be performed. These results will help the detail understandings of contribution of organic aerosols to the Earth's radiation balance and bring accurate prediction of climate change.

Environmental Pollution

Development of VOC Emission Control Technologies Using Advanced Catalyst System Assisted by Special Energy Fields and Promoted Active Oxygen Species

(FY2008-2010)

Principal Investigator: **Atsushi OGATA,** National Institute of Advanced Industrial Science and Technology (AIST) <S2-01>

AIST, Kyushu University

The catalytic combustion method has been considered as one of the best available technologies for the removal of VOC. However, active metal components in the catalysts seem to be restricted to use in the future, because of "restriction of resources" and "environmental risk throughout life cycle in some heavy metals".
On the concept of catalyst system without conventional active metals, we will focus on the development of advanced catalyst system assisted by special energy fields and promoted active oxygen species; (1) the advanced catalyst system assisted by nonthermal plasma and active oxygen species and (2) the microwave-assisted catalytic oxidation system by using perovskite oxides.

Development of Circulatory and Efficient Removal Technology for VOCs in Exhaust Gas without Emitting Carbon Dioxide

(FY2008-2010)

Principal Investigator: **Shigeru TANAKA,** Keio University <S2-02>

Keio University, Japan Gore-Tex Inc., UNITIKA Ltd.

With the aim of reducing the level of Volatile Organic Compounds (VOCs) in the exhaust gas emitted from various fixed sources, we are developing an energy efficient technology that removes and treats the VOCs in exhaust gas cyclically without releasing carbon dioxide, an important factor of global warming.
To put it concretely, we are employing the diffusion scrubber technique, an epoch-making technology for removing and treating the VOCs in exhaust gas by the combined use of a solution to remove the VOCs, parallel plate type of diffusion scrubbers made of porous PTFE membranes and parallel plate type of diffusion scrubbers made of activated carbon fiber sheets. Also, we are developing a technology to recycle and reuse the adsorbents and the solution used to remove the VOCs, and to recover and use the VOCs themselves. The present research and development will make it possible to reduce the level of the VOCs and thus cope with global warming without releasing carbon dioxide into the atmosphere.

Innovative High-rate Biogas Technology of POME (Palm Oil Mill Effluent) Wastewater for CDM Application

(FY2008-2010)

Principal Investigator: **Hideki HARADA,** Tohoku University <S2−03>

Tohoku University, National Institute for Environmental Studies, National Institute of Advanced Industrial Science and Technology, Nagaoka University of Technology

Malaysia and Indonesia are collectively the world largest producers of palm oil, accounting for 86% of world production. Extremely high volume of organic wastewater called POME (Palm Oil Mill Effluent) is generated during crude palm oil production, and a major portion (more than 96%) of POME is presently discharged into the open-pond systems to cause water pollution, bad smell and global warming.

An expert R&D consortium, with Tohoku University, Nagaoka Univ. of Tech., NIES and AIST, is conducting on-site pilot-scale experiment in collaboration with Malaysian national research institute for innovative high-rate biogas technology of POME wastewater treatment for CDM application.

Research and Development of Water-purification and CO_2 Fixation Technology by Bioengineered Tidal Flat Functions

(FY2008-2010)

Principal Investigator: **Kunio KOHATA,** National Institute for Environmental Studies (NIES) <S2−04>

NIES, Chiba Prefectural Fisheries Research Center, Global Environmental Forum

The objective of this research is to clarify seawater in eutrophied semi-enclosed bays by bioengineering methods with the least energy consumption. In this research, we have developed a water-purification method by enhancing the function of tideland as co-benefit technologies, which include the enhancement of bivalve growth rate using waste energy such as warm water generated by industries, and the increase of CO_2 fixation rate of micro-algae using the high pCO_2 medium. Our research showed a perspective of the co-benefit technologies which afforded water purification, CO_2 fixation and food supply simultaneously.

Development of Novel Real-time Detector of Nitro-compounds Using High-sensitivity Spectroscopy

(FY2009-2011)

Principal Investigator: **Hiroyuki YAMADA,** National Traffic Safety and Environment Laboratory (NTSEL) <S2−05>

NTSEL, The University of Tokyo

The objective of this project is to develop a novel device which can measure nitro-compounds in automobile exhaust. The device adopts Cavity Ring Down Spectroscopy (CRDS) and its light source is quantum cascade infra-red laser. The primary target species of nitro-compounds was set to nitro-methane. Its real-time measurement from a vehicle that meets Japanese Exhaust Gas Regulation of 2005 will be performed.

Real-time Monitor of Nitro Organic Compounds from Diesel Vehicle Exhaust Using PTR-TOFMS

(FY2009-2011)

Principal Investigator: **Satoshi INOMATA,** National Institute for Environmental Studies (NIES) <S2−06>

NIES, Hiroshima University

The secondary production of nitro organic compounds at the aftertreatment of the diesel vehicle was recently reported. Such nitro organic compounds are thought to have the potential for adverse health effects in humans. We develop a high mass resolution Proton Transfer Reaction Time-of-Flight Mass Spectrometer (PTR-TOFMS) and then investigate the speciation, quantities, and variation of the nitro organic compounds in the diesel vehicle exhaust by PTR-TOFMS. In addition, we challenge to develop a novel instrument based on mass spectrometry coupled to the laser photoionization for the selective measurement of nitro organic compounds.

Development of Rapid and Low-cost Analytical System of Inorganic Soil Pollutants

(FY2009-2011)

Principal Investigator: **Kohei URANO,** Yokohama National University <S2−07>

Yokohama National University, Institute of Environment and Resource System

We try to develop a rapid and low-cost analytical system for effective research and countermeasures of soil pollution. Adsorption and desorption isotherms and dissolution rate of inorganic pollutants are measured and analyzed for developing rapid test methods. Various packed reagents for photometric analysis are tested, and their application methods for dissolution liquid from soil are developed. A new compact and low-cost Flow Injection Analyzer (FIA) and a distillation unit are developed also. And other present rapid methods are evaluated. Then, we propose rapid and low-cost test and analytical methods of each inorganic pollutant.

Development of Quick and Low-cost Chemical Analytical Method for Toxic Metals in Contaminated Soil

(FY2009-2011)

Principal Investigator: **Katsumi MARUMO,** National Institute of Advanced Industrial Science and Technology (AIST) <S2−08>

AIST, Tokyo Metropolitan Research Institute for Environmental Protection, Railway Technical Research Institute

We will develop a quick and low-cost chemical analytical method for toxic metals (arsenic, lead, cadmium and mercury) in contaminated soils, using a Portable Transmission X-Ray Fluorescence spectrometer (PTXRF). In order to evaluate toxic metal leachabilities from the PTXRF data, we will obtain leaching test data of anthropogenic contaminated soils and contaminated soils caused by natural processes. In conjunction with these leaching test data and the geochemical code PHREEQC, we will attempt to develop a thermo-dynamic simulation program for evaluating leach ability change of toxic metals with time. We will also make soil standard samples for data quality control of PTXRF.

Development of High Capacity Capacitor Using High-energy Density Surface Boundary

(FY2007-2011)

Principal Investigator: **Itaru HONMA,** Tohoku University <B-0702>

Tohoku University, National Institute for Environmental Studies

In order to increase energy storage densities of an electrical double layer capacitor (EDLC), the rational strategy is to increase both of the electrode capacity and the charging potential. This research project will execute the following development plans. (1) Synthesis of nano-carbon materials such as graphenes and development of high capacity technology based on the surface modification chemistry followed by characterization of EDLC properties. (2) Development of high voltage tolerant robust electrolyte materials via solidification of ionic liquids in the inorganic matrix. According to these material innovations, storage energy density of the EDLC can be increased.

Study on Prediction of Acidification and Nitrogen Leaching in East Asia Ecosystems with Catchments Scale Model

(FY2008-2010)

Principal Investigator: **Junko SHINDO,** National Institute for Agro-Environmental Sciences (NIAES) <B-0801>

NIAES, The University of Tokyo, Asia Center for Air Pollution Research

This research aims at the prediction of acidification and nitrogen leaching in tropical ecosystems based on the monitoring of input, circulation and leaching of acidic substances and their models as well as the estimation of changes in emission due to food and bio-energy production. It was shown that the behavior of acidic substances was strongly regulated by the change in the rainy season and the dry season and that ammonia from agriculture were the major nitrogen load, by clarifying the characteristics of material cycle and developing an acidification model and a large area nitrogen circulation model. This study will support EANET monitoring by providing basic data and improved evaluation methods, and will contribute to the air quality and ecosystem management in East Asia.

Study on Transboundary Pollution of POPs in Eastern Asia Region and its Countermeasures

(FY2008-2010)

Principal Investigator: **Masatoshi MORITA,** Ehime University <B-0802>

Ehime University, National Institute for Environmental Studies, United Nations University

The aim of the study is to prevent transboundary pollution by persistent organic pollutants (POPs) from rapidly industrializing East Asian countries. Research project includes development of monitoring method, retrospective analysis for trend analysis, simulation model for understanding transport and fate, and preparation of scenario for pollution reduction in co-operation with scientists from Asian countries and United Nations.

Development of Multi-wavelength High Spectral Resolution Lidar for Next-generation Atmospheric Monitoring Network (FY2008-2010)

Principal Investigator: **Tomoaki NISHIZAWA,** National Institute for Environmental Studies (NIES) <B−0803>

NIES

It is necessary to classify aerosol components and to understand their optical and microphysical properties and their movements in order to evaluate the impact of aerosols on the atmospheric environment and climate. Our objective is to develop a prototype compact multichannel lidar with automatic continuous measurement capability in order to realize a next-generation aerosol-monitoring network that can measure more detailed optical and microphysical properties of aerosols and their movements.

Practical Utilization of Industrial By-products as Materials for Filling up Dredged Hollows -Evaluating Safety of Fill-up toward Establishment of Agreement with Residents- (FY2008-2010)

Principal Investigator: **Takao TOKUOKA,** Nature Restoration Center <B−0804>

Nature Restoration Center, Shimane University, Waseda University

There are many dredged hollows, 10 to 14 meters deep, in brackish Lake Nakaumi. They were formed during the land reclamation by drainage. Total dredged area and total volume of dredged hollows are estimated as 8 million square meters and 30 million cubic meters, respectively. The dissolution of nutritive salts from sludge like sediment in the hollows is causing serious water quality problem in this lake. In order to recover the water quality, one of the promising methods is filling up of those hollows, however, large amount of filling material must be prepared. There are many kinds of nonhazardous industrial by-products that can be used as very effective filling materials.

This study assesses various kinds of industrial by-products as filling up materials. The result will establish a procedure to obtain understanding by local residents. In addition, dynamics of nutritive salt circulation in the hollows, distribution of sludge-like sediment in the lake and filling up method that shows little impact on surrounding water and little re-suspension are discussed. Effects of covering dredged hollows by industrial by-products will be also evaluated.

Research on Elucidation of Organic Pollution Mechanism Considering Biorefractory Organic Matter and its Changes in Production/Degradation (FY2008-2010)

Principal Investigator: **Satoshi ICHISE,** Lake Biwa Environmental Research Institute <B−0805>

Lake Biwa Environmental Research Institute, Ryukoku University, Toray Techno, Inc.

It is very important to elucidate the inner production and organic material flow in Lake Biwa for mechanistic understanding of the fate of organic matters in the lake. In this research the long-term behavior of the plankton community in Lake Biwa is investigated and the biovolume of the planktons is transformed into organic carbon. Characterization of primary productive materials and their biodegradability are also estimated under *in vitro* experiments. Furthermore, bacterial production is experimentally cmsidered to understand the mechanism of biorefractory organic matter production via bacterial activity.

The final goal of this research is to estimate the role of the inner production in organic load to Lake Biwa and to contribute a reasonable lake management planning in the future.

Development of Selective Removal Technique of Environmental Pollutants Using Template Molecule Mimics (FY2008-2012)

Principal Investigator: **Ken HOSOYA,** Tohoku University <B−0806>

Tohoku University, Shimadzu Corporation, Kaneka Corporation

Our goal of this study is practical applications of the previously developed adsorption media having selective adsorption ability for the environmental pollutants. In fact, we have applied the adsorption media for (1) the pretreatment column of on-line column switching liquid chromatographic mass spectrometry systems, and (2) the novel hybrid materials based on the foamed polymer materials for high throughput removal of the environmental pollutants.

Research on Super Flexible Organic Solar Cells Using New Nano-materials (FY2008-2012)

Principal Investigator: **Kenji OMOTE,** Ideal Star, Inc. <B−0807>

Ideal Star, Inc., Shizuoka University, Kanazawa University, Tohoku University, Keio University, Kyushu Sangyo University, Kobayashi Institute of Physical Research

An organic solar fiber expands application fields such as clothes and curtains in domestic use, and many kinds of sheets used in a greenhouse and others in agriculture and solar energy harvesting becomes much familiar in human life. We examined to deposit a photovoltaic active layer and a conductive polymer on a core conductive fiber to fabricate a coaxial solar fiber and demonstrated power generation by the solar fibers with a coaxial structure. The study on solar fiber and textile opens the door of new community directing no fossil fuels and reduction of CO_2 emission.

Improving Kosa Forecasting Model with Assimilated LIDAR Monitoring Network Data and Assessing Human Health/Environmental Effects of Kosa due to Adsorbed Bioaerosols (FY2009-2011)

Principal Investigator: **Masataka NISHIKAWA,** National Institute for Environmental Studies (NIES) <B-0901>

NIES, Meteorological Research Institute, Oita University of Nursing and Health Sciences, Kanazawa University

The kosa, or Asian dust, forecasting models are useful to diminish the various damages due to kosa disaster, therefore people in the eastern Asian countries are expecting improvements in those kosa forecasting model. We are taking the task of the improvement to develop an assimilation method into a forecasting model with real-time data by the NIES-LIDAR network. As social interests regarding health and environmental effects by kosa aerosol attached with biological/chemical substances are increasing, the focused research of bioaerosols onto kosa particles by various gene analyses as well as animal experiments with various kosa samples are accelerating to implementation in our project.

Research on Impacts of Asian Dust on Our Health and Environment (FY2009-2011)

Principal Investigator: **Masao NASU,** Osaka University <B-0902>

Osaka University, Osaka Ohtani University

"Asian Dust" is a transportation of a large amount of soil particles originated in arid regions in China and Mongolia. Even in Japan, more than one million tons of dust particles are estimated to fall on the ground per year. One of the major public concerns on "Asian Dust" is whether Asian Dust particles are harmful to our health or not: "Can they be carrying any pathogenic microbes?", "Do they act as allergens?". We do not have enough scientific evidence. We started to collect Asian Dust particles by a small airplane to avoid contamination of soil particles from the ground. We analyze the collected dust particles from viewpoints of environmental microbiology and toxicology.

Studies on Origin, Long-range Atmospheric Transport and Photochemical Transformation of Organic Aerosols in East Asia and North Pacific (FY2009-2011)

Principal Investigator: **Kimitaka KAWAMURA,** Hokkaido University <B-0903>

Hokkaido University, National Institute for Environmental Studies, University of the Ryukyus

The purpose of this study is to evaluate the influence of long-range atmospheric transport of pollutants from mainland China to the outflow regions in Japan and surroundings by analyzing organic aerosols at molecular levels to better provide the fundamental knowledge for policy makers. In particular, we will determine water-soluble organic compounds such as dicarboxylic acids that are photochemically produced by the oxidation of volatile organic compounds such as toluene emitted from the polluted regions. Further, radiocarbon will be determined in the organic carbon and major organic species such as oxalic acid to evaluate the relative contribution from biogenic and anthropogenic sources.

Source-identification of Polycyclic Aromatic Hydrocarbons (PAHs) in Asian Environments and Evaluation of Long-range Migration of PAHs (FY2009-2011)

Principal Investigator: **Hideshige TAKADA,** Tokyo University of Agriculture and Technology <B-0904>

Tokyo University of Agriculture and Technology, National Institute for Environmental Studies, Keio University, Tokyo University of Pharmacy and Life Sciences, The University of Tokyo

Polycyclic aromatic hydrocarbons (PAHs), one of the unregulated hazardous chemicals, are contained in petroleum products and also derived from various combustion processes. Source-identification facilitates effective regulation on the emission of PAHs to the environments. The present study aims to make quantitative source-identification of PAHs in Asian atmospheric and aquatic environments. This study also reveals the range and magnitude of atmospheric transport of PAHs to Asian environments. This gives scientific basis for international reduction of the emission of PAHs in this region

Study on Potential Threat Caused by Organic Pollutants in Japan Sea Region (FY2009-2011)

Principal Investigator: **Kazuichi HAYAKAWA,** Kanazawa University <B-0905>

Kanazawa University, Hyogo Environmental Advancement Association, Asia Center for Air Pollution Research

The countries surrounding the Japan Sea are rapidly developing industrially and economically, and this area is one of the regions significantly changed in the world. Unfortunately the development is accompanied by pollution and destruction of the environment. It is unclear what corrective measures need to be taken, because little is known about generation and behavior of the pollutants. The goal of this project is to identify the locations of potential threats by clarifying origin and behavior of two markers of organic pollutants in the Japan Sea region: Polycyclic aromatic hydrocarbons (PAHs, compounds that have two or more aromatic rings such as benzo [a] pyrene) and persistent organic pollutants (POPs, compounds that do not decompose easily in the environment and remain for long time such as DDT and dioxin). This project will contribute to understanding the environmental pollution in this region and to developing effective measures on an international scale to prevent the environmental pollution and to conserve resources.

Development of Integrated Environmental Management for Changjiang River Basin to Conserve Sound Environmental Conditions in East China Sea (FY2009-2011)

Principal Investigator: **Kunio KOHATA,** National Institute for Environmental Studies (NIES) <B-0906>

NIES, Fisheries Research Agency, Rissho University, Nagoya University

Recent surveys in East China Sea have found the plankton species which causes serious red tide along the coast of China in central parts of the continental shelf, and indicated the threat to change East China Sea ecosystems. In order to enjoy the continual blessing of East China Sea, we should understand a scientific meaning of this omen precisely to take effective measures for marine environment conservations. This study aims to show realistic measures to reduce the nutrient load flowing into East China Sea from Changjiang delta which accomplishes remarkable economic developments, and to evaluate them with our marine ecosystem model. Such research result is expected to afford scientific knowledge and concrete methodology for Japanese government to promote measures for marine environmental conservations.

Novel Environmental Catalysts for Complete Oxidation of Volatile Organic Compounds at Moderate Temperatures (FY2009-2011)

Principal Investigator: **Nobuhito IMANAKA,** Osaka University <B−0907>

Osaka University

In order to reduce the total amount of Volatile Organic Compounds (VOCs) released from factories, novel VOCs oxidation catalysts, which are applicable to small and medium-sized enterprises, are prepared in this study. Specifically, the Pt/CeO_2-ZrO_2-Bi_2O_3/γ-Al_2O_3 materials originally designed in our laboratory are applied as the oxidation catalysts for ethylene, toluene, acetaldehyde, and formaldehyde eliminations.

Final goals and objectives of this project are preparation and characterization of the novel environmental catalysts, which can convert a larger amount of VOCs at around 150 °C with a smaller amount of precious metals than those of the conventional catalysts.

Research of Effects in Inner Bay Ecosystem by Increased Nutrient Inputs during Rain Events (FY2009-2011)

Principal Investigator: **Takanobu INOUE,** Toyohashi University of Technology <B−0908>

Toyohashi University of Technology, National Research Institute of Fisheries Engineering, Aichi Environmental Research Center, Aichi Prefectural Fisheries Experiment Station

To prevent the occurrence of red tides and hypoxia and to restore the balanced ecosystems in bay, the changes in nutrient loading from river to bay during rain events (when the nutrient inputs increased) are investigated. The effects of increased nutrient inputs during rain events are identified by conducting the detailed survey on the inner part of the Mikawa Bay. Based on these results, the parameter will be determined by constructing the model that can simulate the fluctuation in nutrient loading as well as the occurrence of red tides and hypoxia in the bay. Effective strategies for the management of red tides and hypoxia will be discussed after applying this model to several pollution controls.

Development of High-frequency Monitoring Method for Distributions of Transparency in Waters Using Remote Sensing (FY2009-2011)

Principal Investigator: **Takehiko FUKUSHIMA,** University of Tsukuba <B−0909>

University of Tsukuba

The goal of this study is to develop a method to predict the distributions of transparency in case II waters using satellite images e.g. MERIS, MODIS whose temporal resolutions are 1 to 3 days. The continuous measurement of light attenuation coefficients in several water regions should be evaluated by using them as the field validation data. The distributions of chlorophyll-a, tripton and CDOM should be also predicted in order to propose countermeasures to improve the light conditions in waters. Significance of various water quality indices regarding the light conditions in waters e.g. SD, light attenuation coefficient in each area would be evaluated from the views of measurement, accuracy, meaning, etc.

Establishment of Monitoring System of Seagrass Beds by GIS Database Integrating Field Census Data (FY2009-2011)

Principal Investigator: **Masahiro NAKAOKA,** Hokkaido University <B−0910>

Hokkaido University, National Research Institute of Fisheries and Environment of Inland Sea

This study aims to establish long-term broad-scale monitoring systems of biodiversity and ecosystem functions of major seagrass beds in Japan. To achieve this goal, we will develop a GIS database integrating field census data and remote sensing data. Based on the database, we will analyze interrelationships between environmental factors, biodiversity and ecosystem functions of seagrass beds at three regions (Eastern Hokkaido, Tokyo Bay and Seto Inland Sea) that locate in different climate and environmental conditions.
The results will contribute to plan various environmental policy and subjects such as defining efficient MPA (marine protected area) and evaluating of carbon absorbance in coastal areas.

Development of Brook Renovation Technology Using Molded Zeolite and Aquatic Plants (FY2009-2011)

Principal Investigator: **Yuzuru KIMOCHI,** Center for Environmental Science in Saitama (CESS) <B−0911>

CESS, Waseda University, Mashimo Corp.

Development of brook renovation technology for the purpose of water purification and aquatic life propagation is underway in an actual brook site. Main research themes are: (1) analysis of water purification efficiency and its mechanism especially on nitrogen removal and improvement of the performance, (2) development of maintenance methods that could be handled by people such as NPO, and (3) creation of habitats and breeding places of aquatic life and analysis of the effect of their introduction. It will be expected that this technology is applied to several brooks and streams. Besides, participation of people has great effects on enlightenment and environmental education for renovation of water environment.

Development of Low-cost and Simple All-Inkjet-Printed Water Quality Monitoring Chip Using Nanoparticle-based Chemical Sensing Inks (FY2009-2011)

Principal Investigator: **Daniel CITTERIO,** Keio University <B−0912>

Keio University

The goal of this research project is the fabrication of a globally applicable paper-based water quality monitoring chip (all-printed chemical sensing device) by inkjet printing. For this purpose, printable nanoparticle-based chemical sensing inks are developed, which incorporate all reagents required for sensing. The final chip will allow the low-cost and simple simultaneous monitoring of various analytical parameters in water samples. Analyte concentration dependent color changes induced on the sensing chip are observable by the naked eye, or can be quantified by simple color analysis.

Development of DSi Inflow Load Model in Northeastern Ariake Bay

(FY2010-2012)

Principal Investigator: **Hiroshi KUMAGAI,** Fukuoka Institute of Health and Environmental Sciences <B−1001>

Fukuoka Institute of Health and Environmental Sciences, Fukuoka University

In recent years, there have been abnormal changes caused by phytoplankton blooms in Ariake Bay, for example, laver culture failure, frequent occurrence of red tide and anoxic water generation.

In fact, not only nitrogen and phosphorus but also dissolved silicate (DSi), which is an essential element for diatoms, must be considered when discussing the change in dominant phytoplankton species in Ariake Bay.

However, there are few quantitative discussions on the DSi influence due to the lack of understanding of DSi inflow processes from a watershed.

The aim of this study is to develop a DSi inflow load model for northeastern Ariake Bay in order to estimate the DSi load quantitatively.

Investigation of Environmental Impact of Perfluorinated Compounds (PFCs) and Development of Emission Reduction Method of PFCs

(FY2010-2011)

Principal Investigator: **Akihiro TAKAHASHI,** Tokyo Metropolitan Research Institute for Environmental Protection <B−1002>

Tokyo Metropolitan Research Institute for Environmental Protection, National Institute for Environmental Studies, Lake Biwa Environmental Research Institute, Research Institute of Environment, Agriculture and Fisheries, Osaka Prefectural Government, Osaka Municipal Technical Research Institute, Kobe Municipal Institute of Environment and Public Health, Hyogo Prefectural Institute of Environmental Sciences

Perfluorinated compounds (PFCs) are toxic to wild animals, persistent in the environment, accumulated in biota and move along on the earth. The regulations of PFCs were considered globally and perfluorooctane sulfonate (PFOS) was listed in Annex B of the Stockholm Convention in 2009.

The objectives of this study is to investigate the route of PFCs discharging to the environment and fate in the environment by the detailed fact-finding survey in atmosphere, river water, sea water groundwater and sediment. And this study includes development of the detection methods of PFCs emission sources applied to isomer specific analysis and biological monitoring.

Our result in the PFCs study will provide a fundamental knowledge to formulate an environmental policy and acts for PFCs more effective and promptly.

Development of Monitoring Technique to Assess Impact to Benthic Life by Hypoxia and of Achievement Evaluation Method for Bottom DO Criteria

(FY2010-2012)

Principal Investigator: **Toshihiro HORIGUCHI,** National Institute for Environmental Studies (NIES) <B-1003>

NIES, Aichi Fisheries Research Institute, The Institute of Statistical Mathematics, Hiroshima University, Osaka City University, Yokohama College of Pharmacy

This study aims to standardize the testing methods for water quality criteria of dissolved oxygen (DO) concentrations to conserve marine organisms in coastal waters, to represent candidate values for the criteria of DO concentrations, to show specific divisions of coastal areas to properly assign the criteria of DO concentrations, and to develop the monitoring and statistical techniques to assess achievement of the criteria of DO concentrations. It is expected to contribute to the improvement of water quality, in terms of reduction of mass mortality of marine organisms due to hypoxia and increase of their recruitment through the survival in early life histories, in coastal waters of Japan.

Analysis of Formation Mechanism of Bottom Environment and Development of Sedimentation Control Technology in Shallow Closed Water Area (FY2010-2012)

Principal Investigator: **Osamu NISHIMURA,** Tohoku University <B-1004>

Tohoku University

The purpose of this study is to develop a technology for the sustainable improvement of bottom sediments in shallow closed water area. We evaluate the relationship between flux (wave and flow) and sedimentation or resuspention, and then establish a technology for the improvement of bottom sediments by the control of flux. Thereafter, we examine that the strengthening of flux leads to the decrease in concentration of organic matters in the bottom sediments, which has effects on species and population of the benthos. This technology can contribute to the improvement of the biodiversity in aquatic ecosystems.

Development of Highly Sensitive Dye Nanoparticle-coated Test Strips (DNTS) for On-site Detection of Harmful Inorganic Contaminants (FY2010-2012)

Principal Investigator: **Yukiko TAKAHASHI,** Nagaoka University of Technology <B-1005>

Nagaoka University of Technology, National Institute of Advanced Industrial Science and Technology

Governments throughout the world are continuing to tighten allowable limits of harmful inorganic substances in environmental and industrial water. Instrumental analyses using AAS, ICP, ICP-MS, are extensively performed as standard methods to determine trace level of inorganic chemicals regardless of costly, time-consuming and complicating measurements. This study aims to develop "dye nanoparticle-coated test strips (DNTS)" with indicator dyes for rapid on-site analysis at ppb level. A thin dye nanoparticle layer of DNTS concentrates target ions and then changes its color. DNTS are applicable for day-to-day management of industrial water, monitoring in developing countries, and environmental education.

High Precision Origin/History Analysis of Trans-boundary Particulate Matters Using Innovative Single Particle Structure Analyzer (FY2010-2012)

Principal Investigator: **Masaaki FUJII,** Tokyo Institute of Technology <B−1006>

Tokyo Institute of Technology, National Institute for Environmental Studies, Kogakuin University, Tokyo University of Agriculture and Technology, Osaka Prefecture University

Economic growth in East Asia has led to a rapid increase of pollutant emissions, causing the long range transboundary air pollutions. Therefore, it is urgent to estimate the effects of the particulate matters (PMs).

In this study, we analyze transported PMs using a newly developed Single Particle Structure Analyzer (SPSA) and investigate the distributions of chemical species in the PMs. The SPSA results with the bulk analysis show information of the origin and the transformation processes of PMs.

This study is expected to show the contributions of transboundary PMs to Japan, which helps the air quality control in East Asia.

Study on Chemical-pollutant Transport by Beach Litter and Establishment of Public Education Regimes to Reduce its Environmental Risk (FY2010-2012)

Principal Investigator: **Atsuhiko ISOBE,** Ehime University <B−1007>

Ehime University, National Institute for Land and Infrastructure Management, Kyushu University

We attempt to provide time-series of beach litter quantities on various beaches of Japan by analyzing images of webcams set on those beaches, and to establish a numerical model for drifting objects carried by ocean currents from overseas sources. In addition, our attention is paid to chemical pollutants such as harmful heavy metals and/or POPs carried with plastic litter. One of expected achievements in the present study is "transport maps" of beach litter (hence, litter-carrying chemical pollutants) around the East Asian marginal seas. Our scientific achievements will be shared with the general public through science cafe events to help establish a sustainable regime for beach-litter clearances and surveys.

Research for Measurement, Dynamics, and Control of Long-distance Transboundary Migration of Atmospheric Mercury Using Mountain as Observation Tower

(FY2010-2012)

Principal Investigator: **Osamu NAGAFUCHI,** University of Shiga Prefecture <B-1008>

University of Shiga Prefecture, Toyama Prefectural University, Toyohashi University of Technology, Japan Environmental Sanitation Center

In recent years, the United Nations Environment Programme (UNEP) has called for reductions in mercury discharges to the environment around the world and for reductions health risks. Researches for transboundary movement of mercury, deposition of mercury in polar regions, and atmospheric mercury concentrations in highlands, for example, are considered to be indispensable. However, Japan carries out almost no monitoring of mercury in mountainous and remote areas. In this research, we will develop a simplified sampling method and an analytical method for atmospheric mercury and mercury contained in rainfall. We will apply these in mountainous areas where the effects of advection most readily appear and effective sampling is possible. A multimedia model will be developed based on this detailed observation data, advection and deposition will be analyzed, and forecasts will be developed into impact statements, contributing to global environmental management. The results will offer a scientific basis to establish a mercury discharge reduction treaty by 2013.

Global Distribution and Environmental Fate of Emerging Contaminants, Persistent PPCPs, as New POPs Candidates

(FY2009-2010)

Principal Investigator: **Haruhiko NAKATA,** Kumamoto University <RF-0904>

Kumamoto University, Saga University, National Institute for Environmental Studies, Ehime University

The objectives of this study are to establish analytical methods of persistent pharmaceuticals and personal care products (PPCPs) and brominated contaminants, and to investigate their concentrations, bioaccumulation, temporal trend, and geographical distribution in the marine environment. The results will play an important role to entry persistent PPCPs as new POPs in the Stockholm Convention.

Study on Trans-boundary Air Pollution and Health Effects Induced by Polycyclic Aromatic Compounds Formed via Atmospheric Reactions on Surface of Asian Dust Particles

(FY2009-2010)

Principal Investigator: **Takayuki KAMEDA,** Kanazawa University <RF-0905>

Kanazawa University

The aim of this study is to elucidate atmospheric formation of toxic polycyclic aromatic compounds on the surface of Asian dust particles transported from the Asian Continent to Japan. We also evaluate adverse health effects induced by those compounds.

Dynamics and Nature of Fine to Ultrafine Particles in Atmosphere from East Asia

(FY2009-2010)

Principal Investigator: **Satoshi UTSUNOMIYA,** Kyushu University <RF−0906>

Kyushu University

As the risk of ultrafine particles to human is shown recently, substantial understanding of those particles are becoming more important. The present study demonstrates "multi-scale" analysis of trace toxic metals on ultrafine particles in the East Asia. Our results on the nature of toxic nanoparticles in the atmosphere will provide a fundamental knowledge for the new regulation on PM2.5.

Development of Ink-jet Based Aerosol-generation Device to Calibrate Particle Counter at Sampling Site

(FY2010-2012)

Principal Investigator: **Kenjiro IIDA,** National Institute of Advanced Industrial Science and Technology (AIST) <RF−1001>

AIST

The cooling effects caused by the atmospheric aerosol particles has one of the largest uncertainty in global climate-change-prediction. Accounting for "the aerosol effects" in the climate model partly requires the measured Particle Size Distribution (PSD) of atmospheric aerosol, which is the frequency distribution of the particle number concentration as a function of particle size. The most frequently used device to measure the PSD of the atmospheric aerosol is Optical Particle Counter (OPC), and it is essential to calibrate the particle counting efficiency of the OPC and maintain the credibility of the measured PSD data. In this research we will apply inkjet technology and develop a device that can generate well-controlled particle size distribution in terms of both particle size and particle number concentration. The purpose of using this device is to calibrate OPC routinely at the sampling site. The objective of this research is to introduce a new method to perform a quality control of the measured PSD data and ultimately help reducing the uncertainty of the aerosol effects in global climate-change-prediction.

Identification and Quantification of Bacterial Groups and their Contribution to Nitrogen Removal at Rice Paddy Field

(FY2010-2012)

Principal Investigator: **Akihiko TERADA,** Tokyo University of Agriculture and Technology <RF−1002>

Tokyo University of Agriculture and Technology

A rice paddy field can be used as a site for application of livestock wastewater as fertilizer and its treatment. Forage rice plant, resisting high nitrogen loading, is grown by applying the wastewater and the cropped forage rice is fed to livestock, attaining a sustainable cycle based on a forage rice paddy field. The challenge is water management at the field based on nitrogen mass balance. This study identifies and quantifies unique bacteria responsible for nitrogen removal via pathways without generation of greenhouse gases. The better use of these bacteria at a rice paddy field potentially facilitates effective nitrogen removal from livestock wastewater and reduction of greenhouse gas production.

Health and Ecological Risks

Development of Systematic Assessment of Ecosystem Risk Impact Using Microcosm

(FY2009-2011)

Principal Investigator: **Yuhei INAMORI,** Fukushima University <S2-09>

Fukushima University, Chiba Institute of Technology (Sagami Women's University), Tohoku University, Yokohama National University, Research Institute for Humanity and Nature

This research project was conducted with the aim of creating a risk impact assessment system from the viewpoint of production/respiration (P/R) ratio using a flask microcosm which consists of several species of bacteria (decomposer), three species of phytoplankton (producer), and four species of zooplankton (consumer), as a model for ecosystem function. This P/R ratio method can assess the state of recovery and transfer of an ecosystem by fragmentation, which is not shown by a single species test. This suggests that even when a microcosm receives a structural effect, the functional stability can be maintained by the redundancy of a population or community level.

Research on the Evaluation of Human Impact of Low Frequency Noise from Wind Turbine Generators

(FY2010-2012)

Principal Investigator: **Hideki TACHIBANA,** Chiba Institute of Technology <S2-11>

Chiba Institute of Technology, The University of Tokyo, Institute of Noise Control Engineering, Japan

In Japan, after the commencement of construction of wind turbine generator plants from about 2000, there have been complaints by nearby residents regarding noise pollution. Concerning this kind of noise, however, scientific knowledge is not enough and standard assessment method has not been established, and therefore wind turbine facilities are not yet included in the subjects of environmental impact assessment.

To investigate the influence of the noise generated by wind turbine generators which generally contains dominant low frequency components, physical research by field measurement, social survey on the response of nearby residents, and audibility evaluation experiments on the physiological and psychological effects are being performed in this study over a three-year period. The results of this study will provide basic materials for the formulation of government policy for wind turbine noise problem and for the establishment of the prior evaluation of this type of noise in the environmental impact assessment system.

Studies on Mechanisms by which Environmental Chemicals Affect Developing Nervous System and Immunological System (FY2010-2013)

Principal Investigator: **Shinji FUSHIKI,** Kyoto Prefectural University of Medicine <S2−12>

Kyoto Prefectural University of Medicine, National Institute for Environmental Studies, National Center for Child Health and Development, Oita University of Nursing and Health Sciences

Experimental toxicological research is becoming more important than before as a complement to the epidemiology, considering that the nation-wide epidemiological surveys to study the effects of environmental chemicals on child development being started.

Here focusing on two cardinal bio-systems, i.e., the nervous system and the immunological system, we plan to elucidate the mechanisms how those chemicals perturb brain development and aggravate allergic diseases, by animal experiments.

This project would thus provide not only a scientific evidence on the effects of environmental chemicals on development but also a basis for making the national policy on regulation of those chemicals.

International Collaborative Research to Establish New Gene Mutation Assays to Detect Genotoxicity of Industrial Chemicals Using Gene-disrupted Cells and Medaka Fishes (FY2008-2010)

Principal Investigator: **Shunichi TAKEDA,** Kyoto University <C−0801>

Kyoto University, Keio University

Conventional gene mutation assays, commonly used in developed countries to detect the genotoxicity of industrial chemicals, yield substantial fractions of false-positive and false-negative data. These problems are attributable to the fact that conventional genotoxic tests have used DNA repair proficient wild-type cells (animals), which quickly remove DNA damage caused by mutagenic chemical compounds. We aimed to establish sensitive and reliable screening methods. To this end, we have already generated the gene-disrupted cells and medaka fishes that are not able to quickly remove DNA damage, and will use these biomaterials to establish new gene mutation assays.

Field Survey on Contamination of Aquatic Environment with Retinoic Acid-like Compounds and Assessment of their Potential Risks on Human Health and Aquatic Ecosystem (FY2008-2010)

Principal Investigator: **Michihiko IKE,** Osaka University <C−0802>

Osaka University, Gifu Pharmaceutical University

Retinoic acid (RA)-like compounds, which bind to RA receptor and retinoid X receptor and resultantly can cause various adverse effects such as teratogenic effects on humans and wild animals, are potential risk factors in the aquatic environment. This study aims to widely investigate the current status of RA-like compound contamination in the aquatic environment of Japan, to identify the causative compounds, and to assess the potential risks on human health and aquatic ecosystem for the technological development guideline related to the monitoring and solution of the contamination. This study will make a great contribution to the decrease of risk in water circulation.

Development of Artificial Tissue-Nanodevice Sensor Complex for Versatile Application to Risk Assessment of Health

(FY2008-2012)

Principal Investigator: **Katsumi MOCHITATE,** National Institute for Environmental Studies (NIES) <C−0803>

NIES, Hirosaki University, Tokyo Denki University

For versatile applications to risk assessment artificial tissue-nanodevice sensor (ATNS) complexes have been developed. We have focused on PMP complex for NO molecule, 2DEG-FET GaAs transducer for H_2O_2 molecule, and SAW sensor for the integrity of an epithelial tissue. ATNS complex was further integrated into microfluidics and the condition of the artificial tissue in the microfluidics could be directly monitored through nanodevice sensor. ATNS-microfluidics system is hopeful of contributing to risk assessment of health.

Study on Biomarkers in the effect of Diesel Exhaust Nanoparticles on Brain, Liver, Kidney and Reproductive Organs, and Risk Assessment

(FY2009-2011)

Principal Investigator: **Shoji YAMAMOTO,** National Institute for Environmental Studies (NIES) <C−0901>

NIES, Nagoya University, Tokyo University of Agriculture and Technology

In this study, first, we examine the NOAEL of diesel emission nanoparticles (nanoparticle-rich diesel exhaust: NRDE) on gonadal hormone system (testosterone etc.) and its mechanism of action simultaneously. Then, we develop sensitive biomarkers based on our preliminary experiments that indicate weight variation observed in brain, liver, kidney and reproductive organs and examine the effect and mechanism of NRDE on these organ systems in detail using modern scientific technology. Our results would help get better knowledge for health risk evaluation and environmental standard regulation of particulate matters.

Interventional Study to Reduce Body Burden of POPs in Young Females

(FY2009-2011)

Principal Investigator: **Kunihiko NAKAI,** Tohoku University <C−0902>

Tohoku University, Akita University, Kagawa Nutrition University, Miyagi University, Sendai Shirayuri Woman's College

Perinatal exposure to persistent organic pollutants (POPs) has been shown to cause the defects of child development. The aim of this study is to determine whether the reduction of POPs-contaminated seafood contributes the reduction of POPs level. A randomized controlled intervention trial with 133 young females is designed to examine the potential effects of providing the information on the contamination with POPs in seafood. After the data and samples at baseline were collected, the intervention has started. The data at baseline showed that plasma PCB concentration is positively correlated with fish intake and the n3-PUFAs level in red cell membrane, suggesting that the subjects having much PUFAs are also contaminated with higher level of PCB. Intervention will be continued by providing the information on the POPs contamination in foods, and by conducting nutritional education to the subjects on food safety and risk control through the selection of foods.

Investigation on Risk Assessment for Maternal Dioxin Exposure during Pregnancy on Fetal, Neonatal and Infantile Health and Development

(FY2009-2011)

Principal Investigator: **Kiyomi TSUKIMORI,** Fukuoka Children's Hospital <C−0903>

Fukuoka Children's Hospital, Fukuoka Institute of Health and Environmental Sciences, Kyushu University, University of Occupational and Environmental Health, Juntendo University

We aimed to construct reliable method to analysis fetal and neonatal specimens and to evaluate the risk of dioxin intake in the pregnant woman and influences on fetal growth and development. The knowledge and the problem provided in the whole of analysis method and the investigation procedure will contribute to design and drafting of the investigation technique in an assumed large-scale investigation. In addition to yusho patients, comparison among the normal pregnancy, premature birth, and IUGR fetuses to clarify the influence of dioxin exposure on fetus during pregnancy will be helpful to provide the grounds to an environmental policy about dioxin to study the influence on fetal development.

Study on Relationship between Infant Atopic Dermatitis and Exposure to Environmental Pollutants Including Brominated Flame Retardants (BFRs) during Fetal and Infant Period in Japan

(FY2009-2011)

Principal Investigator: **Chisato MORI,** Chiba University <C−0904>

Chiba University

In this research, newborns are followed to see the correlation between the fetal contamination and the rate of occurrence of allergy. The contamination level of pollutants such as polychlorinated biphenyls (PCBs), some major chlorinated organic pesticides, brominated flame retardant such as polybrominated diphenyl ethers (PBDE), perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), heavy metals (cadmium, lead, mercury) are detected from cord tissues and analyzed. In this research, the correlation between PBDE and allergy will be researched.

Assessment of Environmental Risk for Development of Congenital Anomalies

(FY2009-2011)

Principal Investigator: **Tsutomu OGATA,** National Center for Child Health and Development (NCCHD) <C−0905>

NCCHD, National Institute for Environmental Studies

The objective of this research is the establishment of assessment methods for environmental risks involved in congenital anomalies such as hypospadias (HS). For this purpose, we attempt to identify biomarkers and to establish the banking system of placentas and cord blood. Biomarkers include genetic SNPs/haplotypes and methylation patterns of major genes relevant to the phenotypes. Banking system is made to examine the biomarkers and to measure environmental disruptors. This attempt will permit profiling of genetic biomarkers of the stored tissues, and contribute to compile the list of clinical information and screened tissues that are widely available to Japanese clinicians and scientists.

Elucidation of Novel Toxicity Mechanisms of Dioxins that are not Accompanied with AhR Activation (FY2009-2011)

Principal Investigator: **Chiharu TOHYAMA,** The University of Tokyo <C−0906>

The University of Tokyo

Dioxins are known to have toxicities to reproductive, brain, and immune functions. However, the underlying mechanisms remain to be studied. It can be speculated that the response of dioxin receptor, AhR, in the cytoplasm without exerting transcriptional activation could be a main cause to explain such a variety of toxicities. Thus, we plan to examine this hypothesis by dioxin–induced hydronephrosis in mouse neonates.
The results of the present study may contribute not only to the elucidation of a variety of dioxin toxicities, but also to the further progress of risk assessment of dioxins.

Evaluation of Validity and Predictability of Air Quality Modeling for Urban PM2.5 in Japan (FY2010-2012)

Principal Investigator: **Hiroshi HAYAMI,** Central Research Institute of Electric Power Industry (CRIEPI) <C−1001>

CRIEPI, National Institute for Environmental Studies, Center for Environmental Study in Saitama, Gunma Prefectural Institute of Public Health and Environmental Sciences, Takasaki City University of Economics, Saitama University, Japan Automobile Research Institute, Toyota Central R&D Labs., Inc.

PM2.5 mainly consists of secondary aerosol. To analyze complicated behavior of the secondary aerosol, simulations by air quality models are required. At present, it is difficult to very accurately predict PM2.5 concentrations by air quality models. Thus, this study aims at establishment of air quality models as a utility tool in policy making for PM2.5 control by improving the predictability mainly to secondary aerosol. We plan to carry out field observations of secondary aerosol in Kanto, emission studies for missing substances, and air quality model intercomparison.

New Analysis Method for Internal Mixture State of Diesel-origin Nanoparticle (Contribution to Health-risk Research) (FY2010-2012)

Principal Investigator: **Yuji FUJITANI,** National Institute for Environmental Studies (NIES) <C−1002>

NIES, Kogakuin University, Tokyo Institute of Technology

An atmospheric environmental quality standard of PM2.5 has been established recently in Japan that regulates mass-based concentration of particulate matter. Nanoparticles are included in PM2.5 and diesel-powered vehicles are among the major sources of nanoparticles in the urban atmosphere. Despite minor contribution to PM2.5, nanoparticles have been gaining increased attention due to their toxicity and risks. The information of size-resolved physicochemical properties such as internal mixture of particle including elements and organic components is needed for toxicity assessments of nanoparticles. We will establish an analysis method for above properties of diesel exhaust nanoparticles.

Environmental Risk Minimization Method Based on Lifecycle Risk Assessment and Alternative Assessment for Persistent Organic Pollutant, such as HBCD, in Products

(FY2010-2012)

Principal Investigator: **Shigeki MASUNAGA,** Yokohama National University <C−1003>

Yokohama National University

In order to minimize environmental risk, grasping various aspects of risk caused by the use of a chemical substance and its alternatives (alternative substance and process) throughout their lifecycle is important. Thus, development of comparative evaluation method between alternatives is necessary to identify key life stage of risk reduction and to select optimal alternative.

In this study, case study of comparative lifecycle risk assessment of a brominated flame retardant (such as HBCD) and its alternatives will be carried out, and generalized comparative assessment method will be proposed. The obtained results will be made publicly available such as on the WEB site of Yokohama National University.

Risk Management Strategy for Industry-environmental Systems

(FY2010-2012)

Principal Investigator: **Akihiro TOKAI,** Osaka University <C−1004>

Osaka University

The purpose of this research is to build risk management strategy for industry-environmental systems that attains both convenience for life and preserving environmental quality.

The adaptability of industry-environmental systems is evaluated in terms of risk-proof concept through risk analysis and lifecycle analysis considering the type of uncertainty. Because of its spread and environmental impact, we plan to examine the automobiles as example for this purpose.

Through these analyses, the risk benefit trade-off is clarified. Finally, the product, waste and chemical management policy is integrated and then enables us to find a way to manage and govern the risk of industry-environmental system.

Epidemiological Study on Effects of Chemical Composition of Airborne Particulate Matter and Ozone on Asthma Attacks

(FY2010-2012)

Principal Investigator: **Masayuki SHIMA,** Hyogo College of Medicine <C−1005>

Hyogo College of Medicine, Hyogo Prefectural Institute of Environmental Sciences, NS Environmental Science Consultant Corporation

There remains uncertainty about the health effects of airborne particulate matter (PM) and its composition. In addition, high concentrations of ambient ozone are often observed in spring and summer, and its effect is also a major concern. The purpose of this study is to evaluate the effects of PM composition and ozone on human health.

In Himeji City, the numbers of asthma attacks are reported every week from 46 hospitals and clinics. In this study, the concentrations of PM and ozone will be measured, and the chemical composition of PM will be analyzed. We will evaluate which components are most associated with asthma attacks.

This study will provide a new evidence about the health effects of air pollution.

Investigation into Effect of Environmental Chemicals to Placental Nutrient Transport Activity in Pregnant Women

(FY2010-2012)

Principal Investigator: **Eiji SHIBATA,** University of Occupational and Environmental Health <C−1006>

University of Occupational and Environmental Health

The environmental pollution originates from neighboring countries is a serious problem in Japan. The intravital accumulation of the heavy metals, the dioxins, and the pesticide is thought to be very dangerous. It is necessary to build the appropriate environmental standards for the fetus and child.

Intrauterine growth restriction is a risk factor of the increased perinatal mortality, the developmental impairment, and the future cardiovascular diseases. There is a relationship between the exposure of the environmental chemical to the pregnant women and the intrauterine growth restriction.

The aim of this study is to investigate the relationship between the dysfunctional placental nutrient transport caused by the environmental pollutants and the fetal & childhood diseases.

Molecular Toxicology Study for Risk Assessment of Combined Exposure to Environmental Chemicals

(FY2010-2012)

Principal Investigator: **Jun KANNO,** National Institute of Health Sciences (NIHS) <C−1007>

NIHS, Japan Industrial Safety and Health Association

Exposure to environmental chemicals happens in a combination. However, currently, each chemical is tested separately for risk assessment; toxicity studies monitor symptoms of the experimental animals and a combined exposure of chemicals A and B has to be monitored as if it is a new chemical C.

This fact leads to a problem that the combination to be tested becomes astronomical.

Our experiences on the toxicogenomics studies (designated as "Percellome") suggest that such combinatory effects can be logically predicted from the individual data. This approach should lead to a comprehensive risk assessment of environmental chemicals and contribute to the safety living of the public.

Case-control Study on Epigenetic Alteration of Human Sperm of Environmental Chemical Disrupters

(FY2010-2012)

Principal Investigator: **Takahiro ARIMA,** Tohoku University <C−1008>

Tohoku University, St. Luke Clinic, IDEA Consultants, Inc.

Environmental chemical disrupters may have an influence on the development of human germ cells. In this study, we will apply cutting edge technologies to clarify what effect, if any, chemical substance(s) are on the specific epigenetic modifications associated with genomic imprinting. We will also apply a combination of TOF-MS and the Comprehensive GCxGC method to analyze chemical substance(s). And we will examine the association between epigenetic status of the male sperm and the chemical substance action. The result is expected to contribute to the prevention of diseases in the next generation.

Development of Toxicogenomics Analysis System to Evaluate Actual Combined Toxicities and its On-site Application

(FY2009-2011)

Principal Investigator: **Seiichi UNO,** Kagoshima University <RF−0909>

Kagoshima University, Ehime University

In this study, (1) the new evaluation method for the combined toxicities is established using metabolomics and transcriptomics, and (2) data is constructed and system is established in order to evaluate the effects of pollution in the field with toxicogenomics. This new evaluation quantitates the effects in the organisms. In addition, actual environmental sediments will be evaluated by this evaluation system, and the effect factors obtained at each site in Japan will be compared. Since this evaluation system will be simple and sensitive and will generate much information, this study will strongly contribute to an environment policy.

Development of Monitoring System for Effects of Environmental Stress on Animals

(FY2010-2012)

Principal Investigator: **Takeshi KITANO,** Kumamoto University <RF−1003>

Kumamoto University

Although many chemical substances may possess stress effect for animals, the monitoring systems for assessing such an effect have yet to be developed. In this study, we try to establish a useful system to elucidate the effects of environmental stress on animals using the transgenic medaka strains.

Development of Assessment and Management Technique to Evaluate Environmental Pollution of PPCPs and Surfactants by Whole Effluent Toxicity (WET) Test and Toxicity Identification Using Aquatic/Benthic Organisms

(FY2010-2012)

Principal Investigator: **Hiroshi YAMAMOTO,** University of Tokushima <RF−1004>

University of Tokushima, Center for Environmental Science in Saitama, Kyoto University

Environmental pollution by pharmaceuticals and personal care products (PPCPs) has recently become a public concern. In present study, water and sediment samples are collected and direct effects on fish, daphnia, algae, and chironomid are evaluated using the Whole Effluent Toxicity (WET) test, which has been used in the US and other countries and the Japanese Ministry of Environment started to discuss the possibility of the importation in 2009. Combining the toxicity tests and chemical analyses of PPCPs and surfactants, those with high risk can be identified and quantified. This work contributes the risk assessment and management of PPCPs and surfactants originated from domestic sewage.

Development of High-throughput Screening of Genotoxins Using Genetic Approach

(FY2010-2012)

Principal Investigator: **Kouji HIROTA,** Kyoto University

<RF−1005>

Kyoto University

It is commonly accepted that environmental genotoxins is cause of human carcinogenes. A major challenge in this study is the establishment of sensitive and high-throughput detection method of environmental genotoxin.

In this study, we will detect activity of genotoxin as micronuclei that are derived from DNA lesions induced by the exposure to chemical library. In this assay, we will compare DNA repair mutants and wild type cells as negative control to decrease pseudo-positive. In this study, we will establish novel method to detect genotoxins in sensitive and high-throughput manner by integrating genetic approach into chemical detection.

Protection/Restoration of Nature and Ecosystems

Research on Estimating Population Size of Bears in Japan

(FY2009-2011)

Principal Investigator: **Masaaki YONEDA,** Japan Wildlife Research Center (JWRC) <S2−10>

JWRC, Forestry and Forest Products Research Institute, Hokkaido Research Organization, Research Institute for Environmental Sciences and Public Health of Iwate Prefecture, Iwate University, Yamagata University, Yokohama National University, Waseda University, Wildlife Management Office Inc.

Careful managements of bears (*Ursus arctos* and *U. thibetanus*) are necessary for conservation of threatened local populations, hunting control, and prevention of property damage and other conflict with people. This research aims to provide adequate method for estimating population size of the bears for local governments for their management planning and monitoring. We set up 4 research subjects for the bear population study in Japan; (1) Development of hair trap study, (2) DNA marker analysis, (3) Development of alternative/additional study method, and (4) Population modeling and monitoring.

The Study for Assessment and Control of Ecological Risks Caused by Invasive Alien Parasites

(FY2008-2010)

Principal Investigator: **Koichi GOKA,** National Institute for Environmental Studies (NIES) <D−0801>

NIES, Forestry and Forest Products Research Institute, Mie University, Azabu University, National Institute of Infectious Diseases

In this study we aim to reveal the present status of the accidental invasion of alien species like as ants and chytrid fungus. And we will assess the ecological and health risks of the accidentally introduced species through accumulation of their biological information. We will investigate their invasion route and estimate the process of their expansion of distribution based on not only ecological aspects but also socio-economical aspects. From these results we will devise actual control and quarantine systems. Furthermore we will work in cooperation with the institutes of Asian and Pan-Pacific countries for constructing international-network for control of accidental invasive alien species. Finally this study will provide the scientific bases for reinforcement of law and quarantine systems against the accidental alien species which will increase more and more accompanied with the advance of globalization of economy and global climatic changes.

Conservation Strategy Based on Regional Reef Connectivity and Environmental Load Assessment in SEA-WP Region

(FY2008-2010)

Principal Investigator: **Kazuo NADAOKA,** Tokyo Institute of Technology <D−0802>

Tokyo Institute of Technology, Japan Agency for Marine-Earth Science and Technology, Fisheries Research Agency

The South East Asia and West Pacific (SEA-WP) region is a significant reservoir of the world's richest marine biodiversity, but is deteriorating in its coastal ecosystems due to various environmental threats. For providing a proper conservation strategy, this study aims at clarifying regional reef connectivity in SEA-M/P region and thereby identifying important candidate areas to be properly managed as Marine Protected Areas (MPAs), based on numerical simulations on larval dispersal, molecular biological analysis on meta-population dynamics and others.

Study on Progress of Ocean Acidification and its Effect on Structure and Function of Microbial Community

(FY2008-2010)

Principal Investigator: **Takeo HAMA,** University of Tsukuba <D−0803>

University of Tsukuba, Meteorological Research Institute, Japan Hydrographic Association

Ocean has been absorbing about half of CO_2 emitted to atmosphere by combustion of fossil fuel. The concentration of CO_2 in the ocean is increasing year by year as well as atmospheric CO_2, suggesting that ocean acidification is proceeding steadily. In the present study, we will develop a new analytical instrument to measure the acidity of seawater with high accuracy and build up database on the ocean acidification by combining the numerous data that have been reported so far. The effect of ocean acidification on the structure and function of marine microbial community also will be evaluated. The results of our study will be likely reflected in the environmental policy to reduce the emission of anthropogenic CO_2.

Impact Assessment of Global Warming on the Circulation and Ecosystem of Large Lakes

(FY2008-2010)

Principal Investigator: **Toshi NAGATA,** The University of Tokyo <D−0804>

The University of Tokyo, Tokyo University of Marine Science and Technology, Lake Biwa Environmental Research Institute, The University of Shiga Prefecture, Kyoto University

Lake Biwa, the largest lake in Japan, is known as a hotspot of freshwater biodiversity. Global warming now threatens the lake's ecosystem. Reduced vertical mixing due to warming may reduce the oxygen supply to deeper layers, which in turn may result in the extinction of benthic fauna and deterioration of water quality. The present study is aimed at constructing an ecosystem model of Lake Biwa to improve our ability to predict changes, in coming decades, of ecosystem processes. The obtained results are expected to aid in developing effective measures for adaptation and mitigation.

Landscape Ecological Mapping Using LIDAR Data for Biodiversity Evaluation

(FY2008-2010)

Principal Investigator: **Mamoru KOARAI,** Geospatial Information Authority of Japan (GSI) <D−0805>

GSI, Rakuno Gakuen University, Tottori University

The object of this research is producing landscape ecological maps for estimation of biodiversity using LIDAR data. Basic legend of landscape ecological map consists of the combination of vegetation classification and micro landform classification. Vegetation classification is done using three dimensional vegetation structure detected by the difference between LIDAR DSM in two seasons. As LIDAR data is useful for detection of micro landform under forest area by using last pulse data, automatic landform classification is done using detailed DEM. Study areas are Siretoko Peninsula, Hokkaido Island as a wildness area and Chugoku Mountains as a Satoyama rural area.

Establishment of Methods for Assessing Forest Degradation Caused by Deforestation and Maintenance of Biodiversity

(FY2009-2011)

Principal Investigator: **Ko HARADA,** Ehime University <D−0901>

Ehime University, Osaka City University, Kyoto University, Forestry and Forest Products Research Institute, Kyushu University, Fukuoka Women's University, The Research Institute of Evolutionary Biology

In this study, we are planning to investigate the forest degradation in Southeast Asia, especially on the island of Borneo. We will study the relationship between genetic and ecological deterioration caused by disturbance of forests by recent human activities and establish methods for assessing forest degradation. In order to do this, we will examine the relationship between the reproductive systems of tree species and their genetic vulnerability to disturbances. In a comprehensive survey of soil microorganisms, we are planning to isolate a set of organisms that can be used as indicators of forest degradation. Knowledge obtained in this study may contribute to policy-making decisions on biodiversity issues at international congresses.

Studies on the Conservation Measures of Swamp Forests through Sustainable Use of Ecological Resources by Local Communities

(FY2009-2011)

Principal Investigator: **Takeshi TOMA,** Forestry and Forest Products Research Institute (FFPRI) <D−0902>

FFPRI, Fishery Research Agency, Kyoto University

There are exceptional swamp forests managed by local communities in sustainable ways even under the rapid deforestation in Southeast Asia. The present study aims to provide policy options for sustainable use of ecological resources in swamp forests by learning from the past and on-going forestry projects with community participation. It evaluates the potential and allowable yields of ecological resources in swamp forests as well as their changes over the last half century. It elucidates the incentives and motivation of local communities to conserve swamp forests. It also reveals problems of community forest managements together with possible solutions of them.

Biodiversity Conservation Based on Ubiquitous Genotyping of Critically Endangered Plant Species

(FY2009-2011)

Principal Investigator: **Yuji ISAGI,** Kyoto University <D−0903>

Kyoto University, Tohoku University, Kumamoto University, Hokkaido University

In this research, we aim to obtain general understanding of biological/genetic characteristics of endangered plant species, and establish rational methods to conserve biodiversity based on the genetic analysis for all remnant individuals of critically endangered plant species (15 angiosperms and 5 pteridophytes) and mathematical analysis. The results of this study will directly contribute to the conservation measures of endangered species and the establishment of new approach for biodiversity conservation.

Current Situation of Biodiversity Crisis in the Forest-Alpine Ecotone and its Mechanism under Global Change

(FY2009-2011)

Principal Investigator: **Gaku KUDO,** Hokkaido University <D−0904>

Hokkaido University, Rakuno Gakuen University, Tohoku University, Shinshu University

Mountain region containing many endemic species is a hotspot of biodiversity and most vulnerable ecosystem by global warming. We aim to quantify recent vegetation change, clarify the mechanism, and predict global change impact on mountain ecosystem. We census vegetation change at landscape level, clarify the formation pattern of species diversity, and assess the function maintaining species diversity in mountain ecosystem. We also test the regional variation in genetic diversity of alpine and subalpine plants and its maintenance mechanisms. We try to construct the research protocol for the assessment of global change impact, and present the ecosystem conservation and management policy in the changing world.

Ecophysiology, Phylogeography and Environmental Sociology on Water Blooms of the Globally Distributed Cyanobacterium *Microcystis Aeruginosa*

(FY2009-2011)

Principal Investigator: **Shin-ichi NAKANO,** Kyoto University <D−0905>

Kyoto University, University of Tsukuba, Fukui Prefectural University

Blooms of freshwater cyanobacterium, *Microcystis aeruginosa*, are a serious symptom of eutrophication and have harmful effects on lake ecology and human beings. We aim to elucidate transport, growth and genetic diversity of the cyanobacterium, together with the dynamics of its toxic strains, using large experimental systems and the most sophisticated molecular biological/ecological techniques. We also clarify the relationship between *Microcystis* blooms and human activities conducted around the lakes with the blooms. The present study will contribute the success in the Millennium Development Goals, ODA, demonstrating the raison d'etre of the Japanese Government.

Assessment and Reinforcement of Natural and Social Capital for Biodiversity Restoration in Rice Paddy Ecosystems (FY2009-2011)

Principal Investigator: **Yosihiro NATSUHARA,** Nagoya University <D−0906>

Nagoya University, Kyoto University, Tokushima University, Lake Biwa Museum, Ehime University, Shiga University

Paddy fields are important for biodiversity. Safe, biodiversity-conscious agriculture has ecological benefits such as increasing the population of natural enemies, but the ecological mechanisms vary in different locations. We analyze biological and social data to clarify such local characteristics. Using these findings and experiments, we will develop methods to enhance the biodiversity of rice paddy areas. Simultaneously, we will conduct rural surveys to clarify the conditions that allow biodiversity-conscious agriculture, and offer efficient assistance for local actions. Understanding such communal decision-making systems will contribute to solving global environmental issues.

Investigation on the Risk of Emerging Infectious Diseases for Threatened Birds by Migratory Birds (FY2009-2011)

Principal Investigator: **Takashi KUWANA,** National Institute for Environmental Studies (NIES) <D−0907>

NIES, The University of Tokyo, Core Corporation, University of the Ryukyus

For the prediction of the invasion of West Nile virus (WNV) and the avoidance of it, the infection routes of WNVwill be predicted and the risk for endangered birds are also evaluated by the epidemiological survey. The routes of infection of WNV in snipes and plovers that migrate from Siberia to Australia and New Zealand via Japan will be investigated. Furthermore, fatality rates of each endangered bird species are evaluated by the infection experiments in vitro using established culture system. In conclusion, concentrative sufficient measures against WNV can be taken by the results of the present study.

Development of a Monitoring System for a Mire/Pond Ecosystem Using Sarobetsu Mire and the Wakasakanai Coastal Dune Mire as a Model (FY2009-2011)

Principal Investigator: **Yuko FUJITA,** Hokkaido University <D−0908>

Hokkaido University, National Institute for Rural Engineering, Hokkaido Institute of Environmental Sciences, Hokkaido University of Education, Suiko-Research Co., Ltd., Envision Conservation Office

Freshwater wetlands are readily affected by anthropogenic impact via terrestrial water. We develop a monitoring system to conserve them using the Sarobetsu Mire and Wakasakanai coastal dune mire as model case study areas. We aimed to clarify the developmental processes of the Wakasakanai coastal dune mire including the response of biotic communities to environmental change from the Holocene to present, to understand the current status of biotic communities, to suggest effective indicator species/communities for ecosystem monitoring, to clarify the hydro-environmental aspects, and develop a system that can record the ecosystem changes over the large areas concerned.

Large-scale Estimations of Ecosystem Functions Using Biological Indexes and Development of Eco-informatics (FY2009-2011)

Principal Investigator: **Tsutom HIURA,** Hokkaido University <D−0909>

Hokkaido University, National Institute for Environmental Studies, Gifu University, The University of Tokyo, Yokohama National University

This study aims to specify some biological indicator for revealing spacio-temporal fluctuations of forest ecosystem function. Also it constructs an integrated monitoring system for the forest ecosystem in Japan, by using some networks, Japan Long-Term Ecological Research network, Monitoring site 1000, JapanFlux, and Phenological Eyes Network.

Integrated Study of the Lake Mikata Ecosystem toward the Restoration Using Japanese Eel and Cyprinid Fish as Icon Species (FY2009-2011)

Principal Investigator: **Takehito YOSHIDA,** The University of Tokyo <D−0910>

The University of Tokyo, Fukui Prefectural Government, Fukui Prefectural University

We conduct an integrated, multifaceted study of a lake ecosystem using ecological, humanity and sociological approaches in order to provide a scientific basis for nature restoration. The studied lake is Lake Mikata located in Fukui Prefecture, which harbors distinguished biodiversity. The recent status of biodiversity of this lake, however, has been declining and thus the nature restoration is in demand. We examine what environmental conditions need to be restored primarily in this system. We also test some restoration measures and evaluate the effectiveness.

Evaluation of Growing Abilities of Grassland-type Plants in Various Soil Environments and Development of their Restoring Techniques (FY2010-2012)

Principal Investigator: **Syuntaro HIRADATE,** National Institute for Agro-Environmental Sciences (NIAES) <D−1001>

NIAES

Japanese semi-natural grassland has been maintained by human activities such as cuttings, but its occupancy in Japanese land which was about 20% in the past has now decreased to 2-3%. As a result, many endemic grassland species have been threatened with extinction and listed as endangered species. This study aims to develop techniques to restore the Japanese semi-natural grasslands by conserving and controlling soil environments. These techniques will contribute for restoring and conserving appropriate biodiversity of Japan and help delivering the biodiversity to future generations.

Development of Retrospective Monitoring Techniques for Lake Ecosystems

(FY2010-2012)

Principal Investigator: **Jotaro URABE,** Tohoku University <D−1002>

Tohoku University, Ehime University, Okayama University

Although monitoring data are essential to detect ecosystem changes, few data are available for remote ecosystems like alpine lakes because of difficulties for routine monitoring. In this project, monitoring techniques for detecting changes in lake ecosystems that may have occurred for the past 100 years are developed using biological and chemical information including DNA of plankton remains, specific organic matters indicating biological components and activities, and stable isotope signatures accumulated and preserved in lake sediments. By applying these techniques, we examine recent ecosystem changes in lakes at remote alpine areas and environmental drivers causing these changes.

Development of a Prediction and Decision Support System for Wildlife Management

(FY2010-2012)

Principal Investigator: **Hiroshi SAKATA,** University of Hyogo <D−1003>

University of Hyogo, Research Institute of Environment, Agriculture and Fisheries, Osaka Prefectural Government, Mie Prefecture Agricultural Research Institute, BRAIN Co., Ltd.

To reduce recent serious conflicts with wildlife such as sika deer and wild boar, appropriate operations are necessary. The Specified Wildlife Conservation and Management Plans by prefectural governments are important. We develop the system to support the formulation and implementation of the plans. The system consists of a series of survey and data processing methods to detect the cause of problems and to predict the wildlife populations and damages by them. Software will be developed to apply the methods and to make repots. It is expected to improve wildlife management by prefectural governments.

Development of a Conservation System for Lake Ecosystems by Top-down Effects of Fishes

(FY2010-2012)

Principal Investigator: **Yasuhiro FUJIOKA,** Shiga Prefectural Fishery Experiment Station <D−1004>

Shiga Prefectural Fishery Experiment Station, Fisheries Research Agency, Lake Biwa Museum, The University of Shiga Prefecture

Lake Biwa has an ecosystem with a high biological diversity and its water resources are extensively used by inhabitants of Kyoto, Osaka and Hyogo prefectures, so it's called "Mother Lake". Although recently concentrations of total phosphorus and total nitrogen are decreasing and the quality of water improving, submerged plants and attached algae are showing abnormally high growth causing negative impacts on the activities of local inhabitants around the lake.

In this research project, we aim to develop a conservation system for lake ecosystems based on top-down effects of various fish species.

Experimental Studies for Upgrading REDD Mechanism with Incorporating the Ecosystem Services and Values

(FY2010-2012)

Principal investigator: **Toshinori OKUDA,** Hiroshima University <D−1005>

Hiroshima University, National Institute for Environmental Studies, Kagoshima University, Nihon Fukushi University, Kyoei University, The University of Tokyo, Sophia University, Iwate University

The main objective of the present study is to build up the pilot plan in preventing the forest degradation in South-East Asia tropics. First, we establish the base line of forest degradation. Second, we evaluate the reduction capacity of forest degradation by the practice of ecosystem approach, namely by the reduction of GHG emission, introducing suitable habitat for wildlife, development of incentives by local communities for REDD (Reducing Emissions from Deforestation and forest degradation in Developing countries), and improvement of land-use zoning policies. Third, we assess legitimacy of the new REDD scheme under local rules and international enactments. This study will contribute to global environmental policies and measures as a good practice of REDD schemes.

Maximizing the Co-benefits of REDD in the Biodiversity Conservation of Tropical Rain Forests

(FY2010-2012)

Principal Investigator: **Kanehiro KITAYAMA,** Kyoto University <D−1006>

Kyoto University, Forestry and Forest Products Research Institute

Reducing Emissions from Deforestation and forest degradation in Developing countries (REDD) has been proposed as a post Kyoto mechanism in the United Nations Framework Convention on Climate Change. REDD can reduce net carbon emissions by avoiding the deterioration of forests, which will in turn work to protect the biodiversity in the forests (co-benefits for biodiversity conservation). This research aims at maximizing the co-benefits for the biodiversity conservation in tropical rain forests through (1) developing methods to evaluate forest degradation using a satellite-borne LIDAR, and (2) developing rapid methods to evaluate biodiversity on a landscape level. This research will contribute to synergizing emission reduction and biodiversity conservation.

Sustainable Conservation Management of Isolated Primate Populations in Areas of Human Habitation

(FY2010-2012)

Principal Investigator: **Takeshi FURUICHI,** Kyoto University <D−1007>

Kyoto University

All non-human primates inhabit low- and medium-altitude areas where humans also live in a high density. Therefore, primates are obliged to coexist with humans, and are being endangered by various human activities including cultivation and deforestation.

Many of these primates exist in isolated populations, and are at risk of extinction due to genetic deterioration. Therefore we need to carry out ecological and genetic studies to find an appropriate minimal populations size to be conserved. Furthermore, such isolated populations are being threatened by human-animal transmission of diseases, outbreaks of which frequently kill a large proportion of the population. Therefore we are in an urgent need to establish systems for monitoring and controlling of disease transmission.

We will use the outcomes of these studies for the conservation planning for various endangered primate populations, which may contribute to the ultimate purpose to conserve sustainable populations of many primate species in the world after 20 years.

Development of Biodiversity Index and Evaluation Method for Biodiversity Change Based on Biodiversity Informatics

(FY2010-2012)

Principal Investigator: **Motomi ITO,** The University of Tokyo < D−1008>

The University of Tokyo, National Institute for Environmental Studies, Forestry and Forest Products Research Institute, National Institute for Agro-Environmental Sciences, Kyushu University, Yokohama National University

Convention of Biological Diversity adopted 2010 target for achieving significant reduction of the rate of biodiversity loss. Because accumulation of biodiversity information is insufficient in Japan and methods for estimating rates of biodiversity loss has not establish, it is still difficult to make scientific evaluation of present status of biodiversity.

In this study, we accumulate and integrate biodiversity information of different spatial scales. Then, we establish the method for evaluating biodiversity status with high accuracy based on it.

The outcome of this study can be useful for evaluation of the target of the Convention, and also used for decision making of biodiversity policy.

Evaluation of Economic Values of Ecosystem Services of Seagrass Bed Based on Fish Production: Looking for an Area of the Highest Production in Japan

(FY2009-2010)

Principal Investigator: **Jun SHOJI,** Hiroshima University <RF−0907>

Hiroshima University, Fisheries Research Agency

Biological and physical surveys are conducted in seagrass beds in order to estimate fish production and to detect environmental determinants on the production.

The goal of this project is to evaluate spatial variability of the production and to predict its fluctuation due to the global warming.

A Study on the Specific Concentration of Mercury in the Liver of Javan Mongoose Inhabiting the Nansei Islands, Japan

(FY2009-2010)

Principal Investigator: **Izumi WATANABE,** Tokyo University of Agriculture and Technology <RF-0908>

Tokyo University of Agriculture and Technology, University of the Ryukyus, Kagoshima University

Javan mongoose is an invasive alien species of Nansei Islands where keep rare ecosystems in Japan. Therefore, extirpation of this species is required. We found out that Javan mongoose accumulates mercury with high level. This fact suggests the possibilities to elucidate the details mercury concentration mechanisms using organs and tissues of this animal. This study aims to make clear this phenomenon using cell level approaches and ecological approaches using dynamics through food webs. One of the prospective achievements is to find a new index for understanding the potential of mercury toxicities of wildlife. In addition, effective recommendation for conservation of rare animal is expected.

Study on Genetic Disturbance of Freshwater Fish Species: Genetic Invasions to Native Population by Non-native Population and Predicting the Invasions

(FY2009-2011)

Principal Investigator: **Norio ONIKURA,** Kyushu University <RF-0910>

Kyushu University, Gifu University

In Japan, genetic disturbance by nonnative population have attracted attention as negative effects to native fish population in these days. It needs the development of monitoring methods on genetic invasions. The purpose of this project is to develop the monitoring methods on genetic disturbance of native population by nonnative population. We determine the fish species which affect the genetic invasions, quantify the degree of its genetic disturbance, and build up the databases of the ichthyolofauna and landscape information in Kyushu Island. On the basis of the data, we make the models for predicting the genetic invasions by nonnative population.

Evaluation of Impact from Human Activities on Coral Reef Environments Based on Coral Skeleton

(FY2010-2011)

Principal Investigator: **Mayuri INOUE,** The University of Tokyo <RF-1009>

The University of Tokyo, University of the Ryukyus

Coral reefs are quite common in the tropical shallow oceans and are characterized by richness in biological diversity. They are, however, being greatly stressed by human activities. While it has been studied about impacts of such human activities on coral reefs, little has been studied on coral skeletons.

In order to evaluate the impact of human activities on coral skeletons, polyp skeletons, which are the first skeletal growth stage of corals, are reared under the controlled environments. As polyp skeletons are thought to be sensitive to environmental changes, a method evaluating human impacts quantitatively on coral reefs would be established based on culturing experiments. This study could be a model study for investigating another impact by new environmental stress in near future.

Evaluation of Hybridization Risk and Carbon Fixation Ability in Fragmented Tropical Forests

(FY2010-2011)

Principal Investigator: **Tomoaki ICHIE,** Kochi University <RF−1010>

Kochi University, Osaka City University, Forestry and Forest Products Research Institute

In the tropical forest of Southeast Asia, the ecosystem services are threatened due to forest degradation and fragmentation. Furthermore, we have recently found that Dipterocarpaceae, a dominant family in this area, made an interspecific hybridization in fragmented forests in Singapore. Since hybrids usually show poor growth and environmental adaptability, increasing hybridization may cause the species extinction and forest degradation.

In this project, we will assess the impact of hybridization within Dipterocarpaceae on forest dynamics and carbon fixation. The outcome will contribute directly to drawing out guidelines for forest conservation policy in the area.

Development of Teak Provenancing System in Southeast Asia in Support of Legal Logging

(FY2010-2011)

Principal Investigator: **Akira KAGAWA,** Forestry and Forest Products Research Institute (FFPRI) <RF−1011>

FFPRI

In this project, teak provenancing system over Southeast Asia will be developed. Necessary condition for such provenancing system is high precision of the provenancing results. If successful, then this system may be used for detecting timber with falsely labeled origin at customs.

Global Biodiversity Observation and Assessment Contributing to the Achievement of Post-2010 Targets

(FY2010)

Principal Investigator: **Tetsukazu YAHARA,** Kyushu University <RF−1013>

Kyushu University, Tohoku University, Kyoto University

In 2010, CBD COP10 will be held in Nagoya where the parties will review achievements toward the "2010 Biodiversity Target" and adopt a new strategic plan including "Post-2010 targets". In this context, GEO BON was launched to coordinate efforts for global biodiversity observations. Collaborating with the international activities of CBD and GEO, the project applicants, organizing national and regional biodiversity observation networks (J-BON and AP-BON), will identify scientific challenges required for promoting global biodiversity observations/assessments, and develop a series of strategic research plans on quantifying and predicting biodiversity loss.

Research on Sustainable Society/Policy

Strategic Policy Scenario Design for Sustainable Urban and Industrial System Based on the Integrated Environmental Flux Assessment for Water, Resource and Energy Circulation

(FY2007-2010)

Principal Investigator: **Tsuyoshi FUJITA,** National Institute for Environmental Studies (NIES) <E−0701>

NIES, Toyo University, Keio University, Institute for Global Environmental Strategies

The concentration of human activities in urban regions intensifies local competition for all types of resources such as food, energy and natural resources with water, particularly in Asian cities and regions. Under the natural process of global water cycle and human interferences such as mining of natural resources and land reclamation, environment problems in these areas have become causes for social concern.

After establishing the international research network among Asian and Japanese cities, Liaoning province and Shenyang City, a heavy industrial base in northeast China, are chosen as focal demonstration research projects among Chinese and Japanese research stakeholders. Sustainable water resource management both in Dalian Region and Shenyang Region with five millions populations is contemplated, and sustainable solid waste management with circular perspectives are investigated.

Urban and regional simulation systems for circular technologies and policies are developed both in Japanese demonstration city, Kawasaki, and Asian city, Shenyang. GIS environmental data base has been developed through the international collaboration among municipalities and business enterprises as well as researchers. Regional analytical models such as NICE-Urban for water circulation and resource circulation simulation model for material recycle policies are developed.

Among research findings, the simulation results showed that more benefits could be realized by introducing multiple technologies with appropriate policies. The potential environmental gains of a given set of technologies are dependent not only on the technologies themselves but also on the local conditions such as energy structure and the carbon intensity of electricity. The development of clean energy, as well as the promotion of recycling programs, would contribute to additional GHG emission reduction.

The simulation on technologies has shown the maximum potentials of different management options as scientific reference for planning and policy making.

Developing Integrated Methods for the Evaluation of Forest Ecosystem Services in order to Contribute to "Satoyama Initiatives"

(FY2008-2010)

Principal Investigator: **Ken SUGIMURA,** Forestry and Forest Products Research Institute (FFPRI) <E−0801>

FFPRI, Nagasaki University, Kobe University

Various ecosystem services, such as provision of food and other resources, pest control, pollination, scenic beauty, have been rapidly degraded along with the decline of biodiversity. We study methodologies to evaluate forest landscapes quantitatively in terms of potential and present status of these services, and anthropogenic effects on these services.

Then, we develop integrated evaluation methods in terms of economic scale and attempt to find appropriate management options for the sustainable effective utilization of these services. We have revealed a great variety in the quality and quantity of these services among different regions, forest types and human effects.

Biofuel Use Strategies for Sustainable Development

(FY2008-2010)

Principal Investigator: **Kazuhiko TAKEUCHI,** The University of Tokyo <E−0802>

The University of Tokyo, Osaka University, National Agricultural Research Center, United Nations University, Institute for Global Environmental Strategies

Although increased use of biofuels is expected to have advantageous effects such as CO_2 emissions reduction, it becomes the target of criticism because it has some adverse impacts on environment as well as food supply. Therefore comprehensive analyses and assessments are required to achieve sustainable societies by means of appropriate use of biofuels. The principal goal of the research is to analyze problems and propose national, regional, and global strategies including policy options for biofuel use, with the focus on the Asia-Pacific region, through the approach of Sustainability Science. The preliminary research results show that current US biofuels policy has negative effects such as soaring price of grain. This interdisciplinary research is expected to contribute to international forums in considering sound use of biofuels.

Scenarios and Policies Proposal for Energy Saving in Residential/Non-Residential Buildings toward Creating a Low-Carbon Society

(FY2008-2010)

Principal Investigator: **Shuzo MURAKAMI,** Building Research Institute <E−0803>

Building Research Institute, Tokyo University of Science, Yokohama National University, Tohoku University, Keio University, Akita Prefectual University

There have been many studies for reducing energy consumption of residential and commercial buildings. However, the trend of energy consumption is still increasing. The objective of this study is to find the ways for drastic reduction of energy consumption in residential and non-residential buildings from a middle-to long-term perspective. As a research tool, the forecasting model for energy consumption in the overall Japanese residential and non-residential buildings is developed. The datasets for the model are also organized based on the updated information. In addition, the investigations about energy consumption in Japanese various places are carried out to predict the future energy consumption with high accuracy.

Eco Design of Low Carbon Society Based on Regional Partnership between Urban and Rural Areas

(FY2008-2010)

Principal Investigator: **Yasushi UMEDA,** Osaka University <E−0804>

Osaka University, Hokkaido University, Ritsumeikan University

This study indicates paths toward regional low carbonization by conceptualizing systematic "urban-rural partnership" that creates regional circulation of energy and resources (e.g., biomass). By investigating and planning various pilot models in Japan and China, this study proposes three models; namely, technological innovation and development of low carbon industry in rural areas (sector conjunction model), design of circulation of energy and resources through urban rural coalition (spatial conjunction model), and political proposal for deploying technology and knowledge in Japan to low carbon pilot projects in China (international co-benefit model). These models and proposal of multi-beneficial scenarios, which realize low carbonization, pollution prevention, and social development on the basis of the urban-rural partnership, will contribute to the environmental policies of Japan toward construction of the low carbon society.

Research on Socio-Technology System Planning for Biomass Utilization

(FY2008-2010)

Principal Investigator: **Yuji NAKA,** Tokyo Institute of Technology <E−0805>

Tokyo Institute of Technology, Aomori Prefectural Industrial Technology Research Center, Hirosaki University

The process for promoting biomass utilization is a wicked policy problem that needs to rely on a collaborative strategies between various disciplines i.e., social, cultural and technological, etc. In this research, we are trying to build a Technological Information Infrastructure (TII) that will help the development of new socio-technology system. This socio-technology system will be used in building plans for various biomass utilization processes and provide different products based on the TII. The socio-technology system will enable policy makers to make robust decisions through investigating the different life cycles of various biomass utilization processes from resource collection to final disposal from various stakeholders' view-points such as the environmental and economical impacts of Aomori Prefecture. Therefore, a large number of conversion processes and transportation Unit Processes are included in the socio-technology system to cover possible utilization configurations for a single or multiple inputs.

Study on the Strategic Urban Planning and Assessment of Low-Carbon Cities

(FY2008-2010)

Principal Investigator: **Hidefumi IMURA,** Nagoya University <E−0806>

Nagoya University, National Institute for Environmental Studies

There is an enormous and urgent challenge to deal with the climate change crisis. The key to tackling this challenge is in Asian cities, which have been recently experiencing rapid urbanization. Taking into account the substantial period of time and costs to restructure a once-built city of low efficiency and importance of assessing overall efficiency of the whole urban systems, this study aims to develop methods to analyze impacts of policies and measures for a low carbon city and applies them to actual cities in Japan and Asia.

Assessment and Verification of CO_2 Emissions Reduction by Introducing Environmental Policies into Infrastructure Development

(FY2008-2010)

Principal Investigator: **Takafumi NOGUCHI,** The University of Tokyo

<E−0807>

The University of Tokyo, Tokyo University of Science, Kagawa University, Hiroshima University, The National Institute for Land and Infrastructure Management

The CO_2 emission from construction industry, which has regional characteristics, is estimated over 10% of the domestic total. Political strategies considering those characteristics are required to reduce CO_2 emission in construction industry. This research project is aiming at developing a system which can accurately simulate activities of construction industry and estimate environmental impact. The efficiency of political strategies is evaluated using the simulation system, and the optimum strategies for each region will be finally proposed.

Research on Simulation towards the Low Carbon Model City

(FY2008-2010)

Principal Investigator: **Ben NAKAMURA,** Architectural Institute of Japan

<E−0808>

Architectural Institute of Japan, The University of Tokyo, Nihon University, Tokyo Institute of Technology

This research project aims at realizing appropriate urban environments for an era of reduced CO_2 emissions and shrinking population by creating distinctive and concrete spatial images and a road map for the year 2050. Five characteristic cities are selected as the Low Carbon Model City. Two of five representative municipalities were selected for simulation as Model Cities for a low carbon society. Detailed studies of CO_2 emissions and potential reduction methods are conducted with citizen participation. A collation of the respective results is expected to make available green technologies that can be adapted by other municipalities, and to set new trends in societal goals and urban development policies in Japan.

A Study on Climate Change Policy Options Scenarios in China and International Comparison

(FY2008-2010)

Principal Investigator: **Yutaka TONOOKA,** Saitama University

<E−0809>

Saitama University, The University of Kitakyushu, Tohoku University

In this study, we analyze climate change options and policies in China from a wide interdisciplinary viewpoint based on the detailed data analysis on energy matrix by province and emission models of greenhouse gases, precursors and several air pollutants including Black Carbons. Examination of emissions scenarios toward the world in 2030 is based on such information as regional population, socioeconomic state, technologies, social capitals, transportation and logistics, international relations, human dimensions in urban and rural areas. Regional relations between coastal and inland areas, and urban and rural areas are also analyzed in this study. Climate change policies are evaluated with co-benefit elements, including air pollution control, productivity of resources and so on.

Study on Major Countries' Decision Making Concerning International Negotiation on Future Institution on Climate Change beyond 2012 (FY2009-2011)

Principal Investigator: **Yasuko KAMEYAMA,** National Institute for Environmental Studies (NIES) <E−0901>

NIES, Ryukoku University, The University of Tokyo, Sophia University, University of Hyogo, Tokyo Institute of Technology, Institute for Global Environmental Strategies, Seinan Gakuin University, Hokkaido University, Waseda University

A new round of negotiation has started since 2008 to achieve an agreement on international institution for beyond 2012, which was to be agreed by COP15 in December 2009. The negotiation has been extended for another year. The objective of this study is to analyze domestic decision making concerning climate change negotiation in the U.S., the EU, emerging economies such as China and India, and Russia, and to see how various domestic policies and politics affect countries' positions on climate change at international negotiation.

Ecosystem Services Assessment of *Satoyama*, *Satochi*, and *Satoumi* to Identify New Commons for Nature-harmonious Society (FY2009-2011)

Principal Investigator: **Masataka WATANABE,** United Nations University (UNU) <E−0902>

UNU, National Institute for Environmental Studies, Yokohama National University, The University of Tokyo, Research Institute for Humanity and Nature

The study aims to assess the drivers of changes in the ecosystem services from *satoyama*, *satochi*, and *satoumi* in Japan, and their impacts on human well-being by applying the MA framework and to demonstrate how much degree of human interventions should optimize ecosystem services without losing biodiversity. It will develop national scenarios by qualitatively typifying local societies and analyzing key quantitative data to define a role of *satoyama*, *satochi*, and *satoumi* as a new common so as to propose policy options towards the ideal society. The results are expected to contribute to building sustainable society in Japan and beyond by integrating low-carbon, recycling, and nature-harmonious societies.

Autonomous Energy Management System Enabling the Maximum Penetration of Renewable Energy (FY2009-2010)

Principal Investigator: **Kazuhiko OGIMOTO,** The University of Tokyo <E−0903>

The University of Tokyo, National Institute of Advanced Industrial Science and Technology

The target of the research project is to develop the autonomous energy management technology which maintains and enhances the quality of energy service in household and commercial building sector and to realize the large penetration of renewable energy such as Photovoltaics into the power system. With the boundary conditions of energy service level and renewable energy generation based on the weather forecast, the distributed energy management system autonomously controls the appliances, distributed generations, and energy storages in a cooperative way with the central energy management system. This control of the demand side, taking a part of the power system operation which has been exclusively done by the supply system, is expected to contribute to the maximum penetration of renewable generation penetration and enhancement of power system quality, resulting in the resolution of energy and environmental issues.

Carbon Dioxide Reduction by Diffusing Low Carbon Vehicles

(FY2009-2010)

Principal Investigator: **Yoshinori KONDO,** National Institute for Environmental Studies (NIES) <E−0904>

NIES, National Institute of Advanced Industrial Science and Technology

This study focuses on low carbon vehicles and their infrastructures that highly contribute to realization of low carbon society in transport sector and also estimates their carbon dioxide reduction potential. Firstly, as a short-term reduction target, vehicles currently being sold are examined to clarify factors causing difference between actual fuel economy and catalog value. Next, the CO2 reduction potential of electric vehicles including Plug-in vehicles (whose batteries can be charged from grid electricity) is estimated based on both their vehicle specification and the driving activity data collected by on-board trip loggers for about one year or more. As a short-mid term target, feasible and realistic ways and problems to be solved for providing charge equipments and facilities required for electric vehicle penetration are discussed by resident status. As one of mid-1ong term counter-measures, we aim at establishing next generation transport system by replacing the conventional vehicles with the combination of personal means of transport and mass transit. Taking technological progress into account, we evaluate and propose the possible ways to establish the system according to regional characteristics from various aspects such as CO_2 reduction effect, resource consumption and cost.

Construction of Sustainable-regional Society Model Based on Agricultural Biofuel Production

(FY2009-2011)

Principal Investigator: **Yasuroh KURUSU,** Ibaraki University <E−0905>

Ibaraki University

Sweet sorghum has an advantage for its wide adaptability for cultivation area, rapid growth, and bio-fuel productivity. Besides, it does not compete with food production and food economy. In this study, we develop processes including cultivation in abandonment of farmland and using residual substance after harvest. The purpose is to construct a model of bio-fuel production and use contributing to the sustainability and self-subsistence of regional society. Evaluation of environmental influence and effectiveness is also focused on under analyzing land uses of Japan. For bio-fuel production, sweet sorghum has an advantage for its wide adaptable cultivation area, while growing area of sugar cane is only limited in tropical and subtropical area. Moreover, the model of regional sustainable bio-fuel society is expected for leading production, circulation, and society formation.

Research on Low-Carbon Development in Cities in Asian Developing Countries through International Intercity Partnership

(FY2009-2011)

Principal Investigator: **Hisakazu KATO,** Institute for Global Environmental Strategies (IGES) <E−0906>

IGES, Kyushu University, Hosei University

This study explores the types of policy tools which would effectively promote low-carbon behavior among households and small and medium enterprises, particularly the commercial, household, transport and waste management sector of cities in Asian developing countries. It provides an overview of the low-carbon policies adopted by Japanese municipalities and examines the possibility of an international intercity partnership for Japanese cities. It is proposed that an international institution for intercity partnership among Japanese local governments and cities in Asian developing countries be established to promote local initiatives towards low-carbon development in cities at different stages of development.

Co-benefit Study on Development of GHG Mitigation Technologies toward Asian Low-Carbon Society

(FY2010-2012)

Principal Investigator: **Yohji UCHIYAMA,** University of Tsukuba <E−1001>

University of Tsukuba, National Institute of Advanced Industrial Science and Technology

In order to achieve the reduction target on GHG emission in Japan, the Japanese government is obliged to acquire CO_2 credit including Clean Development Mechanism projects in developing countries. There is high potential to reduce global GHG emission with the spread of Japanese superior environment technologies, especially in Asian countries. In the study we aim to develop a bottom-up approach method to comprehensively analyze GHG mitigation technologies which are expected to be installed as various energy supply systems and energy conservation technologies in Asian countries. In addition, we clarify an economy including co-benefit effect of various energy technology options in each divided region. The results of the study are expected to contribute policy judgment evaluating technology transfer and widespreading of Japanese superior environment technologies, as well as to support technology selection for development and deployment of environment technology in Asian countries.

Incentive of Local Community for REDD and Semi-domestication of Non-timber Forest Products

(FY2010-2012)

Principal Investigator: **Shigeo KOBAYASHI,** Kyoto University <E−1002>

Kyoto University, National Museum for Ethnology, Kochi University

The local community incentive to utilization of forest ecological resources is essential for REDD (Reducing Emissions from Deforestation and forest degradation in Developing countries) proposed on COP13. Therefore we'll clarify these local community incentives to REDD by understanding of present utilization of forest ecological resources at logged-over forests, secondary forests and fallows. We'll also carry out the research on sustainable management of forest ecological resources by semi-domestication of forest resources with local community participation and evaluation of carbon credits during process of reforestation. Local community receive the incentives from semi-domestication of forest ecological resources which will function REDD effectively and contribute global environmental policy.

Urban Infrastructure and Institutions to Realize Low Carbon Transportation Systems Focusing on Promotion of Electric Vehicle Usage (FY2010-2012)

Principal Investigator: **Takayuki MORIKAWA,** Nagoya University <E−1003>

Nagoya University, Nikken Sekkei Research Institute

In order to achieve the low carbon society in transportation sector, promotion of EV (Electric Vehicle) usage and TDM (Transportation Demand Management) are said to be effective. This research aims to propose package policies consisting of both institutional and economic measures for greater low carbon mode usage. They include taxation, road user charge such as congestion pricing and PDS (Parking Deposit System, an alternative road pricing scheme proposed by this research team), car sharing, and strategic placement of EV charging stations. The scheme of institutional rearrangements and public involvement to realize the policies are also investigated.

An Investigation of Transport Policies to Induce the Behavioral Modification toward the Reduction of Carbon Dioxide Emission Considering Economic and Social Sustainability (FY2010-2011)

Principal Investigator: **Shinya KURAUCHI,** Ehime University <RF−1012>

Ehime University, Nagoya University, The University of Tokyo

This research aims to investigate the impacts of economic incentives such as carbon tax and fare reduction on travel demand to reduce the carbon dioxide emission caused by transport sector. In order to explore the efficient policies, laboratory experiment will be firstly conducted to investigate the traveler's cognitive processes toward the various types of incentives, and then we evaluate their impacts on travel demand in the metropolitan area using the data collected by the social experiment. Finally, we propose the policy scenarios for the several cities in Japan considering the cost-effectiveness and social acceptability as well as the environmental sustainability.

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Change by Japan.

CHALLENGE 25

Life in harmony, into the future
COP10/MOP5 AICHI-NAGOYA, JAPAN 2010

This pamphlet provides a summary of the research projects conducted under the Environment Research and Technology Development Fund, as well as its system, research areas and basic structure. We, at the Ministry of the Environment, hope this pamphlet will provide useful information for people interested in environmental issues and that it will encourage further activities for environmental protection and conservation.

ENVIRONMENT RESEARCH & TECHNOLOGY DEVELOPMENT FUND

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