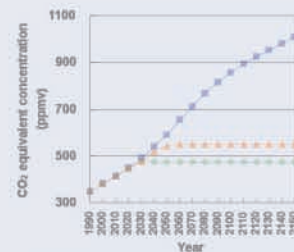
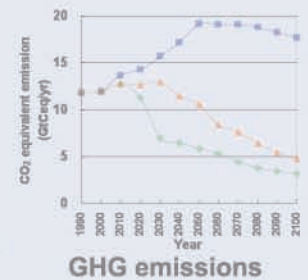
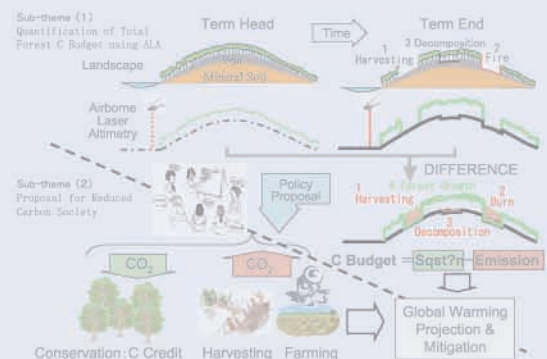
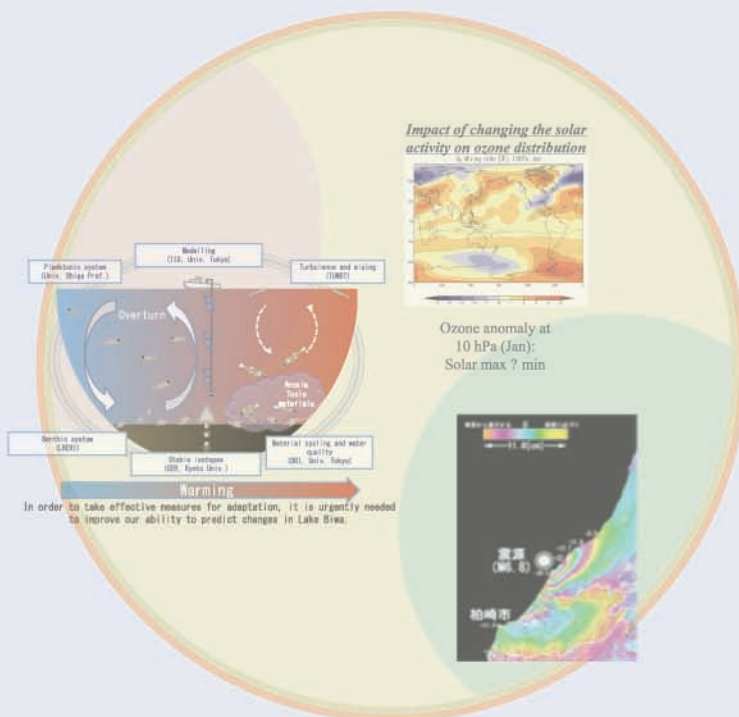


# GLOBAL ENVIRONMENT RESEARCH FUND FY2009



Stabilization target of  
GHG concentrations



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# The Global Environment Research Fund in FY2009

## ■ Outline

### Features:

- The GERF is a competitive grant scheme for global environmental research, initiated in 1990 with calls for proposals. Since then, the GERF has played a role as a core fund in Japan for promoting global environmental studies through interdisciplinary interaction among natural, social and political sciences.
- Each year, Ministry of the Environment formulates a "Global Environment Research Program" through consultation with external reviewers. Based on the program, research projects are conducted in timely fashion in accordance with the international situation, reflecting domestic/international trends in global environmental research.
- Applicants are to be researchers belonging to Japanese research institutions.
- 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 global environment.

### Research Priorities:

- In order to obtain scientific evidence necessary for drafting and implementing policies to protect the global environment, the administration indicates desirable themes for research.
- In FY 2008, we created two special recruitment divisions : the "Wise Adaptation to Climate Change" division and the "Low-Carbon Society" division.

## ■ System

### Research Fields:

- **Global system changes**  
Stratospheric ozone depletion, global warming, and hydrological circulation on a global scale
- **Transboundary pollution in the atmosphere, oceans and inland environments such as international rivers**  
Transboundary pollution in the atmosphere, through oceanic and terrestrial areas, and along international rivers
- **Conservation and recovery of large-regional ecosystems**  
Ecological disturbances, loss of biodiversity, tropical deforestation, desertification broadly occurring on a regional level (e.g. East Asia)
- **Sustainable societies and policies for their implementation**  
Integrated research on global environmental conservation in relation to the environment, economy and society

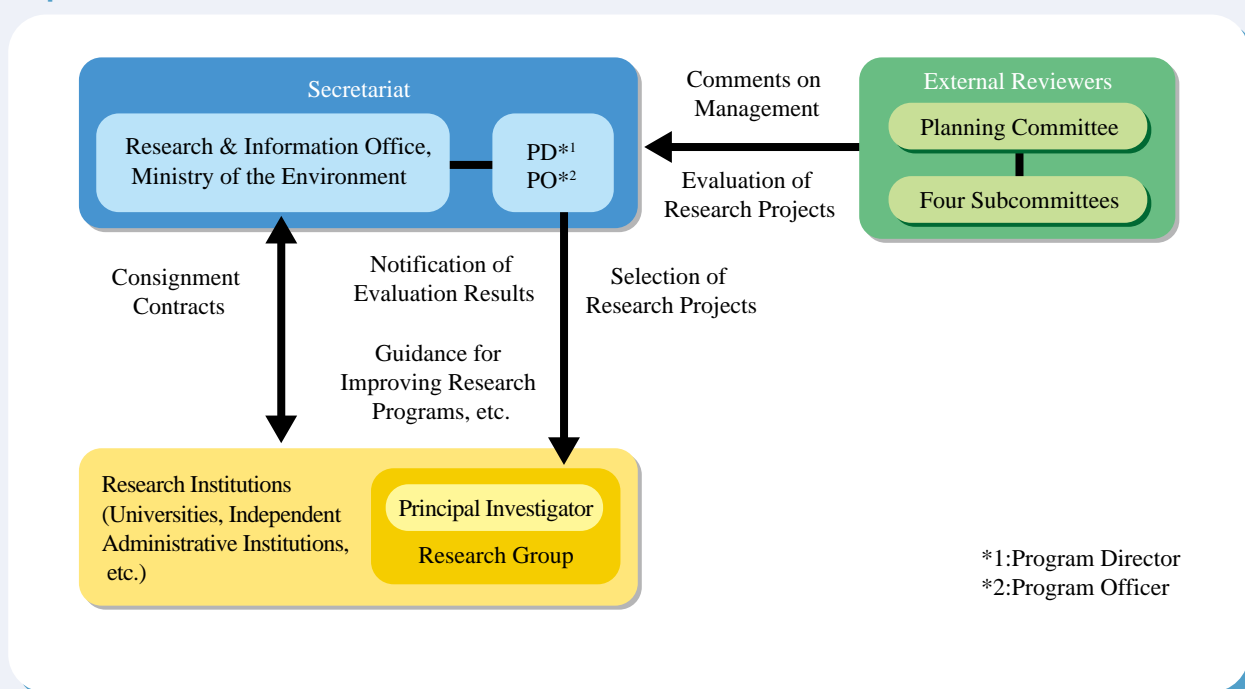
## Areas of Projects:

Research Areas	Conditions	Research Period	Average of Annual Budget per Project (1US\$=120yen)
Strategic R & D Area	Large-scale projects for which Ministry of the Environment provides a research framework	5 years (three years for Period I and two for Period II)	About \$2 million
Global Environmental Research Area	Research contributing to solving individual or combinations of global environmental issues	3 years (could be extended to five years)	About \$0.4 million
Revolutionary Research in Feasibility Studies Area	Researchers required to be 40 year or younger in age	1 or 2 years	About \$80 thousand

## Projects of the Strategic R & D Area:

- S-4 : Comprehensive Assessment of Climate Change Impacts to Determine Dangerous Level of Global Warming and Appropriate Stabilization Target of Atmospheric GHG Concentration (FY2005-2009)
- 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 : Synthetic Research on Elucidation of Regional Air Pollution in East Asia and Promotion of Atmospheric Environment Management Considering Co-benefit with Global Warming Measures (FY2009-2013)

## Implementation Structure:





## Intermediate Evaluation

- Research projects in the Global Environmental Research Area (for which the research period is three years) will undergo intermediate evaluation in their second year.
- Research projects in the Strategic R & D Area (for which the research period is five years) will undergo intermediate evaluation in their third year.
- Research projects in the Global Environmental Research Area rated highly in the evaluation will be considered for an extension. Research projects that achieve good results in the examination will be allowed a two-year extension (bringing the total to five years).

## Recent Major Achievements

- **AIM (Asian-Pacific Integrated Model):**

The analytic results of the AIM are utilized for policy analysis including tax systems, subsidy policies, presumed effects on the Kyoto Mechanism, and presumed effects on global warming and impacts on economics through the introduction of new technologies, etc.

- **Desertification Early Warning System (EWS):**

The analytic results of an integrated model will be submitted to CRIC5 (Committee for the Review of the Implementation of the Convention) as a representative example of Japan's efforts.

- **Impact of Invasive Alien Species on Ecosystems:**

The research on alien species has been helping policymakers shape the Invasive Alien Species Act, and has been utilized in the establishment of protected forest ecosystem areas in the Ogasawara Islands.

- **Japan Low-Carbon Society 2050:**

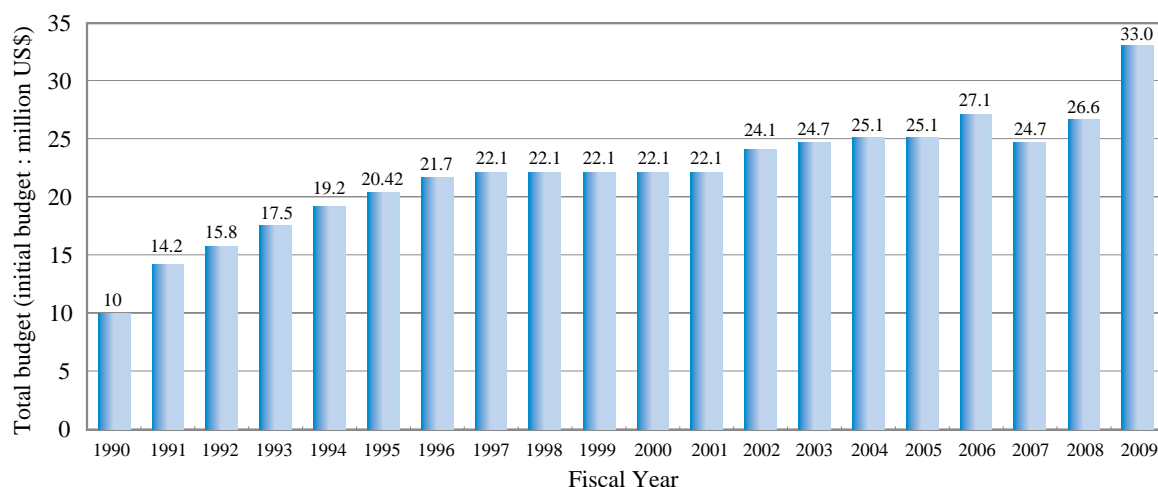
This is a cooperative scientific project between Japan and the UK started in February 2006. The research results are influencing formal/informal international negotiations for the Framework Convention on Climate Change.

- **Dust and Sandstorm (Kosa) Monitoring Network:**

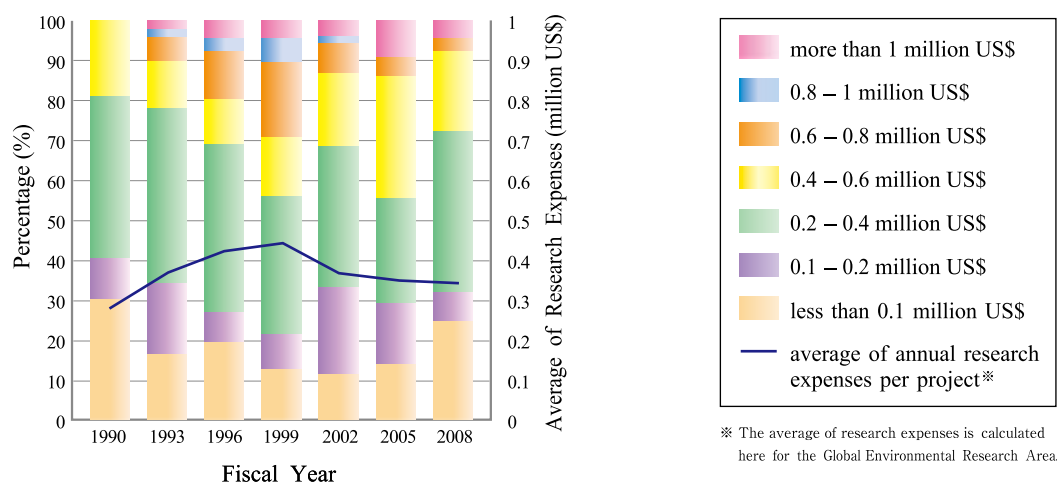
The research on Kosa has been contributing to the devising of policies aiming to solve the Kosa problem, which is a shared concern understood in common by all parties at the Tripartite Environment Ministers Meeting among China, Japan and Korea (TEMM).

## Management Performance

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

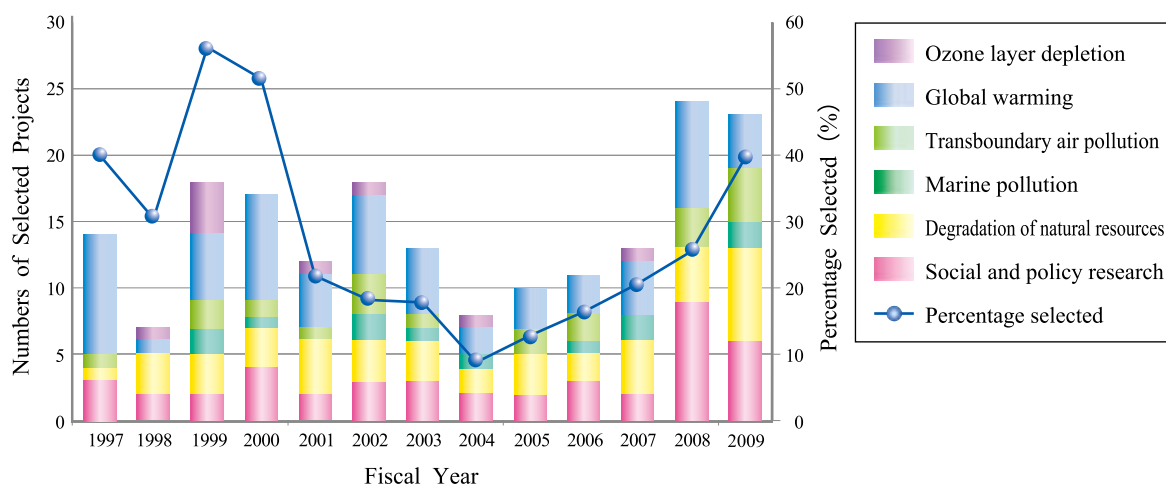


### Trends in Annual Research Expenses per Project (1 US\$ = 120 yen):



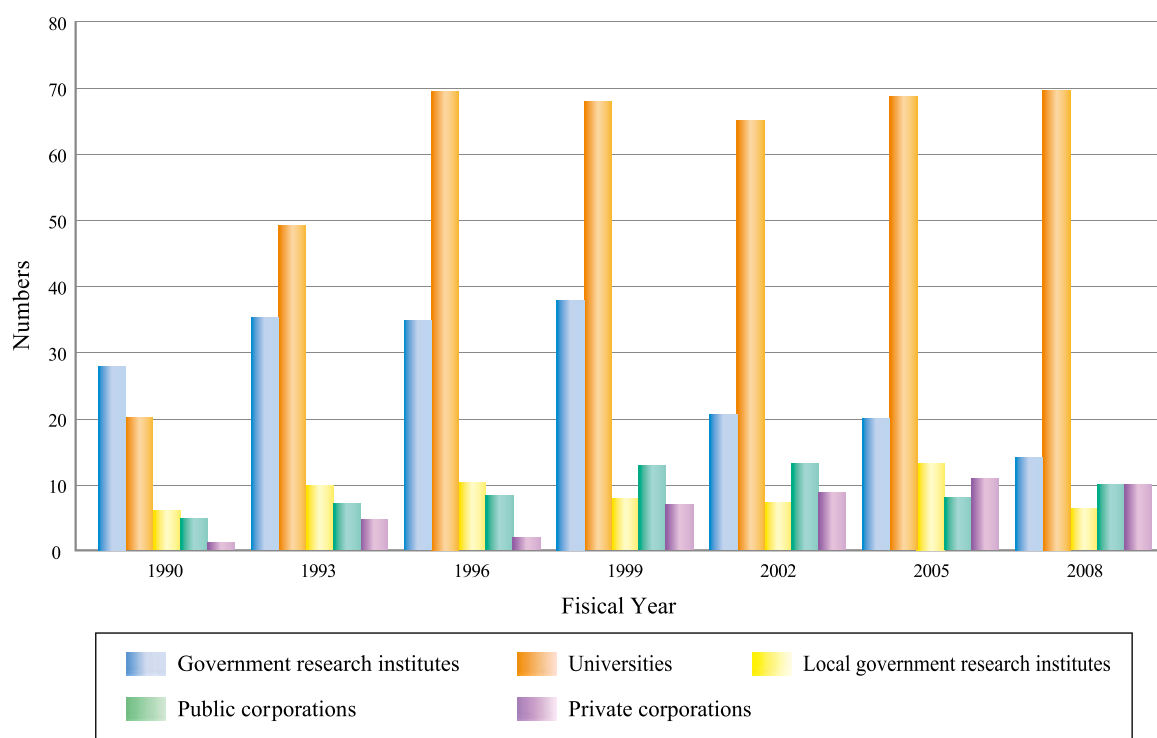
### Percentages of Research Projects Selected:

Numbers of selected projects and trends in the selection ratio (Global Environmental Research Area)



## Numbers of Participating Institutions:

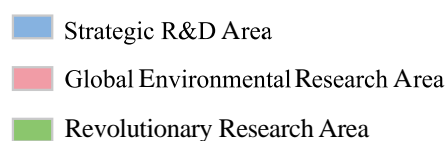
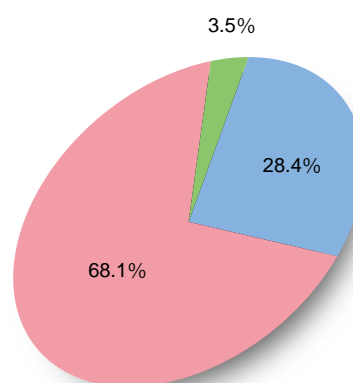
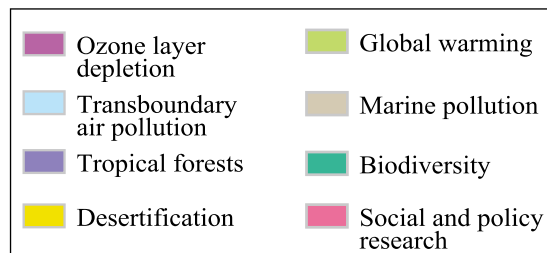
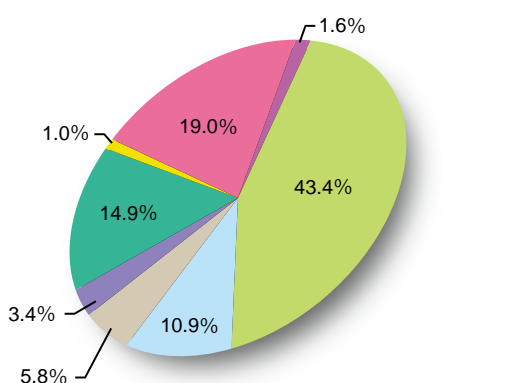
Trends in numbers of research institutions ( in the case of universities, counted by university rather than faculty )



## State of Implementation of Research Categories and Research Areas (based on the budget distribution):

Ratios of research categories conducted in FY2009  
- except for the Revolutionary Research Area -

Ratios of research areas conducted in FY2009



# Strategic R&D Area

## Global System Changes

### Comprehensive Assessment of Climate Change Impacts to Determine the Dangerous Level of Global Warming and Appropriate Stabilization Target of Atmospheric GHG Concentration

(Period I : FY2005-2007)

(Period II : FY2008-2009)

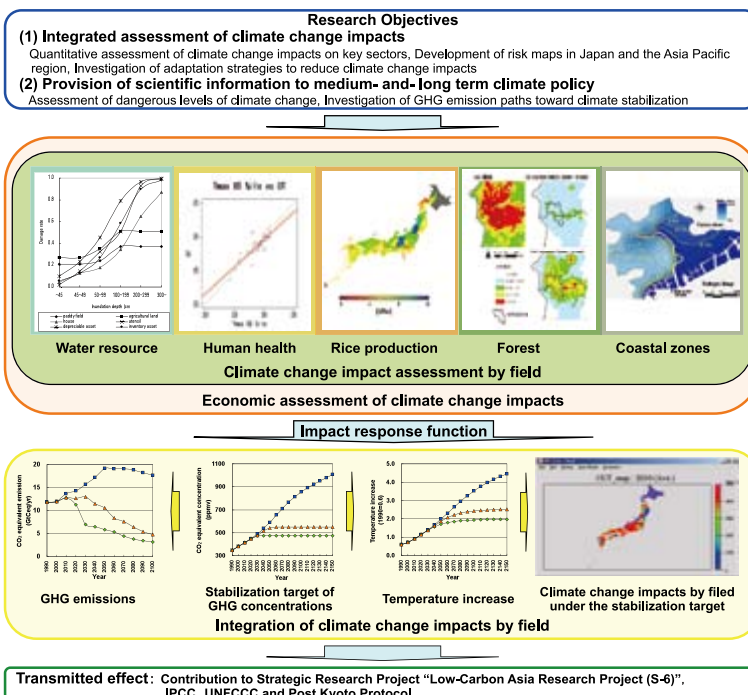
Project Leader : **Nobuo MIMURA**, Ibaraki University

<S-4>

Ibaraki University, National Institute for Environmental Studies, Tohoku University, National Agriculture and Food Research Organization, The University of Tokyo, National Institute for Land and Infrastructure Management, University of Tsukuba, National Institute of Infectious Diseases, National Institute for Agro-Environmental Sciences, Japan International Research Center for Agricultural Sciences, Forestry and Forest Products Research Institute, Kyushu University, Meijo University, The Institute of Statistical Mathematics

This project aims at assessing the physical and socioeconomic impacts of climate change in Japan and the Asia Pacific region, focusing on water resources, human health, agriculture, forest ecosystem, coastal zones, and disaster prevention. Studies of spatial and temporal distributions of the impacts

and adaptation to them are coordinated to determine the dangerous level of global warming. Appropriate emission paths are also studied to build a scientific basis for the stabilization target of atmospheric GHG concentration.



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

(Period I : FY2007-2009)

(Period II : FY2010-2011)

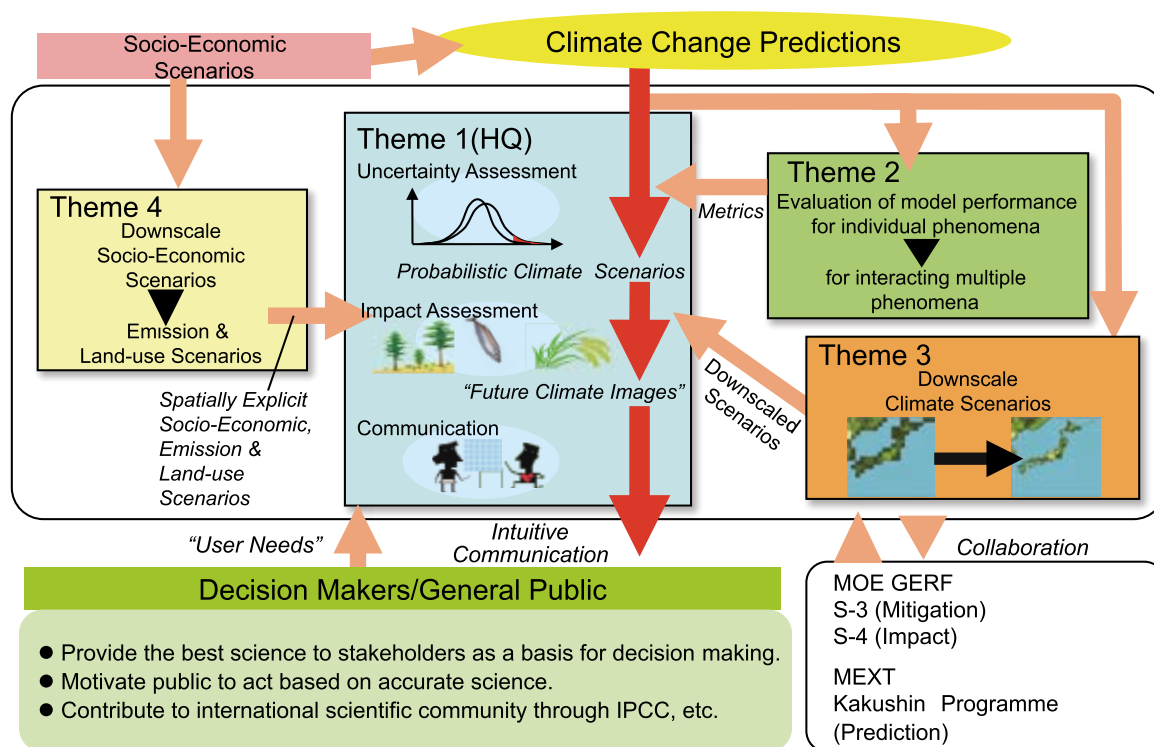
Project Leader : **Akimasa SUMI**, The University of Tokyo

<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 will 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)

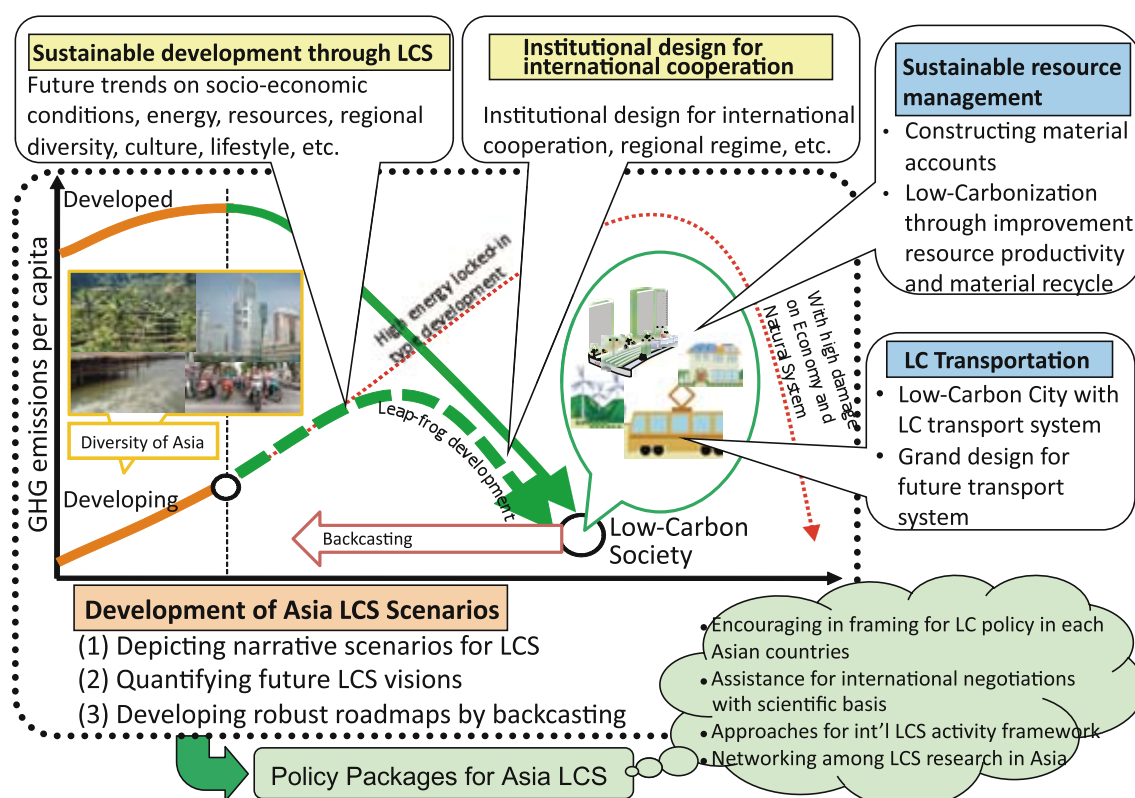
Project Leader : **Mikiko KAINUMA**, National Institute for Environmental Studies (NIES)

<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 back-casting methodology, and also roadmaps toward the societies that cooperated with the policy options for other important problems in the Asian region in the 21st first half of the century.



# Transboundary Pollution in the Atmosphere, Oceans and Inland Environments such as International Rivers

## Synthetic Research on Elucidation of Regional Air Pollution in East Asia and Promotion of Atmospheric Environment Management Considering Co-benefit with Global Warming Measures

(Period I : FY2009-2011)

(Period II : FY2012-2013)

Project Leader : **Hajime AKIMOTO**, Acid Deposition and Oxidant Research Center/

Japan Environmental Sanitation Center (ADORC)

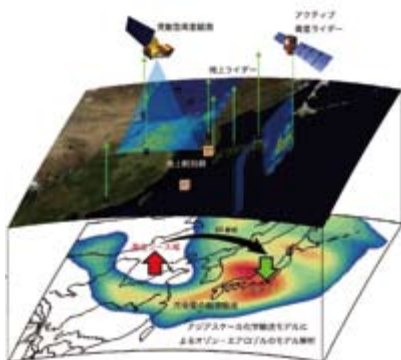
<S-7>

ADORC, 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 (NO<sub>x</sub>) 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 and effect of warming material reduction synthesizing ground/satellite observations and chemical transport models



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

Propose exploiting means of EANET, etc., for atmospheric environment management in East Asia

Propose 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

Theme1:  
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

Theme2:  
Improvement of emission inventories of air pollutants and presentation of air pollutants reduction scenario

Theme3:  
Research on international framework toward promotion of air pollution measures and co-benefit approach

International framework of transboundary air pollution measures are studied considering simultaneous control of global warming



# Global Environmental Research Area

## Global System Changes

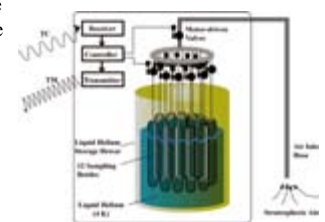
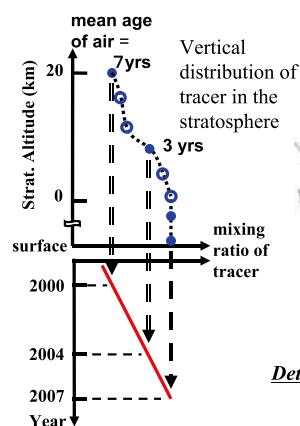
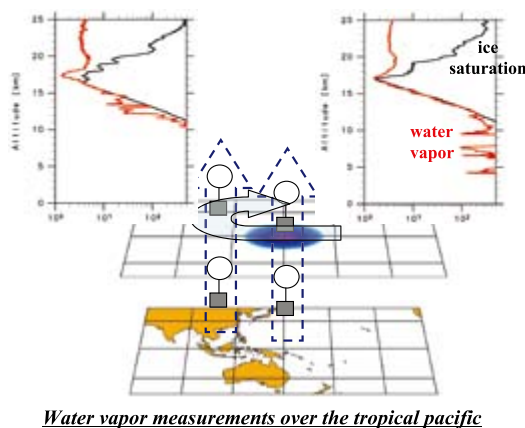
### Studies on Variability of Stratospheric Processes and Uncertainties in the Prediction of Future Change of Stratospheric Ozone (FY2007-2009)

Principal Investigator: **Takashi IMAMURA**, National Institute for Environmental Studies (NIES) <A-071>

NIES, Hokkaido University, Miyagi University of Education, The University of Tokyo

In this research project, the following investigation is being conducted: (i) detection of the variation of water vapor in the tropical tropopause region, (ii) determination of the mean age of stratospheric air over Japan, (iii) understanding the ability of our stratospheric chemistry-climate model to reproduce

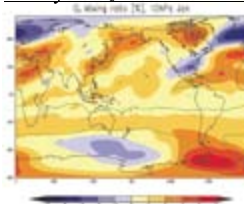
past trend and to predict future change of the ozone layer, and (iv) understanding of the impact of solar activity change on ozone distribution. The results of these works are expected to provide scientific grounds when further countermeasures for ozone layer protection are considered.



*Determination of the age of air*

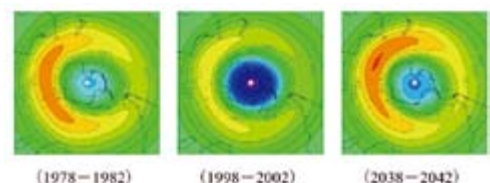
Detection of changing of water vapor and the age of air in the ozone layer  
Evaluation of uncertainty of the predicted change of the ozone layer

#### *Impact of changing the solar activity on ozone distribution*



Ozone anomaly at 10 hPa (Jan):  
Solar max-min

#### *Validation of stratospheric chemistry model* future development of ozone hole



## 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)

<B-062>

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 released from the following web-page.  
<http://www.chikyu.ac.jp/precip/>

## Upgrading of GHG Inventory and Evaluation of Reduction Measures in Waste Sector

(FY2007-2009)

Principal Investigator : **Masato YAMADA**, National Institute for Environmental Studies (NIES)

<B-071>

NIES, Ryukoku University, Osaka University

In order to achieve the reduction target on GHG emission in Japan, strategies for maximizing effects of several reduction measures should be considered. Moreover, it is important to promote the Clean Development Mechanism project in developing countries. Upgrading of the GHG inventory according to change in society and advancement in technol-

ogy is basic for these activities. In this study, we are upgrading emission factors for waste disposal activities, revising emission factors from the waste incineration and the wastewater handling, evaluating methane reduction technologies for the Asian landfill and applying the life cycle assessment to integrated evaluation of reduction measures.

## Research on the Feasibility to Estimate the GHG Emissions Reduction through Avoiding Deforestation

(FY2007-2009)

Principal Investigator : **Mitsuo MATSUMOTO**, Forestry and Forest Products Research Institute (FFPRI) <B-072>

FFPRI, Waseda University, The University of Tokyo

This study aims to examine the feasibility of REDD (Reducing Emissions from Deforestation and Forest Degradation in Developing Countries) from both technical and socioeconomic viewpoints. So far, a total monitoring scheme of forest carbon stocks and changes was developed. It consists of combinations of satellite image analysis and estimation of carbon stocks density. A socio-economical model was devel-

oped as a method to settle reference levels for evaluation of emission reduction. Also the process of deforestation and forest degradation was analyzed, and incentive mechanisms were developed to distribute incentives to stakeholders. These results were provided for international discussion such as COP and SBSTA under the UNFCCC.

## Evaluation of the Effect of Global Warming on Soil Respiration of Japanese Forest Ecosystems

(FY2007-2009)

Principal Investigator: **Naishen LIANG**, National Institute for Environmental Studies (NIES) <B-073>

NIES, Hokkaido University, Shizuoka University, Hiroshima University

Most of the carbon cycle models apply the exponential functions to predict the future global heterotrophic respiration with a  $Q_{10}$  of 2.0 (ranging from 1.3 to 2.5). In their models, global heterotrophic respiration increases exponentially with temperature increase at a rate of  $6.2\% \pm 2.7\%$  per  $^{\circ}\text{C}$ , and resulting that the current carbon sink of terrestrial ecosystem will convert to a carbon source after

2050. Our ultimate objective is to evaluate the potential of carbon sink/source of whole Japanese forest soils under the climate change by using multi-approaches, including the soil warming experiment, open-top chamber facility, cross-country soil incubation and model simulation. Results are expected to improve the scientific basis of the post-Kyoto protocol as well as the IPCC 5th Assessment Report.

## Development of a Method for Evaluating CDM Activities in Asian Countries

(FY2007-2009)

Principal Investigator : **Eiichi ENDO**, National Institute of Advanced Industrial Science and Technology (AIST) <B-074>

AIST, University of Tsukuba

This study aims at developing a method to evaluate Clean Development Mechanism (CDM) activities in the next decades, focusing on investment in supply-side energy technologies in Asian countries, such as China and India. By combining energy system models of Japan and Asia and life cycle assess-

ment models, potential amount of CO<sub>2</sub> emission credit anticipated from those CDM activities will be discussed with their costs and benefits, in the light of the contribution of technology development to Japanese global environment policies.

## Research on the Global Forest Carbon Monitoring System

(FY2008-2010)

Principal Investigator : **Yoshiki YAMAGATA**, National Institute for Environmental Studies (NIES) <B-081>

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.

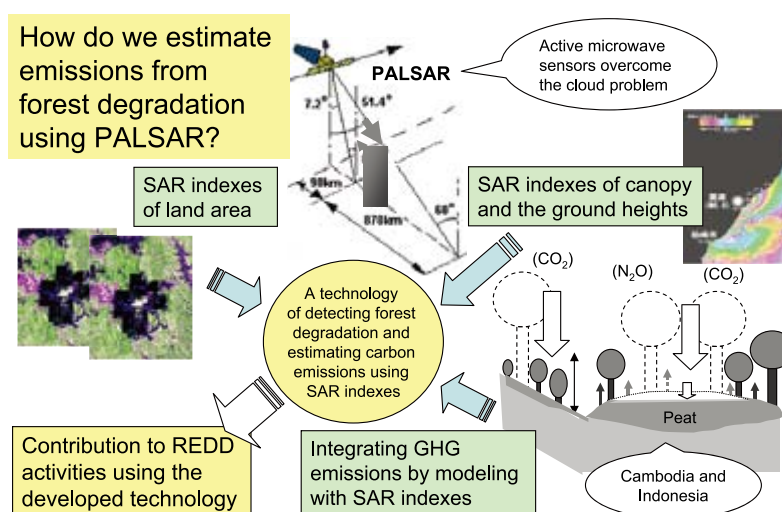
## Development of the Forest Degradation Index and the Carbon Emission Estimation Method Using PALSAR Data (FY2008-2010)

Principal Investigator : **Yoshiyuki KIYONO**, Forestry and Forest Products Research Institute (FFPRI) <B-082>

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

REDD (Reducing Emissions from Deforestation and Forest Degradation in Developing Countries) has 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 Advance Technologies for Improvement of Prediction of Climate Change (FY2008-2010)

Principal Investigator : **Yutaka KONDO**, The University of Tokyo

<B-083>

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 pre-

diction 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) <B-084>

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<sub>2</sub> 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<sub>2</sub> con-

trolling system for culture of benthic calcifies has been developed and has been operated to experiment the near future impact of CO<sub>2</sub> increase on the coastal marine animals. Preliminary results for sea urchin, abalone and coral have been obtained.

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

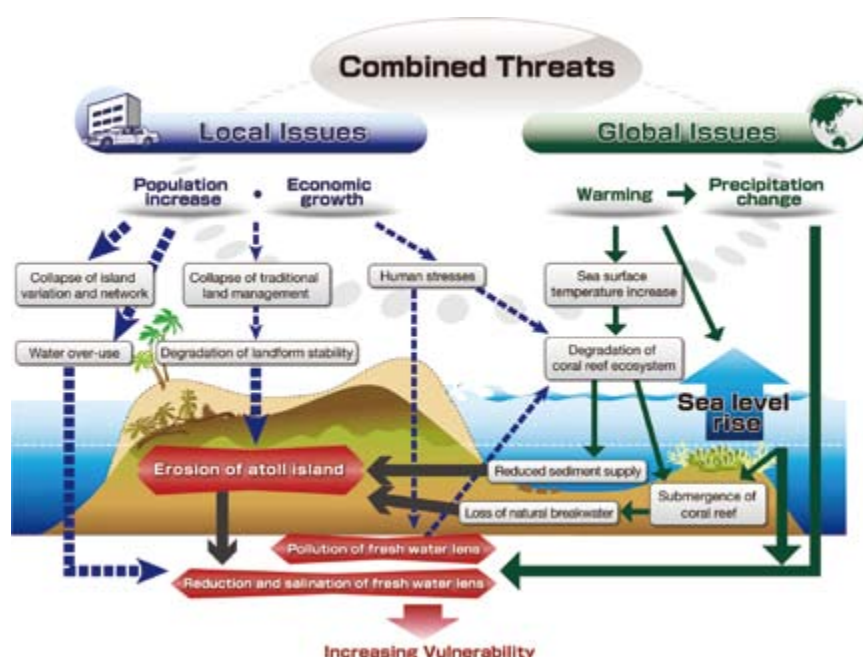
(FY2008-2010)

Principal Investigator : **Hiroya YAMANO**, National Institute for Environmental Studies (NIES) <Ba-085>

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 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) <Ba-086>

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) <Ba-087>

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<sub>2</sub>O), 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<sub>2</sub>O emissions in early spring was found for agricultural

soils in Hokkaido. Therefore, recent shallow soil frost depths in winter may reduce N<sub>2</sub>O 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) <Bc-088>

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)

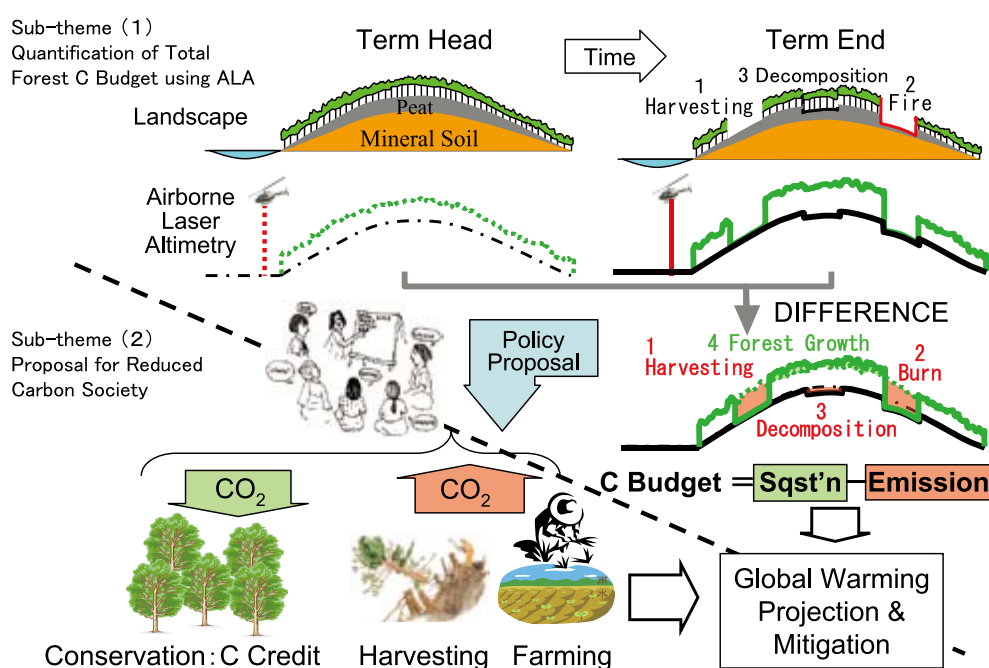
Principal Investigator : **Tatsuo SWEDA**, Ehime University

<B-091>

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 precision measurement of forest canopy height by ALA enables us an accurate estimate of forest carbon stock, the multi-temporal measurement of which results in forest carbon budget. The target study

areas are degraded swamp forest of Borneo and boreal forest of northwestern Canada, where massive carbon emission is either considered underway or suspected in near future due respectively to devastation by aborted paddy reclamation and warming-induced melting of permafrost, and 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

<B-092>

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 unravelling 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

<B-093>

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 for minor constituents, such as O<sub>3</sub>, CO<sub>2</sub> and aerosols, based on the chemical transport models. 4DDA is a technique, which is widely used for weather prediction, optimally uses observation data to estimate the atmospheric states. The core system is composed of

Ensemble Kalman Filter to cope with the difficulty associated with diffusive transport and chemical reactions. Through the data assimilation processes, information is obtained to improve chemical transport model as well. Final goal is to analyze concentrations of O<sub>3</sub>, CO<sub>2</sub> and aerosols, and surface fluxes of CO<sub>2</sub> 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

<B-094>

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.

# Transboundary Pollution in the Atmosphere, Oceans and Inland Environments such as International Rivers

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

(FY2008-2010)

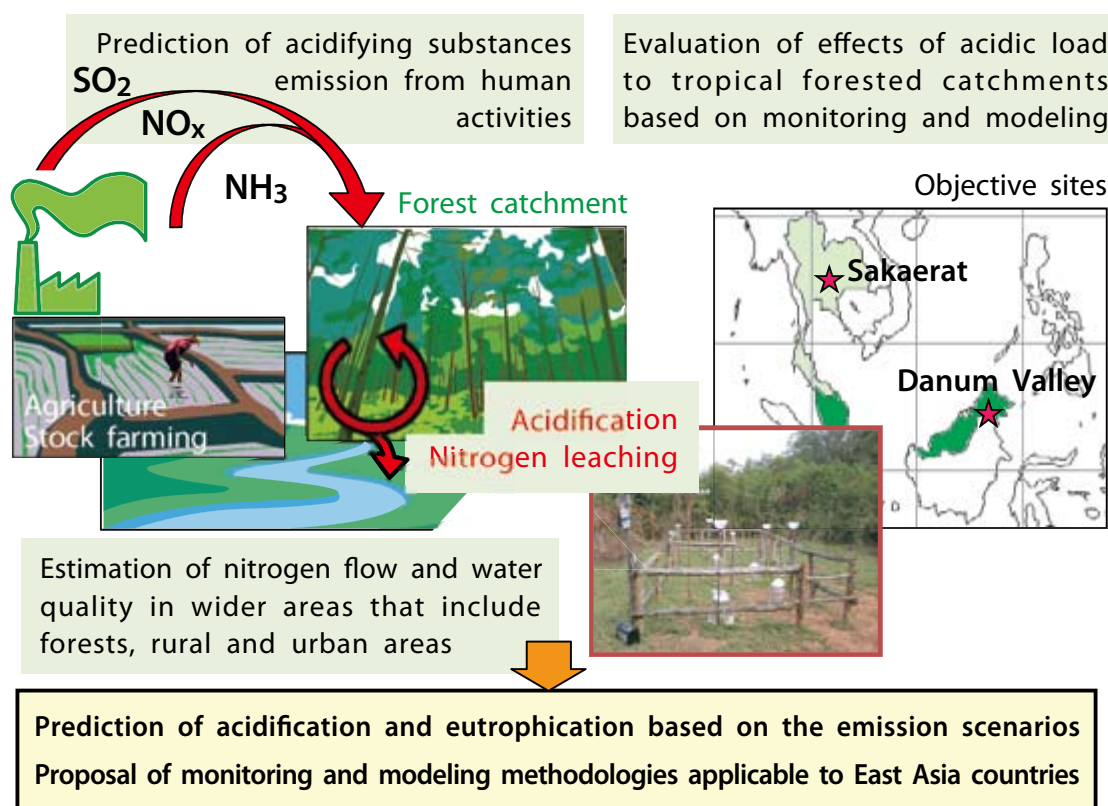
Principal Investigator : **Junko SHINDO**, National Institute for Agro-Environmental Sciences (NIAES)

<C-082>

NIAES, The University of Tokyo, Acid Deposition and Oxidant Research Center

In order to predict the acidification and nitrogen leaching of East Asian ecosystems, monitoring of input, internal cycle and leaching of acidic substances and their modeling are conducted in tropical catchments in Thailand and Malaysia. Land-use changes caused by food and biofuel production, etc., and induced changes in acidic deposition are taken into account. It was shown that the element cycle in the

forested ecosystems was strongly regulated by water dynamics in rainy and dry seasons, and that ammonia emission associated with agriculture contributed largely to the atmospheric nitrogen deposition in the objective area. This study will support EANET monitoring by providing basic data and an improved evaluation method, 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

<C-083>

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.

## Improvement of Kosa Forecasting Model Assimilated with the NIES-lidar Network Data and Health/Environment Effective Research for Attached Bio-Aerosols onto Kosa Particles

(FY2009-2011)

Principal Investigator : **Masataka NISHIKAWA**, National Institute for Environmental Studies (NIES) <C-091>

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

The mineral dust generated from arid areas in the interior of China and Mongolia is known as kosa aerosol (Asian mineral dust). In this study, a high quality assurance method and a system for real-time data processing by NIES-lidar system will be developed to monitor kosa events. Those lidar-network monitoring data should be useful to improve a forecasting system (MAGINGAR). Another objective is to reveal both respiratory health effect and natural environment influence by biological materials including bacteria mixed with kosa aerosols.

## Research on the Impacts of Asian Dust on our Health and Environment

(FY2009-2011)

Principal Investigator : **Masao NASU**, Osaka University

<C-092>

Osaka University, Osaka Ohtani University

"Asian Dust" is a transportation of a large amount of soil particles originated from 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 and we have started to collect Asian Dust particles by an airplane to avoid contamination of soil particles from the ground. We analyze the collected dust particles from the view points of environmental microbiology and toxicology.

## Studies on the Origin, Long-Range Atmospheric Transport and Photochemical Transformation of Organic Aerosols in East Asia and the North Pacific

(FY2009-2011)

Principal Investigator : **Kimitaka KAWAMURA**, Hokkaido University

<C-093>

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 the Evaluation of the Long-Range Transport of PAHs

(FY2009-2011)

Principal Investigator : **Hideshige TAKADA**, Tokyo University of Agriculture and Technology

<C-094>

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.

## East China Sea Marine-Litter Prediction Experiment Conducted by Citizens and Researchers

(FY2007-2009)

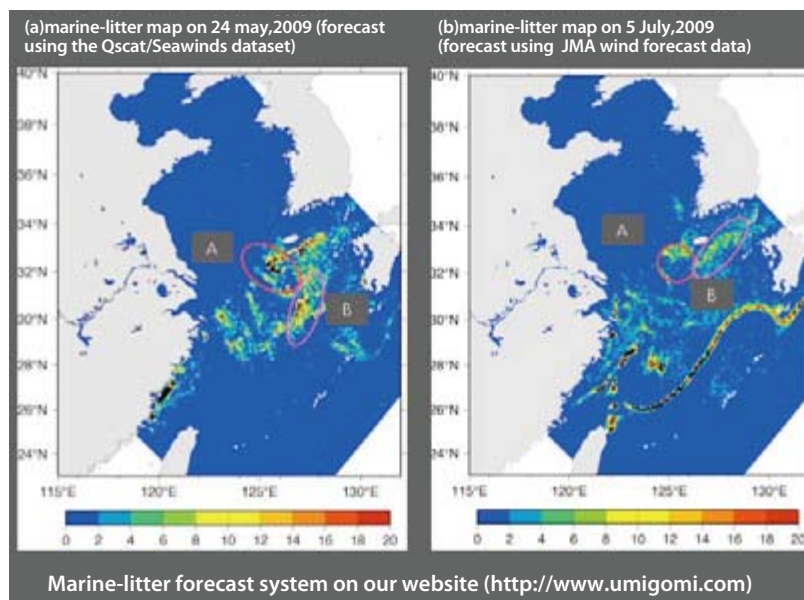
Principal Investigator : **Atsuhiko ISOBE**, Ehime University

<D-071>

Ehime University, The University of Tokyo, National Institute for Land and Infrastructure Management, National Institute of Advanced Industrial Science and Technology

The temporal variability of the marine-litter amount has been investigated at a Goto-Island beach by voluntary civic organizations together with oceanographers. Based on these data, the oceanographers specified major marine-litter sources, and are forecasting the litter amount. In addition, the oceanographers using ocean radars and aerial photography

attempt to establish marine-litter monitoring methods. Information of the marine-litter sources will be available for public awareness to reduce its occurrence. On-board marine-litter recovery procedures will be proposed using the forecast system developed in this project.



## Dynamics of Marine Organisms Carried by Ship Hull/Ballast Water, and Detection of their New Settlement

(FY2007-2009)

Principal Investigator : **Hiroshi KAWAI**, Kobe University

<D-072>

Kobe University, National Institute for Environmental Studies, Hiroshima University, Marine Ecological Institute, Inc., Chiba University, The University of Tokyo, Tokai University

In order to assess the contributions of large-scale cargo ships for intercontinental introductions of marine organisms, we have been monitoring the biodiversity and succession of the biota in the ballast tanks and ship hulls of bulk carriers, as well as investigating the biodiversity of introduced organisms in their ports of call for elucidating the early

settlement processes, and made risk assessment of barnacle introductions. The results will provide a valuable basis for drawing up guidelines to reduce or prevent species introductions, and to contribute to the conservation of the coastal ecosystems of Japan as well as the countries trading with Japan.

## Study on Potential Threat Caused by Organic Pollutants in Japan Sea Region

(FY2009-2011)

Principal Investigator : **Kazuichi HAYAKAWA**, Kanazawa University

<D-091>

Kanazawa University, Hyogo Environmental Advancement Association,  
Japan Environmental Sanitation Center

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 the generation and behavior of the pollutants. The goal of this project is to identify the locations of potential threats by clarifying the origin and behavior of two markers of organic pollutants in the Japan Sea region : Poly-

cyclic 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 the Sound Environmental Conditions in East China Sea

(FY2009-2011)

Principal Investigator : **Kunio KOHATA**, National Institute for Environmental Studies (NIES)

<D-092>

NIES, Fisheries Research Agency, Ritssho 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.



## Conservation and Recovery of Large-Regional Ecosystems

### Establishment of Methods for Assessing Forest Degradation Caused by Deforestation and Maintenance of Biodiversity (FY2009-2011)

Principal Investigator : **Ko HARADA**, Ehime University

<E-091>

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 : **Ryuichi TABUCHI**, Forestry and Forest Products Research Institute (FFPRI) <E-092>

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 poten-

tial 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.

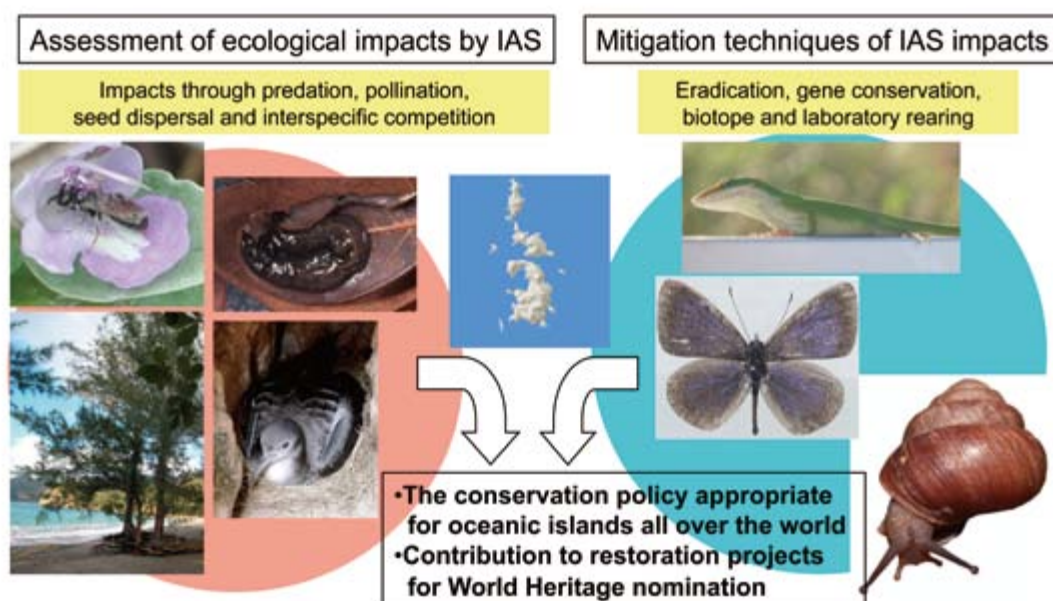
## Impacts of Invasive Alien Species on Biodiversity and Fragile Ecosystems in the Oceanic Ogasawara (Bonin) Islands (FY2005-2009)

Principal Investigator : **Isamu OKOCHI**, Forestry and Forest Products Research Institute (FFPRI) <F-051>

FFPRI, Tokyo Metropolitan University, Tohoku University, Kanagawa Prefectural Museum of Natural History, Japan Wildlife Research Center, Institute of Boninology

The objective of the project is to develop techniques for mitigating invasive alien species by studying their impacts on biodiversity in Ogasawara, where invasive species are thought to destroy native fauna and flora, as has happened in other oceanic islands including the Galapagos Islands. While an oceanic island may become a treasure trove of endemic organisms resulting from evolutionary processes without disturbance thanks to isolation from continents since the dawn of time, the island ecosystem is fragile for the same reason. Invasive alien species

affect the entire ecosystem in Ogasawara through predation, interspecific competition, pollination and seed dispersal. By studying the mechanism of impact and techniques for eradicating invasive species and by proposing mitigation techniques focusing on gene conservation and rearing methods, we expect to contribute to policies for conserving ecosystems in Pacific oceanic islands. We also aim to contribute to restoration projects in the Ogasawaras for World Heritage nomination.



### Targets (IAS):

Pollinator (*Anolis carolinensis* predate endemic pollinators)  
Interspecific competition (invasive alien plants)  
Seed dispersal agents (*Zosterops japonicus*)  
Predator1 (cats predate seabirds)  
Predator2 (*Platydemus manokwari* predate endemic land snails)

### Targets:

for eradication: *Anolis carolinensis*  
for laboratory rearing and biotope:  
Endemic insects  
for gene conservation and laboratory rearing:  
Endemic land snails

## Sustainable Management of Tropical Production Forests with the Economic Incentives of Carbon Sequestration and Biodiversity Conservation

(FY2007-2009)

Principal Investigator : **Kanehiro KITAYAMA**, Kyoto University

<F-071>

Kyoto University, Forestry and Forest Products Research Institute, Tokyo University of Agriculture, Kochi University

A vast area of production forests, which are designated for permanent commercial timber production, exists in the Southeast Asian equatorial tropics. These production also forests function as the reservoir of endangered wildlife. A sustainable forest management that is harmonized with conservation is sought. We investigate the improved manage-

ment effects of reduced-impact logging in conservation and carbon sequestration in Sabah, Malaysia. If improved effects are legitimately evaluated, these will become additional economic incentives so that the sustainable forest management is better adopted in a wider area.

## Developing a Sustainable Program for the Recovery of Wild Japanese Crested Ibis and Public Consensus Strategy

(FY2007-2009)

Principal Investigator : **Yukihiro SHIMATANI**, Kyushu University

<F-072>

Kyushu University, The University of Tokyo, Niigata University, Saitama University, Yamashina Institute for Ornithology, Tokyo Institute of Technology

The captive propagation effort for the Japanese crested ibis (*Nipponia nippon*) on Sado was done experimental release in 2008, aiming at colonization of 60 captive-bred birds in the wild by 2015. The goals of this study are to develop a naturally valid and socially feasible and sustainable program for

restoring the wild Japanese crested ibis and to allow the program to be accepted by the local society. This study will be conducted as collaboration between natural and social scientists addressing both restoration design and the social process to reach public consensus on the restoration program.

## Soil Biodiversity and Ecosystem Functioning

(FY2007-2009)

Principal Investigator : **Nobuhiro KANEKO**, Yokohama National University

<F-073>

Yokohama National University, Hokkaido University, Ibaraki University, Kyoto University, Shizuoka University

Soils play a multi-functional role in providing essential ecosystem services such as mediating global nutrient and water cycles, water purification, primary production, carbon sequestration and buffering environmental disasters. Many of these ecosystem functions are probably sustained by a diverse soil biological community; however, there is a lack of evidence to support this argument. We will study the relationship between soil biodiversity and

ecosystem functioning in soils and propose that the conservation of soil biodiversity is essential to maintaining soil quality. We revealed that some earthworm species exploit aged soil carbon, and microbial community structure has been affected by gut passage. Casts become water stable aggregate and showed high methane decomposition, and carbon sequestration. Thus microbial and faunal diversity can be linked to nutrient cycling.

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

(FY2008-2010)

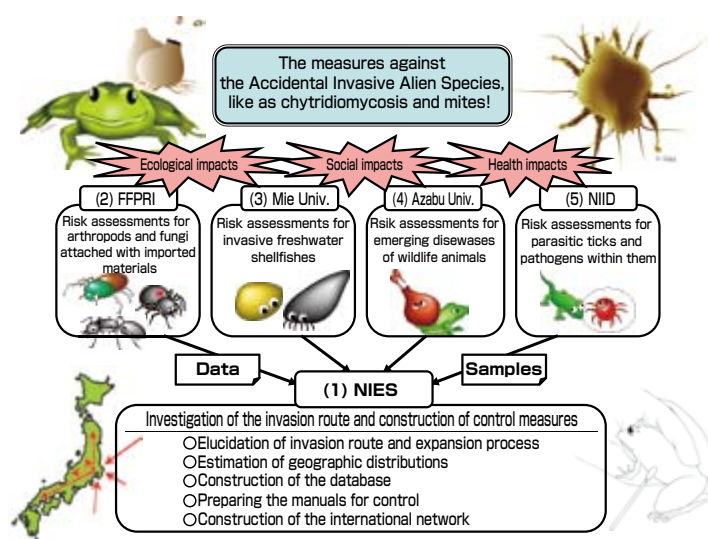
Principal Investigator : **Koichi GOKA**, National Institute for Environmental Studies (NIES)

<F-081>

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 distribution expansion 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 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

<F-082>

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 connec-

tivity in SEA-WP 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

<F-083>

University of Tsukuba, Meteorological Research Institute, Japan Hydrographic Association

Ocean has been absorbing about half of CO<sub>2</sub> emitted to atmosphere by combustion of fossil fuel. The concentration of CO<sub>2</sub> in the ocean is increasing year by year as well as atmospheric CO<sub>2</sub>, 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<sub>2</sub>.

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

(FY2008-2010)

Principal Investigator : **Toshi NAGATA**, The University of Tokyo

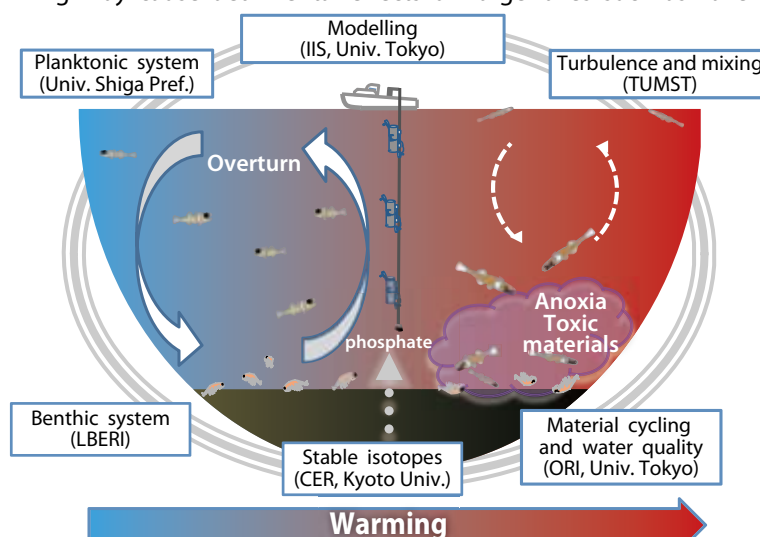
<Fa-084>

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.

Warming may cause detrimental effects on large lakes such as Lake Biwa



In order to take effective measures for adaptation, it is urgently needed to improve our ability to predict changes in Lake Biwa.

## Biodiversity Conservation Based on Ubiquitous Genotyping of Critically Endangered Plant Species

(FY2009-2011)

Principal Investigator : **Yuji ISAGI**, Kyoto University

<F-091>

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

<F-092>

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 diver-

sity, and assess the function maintaining species diversity in mountain ecosystem. We also test the relationship between species diversity and genetic diversity of alpine plants. 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 Eyanobacterium *Microcystis Aeruginosa* (FY2009-2011)

Principal Investigator : **Shin-ichi NAKANO**, Kyoto University

<F-093>

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'être of the Japanese Government.

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

Principal Investigator : **Yoshihiro NATSUHARA**, Kyoto University

<F-094>

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) <F-095>

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

For the prediction of the invasion of emerging infectious diseases and the avoidance of it, the infection routes of West Nile virus (WNV) will 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.

## Desertification Control and Restoration of Ecosystem Services in Grassland Regions of North-East Asia

(FY2007-2009)

Principal Investigator : **Toshiya OKURO**, The University of Tokyo <G-071>

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

This study aims to provide a guideline for the ecosystem restoration and the sustainable resource use in the rangelands of North-East Asia. We will provide the scientific evidences of that to where, and which combination of counter-measures can provide the most effective restoration and sustainable land management. This can contribute

directly to the decertified land as the concrete prescription for desertification, to United Nations Convention to Combat Desertification, and UN Convention on Biological Diversity. Last year we clarified that effects on ecosystem restoration differed among different revegetation measures by long-term field experiments.

## Sustainable Societies and Policies for their Implementation

### Strategic Policy Scenario Design for Sustainable Urban and Industrial System Based on the Integrated Environmental Flux Assessment for Water, Resource and Energy Circulation (FY2007-2009)

Principal Investigator : **Tsuyoshi FUJITA**, National Institute for Environmental Studies (NIES) <H-071>

NIES, National Institute of Advanced Industrial Science and Technology, Keio University

This study aims to develop an evaluation system to quantitatively assess environmental flux considering spatiotemporal distribution of water, resources, energy and GHG emission resulting from urban and industrial activities, which could be utilized to evaluate present situation and the potential of ecosystem services under the constraints and interactions with urban and industrial activities. The prototype of integrated environmental flux assessment system was developed in collaboration with municipal government and policy scenarios were tentatively evaluated to maximize the urban contribution for global environmental improvement.

### Strategies for Sustainable National and Urban Spatial Configuration

(FY2007-2009)

Principal Investigator : **Yoshitsugu HAYASHI**, Nagoya University

<H-072>>

Nagoya University, Kagawa University, Utsunomiya University

This study aims at exploring a new national and urban planning concept and relevant policy measures to realize financially and socially sustainable national and urban areas in Japan, with consideration of mitigation of global warming and adaptation to climate change. A systematic framework for the evaluation of national and urban sustainability is developed by integrating the models for estimating greenhouse gas from human activities, quality of life in residential areas, cost for maintaining built-up areas within land use and transport planning scopes. Appropriate sustainable structure of national and urban areas, and relevant policy implementations corresponding to post-Kyoto protocol are proposed to reduce GHG emissions and to deal with likely effects of climate change.

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

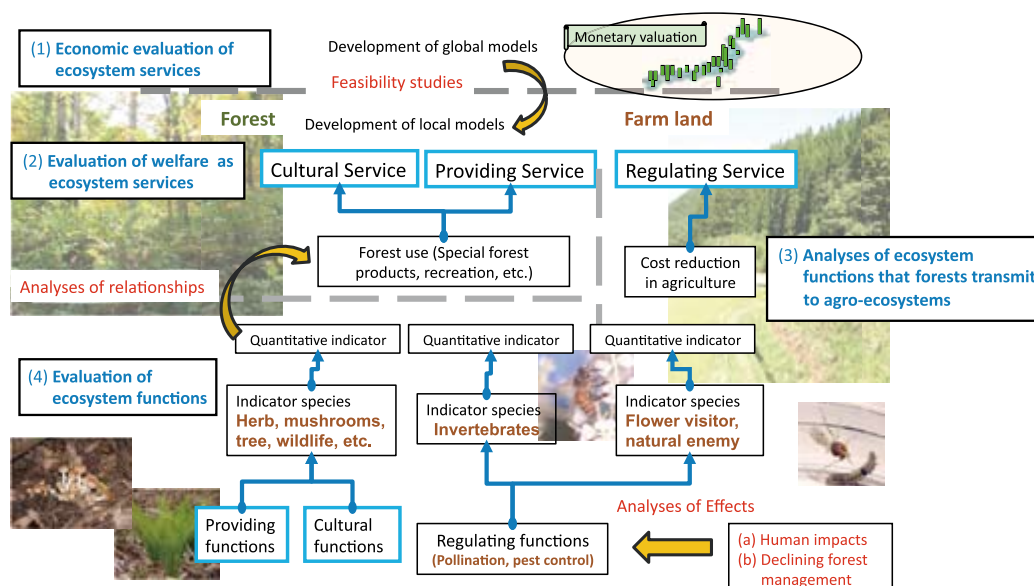
(FY2008-2010)

Principal Investigator : **Ken SUGIMURA**, Forestry and Forest Products Research Institute (FFPRI) <H-081>

FFPRI, University of Tsukuba, 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

<Hc-082>

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<sub>2</sub> 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 shows 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

<Hc-083>

Building Research Institute, Tokyo University of Science, Osaka University, Tohoku University, Keio 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 con-

sumption 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

<Hc-084>

Osaka University, Hokkaido University, Ritsumeikan University

This study will indicate paths toward regional low carbonization by conceptualizing "systematic partnership between urban and rural areas" that creates regional circulation of energy and resources (e.g., biomass). By investigating and planning various pilot models in Japan and China, this study is developing three models; namely, technological innovation and development of low carbon agriculture in rural areas (industrial conjunction model), design of circulation of energy and resources through urban

rural coalition (special 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 industrial development in China under the cooperation of Japan, 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

<Hc-085>

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

The process for promoting biomass utilization is a wicked policy problem that need 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 in the socio-technology system development. This new 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 UPs (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)

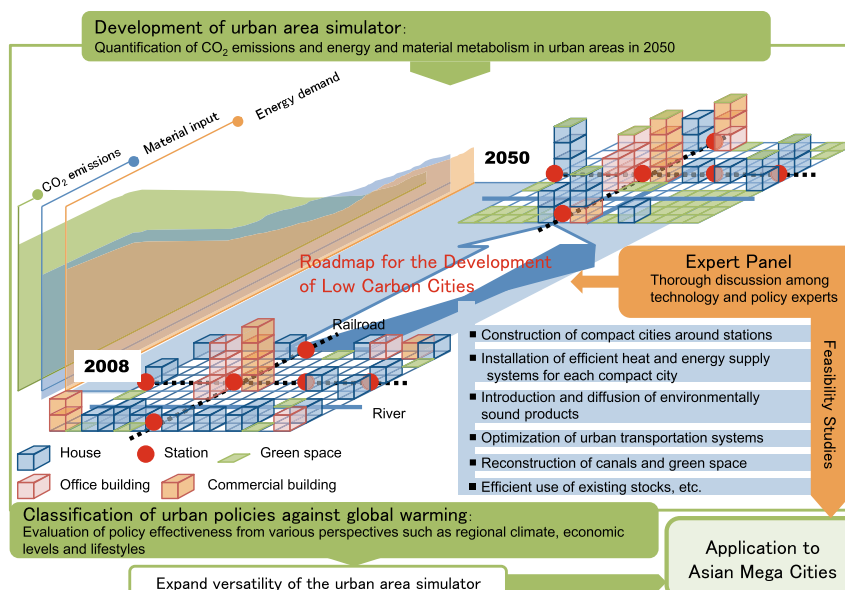
Principal Investigator : **Hidefumi IMURA**, Nagoya University

<Hc-086>

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 has 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<sub>2</sub> Emissions Reduction by Introducing Environmental Policies into Infrastructure Development

(FY2008-2010)

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

<Hc-087>

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

The CO<sub>2</sub> 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<sub>2</sub> 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

<Hc-088>

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<sub>2</sub> 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<sub>2</sub> 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

<Hc-089>

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) <H-091>

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 is to be agreed by COP15 in December 2009. 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) <H-092>

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*, *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 using 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)

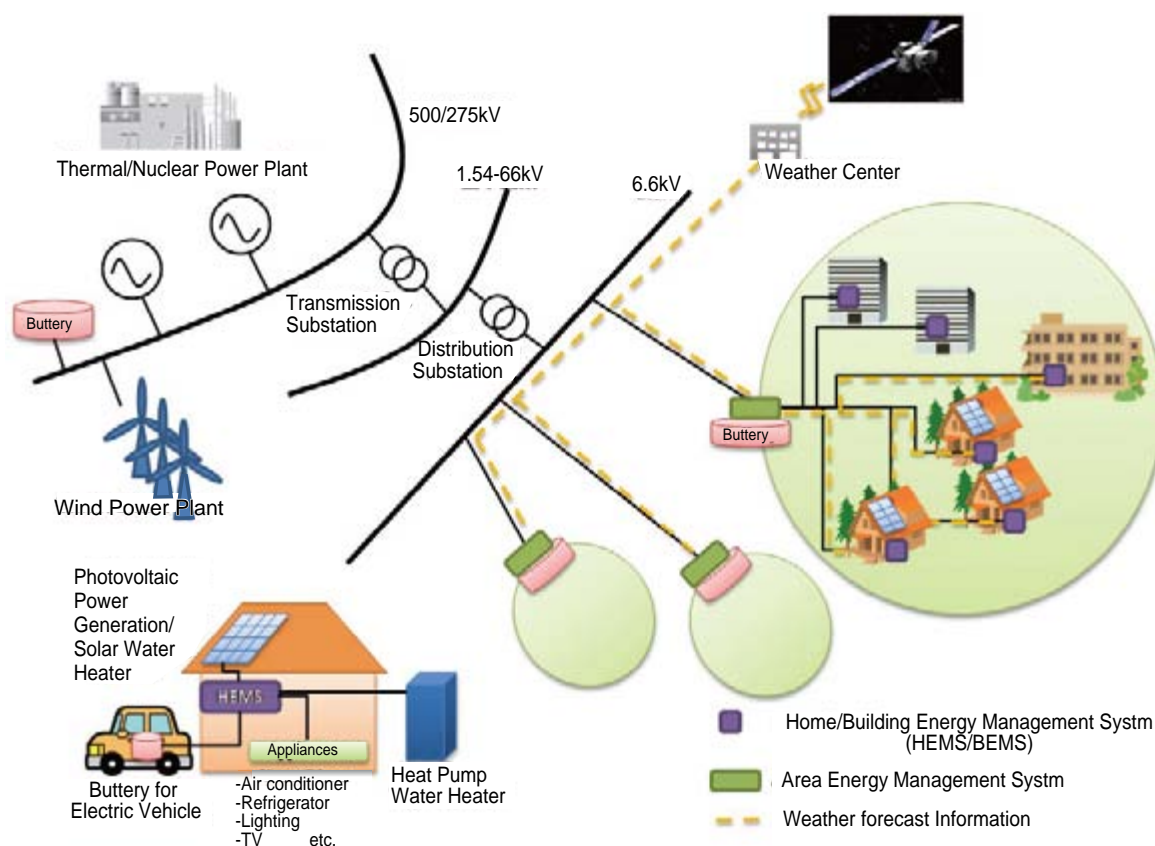
Principal Investigator : **Kazuhiko OGIMOTO**, The University of Tokyo

<H-093>

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 generation, and energy storage system 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) <H-094>

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 CO<sub>2</sub> reduction potential of electric vehicles including plug-in vehicles (whose batteries can be charged from grid electricity) is estimated based on both their charge frequency and the driving activity data collected by on-board trip loggers in monthly term. 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-long 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<sub>2</sub> 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 <H-095>

Ibaraki University

Sweet sorghum has an advantage for its wide adaptability for cultivated area, rapid growth, and biofuel productivity. Besides, it does not compete with food production and food economy. In this study, we develop processes including cultivation in an abandonment of farmland and the using residual substance after harvest. The purpose is to build a model

of biofuel 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. The model of regional sustainable biofuel society is expected for leading production/circulation/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) <H-096>

IGES, Kyushu University, Hosei University

The study explores what kinds of policy tools enable effective low-carbon behavior of households and small and medium enterprises, in particular in the sectors of commercial, households, transport and waste management, in cities in Asian developing countries. The study clarifies low-carbon policies in Japanese municipalities and possibility of inter-

national intercity partnership for Japanese cities. The research proposes an international institution for intercity partnership among Japanese local governments and cities in Asian developing countries in order to promote local initiatives towards low-carbon development in cities in different developmental stage in Asia.

# Revolutionary Research in Feasibility Studies Area

## Reconstruction of Past Water Isotopes Using Isotope Data from Corals and Atmospheric-Ocean General Circulation Model (FY2008-2009)

Principal Investigator : **Yusuke YOKOYAMA**, The University of Tokyo

<RF-081>

The University of Tokyo, Japan Agency for Marine-Earth Science and Technology

Water oxygen isotopes will be reconstructed using coral samples to understand characteristics of Climate Models (Atmospheric-Ocean General Circulation Models). This will be an important benchmark data to be used for inter models comparison which improves climate projections.

## Impacts of Global Warming and Ocean Acidification Reef Building Corals at Northern Latitude Limit in Japan (FY2008-2009)

Principal Investigator : **Tsuyoshi WATANABE**, Hokkaido University

<RF-082>

Hokkaido University, Fukuoka University, National Institute for Environmental Studies

Reef building corals growing at their latitudinal limit in Japan can provide an unique opportunity to reconstruct the recent histories of environmental changes. The goal of our project is to evaluate global warming and ocean acidification, and it's impacts on coastal ecosystems.

## Using Stable Water Isotope to Evaluate Hydrological Cycle of Climate Model (FY2008-2009)

Principal Investigator : **Naoyuki KURITA**, Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

<RF-083>

JAMSTEC

Predictability of precipitation change using the climate model largely depends on how latest model can precisely reproduce present-day global precipitation field. In this project, the reproducibility of simulated present-day atmospheric circulation in Asia will be evaluated using novel dataset: stable water isotopes.

## Investigation of Ultimate Source of Arsenic Found in Groundwater Contaminated with Arsenic in Bangladesh by Antimony Isotopic Ratio (FY2008-2009)

Principal Investigator : **Yoshio TAKAHASHI**, Hiroshima University

<RF-084>

Hiroshima University, Japan Agency for Marine-Earth Science and Technology

In this study, we develop a new method to identify ultimate source of arsenic in various contaminated area using antimony isotopic data, which will be applied to arsenic contaminated area in Bangladesh to verify whether the ultimate source of arsenic in Bangladesh is sulfide ores in the Himalayas.

## Evaluation and Prediction of the Effects of Environmental Changes Based on the Diversity Profile of Phyllosphere Fungi (FY2008-2009)

Principal Investigator : **Hayato MASUYA**, Forestry and Forest Products Research Institute (FFPRI) <RF-086>

FFPRI, Kyoto University

The objective of this study is to clarify the diversity of philosopher fungi on *Fagus crenata* and to show the effects of environmental changes to the fungal diversity. The knowledge obtained from this study will contribute to construct a system assessing and forecasting the response of Japanese beech forests to environmental changes.

## Study on Consumers' Behavior that Can Fulfill both Satisfactory Progress in Our Daily Life and Reduction of CO<sub>2</sub> Emissions (FY2008-2009)

Principal Investigator : **Yuki KUDOH**, Institute of Advanced Industrial Science and Technology (AIST) <RF-087>

AIST, Shibaura Institute of Technology

This study aims at investigating potential CO<sub>2</sub> reduction of CO<sub>2</sub> emissions of daily activities that meet our needs of life by various life styles. In this study, we will propose daily activities that can be carried out spontaneously for the mitigation of CO<sub>2</sub> emissions and increase of utility.

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

Principal Investigator : **Toshihiko TAKEMURA**, Kyushu University

<RF-091>

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-092>

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<sub>4</sub> 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-093>

FFPRI

To clarify the effective control techniques of CH<sub>4</sub> flux in the forest, this study aims to develop a newly CH<sub>4</sub> and total hydro carbon flux monitoring system for long-term measurement using the tunable diode laser spectrometer and the eddy covariance method.

## Global Distribution and Environmental Fate of Emerging Contaminants, Persistent PPCPs, in the Marine Ecosystems

(FY2009-2010)

Principal Investigator : **Haruhiko NAKATA**, Kumamoto University <RF-094>

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

The objectives of this study is to investigate the concentrations, bioaccumulation, temporal trend, and geographical distribution of emerging environmental pollutants, persistent Pharmaceuticals and Personal Care Products (PPCPs), in the marine ecosystems.

## Study on Transboundary Air Pollution and Health Effects Induced by Polycyclic Aromatic Compounds Formed via Atmospheric Reactions on the Surface of Asian Dust Particles

(FY2009-2010)

Principal Investigator : **Takayuki KAMEDA**, Kanazawa University <RF-095>

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 and to evaluate adverse health effects induced by the compounds.

## Dynamics and Nature of Fine to Ultrafine Particles in the Atmosphere from East Asia (FY2009-2010)

Principal Investigator : **Satoshi UTSUNOMIYA**, Kyushu University <RF-096>

Kyushu University

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 in establishing the new regulation on PM2.5.

## 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-097>

Hiroshima University, Fisheries Research Agency

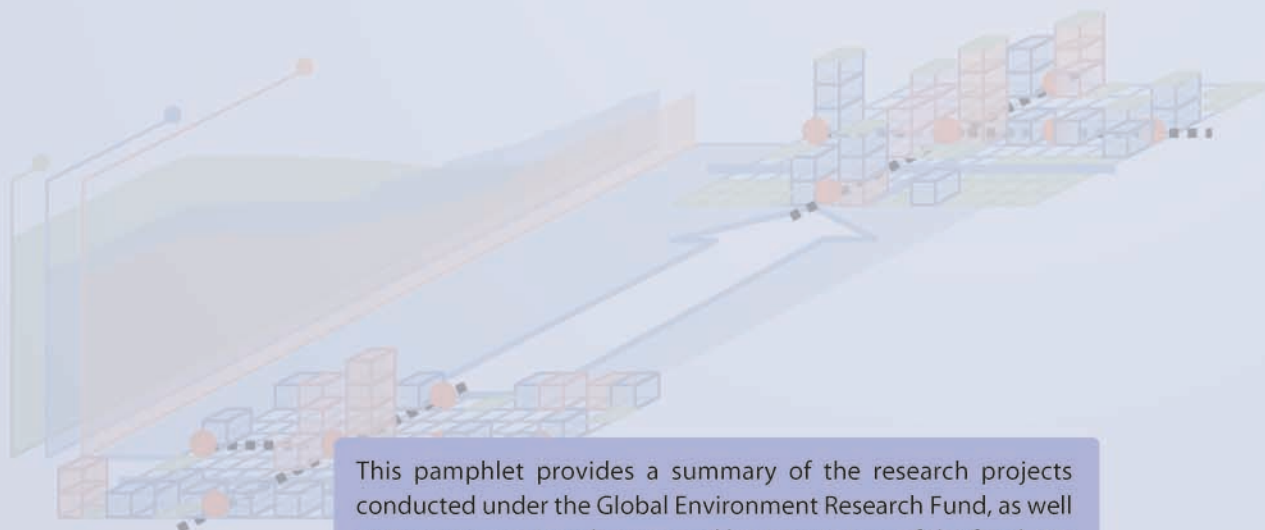
Biological and physical surveys are conducted in seagrass beds in order to estimate fish production and to detect environmental determinants on the production. The goal of this project is to evaluate spatial variability of the production and to predict its fluctuation due to the global warming.

## 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-098>

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.



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

## GLOBAL ENVIRONMENT RESEARCH FUND

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