NIAES Annual Report 2012

National Institute for
Agro-Environmental Sciences
Japan

Annual Report

2012

(April 2011 - March 2012)

National Institute for

Agro-Environmental Sciences

About the symbol.....

The symbol's colors represent the research domains of NIAES: the sky is light blue, clouds and water are white, biota are green, and soils are brown.

Editorial Board

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Message from the President

Dr. Kiyotaka Miyashita

In 2011, Japan experienced the Great East Japan Earthquake, an unprecedentedly enormous disaster. In particular, the nuclear accident at Tokyo Electric's Fukushima Daiichi Nuclear Power Plant, which was caused by the earthquake-induced tsunami, released radioactive material into the environment which also descended on farmland. Since 1959, when the National Institute for Agro-Environmental Sciences (NIAES) was still known as the National Institute for Agricultural Science, our institute has continually monitored radioactive substances in soil and agricultural products throughout Japan. In those days, the contamination of agricultural produce by radioactive fallout from atmospheric nuclear testing was a worldwide issue. Immediately after last year's earthquake, NIAES set up a system making it possible to quickly perform radiation surveys and measurements, and started analyzing the concentrations of radioactive substances in soil and in vegetables and other agricultural produce in response to requests from prefectures and the government. Measurement results were immediately sent to prefectures and were used to restrict shipments of agricultural products produced in areas where levels exceeded limits and to restrict 2011 rice planting. This helped supply citizens with safe food. To determine the wide-area extent of farmland contamination, we obtained farmland soil samples in Fukushima Prefecture and nearby prefectures and created a contamination map showing radioactive cesium concentrations. Such information is used in agriculture for responses to radioactive contamination. Dealing with radioactive contamination from nuclear accidents requires long-range initiatives, and for the purposes of food safety and restoring the agricultural environment, NIAES is conducting research while collaborating with relevant institutions.

For NIAES, 2011 was the first year of the third five-year medium-term target period. The third period has these four priority areas:

1. Investigating interactions between global environmental change and agriculture
2. Investigating mechanisms underlying variations in agrobiodiversity and environmental functions
3. Managing hazardous chemical substances in agroenvironments
4. Advancing agroenvironment inventory

Following are just a few of the research accomplishments from 2011.

With regard to climate change, we developed a model to predict changes in food production that can assess Japan's rice productivity over wide areas and includes inter-cultivar differences, and we made progress in building a data set. In relation to biodiversity, the general public was given access to the Rural Landscape Information System (RuLIS), which we devised to determine the dynamics of agricultural ecosystems, and to determine and predict changes to those ecosystems. More data were also accumulated. Indicator organisms were chosen to analyze the effects that different farming methods (conventional, reduced-pesticide, organic) had on differences in insect populations and to assess the effects of farming activities on biodiversity. With respect to hazardous chemical substances, we used ion beam irradiation to successfully create a rice cultivar which absorbs hardly any cadmium at all. This achievement will not only make it possible to substantially reduce the amount of cadmium ingested by Japanese, which is internationally high, but also to reduce the arsenic content of rice grains by means of long-term flooded cultivation. There are expectations for quick deployment of this cultivar.

Transboundary international initiatives are important for environmental research. In 2006 NIAES established the Monsoon Asia Agro-Environmental Research Consortium (MARCO), and each year since we have held international symposiums and international seminars to provide for networking among researchers. In the Global Research Alliance (GRA), an international network which aims to reduce greenhouse gases from agriculture, NIAES has served as the institution that represents Japan and is co-chair country of the Rice Paddy Research Group, and in this capacity NIAES sent experts to international meetings in 2011 and in September hosted a MARCO workshop, "Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture." I firmly believe that as environmental problems involving agriculture increase in seriousness around the world, international networks of researchers and research institutions formed in this manner will be a major force in solving agriculture-related environmental problems.

We hope to receive your frank comments and suggestions about NIAES.

Kiyotaka Miyashita, President

The National Institute for Agro-Environmental Sciences (NIAES) has endeavored to solve a wide range of environmental problems affecting agriculture, such as the contamination of agricultural crops by dioxins, radioactive substances, cadmium and other harmful chemical substances; the environmental impact of genetically modified food plants and exotic organisms; and the relationship between global environmental change and agriculture. There is increasing concern about the risks to human health and the environment, and researchers are being asked to offer solutions based on scientific findings.

The period of NIAES's phase III medium-term target, which started in April 2011, calls for emphasizing research on risks in the agricultural environment in order to ensure the environmental safety that underpins agricultural production. By means of exploratory and basic research on risk assessment and risk management, NIAES will develop risk mitigation technologies and pass the benefits of research on to society at large, as well as contributing to the policy measures of administrative authorities and international agencies.

NIAES has created the following Basic Philosophy, Code of Conduct, and Environmental Charter so that personnel will conduct themselves with a high sense of ethics and an awareness of their social responsibility, and undertake to conserve and improve the environment as they proceed with research under the new medium-term target and medium-term plan.

Basic Philosophy

NIAES conducts high-level research aiming at the harmony and coexistence of nature, society, and humans, thereby helping to overcome food and environmental problems throughout the world.

Code of Conduct

Philosophy of Conduct

To act with a strong sense of ethics and sound social judgment for the purposes of building a safe and worry-free society and preserving an agricultural environment to be passed on to the next generation. To pass the benefits of NIAES activities on to society at large.

Guidelines for Conduct

• Environmental Research

As a research institute in the forefront of agro-environmental research in Japan and abroad, NIAES actively conducts high-level research activities to solve environmental problems related to agricultural production.

• Legal Compliance

NIAES complies with the relevant laws and social norms to provide a sound and safe working environment, and as a member of society undertakes its program activities ethically and with sound judgment. In particular, there must be no impropriety committed through research activities. Furthermore, NIAES works to partner with society, assures transparency by upholding openness, fairness, and neutrality, and so enhances its trustworthiness.

• Technology Transfer

To protect and apply the results originating from our research as intellectual property, NIAES creates the conditions for providing patents and other information and for domestic and foreign technology transfers.

• Public Communications and Information Disclosure

By publishing the results of studies and research and by actively disseminating and communicating such results through public lectures and other means, NIAES provides for the dissemination of research meant to assure the safety of food and the agricultural environment and also works to release information on program activities.

• Cooperation, Partnership, and International Contributions

By reinforcing partnerships and collaboration with industry, academia, and government, NIAES promotes joint research and research cooperation, and extensively shares the research results with society. NIAES works to benefit the agro-environmental policies of administrative authorities and international agencies.

Environmental Charter

Environmental Philosophy

To vigorously carry out research activities on agro-environmental problems and take positive action to contribute to conserving and improving the environment and to building a sustainable recycling society.

Environmental Action Guidelines

• Raising Environmental Consciousness

To create organizations and institutions for environmental management and to work to raise environmental consciousness.

• Concern for the Environment

To reduce the burden on the environment by being diligent in everyday activities such as energy conservation, reuse, recycling, and green procurement.

• Publicizing Activities

For the purpose of improving environmental conservation and safety and health in program activities, to broadly publicize the results of environmental conservation activities by means including preparing environmental reports and posting on the Web.

• Symbiosis with Society

As a member of the local community and international society, to build a cooperative and symbiotic relationship with society and actively conduct environmental conservation activities.

History of NIAES

1893 National Agricultural Experimental Station (NAES) of the Ministry of Agriculture and Commerce, a predecessor of the National Institute for Agro-Environmental Sciences (NIAES), is founded.

1950 National Institute of Agricultural Sciences (NIAS) of the Ministry of Agriculture and Forestry is founded, succeeding NAES.

1980 NIAS main campus is relocated from Nishigahara, Tokyo, to Tsukuba, Ibaraki.

1983 National Institute of Agro-Environmental Sciences (NIAES) of the Ministry of Agriculture, Forestry and Fisheries is founded from NIAS to conduct advanced and basic technological development pertaining to control, maintenance, and utilization of the agro-environment, including the biological environment.

2001 NIAES becomes a semi-autonomous agency on 1 April and begins its first research period (FY 2001 to FY 2005).

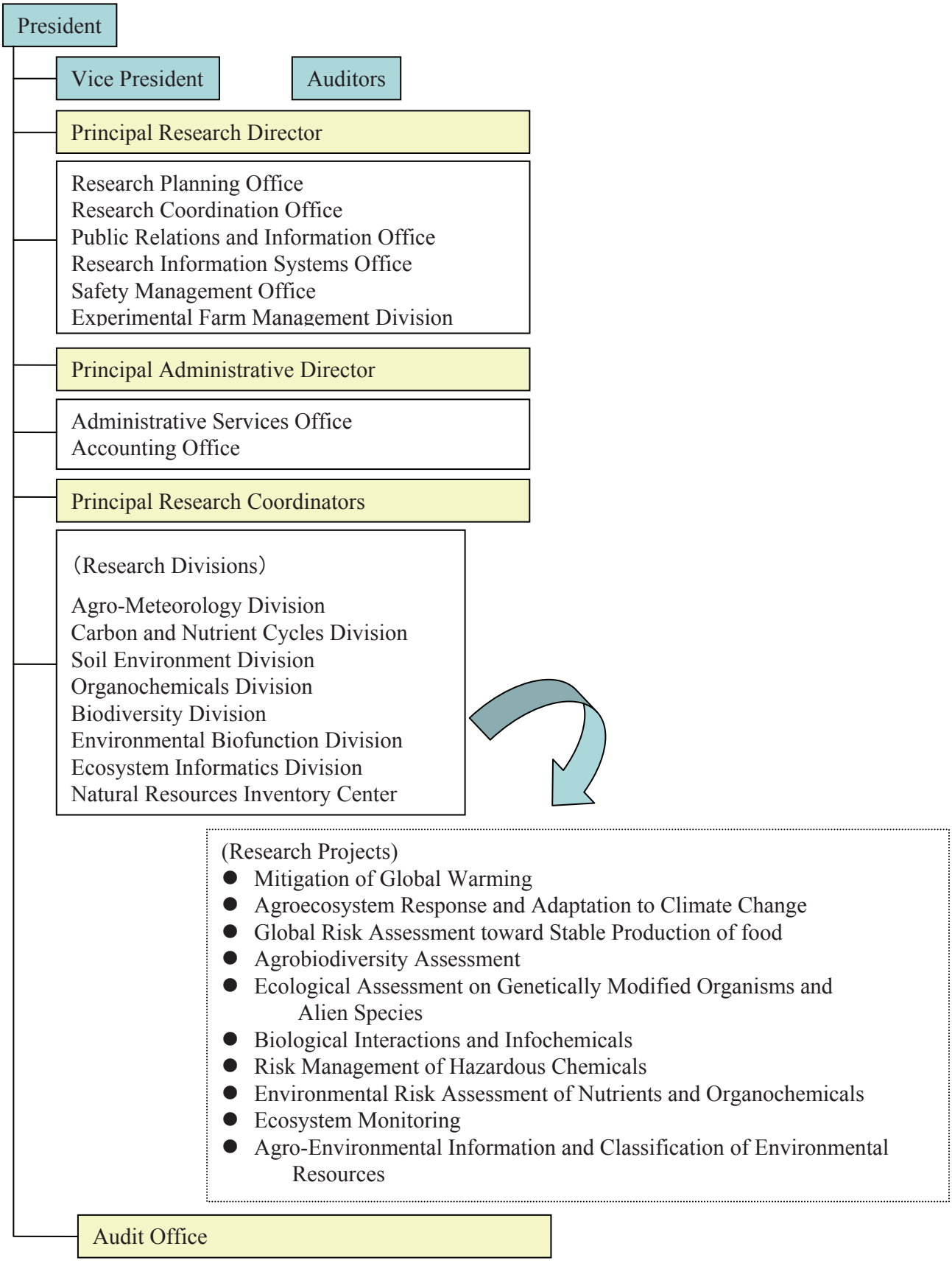
2006 NIAES becomes an autonomous agency on 1 April and begins its second research period (FY 2006 to FY 2010).

2011 NIAES begins its third research period (FY 2011 to FY 2015).

The main building of NIAES

Research Overview in FY2011

Research Organization



Summary of NIAES Research Projects

Environmental problems involving agriculture are a serious matter around the world, and at this time when citizens' concerns about food and environmental safety are growing, the National Institute for Agro-Environmental Sciences (NIAES) works under a basic philosophy of helping overcome the world's food and environmental problems through high-level research activities which aim to bring about a harmony between nature, society, and humans. NIAES also conducts basic technology-related studies, research, and other activities on the environments in which organisms used in agricultural production are raised for the purpose of helping improve technologies related to conserving and improving those growing environments.

To achieve this aim, in the phase III medium-term target period (the five years from 2011 to 2015) NIAES, in line with the following four priority areas, is forging ahead with research and development with a clear sense of mission by making full use of knowledge accumulated thus far and the domestic and international networks we have built, and bringing together a cross-cutting force of researchers.

A. Interactions between global environmental change and agriculture
B. Investigation of mechanisms of variation in agrobiodiversity and environmental function
C. Dynamics of agro-chemicals and methods of reducing their risks in agro-environments
D. Advancing inventory of natural resources

Following are descriptions of initiatives and achievements in 2011, the first year of the phase III medium-term target period.

A. Interactions between global environmental change and agriculture

1) Quantification of mitigation options for greenhouse gas emissions from agricultural lands

Medium Term Plan:

To quantitatively assess comprehensive global warming mitigation measures in order to effectively and efficiently implement such measures for farmland under international frameworks for addressing climate change in 2013 and thereafter.

Specifically, NIAES aims to decipher the processes involved in soil carbon storage and greenhouse gas emissions, proceeding from test plots and laboratory experiments to farmland, and will also use newly acquired observation data and improve models that forecast carbon storage and GHG emissions.

In addition to these models, the institute will accumulate and use activity data such as fertilizer management and land use information to further refine forecasts of methane and nitrous oxide emissions from Japan's farmland and forecasts of fluctuations in soil carbon storage amount.

Further, NIAES will devise future farmland management options that take into consideration factors such as tradeoff relationships, the amounts of organic resources that can be used, and lifecycle assessments of overall crop production processes, and then quantitatively assess the amounts of GHG emissions that could be achieved by means of comprehensive global warming mitigation measures based on those options.

Additionally, the institute will use the information databases and monitoring networks for GHG emissions and other information in the monsoon Asia region to assess the mitigation potential of global warming mitigation measures if they are applied in this region.

Research Overview:

i. Understanding and quantitatively assessing the processes of soil carbon storage and greenhouse gas emissions

We used specific gravity fractionation to investigate the accumulation of organic matter in the topsoil of an area fertilized continuously with compost and an area using chemical fertilizer. We found that in Andosols nearly all of the soil carbon that had increased due to continuous compost application existed as decomposing plant residue (light fraction), while in non-Andosols part of it accumulated in a form that is strongly bonded with mineral particles (heavy fraction). Also, in 10 prefectures throughout Japan we measured the N_2O emission from the application of organic matter to fields, and estimated the N_2O emission factor for the application of composted cow manure to be 0.04% of nitrogen input.

ii. Improving and refining models to predict soil carbon storage and GHG emissions

We validated the DNDC (DeNitrification-DeComposition)-Rice model. We found that the model can generally predict the percentage of carbon contributed by rice plants, with the model well

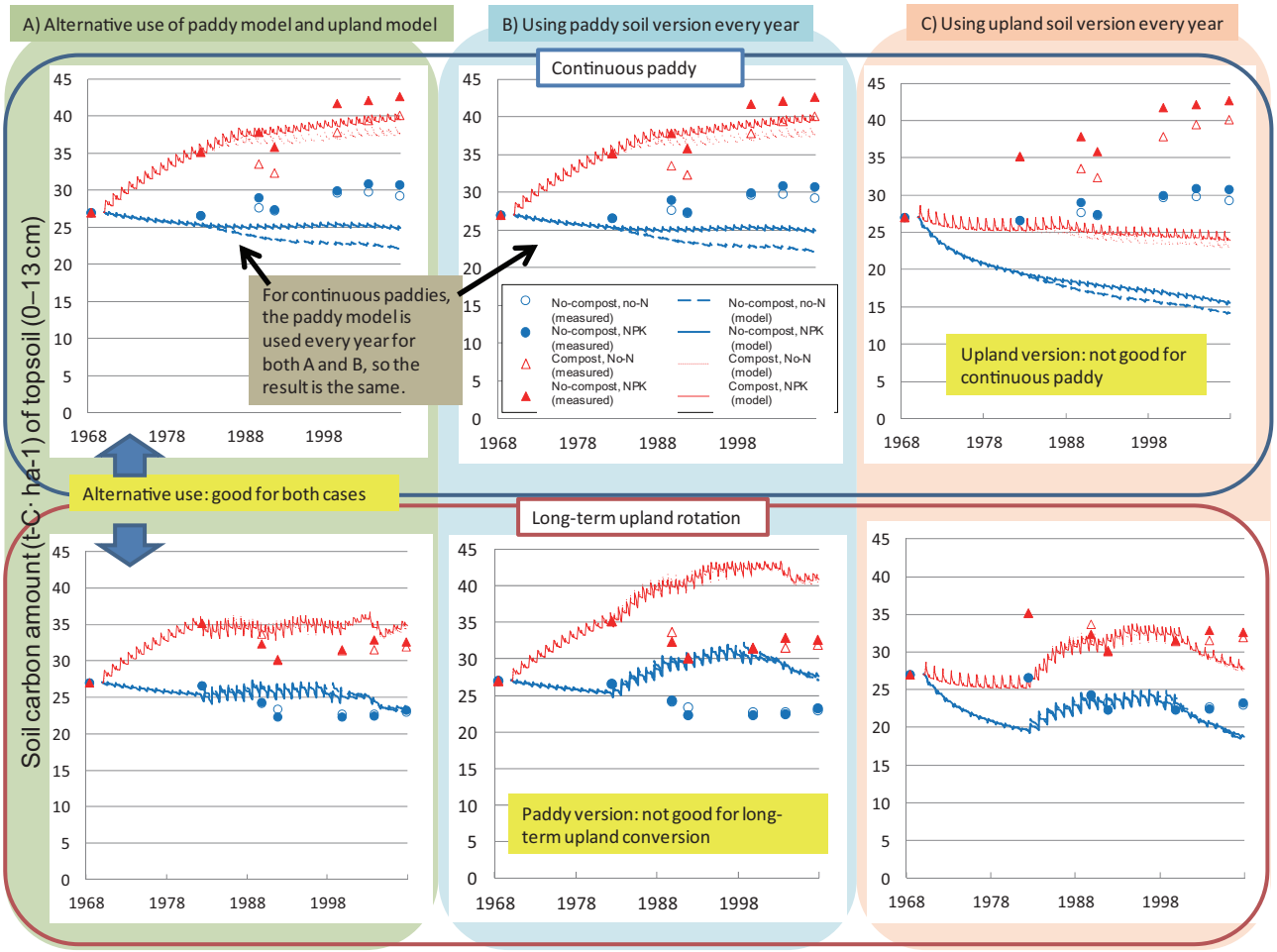


Fig. 1-1 Application of RothC soil carbon dynamics model to paddy/upland rotation

Using two models in conjunction— i.e., using the improved RothC for paddies (RothC-26.3_p: carbon decomposition rate changed to 0.2 for the month when rice is planted and 0.6 for other months) for years when the summer crop is wet rice, and using the original RothC (RothC-26.3) for upland fields in years when the summer crop is soybeans— resulted in the best coincidence between the model and measured values. Although not shown in the figure, similar results were obtained in the short- and medium-term upland rotation plots.

reproducing the CH_4 flux and CH_4 flux during the heading stage observed in a Free-Air CO_2 Enrichment (FACE) experimental rice paddy created in Tsukubamirai City.

To develop a statistical model for N_2O emissions, we built a GHG database for Japan's farmland and populated it with observation data. To refine our N_2O emission assessment, we accumulated activity data such as fertilizer management and land use information, and used the basic soil environment survey (stationary monitoring) and statistics from the Ministry of Agriculture, Forestry and Fisheries to estimate the application amounts for composted livestock waste and chemical fertilizer N. Additionally, we endeavored to improve the Rothamsted Carbon (RothC) soil carbon dynamics model by (a) making further improvements to the general-use improved RothC model for Andosols using a phosphate absorption factor, and (b) applying it to paddy/upland rotation land use (Figure 1-1).

iii. Assessment of mitigation potential in the Monsoon Asia region

We used long-range continuous test data from China to validate the RothC model. We found, for example, that the current model yields accurate results for upland fields, while the improved Japanese model for paddies is accurate for double-cropped paddies. We also initiated a test to compare GHG flux and soil carbon change in Thai rainfed paddies.

2) Mechanisms and impacts of global environmental change on crop production

Medium Term Plan:

To aid in the development of rice cultivars and cultivation management techniques suited to the high CO_2 concentrations and warmer environments predicted for the future, we aim to determine the response

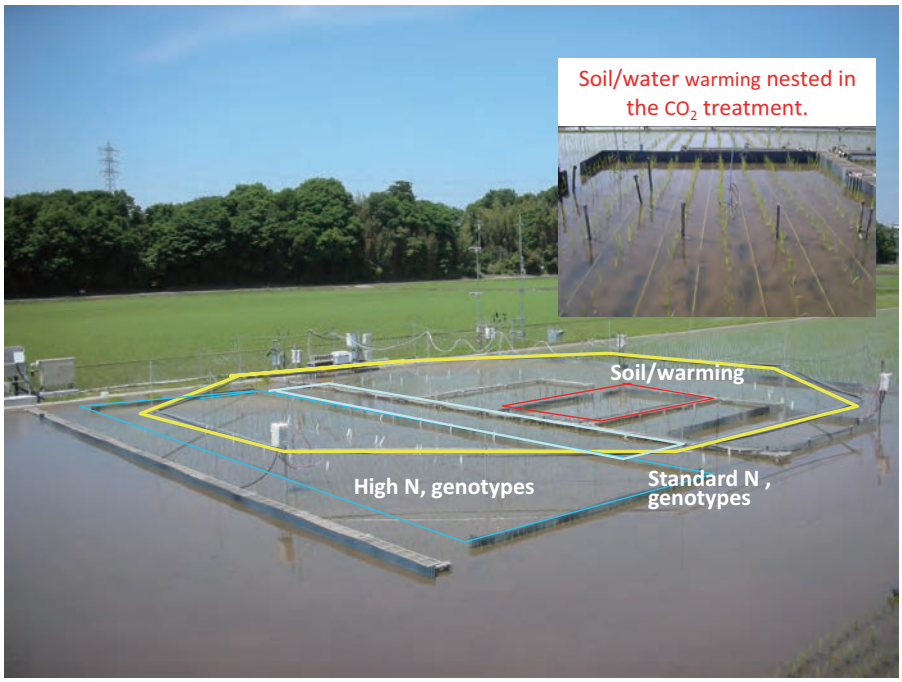


Fig. 1-2 Tsukubamirai FACE (Free-Air CO_2 Enrichment) experiment

Split plot design with four replications. Main plot: CO_2 was 200 ppm higher than ambient air.
Subplots: Three nitrogen-fertilization levels: 0, 8, 12 gm^{-2}. Two levels of soil and water temperature (control +2˚C).
Cultivars: Koshihikari, Akitakomachi, Takanari, Akita #63, Aikoku, Norin 8 , Akihikai, Akidawara, and others

characteristics of rice plants to high CO_2 concentrations and their mechanisms of tolerance to high-temperatures, and to develop an impact prediction model. Additionally, we aim to develop a method to assess the vulnerability to climate change of the main crops in Japan and other Asian countries and predict changes in food production amount.

Environmental manipulation experiments such as free-Air CO_2 Enrichment (FACE) experiments and chamber experiments will be used to determine, on the individual plant level and on the community level, how responses by rice plants to increased CO_2 concentrations differ depending on genetic type and cultivation environment, and to experimentally elucidate the tolerance mechanisms of rice plants to high-temperature stress, which is feared will occur more frequently in the future.

Based on what is found, we aim to develop a model to forecast crop growth, yield, and quality in the future environment forecast by climate scenarios, in order to assess the effectiveness of techniques for adaptation to global environmental change.

Additionally, we aim to develop a model which forecasts food production amount nationally for Japan and for Monsoon Asia as a whole, taking into account climate change and technologies to adapt to it, based on downscaling techniques for climate model calculation results and on research on field-scale environmental response mechanisms of crops and the achievements of region-scale yield change predictions.

Further, while taking into consideration the frequent occurrence of climate extremes that could happen under climate scenarios by the IPCC and others, as well as changes in water resources and land use, we aim to develop methods of assessing, according to region, the vulnerability of medium- and long-term food production capacity due to climate change.

Research Overview:

a. Understanding the mechanism of crop response to climate change, and predicting impacts

i. Characteristics of reaction to high CO_2 concentrations with respect to rice yield and quality, and causes of change

A FACE experiment (Figure 1-2) showed that yield response to high CO_2 concentrations ranged between 4% and 37% depending on cultivar, and that the difference depended mainly on the high-CO_2 response of the sink capacity (the number of spikelets per panicle and grain set). Also, although the apparent quality of rice declines under high-CO_2 conditions, the extent of decline differed greatly among cultivars, suggesting the potentials of genetic improvements.

The FACE experiment in 2010, a year of record heat, found that rice yields increased when the CO_2

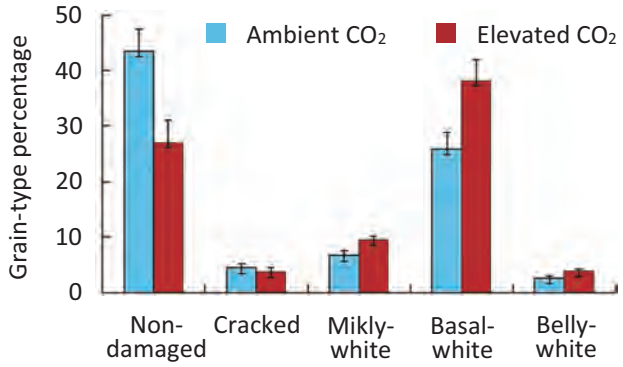


Fig. 1-3 High CO_2 concentrations considerably reduce Koshihikari brown rice quality

Under conditions of high CO_2 concentration, non-damaged grain percentage declined while milky-white and immature grains increased. The main cause of the reduced non-damaged grain percentage is white immature grains (milky white, basal-white, white-belly). In particularthe basal whilte accounted for most of the reduction. (Averages for three different nitrogen levels and two different water temperature regimes. Error bars show standard error.)

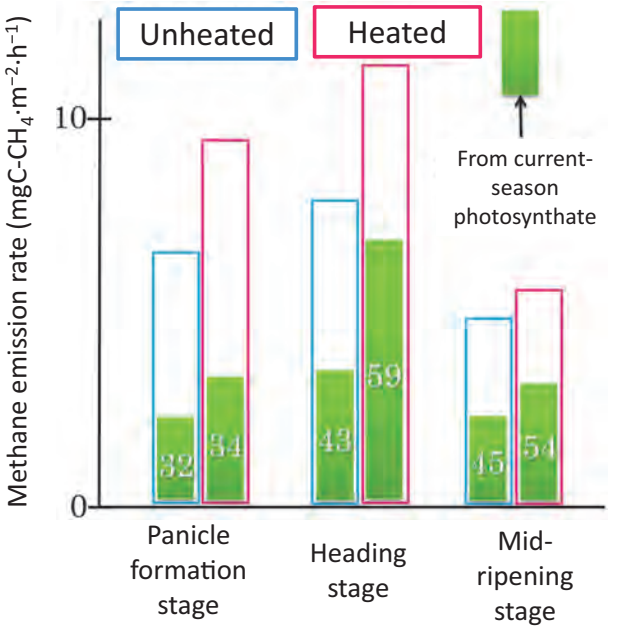
concentration was 200 ppm higher than ambient air, but we found that there was a marked increase in the percentage of white immature grains (chalky grains), and that the non-damaged-grain percentage, which influences rice quality, declined substantially. The results suggest that high-temperature injury to rice, which will occur more frequently owing to global warming, will likely worsen because of elevated CO_2 concentrations (Figure 1-3).

ii. Analyis of the variation in panicle temperatures

We focused on nitrogen application as a management technique to mitigate high-temperature stress, and showed that nitrogen application is effective as a means of lowering panicle temperature and avoiding high-temperature stress during the flowering period.

iii. Climate change influence on carbon and nitrogen dynamics in rice paddies

In a FACE experiment, we employed an isotope tracer method which takes advantage of the difference in carbon isotope ratios between soil carbon and rice plants raised in an elevated-CO_2 plot (adding CO_2 with less ^{13}C), and found that the photosynthates of the rice plants under cultivation are one of the main substrates of methane emitted from FACE paddies (Figure 1-4).



Contribution of the current-season photosynthates to substrate of emitted methane measured at three growth stages and under two temperature retimes.

Height of green boxes shows the methane emission rate from the current-season photosynthates, and white figures indicate the percentage of emissions from photosynthates in the total emission rate. The heating treatment tended to raise the methane emission rate and the contribution of photosynthates.

Fig. 1-4 Current-season plant photosynthates are a major source of methane emissions from FACE paddies

Research Overview:

b. Development of a method for wide-area assessment of food production activities under global environmental change, and future outlook

i. Assessment of food production change in Japan

We incorporated into a rice productivity environmental response model a development forecasting submodel for 15 major Japanese cultivars, and refined the model to enable it to predict productivity according to cultivar. Into this model we entered wide-area cultivation management information obtained from agricultural statistics and other sources, and weather data based on measurements. We then performed calculations and verified the developmental stage (heading day) and yield reproducibility by comparison with statistical values for each cropping zone. We confirmed that the model outputs reasonable values for heading date if users appropriately set the cultivar and transplanting period for the target geographical area. With respect to yield, the yield decrease in cold-injury years was appropriately reproduced. Additionally, we developed and verified a model which predicts the percentage of

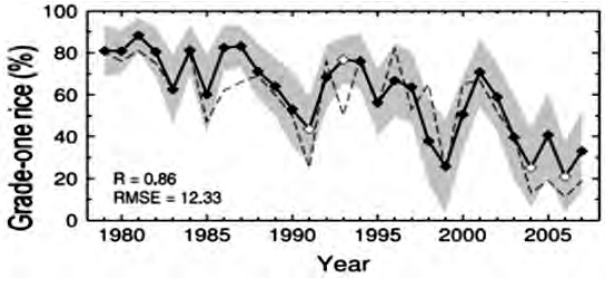


Fig. 1-5 Model which forecasts the percentage of grade-one rice at the prefectural level by taking into account air temperature and insolation environment: An example of Prediction for Fukuoka Prefecture

Broken line shows statistical values, solid line shows model's estimated values. Years marked by white dots had typhoon damage and are not counted. We created the model while excluding data for certain years, and verified the model by repeatedly predicting the data for the excluded years. The correlation coefficient was 0.86, and the root-mean-square error was 12.33%.

grade-one rice at the prefectural level based on air temperature and insolation environment (Figure 1-5).

ii. Climate change scenario downscaling

We developed and populated a local-scale, daily climate change scenario dataset (ELPIS-JP) which can be used to explore the impacts of climate change on Japan's food production and adaptation strategies. This dataset includes time-series data for seven variables: mean daily temperature, high temperature, low temperature, precipitation, integrated solar radiation, relative humidity, and ground-level wind velocity for a maximum of 938 locations, making it possible to use 1,300 climate change scenarios at each location. Using ELPIS-JP makes it possible to obtain information on the uncertainty of future changes in climate variables, which cannot be delineated with a simple scenario (Figure 1-6), and it also makes possible applications such as estimating the risk of high temperatures at certain crop developmental stages such as the rice plant flowering period.

iii. Assessing worldwide food production changes

As the basic data for creating a major-crop productivity environmental response model for areas of the world that produce major grains, we collected agricultural statistics for the world's 14 major crop producing and exporting countries on rice, corn, soybeans, and wheat, plotted the data on a grid which has the same resolution as JRA25 weather data (1.125° longitude and latitude), and created a crop productivity dataset. Also, we enhanced the responsiveness of the productivity environmental response model to high CO_2, linked it with a water resource model, and proposed a procedure that calibrates the model using crop yield and river flow rates. We then examined the soundness of the model by applying it to China's Northeast region.

B. Investigation of mechanisms of variation in agrobiodiversity and environmental function

1) Investigation of mechanisms of variation in agrobiodiversity and development of appropriate management technologies

Medium Term Plan:

To provide for the compatibility of biodiversity conservation and agricultural production in agricultural ecosystems, we aim to determine the responses of ecosystem structures and representative biological communities to changes in agricultural activities, and to develop methods to predict biodiversity changes.

In other words, this would involve understanding the impacts on, for example, mutual relationships among plants, insects, and birds by changes in agricultural activities such as the increasing acreage of abandoned farmlands. Also, we aim to develop biodiversity indicators by which the effectiveness of initiatives such as environment-friendly agriculture on biodiversity can be assessed, and to develop assessment/management methods which use those indicators. Additionally, we aim to develop other tools for a wide-area biodiversity assessment/prediction which also use the biodiversity indicators and the Rural Landscape Information System (RuLIS) for biodiversity conservation.

We also aim to develop a method to assess the impacts that exotic organisms and crops genetically engineered to tolerate environmental stresses and other adverse conditions have on biodiversity, and to develop a management method for the coexistence of crops that are and are not genetically modified.

Research Overview:

a. Effects of changes in agricultural activities on biodiversity: impact analysis and assessment methodology

i. Methods for integrated and wide-area assessments of biodiversity in agricultural ecosystems

We analyzed the mutual interrelationships in several species groups studied around abandoned rice paddies used for cattle grazing, and identified the interspecies group relationships which correspond to the local

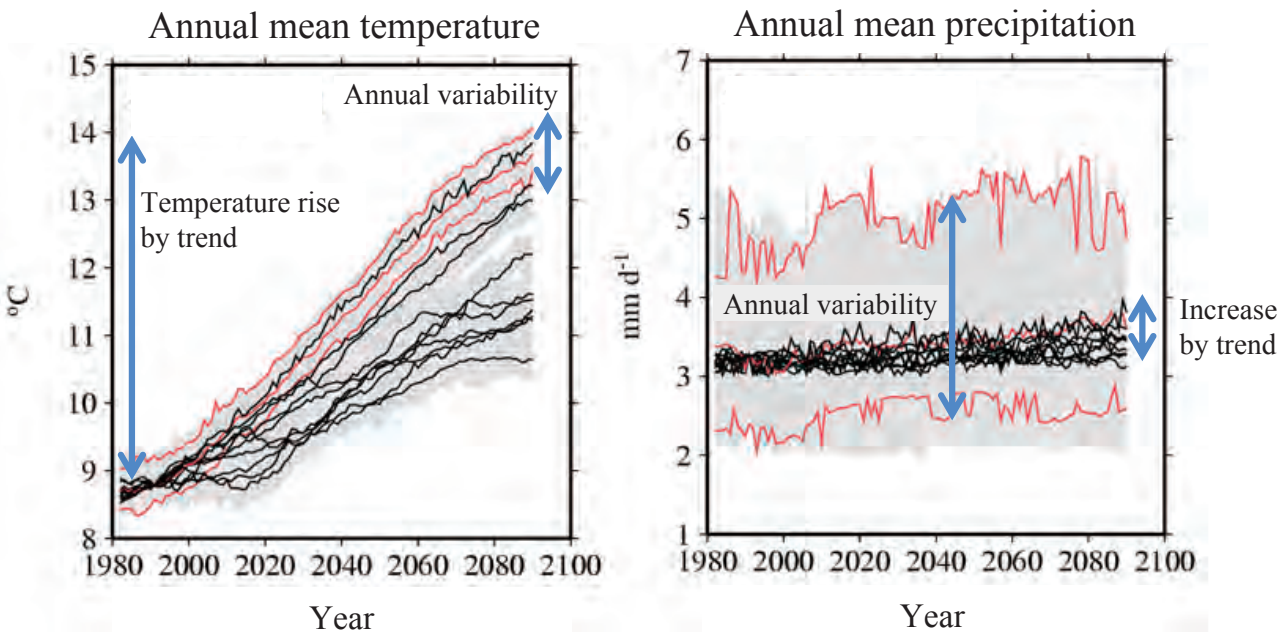


Fig. 1-6 An example of using the local-scale daily climate change scenario dataset (ELPIS-JP)

Using Sapporo, Hokkaido as an example, we used the ELPIS-JP dataset to calculate the annual mean temperature and precipitation for 1981–2091. The gray area shows the range between the maximum and minimum values of 50 time series created by applying a weather generator to 10 global climate models which are supplied with the 7 climate variables, while the black lines plot the median values produced by each climate model. (By way of comparison, the red lines show the predicted median values and the 90% confidence interval produced by a model called MIROC-H.) At this location, it is safe to say that the annual mean temperature will rise in the future, even if we take prediction uncertainty into consideration, but the results suggest that there is too much uncertainty to say whether precipitation will increase over the long term.

landscape structure, including pastureland and abandoned farmland. We also entered NIAES biodiversity observation data (currently about 60,000 items) into the Rural Landscape Information System (RuLIS), and via RuLIS-WEB we released about 20,000 items that could be made publicly available.

ii. Effects of landscape structure around farmlands on biodiversity and biodiversity indicators

We surveyed candidate indicator species groups that show the effects of environment-friendly (environment-preserving) agriculture in rice paddies in Tochigi Prefecture. We examined the differences in densities of the species groups due to differences in farming practices (conventional, reduced-pesticide, and organic farming), and showed that *Tetragnatha* spiders, lycosid spiders, *Sympetrum* dragonflies, coenagrionid damselflies, and aquatic insects (aquatic beetles and aquatic hemipteran bugs) are appropriate as indicator organisms. We determined reference values to discriminate farming practices based on the average numbers of individuals in organic/reduced-pesticide paddies and conventional paddies, and proposed a method to assess the effectiveness of environment-friendly agriculture on biodiversity using these values. Specifically, this method involves finding scores for the numbers of individuals in each of five indicator organisms (Table 2-1), and then totaling them to calculate the overall score. We applied this method to the study fields, resulting in different overall scores: conventional farming (overall score 1-3), reduced-pesticide farming (5-6), and organic farming (8-10). These results show that this assessment clearly reflects the differences in farming practices.

Using the study results from rice paddies in 230 locations in 12 prefectures throughout Japan, we statistically analyzed the environmental factors affecting the number of individuals (abundance) in the candidate indicator organisms, *Tetragnatha* spiders. We found that reducing pesticide applications increases spider abundance, depending on natural environments (e.g. precipitation and forest area), thereby producing interregional differences in the effectiveness of environment-friendly agriculture on the spider abundance (Figure 2-1).

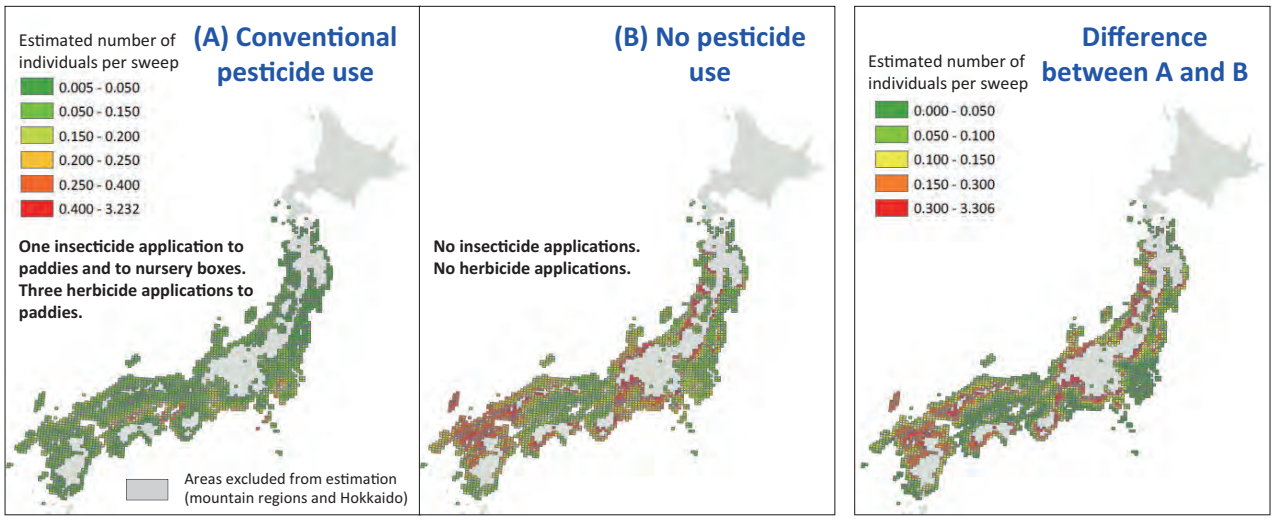
iii. The mechanism of changes in biodiversity caused by increased acreage of abandoned farmlands

We analyzed the population dynamics and other attributes of plants in long-abandoned farmlands, and

Table 2-1. Indicator organisms and scores based on the number of individuals surveyed in rice paddies

Find the scores from the numbers of individuals in each of the 5 indicator organisms, total them, and calculate the overall score. This overall score can be used as a biodiversity indicator to assess the effectiveness of farming practices on biodiversity conservation.

Indicator organisms	Survey method	Survey sites in a field plot	Score		
			0	1	2
Tetragnatha spiders	Sweeping rice plants with an insect net	20 swings × 2 sites	<5	5-15	≥15
Lycosid spiders	Visual counting on rice plants	5 rice hills × 4 sites	<4	4-12	≥12
Sympetrum dragonflies (adults or nymphal exuviae) or Coenagrionid damselflies (adults)	Visuall counting on and around rice plants along a paddy levee	10 m × 4 sites	<1	1-3	≥3
Rana porosa species group or *R. japonica* species group	Visual counting on and around paddy levees	10 m × 4 sites	<3	3-9	≥9
Aquatic beetles (Coleoptera) and Aquatic bugs (Hemiptera)	Dipping a D-flame net into paddy water along a paddy levee	5 m × 4 sites	<1	1-3	≥3



We used a hierarchical linear model to estimate the numbers of *Tetragnatha* individuals nationally, assuming conventional pesticide use and no pesticide use. The difference between them varied among regions, depending on their natural environments such as climatic factors.

Fig. 2-1 Natural environment alters the effectiveness of environment-friendly agriculture on biodiversity

found that, in the dynamics of perennial herbs, competition with vines has an influence, while with the establishment of tree seedlings, selective grazing by wild animals and sprouting capacity have an influence.

Research Overview:

b. Development of a method to assess the impacts of genetically modified (GM) crops and alien species on biodiversity, and a method to manage the cross pollination and mixing between GM and non-GM crops

i. Developing a method to assess the impacts of genetically modified crops and alien plants on biodiversity

We used a transition matrix model to analyze a scenario in which GM soybeans (*Glycine max*) fall outside the field where grown and become feral.

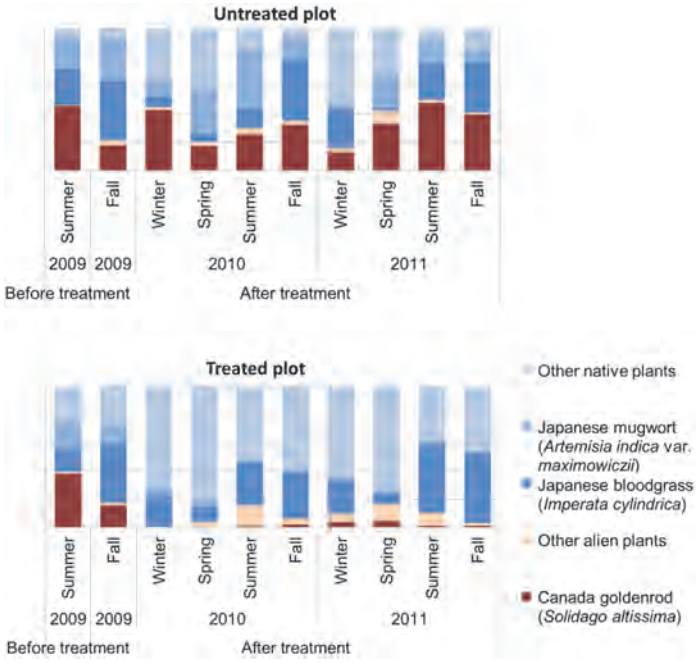


Fig. 2-2 Control of Canada goldenrod by spreading aluminum chloride

Relative vegetation coverage of test site. In the treated plot, Canada goldenrod was suppressed for a long time, and the site gained diverse vegetation dominated by Japanese bloodgrass and other native plants.

Results showed that the fallen soybean seeds would be unable to survive the winter and would disappear. It was conjectured that for soybeans to become feral, it would be necessary to gain dormancy or wintering ability, and to produce more seeds. Also, to contribute to the preparation of a biology document (which provides basic information for "Biological Diversity Risk Assessment Report") on the closely related wild soybean (*Glycine soja*), we analyzed the information on wild soybean collection areas registered in the National Institute of Agrobiological Sciences gene bank and the meteorological conditions of collection areas gained from Rural Landscape Information System (RuLIS), and from this we determined the meteorological conditions that enable wild soybean growth.

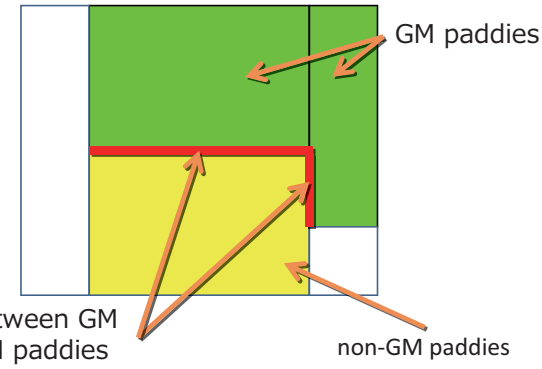
We found that the alien plant Canada goldenrod (*Solidago altissima*) is distributed in eutrophic environments with high soil pH, and confirmed that in abandoned orchards with heavy infestations of this plant, controlling soil chemical characteristics (by spreading aluminum chloride on the soil surface) makes it possible to induce the dominance of Japanese bloodgrass (*Imperata cylindrica*) and turn the area into a grassland with many native plants (Figure 2-2).

To assess the management priorities for alien afforestation plants that have escaped from vegetated slopes, we indexed the amount of land in national parks where four species could grow: redtop (*Agrostis gigantea*), white clover (*Trifolium repens*), orchard grass (*Dactylis glomerata*), and tall fescue (*Festuca arundinacea*). We then calculated their weed risk by multiplying the indexes by the grade (degree of impact) assigned under the Japanese version of the Australian weed risk assessment system (JWRA).

ii. Developing a method to manage the cross pollination and mixing between GM and non-GM crops

To investigate cross pollination between GM rice (*Oriza sativa*) and non-GM rice plants, we built a Geographic Information System (GIS) database to estimate the regional average cross pollination rate and devised an average cross pollination rate estimation index which uses the tangential line length between paddies with GM and non-GM rice, and the size of the non-GM rice paddy (Figure 2-3). This index will provide a benchmark for the average cross pollination rate if one has the GIS data from the local municipality. It correlates well with the results of simulations performed thus far for average cross pollination rates based on the datasets for things such as meteorological conditions during the flowering period, and our research showed that the index can replace simulations.

We developed an optimum sampling method to use when sampling GM seeds under conditions in which fields are of different sizes. When we derived a relational equation for field (lot) size and optimum sampling number, we found that, contrary to



$$\text{Cross-pollination rate estimation index} = \frac{\text{Length of tangent between GM and non-GM paddies}}{\text{Size of non-GM paddy}}$$

$$index = \frac{Tangent_{GM\text{ - }nonGM}}{Area_{nonGM}}$$

Fig. 2-3 Index providing a simple estimation of the cross pollination rate between genetically modified (GM) rice and non-GM rice plants

Conceptual diagram showing calculation of cross pollination rate estimation index
Green shows the GM paddies, yellow shows the non-GM paddy, and white shows other land use. Dividing the length of the red line adjacent to the paddies by the size of the non-GM paddy gives the cross pollination rate estimation index. When a non-GM paddy is adjacent to several GM paddies as shown in this diagram, the total of all lines is used. Because this index is calculated for each non-GM paddy adjacent to GM fields, the index's average is calculated when there are multiple non-GM paddies.

conventional sampling theory, one should collect more seeds from large fields. When managing the risk for all seeds gathered from all fields, if one bungles the inspection in a large field, then many more seeds will be mixed in with those shipped than if the inspection of a small field was botched, and our interpretation was that this is the reason the relational equation works.

2) Investigation of environmental biofunctions for environmentally friendly and sustainable agriculture

Research Overview:

i. Application to allelochemical herbicides

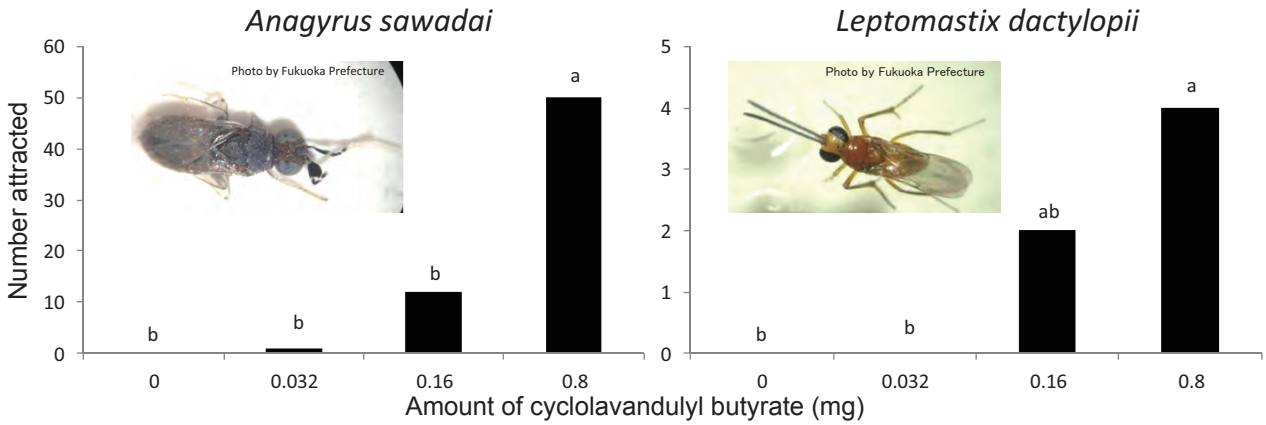
For the selection of chemical compounds leading to the development of new agricultural materials, we screened plants with high allelopathic activity and found that a plant native to Malaysia, *Goniothalamus andersonii*, displayed activity in the highest group. We isolated the allelochemical and determined that its chemical structure is goniothalamin. We used a DNA microarray to investigate this compound's effect on gene expression in *Arabidopsis thaliana*, and the results suggested that it displays growth inhibiting activity by inducing the responses to oxidative stress.

ii. Use of semiochemicals to control insect behavior

In a study involving mealybugs, which are a serious insect pest of vegetables and fruit, we investigated the seasonal prevalence of adult males (monitoring) with a trap using female sex pheromones, and confirmed that it is possible to easily and with high accuracy determine the best time to apply insecticides (when insecticides are most effective on the young larvae). NIAES licensed the related patents to a private firm, which contributed to the deployment of Japan's first monitoring and attraction agent for mealybugs. At the same time, we discovered a substance which attracts a parasitic wasps that are native natural enemies of the mealybugs (Figure 2-4).

iii. Easy-to-use agricultural materials that decrease waste

We found the best conditions for biodegradable plastic degrading enzymes, derived from molds and



Relationship between the impregnated amount of the discovered attractant (cyclolavandulyl butyrate) and the parasitic wasp attractant activity.

The number attracted is the total number of individuals captured in 3 traps set from October 6–21, 2008. Values indicated by different letters are significantly different (Tukey–Kramer HSD test, $P < 0.05$).

Fig. 2-4 Discovery of a substance that powerfully attracts parasitic wasps preying on mealybugs

yeasts, and developed a method for their large-scale production. Additionally, we demonstrated the rapid decomposition of biodegradable plastic mulch on farmland treated with a mold-derived enzyme (Figure 2-5). We applied for three patents for this novel technology for accelerating mulch film degradation.

C. Dynamics of agro-chemicals and methods of reducing their risks in agro-environments

1) Improvement of methods for reducing risks of toxic chemicals

Medium Term Plan:

To mitigate the risk of agricultural crop contamination by hazardous substances such as cadmium, arsenic, and persistent organic pollutants (POPs) in the agro-environment, we aim to illuminate the dynamics of these hazardous substances in the soil–crop system and the mechanism of their absorption by plants, and we aim to facilitate the enhancement of risk-mitigation techniques based on contamination risk prediction techniques and on methods that use plants and physical or chemical means.

In other words, we aim to develop techniques which forecast the contamination risk to crops based on the extent of soil contamination, for POPs in the case of vegetables, and cadmium in the case of major upland crops.

To decrease the concentrations of cadmium in upland crops, arsenic in wet rice, and POPs in vegetables, we aim to develop soil remediation technologies and absorption-suppression cultivation techniques using plant functions and physical and chemical methods.

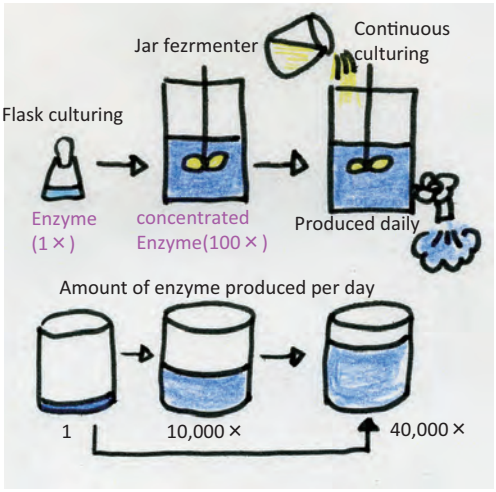
Research Overview:

i. Development of crop contamination risk forecasting techniques

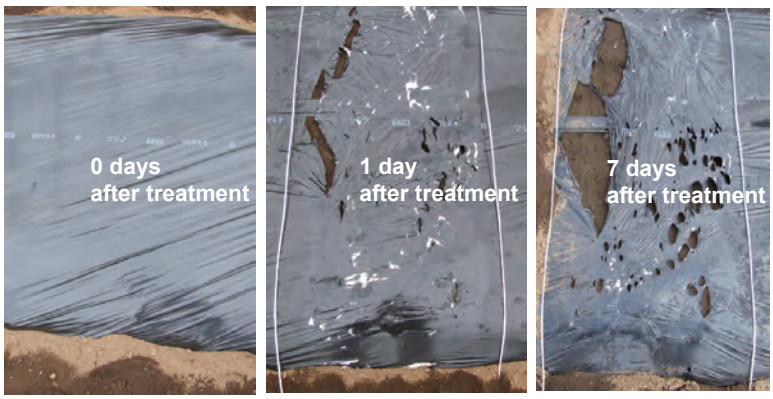
We found that when using a 50% methanol-water solution the extraction rate of dieldrin from soil to which activated charcoal had been applied generally matched the residue in cucumbers. Using this extraction method it is possible to predict in advance the dieldrin residue when applying activated charcoal, and one can determine the amount of activated charcoal that needs to be applied.

ii. Development of contaminated soil remediation technology

In the development of a technology to remediate contaminated soil, we created soil in which Cd content decreases by stages while changing soil washing intensity (concentration of washing agent, i.e. ferric chloride). We then cultivated wheat and soybeans, and found a high correlation between seed Cd concentration and soil Cd, and obtained the knowledge needed to set target values for soil washing remediation. In a bid to achieve practical phytoremediation, we produced several high-Cd-accumulating rice lines resistant to shattering and lodging by gamma-ray irradiation to high-Cd accumulating rice cultivars, Jarjan and Anjana Dhan.



Mass production of yeast-derived enzyme



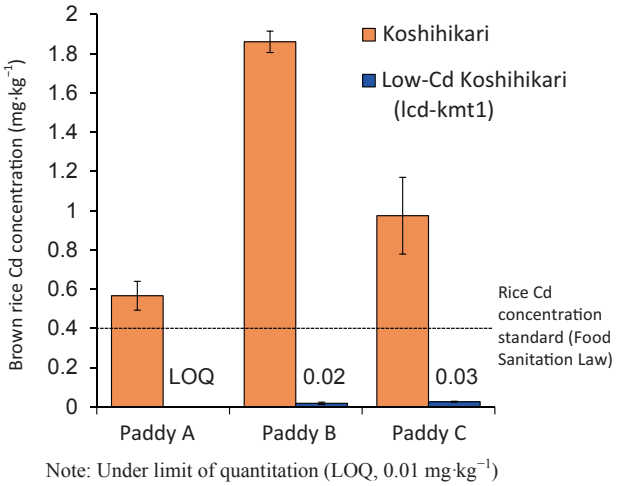
Accelerated decomposition of biodegradable plastic mulch films in the field using mold-derived enzyme

Fig. 2-5 Development of a technology using biofunctions for rapid decomposition of biodegradable plastics

iii. Development of cultivation techniques that suppress Cd absorption

We irradiated Koshihikari rice seeds with an ion beam and obtained a low-Cd-accumulating Koshihikari mutant (lcd-kmt1) from among approximately 3,000 M2 (second generation of mutant) platns grown in a Cd-contaminated paddy soil. The Cd concentration in brown rice was extremely low at under 0.03 mg·kg^{-1} (Figure 3-1). The plant shape and the quality of the brown rice were equivalent to that of wild type Koshihikari (WT), there was no significant difference in brown rice weight, and eating quality scores by a taste analyzer was estimated as good quality as Koshihikari. On the basis of the sequence in the mutation region in lcd-kmt1, we developed a DNA marker that can distinguish between WT and lcd-kmt1. This DNA marker is a powerful tool to introduce a mutant allele responsible for low Cd into various rice cultivars. This will not only make it possible to substantially reduce dietary Cd intake, which is high in Japan when compared internationally, but also eliminate the need for the deep ponding necessitated for soil with high Cd concentrations. Therefore, it is also possible to reduce the intake of arsenic, whose absorption increases with deep ponding. This is also a very important achievement with respect to administrative policy.

We applied positron emission tomography imaging, which is used in applications such as early cancer detection, on plants. We successfully used positron-emitting ^{107}Cd to visualize and analyze in real time the movement of cadmium in rice plants.



Note: Under limit of quantitation (LOQ, 0.01 mg·kg^{-1})

Fig. 3-1 Cd concentration of brown rice when cultivating low-Cd-absorption Koshihikari in high-Cd soil

We cultivated low-Cd-absorption Koshihikari (lcd-kmt1) and ordinary Koshihikari in three paddies with high soil Cd concentrations (0.35–1.4 mg·kg^{-1}) using intermittent irrigation or draining the paddies around heading time, which are conditions under which rice plants readily absorb Cd, and measured the brown rice Cd concentration. While Cd concentration in ordinary Koshihikari brown rice from all paddies far exceeded the standard, the maximum concentration in lcd-kmt1 was extremely low at 0.03 mg·kg^{-1}.

2) Methods of predicting the environmental dynamics of agro-chemicals and evaluating their impacts on agro-ecosystems

Medium Term Plan:

We aim to produce numerical models of the dynamics of pesticides and other organic agro-chemicals, and nutrients such as nitrate nitrogen and phosphorus in the agro-environment, develop a technique to predict their environmental loads at the watershed level, and develop a method to assess the impacts of those environmental loads on organisms.

Specifically, we aim to develop numerical models that comprehensively and quantitatively describe the dynamics of pesticides, nutrients, and other substances at the level of watersheds with rice paddies, and, with regard to non-point source pollution, develop a method to assess the amounts of the effluent loads and the techniques to address them.

Additionally, we aim to develop a method to assess the impacts of pesticides and other substances on communities of aquatic animals, plants, and other organisms, and develop a method, which incorporates probability theory, for assessing the ecosystem impacts of pesticides and other substances.

Research Overview:

i. Development of techniques to predict the environmental dynamics of agro-chemicals and other substances, and methods to assess the ecosystem impacts of agro-chemicals and other substances

In a bid to develop a method to predict the ecosystem impacts of agro-chemicals and other substances, we determined the dose-response relationships for growth inhibition and lethality induced by herbicide exposure in the green alga *Pseudokirchneriella subcapitata*, a standard alga species in OECD test guidelines, and conducted subsequent recoverability tests. We used the results to build an alga population model, and showed that the model-predicted values and actual measurements closely coincided and that the same model can be applied to other herbicides.

ii. Development of a technique to predict environmental dynamics of nitrate nitrogen and other substances, and a method to assess techniques to mitigate the effluent loads

Referring to the RothC model, we improved the source code for the decomposition process of organic matter in LEACHM, a model that predicts the dynamics of water, carbon, and nitrogen in soil, and parameterized various reaction rate constants and other items. We used the model for predictions under conditions of different soils (Sand-dune Regosols, Humic Andosols, Light-colored Andosols, and Medium and Coarse-textured Yellow soils), fertilizers (chemical fertilizers, pig manure compost, cattle manure compost, rice straw compost), and farmland types (vegetable fields and orchards), and worked on comparisons and verification of the model predictions with long-term observation data.

We calculated the potential nitrate concentration (PNC; i.e., excess nitrogen amount divided by effective precipitation) on small-watershed units for 6 watersheds or regions with different land uses (Tokachi River; Omono River; Naka River [in Tochigi Prefecture only]; Tone River tributaries [in Tochigi and Ibaraki prefectures]; Yahagi and Toyo Rivers; and Ooyodo and Kimotsuki Rivers). We classified the small-watershed units into 10 different land-use types, and investigated the influence of land-use type and watershed size on PNC and nitrogen runoff amount. Results showed that the relationship between the nitrogen load generated in the watershed and nitrogen runoff amount from the watershed has a positive linear relationship in each land -use type regardless of the watershed size.

iii. Development of technique to predict environmental dynamics of phosphorus and other substances, and a method to assess techniques to mitigate the effluent loads

To determine the regional scale dynamics of phosphorus derived from agricultural activities, we used the data of measurements of soil properties and results of questionnaires to farmers in the Stationary Monitoring data of the Basic Soil Environment Monitoring Project. We investigated the amount of phosphorus application, harvest, and mass balance at the soil surface, and the available phosphorus content in the top soil layer (by Truog test) from the first round of the Stationary Monitoring (1979-1983) to the fifth round (1999-2003) according to 7 regions, 16 Soil Groups, and 7 crop groups, and we then databased the information. We found that although the amounts of phosphorus applied to farmland tended to decrease year by year, application of phosphorus to vegetable fields is particularly large, with extremely excessive amounts of 10-30 times the harvest amount being applied.

In 2003, the environmental quality standard for zinc pollution was set at 0.03 $mg \cdot L^{-1}$ for rivers and lakes, but the state of effluent zinc loads from agricultural point and non-point sources is still unknown. For this reason we investigated the effluent zinc loads from pig farms at

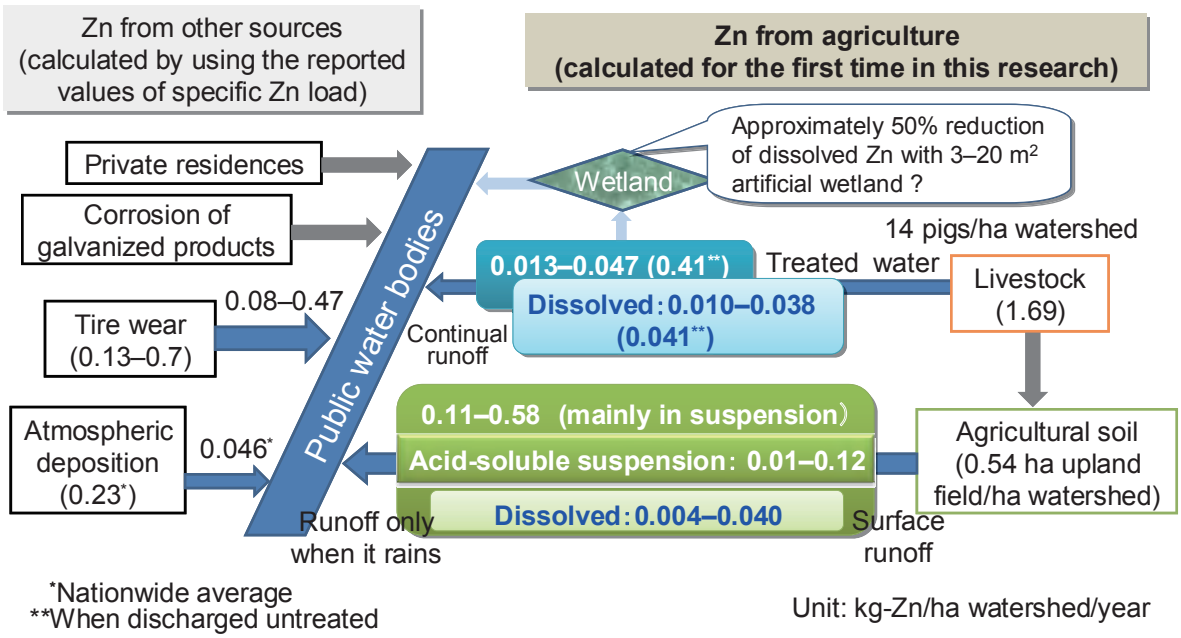


Fig. 3-2 Determining the state of zinc runoff from agriculture
Zinc flow from agricultural catchment area to public water bodies (Arata River watershed)

different regions, and monitored zinc runoff from upland fields to which composted livestock manure was applied. Results indicated that zinc running into river systems from livestock farms after wastewater treatment was mainly dissolved, while that from upland fields was mainly in suspension. Furthermore, we calculated the zinc flow within the watershed of an agricultural catchment area with much livestock farming and upland field farming (Arata River, 3.2 km^2) using zinc runoff monitoring results and a regional scale model estimation method based on those results (Figure 3-2). The amount of zinc running off from this agricultural catchment area to public water bodies was estimated at 0.1~0.6 $kg \cdot ha^{-1} \cdot yr^{-1}$. This research was the first to reveal the state of agricultural zinc runoff in Japan.

D. Advancing inventory of natural resources

1) Monitoring and predicting agro-environmental dynamics using geoinformation and flux-measurement

Medium Term Plan:

To benefit the computerization and wide-area assessment of agro-environmental resources, we aim to develop technologies to analyze remote sensing data using hyperspectral imaging and heretofore unused wavelength bands, and to develop highly accurate, wide-area assessment methods for ecosystem dynamics including crop productivity, land use, vegetation coverage, and soil characteristics.

We aim to fuse these methods with achievements in the areas of gas-flux monitoring research and to develop a system for the wide-area monitoring and prediction of biophysical ecosystem dynamics such as greenhouse gas flux, water and carbon dynamics, and crop productivity.

Research Overview:

i. Development of wide-area assessment methods for agricultural ecosystem information

One of our recent results is a method for wide-area assessment of developmental stage of corn canopy using MODerate resolution Imaging Spectroradiometer (MODIS) satellite data. On the basis of developmental stages estimated using the method, we further developed and verified a simple method that estimates daily photosynthesis of corn from the product of the vegetation index and shortwave radiation (Figure 4-1).

ii. Quantitative assessment of gas flux dynamics in agricultural ecosystems

We are continually monitoring biophysical ecosystem variables including CO_2 and evapotranspiration fluxes at Japanese and overseas sites using mainly the eddy correlation method. The rice paddy flux site in Mase, Tsukuba City is an ancillary site of the Japan Long-Term Ecological Research Network. The high quality dataset obtained are used for the analysis of exchange of greenhouse gas, water, and

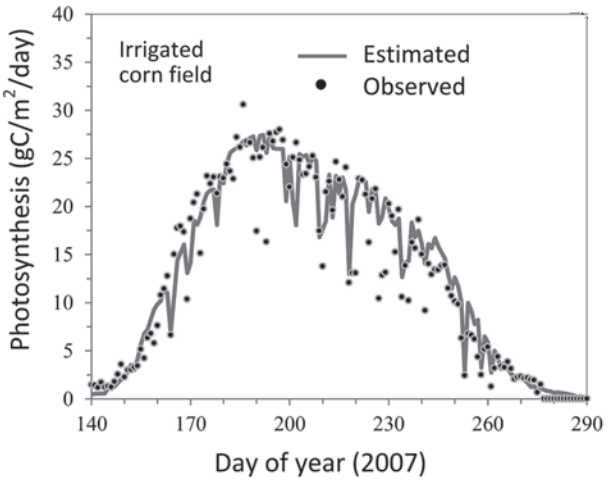


Fig. 4−1 Estimation of daily photosynthesis of corn using MODerate resolution Imaging Spectroradiometer (MODIS) satellite data

The results closely coincide with the pattern of seasonal change in photosynthesis estimated from flux observations.

energy in agro-ecosystems. One of the recent results showed a new method enabled to assess the components of CO_2 flux, i.e., photosynthesis, plant respiration, and microbial respiration separately. This method is useful to analyze the biophysical mechanisms for yearly changes in paddy CO_2 balance and to model such processes.

iii. Building a wide-area monitoring and forecasting system

We formulated the basic functions and structure of a wide-area monitoring and forecasting system for ecosystem dynamics information (Figure 4-2). We then designed and built the prototype for a networked data system that allows near real-time online collection and systematic management of fluxes of CO_2 and other gases, micro-weather, photographs and videos, spectral ground measurements, satellite images, and other data from multiple locations that are the core elements of the system. We also used eddy correlation data collected online with a ground sensor network, and made it possible to quickly process and analyze agricultural ecosystem CO_2 and evapotranspiration fluxes in near real-time, and continuously output multi-location changes and quality information.

2) Collecting agro-environmental information and development of integrated database

Medium Term Plan:

We aim to facilitate the use of agro-environmental resources and information on them, build and expand individual databases for soil, insects, weather, and other elements, and develop methods to use the data. Also, we aim to monitor radioactive substances in the agro-environment and determine their levels over time.

We also aim to build an integrated agro-environmental information database capable of centrally providing nationwide agro-environmental information including that on soil, weather, organisms, land use, satellite images, and agricultural statistics.

Further, to assist the creation of agricultural ecosystem management scenarios aimed at compatibility between high agricultural productivity and environmental conservation, we aim to develop an integrated environmental impact assessment (eco-balance assessment) method which makes use of diverse spatial information, models, LCA methods, statistical methods, and more, and takes into consideration factors such as GHG emissions, soil carbon storage, biodiversity, leaching of nitrate nitrogen into groundwater, and wide-area nitrogen flow, as well as productivity.

Research Overview:

i. Building and expansion of individual databases including soil, insects, and weather, and development of ways to use the data

We worked on expanding individual databases, registered 209 images of pressed leaf specimens, added information on insect literature, and made other additions, and in the area of insect classification research, as a new species we described a weevil that infests upland wasabi and is confused with closely related species (Figure 4-3).

We applied the Comprehensive Soil Classification System of Japan First Approximation to National Land Survey data (200,000:1), assembled soil information on the entire Kanto region plus Fukushima Prefecture, and created a soil map of Ibaraki Prefecture. We also developed a method of very accurately mapping yearly mean soil temperature (30-50 cm below the surface layer), and made it possible to view a national soil temperature map with a soil information viewing system.

ii. Radioactive substance monitoring

From March through August after the Tokyo Electric Fukushima Daiichi Nuclear Power Plant accident, we sampled farmland soil at 579 locations in 6 prefectures from Miyagi Prefecture to Chiba Prefecture, mainly in Fukushima Prefecture, with the cooperation of

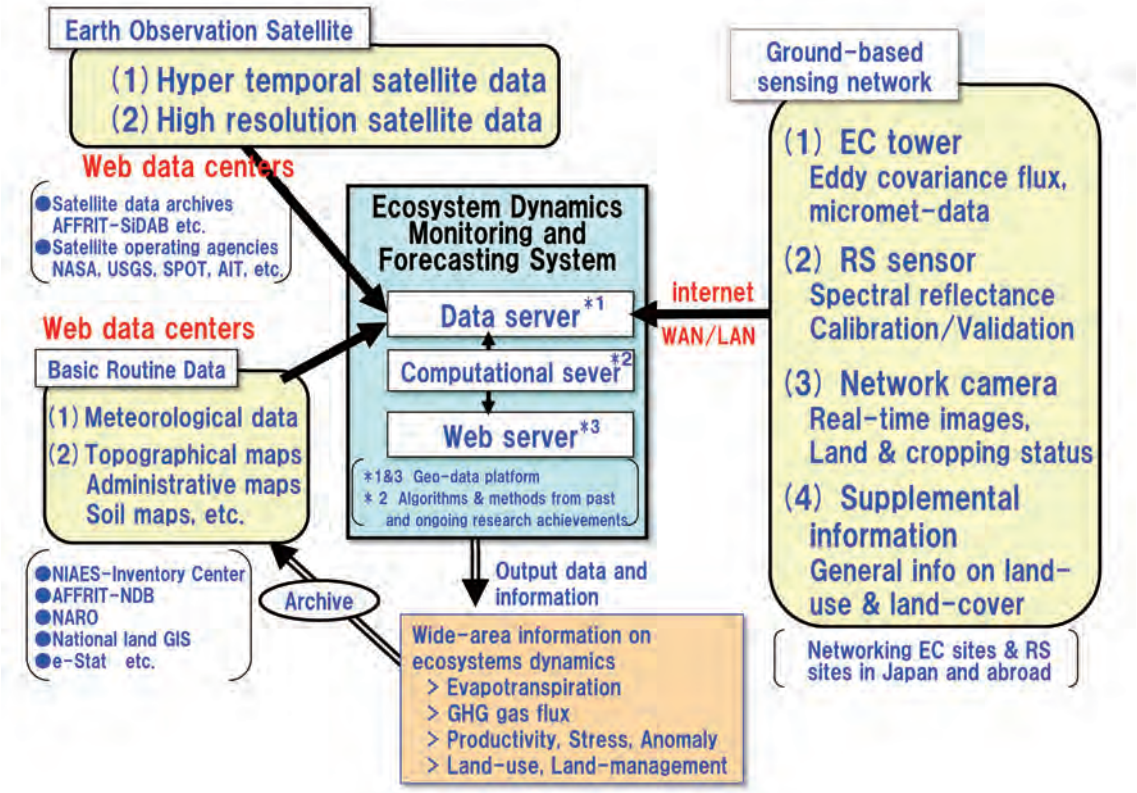


Fig. 4-2 Basic functions and structure of the wide-area ecosystem monitoring and forecasting system

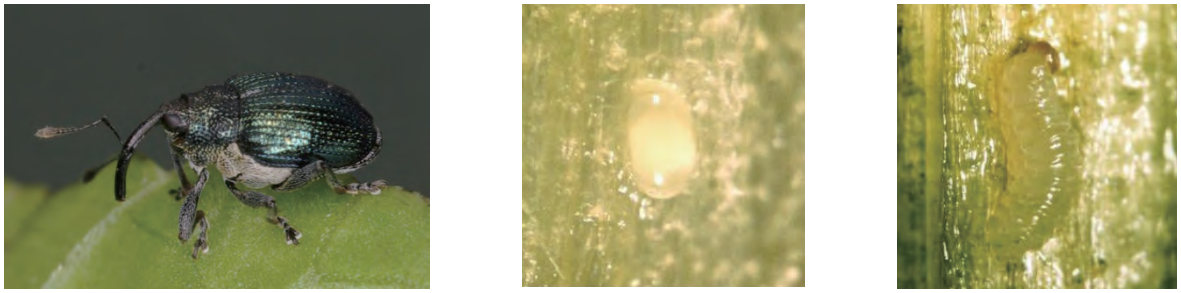


Fig. 4-3 A new weevil attacking upland wasabi: *Ceutorhynchus wasabi*
Left: an adult on a wasabi leaf; middle: an egg laid in a wasabi stem; right: a larva in a wasabi stem.

agricultural experiment and research institutions in those prefectures (Photo 4-1). We measured the radioactive cesium concentrations, mapped them, and revealed the state of contamination. Then, in order to determine in detail the regional distribution of contamination over a wide area, in November and December we sampled farmland soil at 3,420 locations in 15 prefectures from Iwate Prefecture to Shizuoka Prefecture with the cooperation of agricultural experiment and research institutions in those prefectures, and measured and mapped the radioactive cesium concentrations. We found a linearrelationship between the air dose rate at a 1 m height measured during the farmland soil survey and the radioactive Cs concentration in soil (Figure 4-4). We used this finding to create a regression formula for radioactive Cs concentration in farmland soil from the air dose rate and classify the formulas into 10 types according to soil type and land use. We then estimated the spatial distribution pattern of radioactive Cs concentration in farmland soil at unsampled locations by using this regression formula together with data from radioactive Cs concentration measurements, digital soil map of arable land prepared by NIAES based on land use in 2001, and air dose rate distribution maps produced by the Ministry of Education, Culture, Sports, Science and Technology using aircraft (Figure 4-5).

We found that radioactive cesium in farmland soil was distributed in high concentrations exceeding 10,000

Determining the distribution of concentrations of radioactive substance in farmland soil

Photo 4-1. Soil survey and sampling in the evacuation zone. Twenty-eight staff members including the director were sent into the evacuation zone.

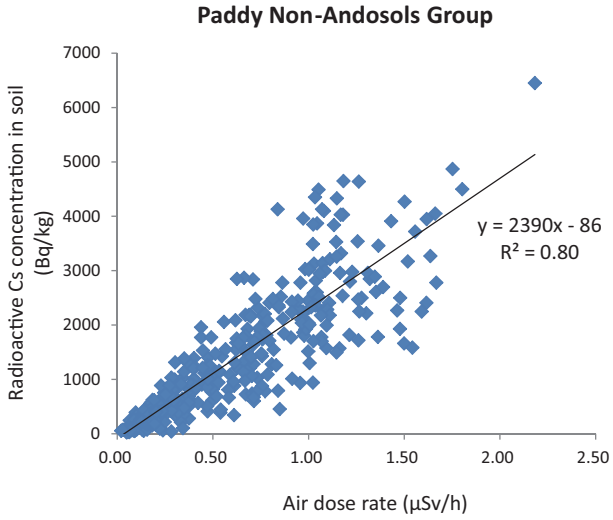


Fig. 4-4 Relationship between air dose rate and radioactive Cs concentration in soil

Radioactive Cs concentration (Paddy non-Andosols group).

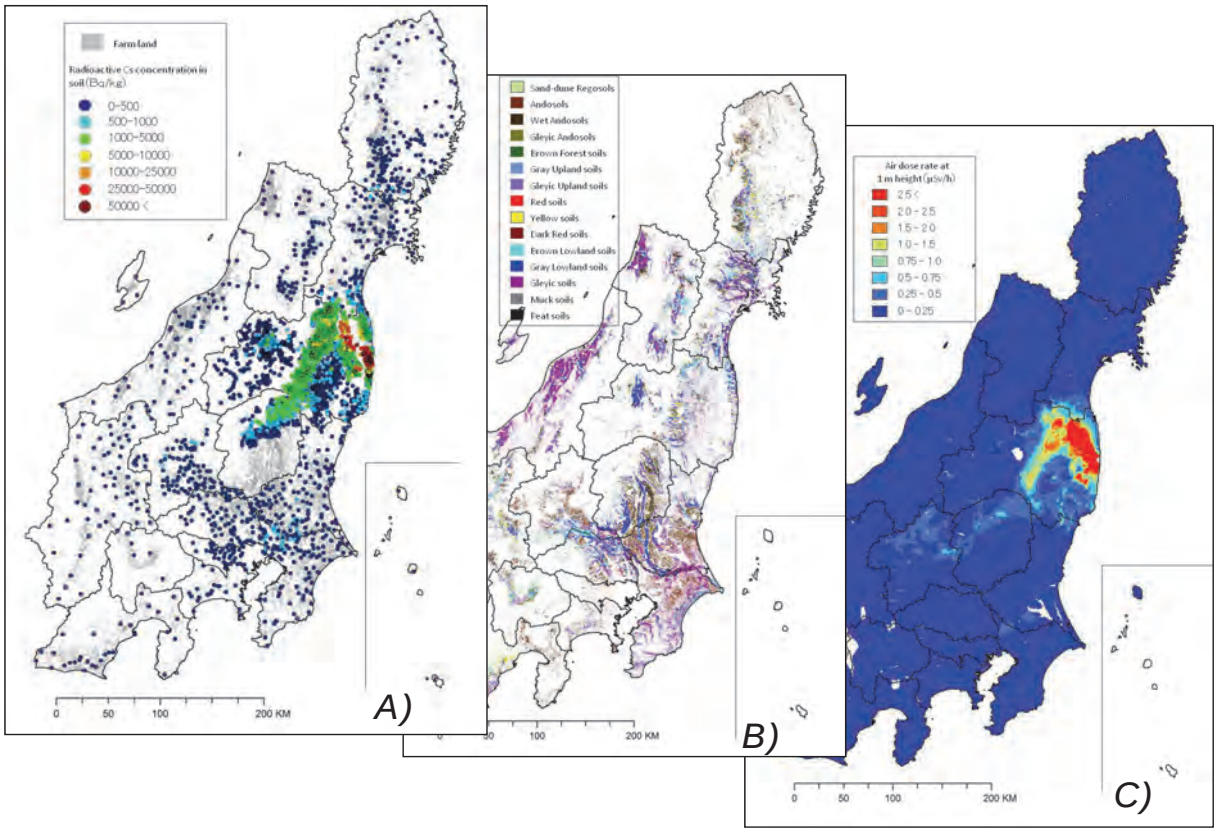


Fig. 4-5 (A) radioactive Cs concentration in farmland soil at survey sites, (B) digital soil map of arable land, and (C) air dose rate distribution map.

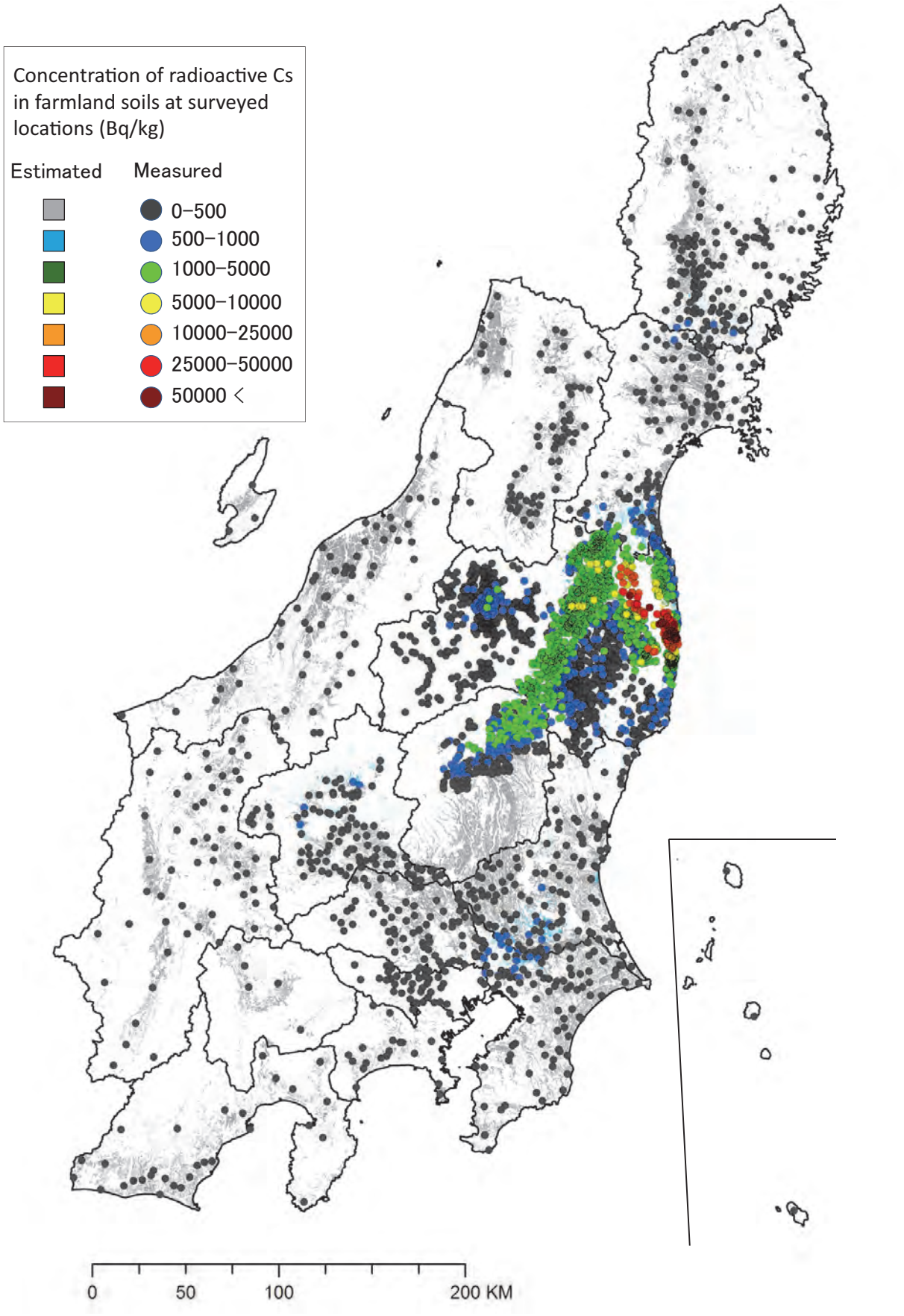


Fig. 4-6 Map of measured and estimated distribution of radioactive Cs concentration in farmland soil

We found that farmland whose soil has radioactive Cs concentrations of 5,000 Bq·kg^{-1} or greater extends northwest from Fukushima Daiichi, while there is a continuous band of farmland with 1,000 Bq·kg^{-1} or greater from the Nakadori region of Fukushima Prefecture through northern Tochigi Prefecture and southern Miyagi Prefecture.

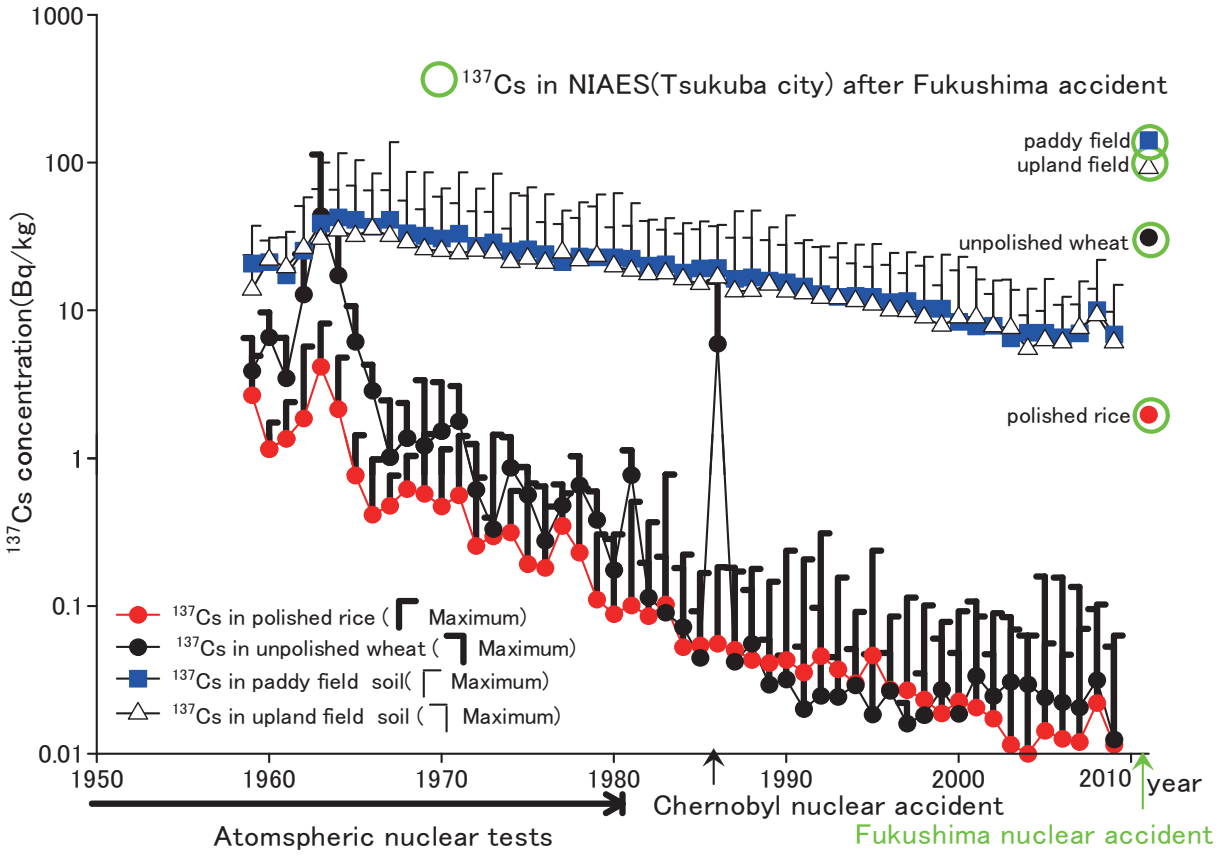


Fig. 4-7 Chronological change in mean ^{137}Cs concentration of Japan's major cereal grains and field soil

Bq·kg^{-1} northwest from Fukushima Daiichi, and that concentrations exceeding 1,000 Bq·kg^{-1} existed from the southwest part of Fukushima Prefecture's Nakadori region to the central and northern parts of Tochigi Prefecture and southern Miyagi Prefecture. Additionally, there were scattered locations with localized high radiation concentrations called hotspots, showing that radiation distribution did not describe simple concentric circles. Concentrations were generally below 500 Bq·kg^{-1} in southern Iwate Prefecture, central and northern Miyagi Prefecture, Ibaraki Prefecture, southern Tochigi Prefecture, Gunma Prefecture, and Chiba Prefecture, but we also discovered high concentrations in parts of their mountain areas and plains (Figure 4-6).

On August 30, 2011 and March 23, 2012 the Ministry of Agriculture, Forestry and Fisheries issued press releases reporting these results. The area of farmland with soil having radioactive Cs concentrations of 5,000 Bq·kg^{-1} or higher, which is one benchmark for decontamination, was calculated at about 8,900 ha. This information makes it possible, for example, to estimate trends of concentration distribution and the areas of farmland in individual municipalities needing measures to suppress absorption by crops and requiring decontamination, and knowing the distribution of radioactive cesium concentration for each soil classification also makes it possible to estimate the coverage of decontamination techniques. This information has been used by the Ministry of Agriculture, Forestry and Fisheries and the Environment Ministry.

Continuously since 1959 we have received rice or wheat cultivated in paddies and upland fields, as well as topsoil samples, from public agricultural experimental institutions from Hokkaido to Kyushu, and we have used instruments such as germanium semiconductor detectors and official analytical methods to analyze the radioactivity concentrations of ^{137}Cs and ^{90}Sr in brown rice, milled rice, unmilled wheat, wheat flour, and soil. ^{137}Cs and ^{90}Sr radiation concentrations in milled rice, wheat, and topsoil produced in 2010 throughout Japan were at normal levels. We are currently analyzing the 2011 samples, but we have found samples from the Tohoku and Kanto regions in which ^{137}Cs is at or above the concentration levels of the 1960s (Figure 4-7).

iii. Building an integrated database of agro-environmental information

For both specimens and observation records we created a data description format that can describe distribution information in a uniform manner that is also compatible with standard international formats.

iv. Developing an integrated environmental impact assessment method

Based on deliberations by a study committee, informal discussions with outside experts, and other consultations, we conducted an exploration of the framework necessary for developing an integrated environmental impact assessment method. We found that for inventory analysis and its characterization, it would be effective to apply LIME2, which is a life-cycle impact assessment (LCIA) method used in life-cycle analyses, although it is inadequate in the agricultural sphere. On the other hand, for inventory analyses on benefit, it was deemed promising to characterize returns, working time, and multifunctionality.

Plans and Results for Research Projects with External Competitive Funding

The National Institute for Agro-Environmental Sciences (NIAES) promotes many research projects funded both publicly and privately. Listed here are the main projects beginning or ending in FY 2011 in which NIAES has been acted as the chief research organization.

Starting in FY 2011

1. Roles of soil microorganisms and plants in arsenic transport

This project was started in 2011 with the approval of the Japan Society for the Promotion of Science under Science Research Program B. Arsenic (As) is a toxic metalloid that enters the environment through natural processes and anthropogenic activities. Intake of As-contaminated groundwater and foods poses a serious health risk to humans, and inorganic As has been classified in Group 1 as a carcinogen by the International Agency for Research on Cancer. Compared with other staple cereal crops, rice is much more efficient at assimilating As into its grains because of the high mobility of inorganic trivalent arsenite in anaerobic paddy fields. Therefore, rice is a major source of dietary intake of As for populations that consume rice as a staple food. Arsenic in rice grains is present mainly as inorganic As (arsenite and arsenate) and organic species such as dimethylarsinic acid (DMA). To reduce As concentrations in rice, we need to understand the system of transport of As species in the rice plant body. Moreover, whether the DMA in rice grains originates from methylation by rice plants or by soil microbes remains unresolved. To elucidate these points, this project has been investigating the following three subjects:

1) Identification of functional genes from the microbial community in the rice rhizosphere that are involved in As methylation
2) Real-time exploration of the dynamics of As species in rice plants by using isotope techniques
3) Gene expression in rice in response to As species.

The results obtained in this project will be useful for improving our understanding of the physiological and genetic aspects of As transport system in rice.

2. Dynamic laboratory study of soil gas exchange (H23–25)

Extensive field measurements of trace gases such as greenhouse gases or indirect greenhouse gases have been conducted at our institute by using automatic chamber systems. Although these automatic chamber systems are very important for the systematic study of soil gas exchange, they were not developed for laboratory soil gas exchange experiments because technical difficulties hamper their use for this purpose. In this KAKENHI (23310017) project, we have developed a system for use in the laboratory to continuously measure CO_2, CH_4, H_2, CO, NO, and N_2O soil gas exchange. The system can measure the exchange of these gases simultaneously. Continuous measurement enables the study about gradual changes in gas exchange from soils after experiencing heat or water stress. All data from the system's datalogger and gas analyzers are transferred to a data server through a LAN (local area network), and graphs are automatically drawn to monitor the experiments. The features of the experimental system are as follows:

(1) Continuous measurement of soil gas exchange. The response time depends on the size of the chamber. Several sizes of chamber have been developed to suit various purposes.
(2) Temperature control from –20 to 80 °C.
(3) Measurement of gas exchange from both aerobic and anaerobic soils.
(4) Measurement of four samples at the same time.
(5) Measurement of exchange of other gases once other gas analyzers have been attached to the system.

The following studies are currently in progress:

(1) Soil carbon dynamics through dynamic CO_2 gas exchange
(2) Universality of temperature dependence of soil gas (CH_4, H_2, and CO) uptake
(3) Nitrogen gas (N_2O and NO) emission after application of nitrogen fertilizers
(4) Trade-off relationships between emission and uptake of gases
(5) Gas exchange in polar soils
(6) Systematic modeling using the data obtained

3. Development of new biopesticides and methods for application in low-input farming

Control of plant diseases by microorganisms that inhibit plant pathogens is called biological control (biocontrol). There are currently 25 biopesticides for disease control on the market in Japan. Because interest of farmers and consumers in environmentally friendly agriculture and food safety has been growing and is

receiving government backup in the form of agri-environmental policies, use of biopesticides in agriculture is likely to become more popular. However, because of difficulties in achieving stable inhibitory effects, progress has been slow in developing microbial pesticides, or even chemicals, against soil-borne diseases that can seriously damage crop production. Further development of microbial agents against soil-borne diseases is therefore urgently needed. From this perspective, we are conducting a research project funded by the Ministry of Agriculture, Forestry and Fisheries from FY 2011 to develop novel microbial agents that can be used as biopesticides. The project also aims to develop methods of using these microbes against important diseases of Solanaceae, such as bacterial wilt, *Fusarium* wilt, and crown and root rot. In selecting microbes we are focusing on *Bacillus* spp., PGPR or PGPF (plant-growth-promoting rhizobacteria or fungi), and arbuscular mycorrhizal fungi. Several of these microbes cause ISR (induced systemic resistance) against various plant pathogens in plants, and this mode of action appears to be suitable for controlling soil-borne disease more efficiently. So far, we have found several microbial isolates that show superior disease inhibitory effects in pot and field experiments. Further experimental studies are ongoing to achieve the goals of the project.

4. MAFF soil-borne disease diagnosis system: development of a preventive diagnosis system for soil-borne diseases, including soil eDNA properties

Integrated pest management (IPM) is a powerful tool for achieving sustainable production of high-quality crops and vegetables by reducing the use of chemicals for control of soil-borne diseases. A system that can estimate the potential for disease development in each field and support decision-making for disease control is essential for preventive IPM of soil-borne diseases. However, little is known about such systems for soil-borne disease, because of a lack of information on some of the indicators associated with disease development and also on appropriate methods for examining the soil microbial populations considered important for disease development.

Recently, a simple and low cost method of analyzing soil microbial diversity – a type of standardized polymerase chain reaction / denaturing gradient gel electrophoresis (PCR-DGGE) – was developed as part of the Ministry of Agriculture, Forestry and Fisheries (MAFF) eDNA (environmental DNA) project (2006-2011). This method enables us to analyze any kind of soil type in Japan in a standard way by using a NIAES protocol and will also facilitate the rapid analysis of many soil samples.

MAFF began funding the 3-year project in FY 2011. The objective of the project is to develop a preventive diagnosis system for soil-borne diseases of various crops and to use the diagnoses to construct a list of control tactics. NIAES is managing the eight minor subjects of the project and is supervising project activities at one national institute and six prefectural institutes.

As part of the project, we explored the following two main subjects in FY 2011:

Subject 1: PCR-DGGE analysis of soil samples and development of a soil-borne disease preventive diagnosis system

A total of more than 500 soil samples collected from various arable fields at the above-mentioned seven institutes in Japan have so far been analyzed by using PCR-DGGE. On the basis of information such as soil properties (physical, chemical, and eDNA data) and disease severity in various crops, a diagnostic table is now being constructed and will be available on the NIAES Web site.

Subject 2: Analysis of the relationship between agricultural production and soil properties, including microbial diversity, and test of usefulness of the new diagnostic system

In each test field, we are investigating the indicators associated with the development of five economically important soil-borne diseases of tomato, ginger, cruciferous crops (broccoli, cabbage etc.), soybean, and lettuce.

We also plan to test the usefulness of the diagnostic system in each field for preventive IPM of each soil-borne disease.

Ending FY 2011

1. Development of techniques for biological soil disinfestation (BSD) with diluted ethanol

Methyl bromide (CH_3Br) was once a major fumigant used in Japan to control soil-borne diseases in crops such as cucumbers, gingers, tomatoes, melons, and green peppers. Phase-out of the use of CH_3Br as a soil fumigant began in 2005, when it was classified as a stratospheric ozone-depleting substance, but no new chemical or non-chemical alternative has yet entered common use. For now, chloropicrin (trichloronitromethane) and 1,3-D (1,3-dichloropropene) are seen as the best alternatives to CH_3Br. However, although these two

fumigants are not recognized as stratospheric ozone-depleting substances, their rapid volatilization causes air pollution, which is a public health concern. Economically feasible new soil fumigation techniques are eagerly awaited by growers. Japanese researchers have therefore been developing techniques for biological soil disinfestation (BSD) with diluted ethanol to prevent soil-borne diseases.

This project was conducted from FY 2008 to FY 2011 by NIAES and the Central Agricultural Experiment Station of Hokkaido Research Organization, the Chiba Prefectural Agriculture and Forestry Research Center, the Kanagawa Agricultural Technology Center, the Gifu Prefectural Agricultural Technology Center, the Gifu Prefectural Institute for Agricultural Technology in Hilly and Mountainous Areas, the Tokushima Agriculture, Forestry and Fisheries Technology Support Center, the Japan Horticultural Production and Research Institute, and the Japan Alcohol Corporation. It was subsidized by a grant from the Japanese Ministry of Agriculture, Forestry and Fisheries for Research and Development Projects for Application in Promoting New Policy in Agriculture, Forestry and Fisheries (2019).

The main purposes of this project were (1) to clarify the mechanisms of BSD; (2) to optimize and adapt BSD methods to different agricultural conditions; and (3) to compile a manual for implementing BSD with diluted ethanol. The key points of our research were:

1. Differences in BSD mechanisms of diluted ethanol on soil-borne pathogens are accountable for differences in pathogen sensitivities to changes in physical and chemical soil environments.
2. Because the diluted ethanol solutions used in BSD have little direct effect on soil-borne pathogens, the ethanol used does not fall into the Japanese pesticides category. Therefore, it is not to subject to control under the pesticide regulation, and farmers can freely use the BSD techniques.

An implementation manual and technical data on BSD with diluted ethanol have been published and distributed on demand, and are on NIAES website in Japanese.

Major Symposia and Seminars

1. International Workshop on Advanced Use of Satellite- and Geo-Information for Agricultural and Environmental Intelligence — In association with MARCO

From March 2 to March 4, 2011, the National Institute for Agro-Environmental Sciences (NIAES) hosted the International Workshop on Advanced Use of Satellite- and Geo-Information for Agricultural and Environmental Intelligence — In association with MARCO at the Tsukuba International Congress Center (Tsukuba City, Ibaraki Prefecture). Monsoon Asia countries have increasingly serious problems in connection with food production and the environment. Addressing these problems makes it essential to gather and analyze information on conditions over vast areas, and perform diagnoses and forecasts (together these are called "intelligence"). For this purpose there is a great need for data from Earth observation satellites and for the sophisticated use of geospatial information systems. Spatial information technology is essential for providing a variety of information in an easy-to-understand manner, such as in the form of maps, so as to benefit government and the public.

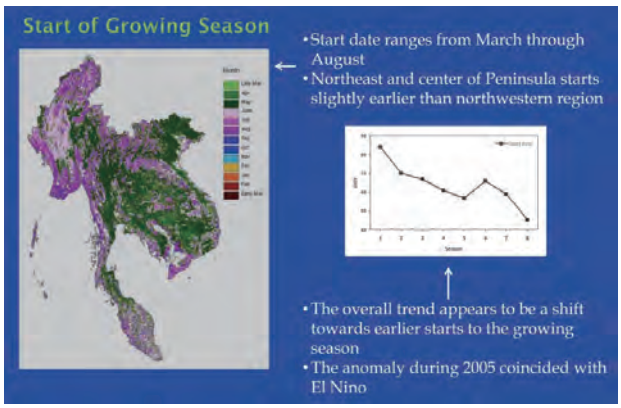
This workshop had about 100 participants from universities, private institutions, and other organizations in Japan and 16 other countries, including nearly all monsoon Asia countries from Bangladesh to Japan, plus the USA, Netherlands, Denmark, and others.

On the first day, NIAES Director Yohei Sato's opening remarks were followed by a presentation from Research Project Leader Yoshio Inoue, who planned this workshop, explaining the workshop's intent and giving an overview of advanced remote sensing methods. Following this there were research presentations from Professor Erling Andersen (Denmark) on comprehensive agro-environmental databases in the EU, from Professor Ryutaro Tateishi (Chiba University) on the current state of global-scale arable land mapmaking, and from Professor Jiaguo Qi (USA) on the application of satellite data to monitoring ecosystem changes in Asia (see figure).

Session 2 featured wide-ranging and highly interesting reports including analyses of ecological problems using remote sensing and spatial information technology and the building of spatial information databases in various countries. For example, Dr. Mai Van Trinh from Vietnam described how spatial information technology was used to integrate satellite, soil, topography, and other data with soil erosion models to perform a wide-area impact assessment of chemicals used in the Vietnam War (dioxin and arsenic contamination). The presentation vividly illustrated how spatial information is used as basic data for measures to overcome the tragic ravages of war, and it highlighted how spatial information technology plays an important role in a variety of situations.

Session 3 featured reports on new initiatives to refine and expedite the use of remote sensing and spatial information technologies, including the advanced use of the instrument "MODIS" aboard the high-frequency observation satellites "Terra" and "Aqua", soil environment inventory systems, historical GIS, and open GIS.

Last was the general discussion, in which participants enthusiastically discussed expediting spatial information research and reinforcing collaborative and cooperative relationships. Some participants suggested, for example, information-exchange networks and the joint preparation of research proposals, and the



Trend toward earlier start of growing season as seen in satellite images. It is presumably because of global warming.
Left: Mean start of growing season from 2001 to 2008
Right: Trend of change during that period

gathering hammered out an approach toward forming a spatial information technology research consortium aimed at generating intelligence on the food environment. There are considerable expectations for future developments.

2. 11th Seminar on Organic Chemicals Studies "Regulatory Science which Aims to Harmonize Chemicals with Humans and the Environment"

To discuss the various problems involving pesticides, persistent organic pollutants (POPs), and other organic chemical substances in the agro-environment, the National Institute for Agro-Environmental Sciences (NIAES) holds an Annual Seminar on Organic Chemicals Studies. On October 4 we held a seminar on the theme "Regulatory Science which Aims to Harmonize Chemicals with Humans and the Environment."

Regulatory science is a concept proposed as "science which forecasts and assesses the reliability and spillover effects of advancing science and technology, and regulates them so that in substance and orientation they are desirable to society, humans, and the environment." It is desirable that regulatory science be enhanced and reinforced as a research field that will be of benefit to the support and rationalization of administrative policy measures and the creation of rules for social life.

At the seminar, seven speakers delivered lectures on the role and outlook for regulatory science; the demands and expectations of people involved in agriculture, forestry, and fisheries, and in environmental administration; and examples of practice at research institutions including the National Institute for Environmental Studies (NIES), National Institute of Advanced Industrial Science and Technology (AIST), and NIAES. The seminar was attended by 138 people representing a broad cross section including experimentation and research organizations, universities, administrative authorities, businesses, affiliated organizations, and the general public. They listened intently in the lectures, and they conducted a lively discussion such as whether research results should be provided to government or the citizens, and what the role of researchers is in building a consensus. We believe it was a good opportunity to consider the significance and desirable form of regulatory science from a variety of standpoints.

3. 34th Agro-Environment Symposium: "Soil Contamination by Radioactive Substances: Current State and Abatement Measures"

Since 1959 the National Institute for Agro-Environmental Sciences (NIAES) has been performing long-term monitoring of the radioactive substances in agricultural produce and farmland soil. During this period we conducted emergency radiation studies on the occasions of the Chernobyl accident and the JCO accident. Immediately after this year's accident at the Tokyo Electric Power Company's Fukushima Daiichi Nuclear Power Plant, NIAES received a request for cooperation from the government. Proceeding from one site to the next, we measured and reported concentrations of radioactive substances in the agricultural produce and farmland soil in prefectures near the stricken plant, and the results have been used to inform the thinking on limiting shipments of agricultural produce and restricting rice planting. With the passage of several months since the accident, determining the state of farmland radioactive contamination and remediating contaminated soil are urgent tasks in consideration of future agricultural work. NIAES therefore reviewed the research performed to date on the radioactive contamination of farmland, and with the support of the Ministry of Agriculture, Forestry and Fisheries held the 34th NIAES Symposium for the purposes of describing the situation including the state of radioactive contamination of farmland soil due to the nuclear accident, and discussing on, among other things, measures to reduce agricultural produce contamination

Lecture by Principal Research Coordinator Taniyama

and the remediation of contaminated soil.

This symposium was held at Shinjuku Meiji Yasuda Life Hall in Tokyo on Friday, October 7 starting at 1:30 p.m. The auditorium was almost filled to capacity with over 300 participants including people from the private sector and from prefectural governments.

After opening remarks by Dr. Kiyotaka Miyashita, NIAES President, Professor Yasuyuki Muramatsu of Gakushuin University Faculty of Science delivered a keynote lecture titled "Impacts of Radioactive Substances on Farmland: A Consideration from the Viewpoint of Radioecology," in which he described the migration of radioactive cesium from soil into rice plants, migration pathways into new tea leaves and fruit, migration into edible wild plants and mushrooms, and behavior in the ecosystem. Regarding the migration of radioactive cesium from soil into rice plants, he showed that migration proceeds more readily in andosols than in gray lowland soil, and explained that while gray lowland soil has many clayey minerals that easily adsorb cesium, the high amount of organic matter (humus) in andosols means that cesium is not adsorbed very strongly, and tends to readily be uptaken via roots. With regard to the migration pathway of radioactive cesium into agricultural crops, he pointed out the possibility of large differences depending on factors such as type of crop, type of soil, and growing environment. For example, while it was formerly thought that cesium was taken into crops mainly via the soil, cesium deposited on leaves and tree bark sometimes migrates into new buds and fruit by translocation.

Following this keynote lecture, four speakers presented the findings of their research, such as what they have determined about the state of contamination. NIAES Senior Researcher Nobuharu Kihou spoke on "Long-Term Monitoring of Radioactive Substances in Agricultural Crops and Farmland Soil," NIAES Senior Researcher Hideshi Fujiwara on "Migration of Radioactive Substances from the Atmosphere to Soil," Institute for Environmental Sciences Chief Researcher Hirofumi Tsukada on "Migration of Radioactive Nuclides from Soil Into Crops," and NIAES Principal Research Coordinator Ichiro Taniyama on "Farmland Contamination Caused by the Nuclear Plant Accident: Situation and Response."

There were many questions from the floor during the panel discussion, and questions and answers were divided into (1) the state of contamination by radioactive substances, (2) migration from soil into crops, and (3) decontamination measures. In the 153 responses to questionnaires for audience, the most part respondents commented that the symposium subject matter was timely and helpful, such as by saying, "This made sense of information and knowledge that was fragmentary until now.", although a few of respondents express their opinion that the important research is for contributing to develop technologies for decontamination at this time. Many people also said that once we have a certain amount of research results, they would like NIAES to hold a similar symposium again next year.

4. MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture

At this time when discussions proceed on worldwide initiatives to mitigate global warming, the agricultural sector has a need for technologies to reduce greenhouse gas emissions without impacting food production. To address this issue, the National Institute for Agro-Environmental Sciences (NIAES) held the MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture from November 15 through 19 at Tsukuba International Congress Center (Tsukuba City, Ibaraki Prefecture). This workshop had the participation of 122 people from 15 countries and 2 international agencies, including Japanese researchers participating in research projects commissioned by the Ministry of Agriculture, Forestry and Fisheries and foreign researchers invited under the

Panel discussion

framework of the Monsoon Asia Agro-Environmental Research Consortium (MARCO). Participants reported the latest research information on technologies to reduce emissions from livestock and farmland, and exchanged opinions on what areas should have research priority henceforth. On the final day, there was a meeting of the Paddy Rice Research Group of the Global Research Alliance on Agricultural Greenhouse Gases (GRA)*, at which discussion was held on plans to expedite research with international collaboration.

* GRA is an international research network concerned with reducing greenhouse gas emissions from the agricultural sector. It was established under an agreement by a number of countries on the occasion of the 15th Conference of the Parties of the UN Framework Convention on Climate Changes (COP15), held in Copenhagen in 2009. Currently 33 countries are official members. Japan is one of the countries coordinating the Paddy Rice Research Group.

5. NIAES Open Seminar in Chiba The Quest for Agriculture with a Small Environmental Burden

On December 8, the National Institute for Agro-Environmental Sciences (NIAES) and Chiba Prefecture co-hosted the "NIAES Open Seminar in Chiba: The Quest for Agriculture with a Small Environmental Burden." We hold these seminars to describe NIAES research achievements to a broad cross-section of people and to intensify mutual understanding and collaborative relationships with people from prefectures and municipalities who disseminate research results. This was the fourth such seminar after those in Fukushima Prefecture in 2008, Shiga Prefecture in 2009, and Kumamoto Prefecture in 2010.

NIAES presented the results of research on soil disinfection using low-concentration ethanol and research on the decomposition of biodegradable plastic agricultural materials by microorganisms. The Chiba Prefectural Agriculture and Forestry Research Center presented results of research on the cultivation of cucumbers using the low-concentration-ethanol soil disinfection method and research on preventing insect pests in greenhouse horticulture using the bug *Piocoris varius*, which is a euryphagous native natural enemy. A simultaneous poster exhibit showed the recent research achievements of both institutions. The technologies described at this seminar were all developed so that agriculture has a lower environmental burden. Participants expressed expectations for further development and dissemination from perspectives such as protecting biodiversity and arresting global warming.

Despite the unfortunate bad weather on that day, there were 135 participants from Chiba and other prefectures.

6. 26th Workshop on Climate and Agro-Environment "Towards Wide-Area Projections of Climate Change Impacts on Food Production"

On February 9, 2012, NIAES held the 26th Workshop on Climate and Agro-Environment: Towards Wide-Area Projections of Climate Change Impacts on Food Production at the Tsukuba International Congress Center. About 90 people from universities, national and public research institutions, administrative agencies, food companies, and other organizations participated.

In recent years, the production areas of major crops have been concentrated with the globalization of agricultural production and trade in the world. Consequently, there is a risk that extreme weather in major production areas will destabilize food supplies worldwide. Against this risk, the workshop discussed the current situation and issues of related researches such as the relationship between food production and extreme weather associated with climate change.

Presentations by leading researchers on their work was divided broadly into three categories: (1) the uncertainty of basic data such as data used in climate change forecasting, (2) the responses of crops to

weather extremes and other environmental changes, and (3) socioeconomic factors that affect production quantity via land uses and market prices. In the discussion, people from administrative agencies expressed their expectations for the results of research for stabilizing the food supply, which revealed the strong interest in this research theme.

National Institute for Agro-Environmental Sciences (NIAES) plans to push ahead with researches on this theme based on the issues and approach discussed at the workshop and centered on the research project for "Global Risk Assessment toward Stable Production of Food (GRASP)".

7. 29th Seminar on Soil and Water: "Radioactive Contamination of the Agro-environment from the Fukushima Daiichi Nuclear Power Station Accident: 1 Year's Survey, Research, and Review"

The 29th Seminar on Soil and Water was held on 22 February 2012 at Tsukuba International Conference Hall. There were 378 participants.

Substantial discharge of radioactive substances resulted from the nuclear accident at the Fukushima Daiichi nuclear power plant in association with the Great Tohoku Earthquake and Tsunami on 11 March 2011. Fukushima and adjacent prefectures were contaminated with fission products from the accident. In some areas, the levels of radioactive substances in rice, vegetables, fruit, and milk exceeded the official government limits.

This seminar focused on monitoring, assessment, and remediation of radionuclides in agricultural areas in the contaminated sector.

NIAES researchers made several presentations: Nobuharu Kihou presented on the NIAES monitoring survey and agricultural environment assessment in the wake of the Fukushima Daiichi accident; Toshiaki Ohkura reported on the survey of the gricultural impacts of radioactive contamination in countries stricken by the Chernobyl nuclear power plant disaster that included a comparison with the Fukushima Daiichi accident; and Kazunori Kohyama presented a distribution map of ^{134}Cs and ^{137}Cs concentrations in farmland soils after the Fukushima Daiichi accident and its use.

Other presenters were Mr. Yoshinori Suzuki from the Ministry of Agriculture, Forestry and Fisheries, on countermeasures taken by the agricultural sector as a basis for recovery and maintenance of sustainable agriculture; Dr. Mutsuto Sato from the Fukushima Agricultural Technology Center, on responses to radionuclide contamination by the agricultural research sector of Fukushima Prefecture; Dr. Mamoru Sato of the Fruit Tree Research Center of Fukushima Agricultural Technology Center, on the vertical and spatial distributions of radiocesium in the soils of deciduous orchards; and lastly, Dr. Yoshisada Nagasaka of the Agricultural Research Center, National Agriculture and Food Research Organization, the removal of field topsoil for nuclear decontamination with tractors and implements.

All presentations were very interesting, and the discussions that ensued were very lively. In the general discussion, participants discussed methods for monitoring the concentrations of radioactive substances in soil, plants, and water and developments in radioactive decontamination of farmland soils.

8. 2nd Agro-Environment Inventory Workshop "A System for Building and Effectively Using an Insect Inventory"

We held this workshop on Thursday, February 23 at the Tsukuba International Congress Center. More than 100 participants attended from experiment and research facilities, universities, businesses, related organizations, and the general public.

Last year, the National Institute for Agro-Environmental Sciences (NIAES) held the the 1st Agro-Environment Inventory Workshop. Presentations at that workshop included the current state of research into the soil inventory*. This year's workshop dealt with the insect inventory.

* Inventory: Specimens, samples, information about them, etc.

At the workshop, Professor Osamu Tadauchi from Kyushu University delivered the keynote address, which was followed by Part I (What We Hope to Find from Insect-Related Information), Part II (Current State of Insect Inventory Research), and Part III (Examples of Insect Inventory Use), each with two lectures on two topics. After Part II, there was an exhibit of insect specimens in the lobby and a demonstration of an insect database with a computer.

A lecture in progress

During the general discussion period, Mr. Hideaki Sugawara, a NIAES special researcher and professor at the National Institute of Genetics, described the current state of biological information networks in Japan and abroad and summarized the thinking behind inventory research and how such research is conducted. This workshop made it clear that in addition to inventory accumulation it is very important to set up systems for inventory use, and for that purpose there is a need for two-way communication between research institutions and many people.

Insect specimen exhibit in the lobby

Conferences, Workshops, and Research Meetings

Title	Place	Date	Participants
Symposium FY 2011			
International Seminar on Increased Agricultural Nitrogen Circulation in Asia: Technological Challenge to Mitigate Agricultural Nitrogen Emissions	Taipei	27-30 Sep 2011	60
This international seminar, which was jointly organized by the Food and Fertilizer Technology Center (FFTC), National Taiwan University, and NIAES, aimed to promote better understanding of how much anthropogenic N is loaded into the environment, particularly from agriculture, including in the supply and consumption of food in Asia. It also aimed to give a full understanding of overall N budgeting in each Asian country to enable the establishment of a strategy for mitigating N loading in the environment in the entire Asian region and in each country.			
34th Agro-Environment Symposium, "Soil Contamination by Radioactive Substants: Curruent State and Abatement Measures"	Tokyo	7 Oct 2011	301
Fukushima Nuclear Power Plant accident had occurred, following the Tohoku earthquake and tsunami on 11 March 2011. Determining the levels of radioative contamination around the plant and finding ways of cleaning up farmland soils are extremely urgent tasks. In this symposium, we reviewed previous studies relating to radioative contamination in foreign countries and also the current situation in Japan. We discussed methods of alleviating the contamination of radioative on crops and remediating arable land soils.			
Meeting for Presentation of Research Project "Towards Risk Mitigation of Crops: Heavy Metals/POPs and Farmland Management"	Tokyo	7 Nov 2011	107
After the keynote speech, progress made by the Chemical Team of the Research Project to Ensure Food Safety from Farm to Table was presented orally and in poster form. Risk assessment and management of important hazards, such as heavy metals and POPs (persistent organic pollutants) in farmland were discussed.			
MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture	Tsukuba	15-19 Nov 2011	122
This Workshop was organized in the framework of MARCO. It provided a venue to share the results of the Japanese research project on Development of Mitigation Technologies for Climate Change in the Agriculture Sector with invited foreign experts to help improve understanding of the issues involved in mitigation of agricultural GHG emissions.			
Seminars			
NIAES Open Seminar, "New Deployment in Greenhouse Gas Research through Practical Use of Microbial Genome Information"	Tsukuba	6 Dec 2011	106
At this seminar, advanced technologies using genome information and leading research using soil metagenome or metatranscriptome analyses to reveal the microorganisms and mechanisms involved in greenhouse gas emission from agricultural fields were presented.			
NIAES Open Seminar in Chiba: Promoting Environmentally Friendly Agriculture	Sanmu	8 Dec 2011	135
The latest research results on techniques of environmentally friendly agriculture, including sterilization by soil reduction and pest control by using natural enemy insects, were presented by the Chiba Prefectural Agriculture and Forestry Research Center and NIAES.			

Title	Place	Date	Participants
Research Meetings			
11th Seminar on Organic Chemicals Studies: Regulatory Science which Aims Harmonize Chemicals with Humans and the Environment	Tsukuba	4 Oct 2011	138
With a central focus on the influences of chemicals on living things in the environment, the current status of regulatory science was presented at this meeting. The background of this concept and some research topics were introduced. The importance of transmitting information to the public and the contribution of regulatory science in administrative organizations were discussed.			
28th Research Meeting on Pesticides: Progress Status of Research on Pesticides in 2011	Tsukuba	5 Oct 2011	45
The research topics studied by prefectural experimental stations in 2011 dealing with pesticides in the agro-environment were presented at this meeting. The subjects of concern can be summarized as follows: pesticide residues in successive crops; pesticide behavior in the atmosphere and water; and techniques for analyzing pesticide behavior. The needs of further cooperative research into these problems were discussed.			
26th Workshop on Climate and Agro-Environment, "Towards Wide-Area Projections of Climate Change Impacts on Food Production"	Tsukuba	9 Feb 2012	97
Focusing on the impacts of climate change on variations in major cereal production at the global scale, state-of-the-art studies of such topics as crop modeling, global datasets, seasonal weather forecast, and land-use change were presented. Future directions for integrating these studies toward achieving a stable food supply were discussed.			
29th Seminar on Soil and Water	Tsukuba	22 Feb 2012	378
The title of the seminar was "Radioactive Contamination of the Agro-environment from the Fukushima Daiichi Nuclear Power Station Accident: 1 Year's Survey, Research, and Review." We focused on monitoring, assessment, and remediation of radionuclide-contaminated areas in the agricultural sector. Participants had a lively discussion of methods of monitoring radioactive substance concentrations in soil, plants, and water and developments in radioactive decontamination of farmland soils.			
2nd Agro-environmental Inventory Workshop, "A System for Building and Effectively Using an Insect Inventory"	Tsukuba	23 Feb 2012	107
First, the history of insect databases and their use was presented. Second, the diversity of insects in paddy fields and information on the insects required for conservation of agro-ecosystems were presented. Third, the current status of the NIAES Insect Inventory and its use was presented. Insect specimens and the databases of the Insect Inventory were displayed in the auditorium.			

Research Collaborations

1. Activities of the Research Consortium MARCO

The Monsoon Asia Agro-Environmental Research Consortium (MARCO) was established in 2006 to foster international research collaboration in Monsoon Asia. In 2011, the following activities were conducted under the auspices of MARCO. For details of each meeting, please visit the MARCO website at http://www.niaes.affrc.go.jp/marco/news.html

- The MARCO-FFTC (Food and Fertilizer Technology Center) International Seminar on Increased Agricultural Nitrogen Circulation in Asia: Technological Challenge to Mitigate Agricultural Nitrogen Emissions was held from 27 to 30 September 2011 in Taipei, Taiwan.
- The MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture was held from 15 to 18 November 2011 at Tsukuba.

MARCO's website contains plenty of information on the consortium.
http://www.niaes.affrc.go.jp/marco/

Evaluation Committee FY2011

The Evaluation Committee provided outside opinions and recommendations on the management of NIAES. The members of the committee are external experts and include professors and a consumer representative (see Appendix).

The following comments were made:

1) The creation of rice plants with low cadmium uptake is an achievement that will lead to a fundamental solution to the problem of cadmium contamination, and is highly commendable. It is hoped that these plants will be quickly deployed.
2) The quick preparation and release of a map showing the concentration distribution of radioactive cesium was a superb response to a national emergency situation, and is highly commendable.
3) In addition to pursuing studies and research in response to the needs of public administration, it is also commendable that NIAES is active in dispatching experts to serve on administrative committees as well as in making policy recommendations and taking on other such important duties.
4) It is commendable how NIAES uses symposiums, public seminars, and other events to actively disseminate information that meets contemporary needs. It is hoped that henceforth the institution will augment its provision of easier-to-understand information to the general public.
5) Because the institution's superb research results are not necessarily available to farmers, it is hoped that NIAES will enhance the dissemination of information to farmers, such as by providing it widely to prefectural agricultural extensions.

NIAES Evaluation Committee

Ayumi Ohnuma	Professor, Keio University
Toyoki Kozai	Professor Emeritus, Chiba University
Masahiko Saigusa	Professor, Toyohashi University of Technology
Fuminori Kaneko	Deputy Director General, Chiba Prefectural Agriculture and Forestry Research Center
Maki Morita	Writer, Consumer Specialist
Michiko Oki	President of Consumption Science Federation
Michiko Oshima	Director of Oshima Nojo Co., Ltd.

Academic Prizes and Awards

1. Phytopathological Society of Japan Fellowship

Recipient: Seiya Tsushima (Director of Natural Resources Inventory Center)

"Research on the Epidemiology and Prevention of Bacterial Grain Rot in Rice"

Director of the Natural Resources Inventory Center, Seiya Tsushima, was awarded the Phytopathological Society of Japan fellowship for 2011. This fellowship is awarded to Phytopathological Society of Japan members with outstanding achievements or excellent track records in plant pathology. In this case the prize recognized the many years of research achievements on the "epidemiology and prevention of bacterial grain rot in rice."

Inventory Center Director Tsushima discovered the mechanism of occurrence and the infection route of bacterial grain rot in rice paddies, which has been a problem in warm southwestern regions. He also developed an infection testing method and shed light on the conditions for contracting the disease. Further, he selected from rice plants an antagonist that markedly suppresses the outbreak of the disease, thereby demonstrating the effectiveness of biological prevention.

These achievements are also significant as a model case in preventive strategy for facilitating integrated pest management (IPM) and conservation agriculture. The research is widely referenced and used in ecological and basic research in other countries including the Philippines, Republic of Korea, and the United States.

A diseased panicle

2. Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology (Science and Technology, Research Category)

Recipient: Yoshio Inoue (Ecosystem Informatics Division)

"Research on Methods for Remote Sensing of Plant Eco-Physiological Information and Ecosystem Dynamics"

Determining the state of agricultural management, forecasting crop production, finding the amount of carbon circulation, etc. on a regional, national, or global scale are considered necessary for developing and implementing food and environmental policy measures. It was therefore a major challenge to pioneer methods of measuring and assessing plant and ecosystem dynamics quantitatively and over wide areas.

By measuring electromagnetic waves across a broad spectrum from visible light to microwaves, Senior Researcher Inoue gained basic knowledge for estimating plant environmental stress, nitrogen content, photosynthetic efficiency, CO_2 absorption and emission amounts, etc. He also used remote sensing data from aircraft sensors and Earth observation satellites to create an information measurement method for diagnosing and managing crops.

These achievements produced a vital breakthrough for developing remote sensing methods to investigate plant eco-physiological information and ecosystem dynamics, thereby greatly reducing labor and raising accuracy in collecting agricultural information. What is more, it made possible the creation of a wide-area, permanent global ecosystem monitoring system using Earth observation satellites. There are expectations that henceforth these achievements will make a great contribution to measures for food production and environmental conservation, such as in considering ways to manage crops at the production-district level and making decisions on ecosystem management methods.

3. Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology (Public Understanding Promotion Category)

Recipient: Shin-ichi Yoshimatsu, Yukinobu Nakatani, Hiraku Yoshitake (National Resources Inventory Center), Koji Yasuda (Director of Biodiversity Division)

"Better Public Understanding of Agriculture and Nature by Using Agriculture-Related Insect Specimens"

Currently, initiatives are unfolding to understand and protect biodiversity all around the world, and research institutions are being asked to do their part in researching farmland and satoyama biodiversity. The National Institute for Agro-Environmental Sciences (NIAES) Insect Museum has Japan's largest collection of agriculture-related insect specimens (about 1.3 million), but because information was not sufficiently provided to members of the public, they did not understand the significance of collecting and managing the specimens.

The activities of the Insect Museum have involved using the insect specimens held to respond to identification requests (about 9,200 since 1948) and explaining them to visitors. Events of various kinds have been held to give children — the scientists of the next generation — a deeper understanding of insects, the natural environment, and agriculture, and recently the museum has provided guidance to over 1,000 elementary and junior high school students in collecting insects and making specimens. Additionally, in 2006 the museum cooperated with the Japanese Society of Applied Entomology and Zoology in the publication of *List of Animal and Insect Pests in Agriculture and Forestry: Enlarged and Revised Edition*, which lists all insect pests native to Japan.

From left: Yoshio Inoue, Shin-ichi Yoshimatsu, Yukinobu Nakatani, Hiraku Yoshitake, Koji Yasuda

These activities have helped stem the loss of young people from the sciences and increase their interest in living things. What is more, reporting of new insect pests identified through requests has been helpful to control measures in the affected localities.

The award ceremony was held at the institute on May 13.

4. Japan Prize in Agricultural Sciences, Achievement Award for Young Scientists

Recipient: Yuko Hoshino (Yuko Takada) (Environmental Biofunction Division)

"Analysis of Soil Microbial Communities by Direct Extraction of DNA/RNA from Soil"

This research created a method of analyzing the structure of soil microbial communities, including hard-to-culture microorganisms, by for example making it possible to extract DNA and RNA from volcanic ash soils, which was previously difficult. This method revealed the impacts of soil sterilization on the structures of microbial communities, thereby demonstrating that this method can be applied in the assessment and diagnosis of soil microbial communities. These achievements have been adopted into standard methods for analyzing soil microbial flora, and are widely used in farmland soil analyses.

Career Building and Outreach Programs

1. NIAES Model Program for Female Researchers

NIAES has been promoting gender equality in the framework of the project, NIAES Model of a Bi-directional Career Building Program, which until end of FY2011 was funded by the Science and Technology Promotion Fund of MEXT. Although the funding has ended, we are continuing with our gender equality activities and are also trying to support a variety of both male and female researchers at our institute. The main agenda of our ongoing project supporting gender equality is as follows:

1 Mentoring program (for young researchers, both male and female)
2 Provision of international services (financial support for short-term overseas activities and for English proofreading, for female researchers only)
3 Employment of research assistants as temporary staff maternity leave
4 Provision of physical, life and mental health counseling (mainly for female researchers)
5 Outreach activities (e.g. visiting lecturers, science café, for both male and female researchers)

Examples of some events held in FY 2011 were:

(1) NIAES Science Café:

"Agriculture warms the planet!?"

On Sunday, October 16 NIAES used the tea room of With Garden Tsukuba in iias TSUKUBA to hold the Science Cafe: "Agriculture warms the planet!? — Greenhouse gases from farmland."

This Science Cafe session was held as part of the Ministry of Education, Culture, Sports, Science and Technology's Supporting Activities for Female Researchers, which was started as an attempt to create venues where members of the general public can meet and talk with researchers, with whom they ordinarily have little familiarity, and chat casually about science in a homey atmosphere while drinking tea.

At this fourth session, Carbon and Nutrient Cycles Division Senior Researcher Hiroko Akiyama focused mainly on the agricultural sector in her talk about global warming, which is currently in the spotlight. Starting with the basics of global warming, she explained the current greenhouse gas situation, as well as the mechanism of GHG emissions from farmland and ways to reduce them.

From start to finish, the 23 participants asked a variety of questions, which indicated their intense interest in global warming. Everyone gained a deeper understanding of the research objectives and concrete responses to the question of how to reduce GHG emissions while maintaining food production.

(2) The 4th lecture on overseas examples of role models for female researchers: "USDA Women Scientists: Employee and Organizational Benefits of the ARS Workforce Plan"

On Monday, August 5 NIAES invited Dr. Sophie M. Uchimiya of the United States Department of Agriculture's Agricultural Research Service to describe not only her own career and daily life, but also how treatment as a Federal Government employee is useful in sustaining employees' balance between their work and personal lives.

Dr. Uchimiya described the progressive system under which, for example, employees can work their 40 weekly hours at any times during the week, and how co-workers can donate their paid vacation to employees who need long-term vacations for reasons such as illness or pregnancy and childbirth. This system helps women continue working while raising children or

Dr. Uchimiya (far left) chatting with participants after the lecture.

providing nursing care, and at present women make up 42% of full-time employees. However, the system was built gradually starting about 1990.
The approximately 30 participants spent the entire allotted time in lively discussion on the USDA's progressive programs and research system.

(3) Gender Equality Symposium Hosted by Three Tsukuba Research and Education Institutions
"Diversity and Its Management: Joint Declaration on Gender Equality in Tsukuba, and What the Future Holds"

Two years ago, six research and education institutions implementing the programs provided by JSPS in the Tsukuba area issued the "Gender Equality Declaration." This symposium was held to review subsequent changes in activities and environment for gender equality, and to explore directions for future activities.

The symposium was held on Monday, September 5 at the Tsukuba International Congress Center starting at 1:00 p.m. Of the over 100 participants, 40% were men, indicating the high gender-equality consciousness which transcended gender.

After introductory remarks on behalf of the host by Mr. Tadashi Yamaki, director of the National Agriculture and Food Research Organization (NARO), remarks were read from Director Atsuko Okajima of the Cabinet Office's Bureau for Gender Equality. Dr. Joan W. Bennett (Rutgers University in the USA) delivered the keynote speech, "Career Building by Women Researchers in the United States," after which Dr. Satsuki Ariga (director of the Hokkaido University Support Office for Female Researchers) gave a special lecture entitled "From Career Continuance to Career Advancement: How to Support Women Researchers Without Giving Men a Sense of Inequality" to explain the FResHU activities carried out at Hokkaido University.

The commentator Dr. Bennett (far left), Dr. Ariga (second from left), and the six representatives of research and education institutions participating in the discussion.

In the second half of the program, representatives of the symposium's three host organizations (NIAES, NARO, University of Tsukuba) described their current activities, after which Dr. Ariga chaired a panel discussion which included representatives of the National Institute of Advanced Industrial Science and Technology (AIST), National Institute for Materials Science (NIMS), and Forestry and Forest Products Research Institute (FFPRI). With comments from Dr. Bennett, symposium participants were given descriptions of the activities conducted by these institutions in the Tsukuba area. Finally, it was proposed that the loose collaboration among the diverse institutions in the Tsukuba area be fostered as the "Tsukuba model," and with that the symposium was brought to a close.

2. 2011 NIAES Young Researcher Encouragement Awards

Research Fellow Ryota Kataoka (Organochemicals Division) was awarded the prize for "Research on the Decomposition of Persistent Organic Pollutants (POPs) Using Soil Filamentous Fungi."

The NIAES Young Researcher Encouragement Awards, which were started in 2007 to encourage the institute's younger researchers, are presented to researchers and research fellows aged up to 40 who work at the National Institute for Agro-Environmental Sciences (NIAES) and who have excellent research achievements.

Foreign Visitors

1. Foreign Scholars

Affiliation	Number of Scholars	Subject	Duration
China, Institute of Soil Science, Chinese Academy of Sciences	1	The collaborative research on development of bioremediation of heavy metal polluted soil for food safety	Jun 3, 2011~ Jul 31, 2011
Thai, Kasetsart University Kamphaeng Saen Campus	1	Exchange of scientific findings and future collaborative studies on soil carbon and Nutrition Cycling	Jun 6, 2011~ Dec 1, 2011
USA, USDA Forest Service	1	Invasive exotic insects in Japan and USA: Historical trends and future	Jul 19, 2011~ Jul 25, 2011
USA, USDA	1	NIAES Role Model seminar by outstanding women scientists working in the agricultural sciences	Aug 5, 2011~ Aug 8, 2011
Korea, National Academy of Agricultural Science of the Rural Development Administration	1	Studies on adsorbent application technologies to remove the residual pesticides in agricultural environment	Aug 18, 2011~ Aug 21, 2011
Thai, Joint Graduate School of Energy and Environment	2	Mitigation of greenhouse gas emission from agro-ecosystems and to build low carbon society in Thailand	Aug 22, 2011~ Sep 5, 2011
Peru, Research Institute of Biochemistry and Molecular Biology of the Universidad Nacional Agraria La Molina	1	Study allelopathic plants and their practical application in sustainable agriculture	Sep 5, 2011~ Sep 22, 2011
China, Institute of Soil Science, Chinese Academy of Sciences	1	To conduct a collaborative study on the evaluation of mitigation options for greenhouse gas emissions from paddy fields	Sep 6, 2011~ Oct 5, 2011
Peru, Peruvian Amazon Research Institute	1	To learn the methodology for identification of allelopathic compounds and coordinate investigations	Sep 7, 2011~ Sep 22, 2011
Korea, the Rural Development Administration	3	Information exchange and discussion of the collaborative research between Japan and Korea	Sep 27, 2011~ Oct 1, 2011
Korea, National Academy of Agricultural Science of the Rural Development Administration	1	Studies on adsorbent application technologies to remove the residual pesticides in agricultural environment	Oct 7, 2011~ Oct 28, 2011
Bangladesh, Bangabandhu Sheikh Mujibur Rahman Agricultural University	1	Advancement of remote sensing methodologies and geo-information systems in monsoon Asia	Oct 16, 2011~ Dec 17, 2011
China, Institute of Soil Science, Chinese Academy of Sciences	3	The collaborative research on development of bioremediation of heavy metal polluted soil for food safety	Nov 13, 2011~ Nov 16, 2011
China, Institute of Environment and Sustainable Development in Agriculture, Chinese Academy of Agricultural Sciences	1	Participation in “MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture”	Nov 14, 2011~ Nov 19, 2011
China, Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences	1	Participation in “MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture”	Nov 14, 2011~ Nov 19, 2011
China, Institute of Soil Science, Chinese Academy of Sciences	1	Participation in “MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture”	Nov 14, 2011~ Nov 19, 2011

Affiliation	Number of Scholars	Subject	Duration
India, Central Rice Research Institute	1	Participation in "MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture"	Nov 14, 2011~ Nov 20, 2011
Indonesia, Indonesian Agricultural Environment Research Institute	1	Participation in "MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture"	Nov 14, 2011~ Nov 19, 2011
Malaysia, Malaysian Agricultural Research and Development Institute	1	Participation in "MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture"	Nov 14, 2011~ Nov 19, 2011
Mexico, Instituto Nacional de Investigaciones Forestales Agricolas y Pecuarias	1	Participation in "MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture"	Nov 14, 2011~ Nov 19, 2011
Pakistan, Pakistan Agricultural Research Council	1	Participation in "MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture"	Nov 14, 2011~ Nov 19, 2011
Thai, Khon Kaen University	1	Participation in "MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture"	Nov 14, 2011~ Nov 19, 2011
Thai, Prachinburi Rice Research Center	1	Participation in "MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture"	Nov 14, 2011~ Nov 19, 2011
Philippines, Philippine Rice Research Institute	1	Participation in "MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture"	Nov 14, 2011~ Nov 19, 2011
UK, Scottish Agricultural College	1	Participation in "MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture"	Nov 14, 2011~ Nov 19, 2011
UK, University of Aberdeen	1	Participation in "MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture"	Nov 16, 2011~ Nov 20, 2011
Uruguay, Universidad de la Republica	1	Participation in "MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture"	Nov 14, 2011~ Nov 20, 2011
USA, Kansas State University	1	Participation in "MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture"	Nov 14, 2011~ Nov 18, 2011
Vietnam, Institute for Agriculture Environment	1	Participation in "MARCO Workshop on Technology Development for Mitigating Greenhouse Gas Emissions from Agriculture"	Nov 14, 2011~ Nov 19, 2011
China, Institute of Soil Science, Chinese Academy of Sciences	1	The collaborative research on development of bioremediation of heavy metal polluted soil for food safety	Nov 16, 2011~ Dec 14, 2011
Philippines, IRRI Crop and Environmental Sciences Division	1	Research discussion of the effect of temperature and humidity on several varieties of rice production	Jan 29, 2012~ Mar 15, 2012

Affiliation	Number of Scholars	Subject	Duration
Food and Agriculture Organization of the United Nations	1	The 26th Workshop for Meteorological Environment - Protection of Large-scale Food Production Variability under Changing Climate and Environments	Feb 8, 2012~ Feb 12, 2012
China, Institute of Soil Science, Chinese Academy of Sciences	2	The collaborative research on development of bioremediation of heavy metal polluted soil for food safety	Feb 8, 2012~ Feb 11, 2012
China, Nanjing Agricultural University	1	Analysis of form and dynamics of heavy metals in soil	Mar 1, 2012~ Aug 31, 2012

2. Fellows

Fellowship	Affiliation	Research Subject	Duration
JSPS-Postdoctoral fellowships for foreign researchers	China, Chinese Academy of Sciences	Mechanisms underlying genotypic variation in rice growth response to elevated CO_2	Jul 1, 2009~ Jun 30, 2011
JSPS-Invitation fellowship programs for research in Japan	Philippines, International Rice Research Institute	Predicting the impacts of night temperature increase on rice production	Aug 2, 2011~ Sep 8, 2011

3. Training

Affiliation	Subject	Duration
China, Chinese Academy of Agricultural Sciences	Simulation of soil carbon dynamics	Sep 20, 2010~ Mar 31, 2012
Germany, Freiberg University of Mining and Technology	Mitigation options for greenhouse gas emissions	Nov 16, 2010~ Oct 27, 2011
Pakistan, Khyber Pakahtunkhwa Agriculture University	Isolation and identification of allelochemicals	Apr 1, 2011~ Mar 31, 2012
Myanmar, University of Tsukuba	Isolation and identification of allelochemicals	Apr 1, 2011~ Mar 31, 2012
Vietnam, Tokyo University of Agriculture and Technology	Reduction of the environmental impact in the drain water from paddy field	Apr 1, 2011~ Mar 31, 2012
Ghana, Yokohama National University	Analytical method of persistent organic pollutants in the atmosphere	Apr 1, 2011~ Mar 31, 2012
China, The University of Tokyo	Effect of CO_2 concentration on the quality of rice grain	May 1, 2011~ Mar 31, 2013
Malaysia, University of Tsukuba	Isolation and identification of allelochemicals	Jun 13, 2011~ Sep 30, 2011
Korea, Tokyo City University	Isolation and identification of allelochemicals	Jul 1, 2011~ Sep 30, 2011
China, University of Tsukuba	Analytical method of radioactive cesium in soil	Aug 1, 2011~ Mar 31, 2012

Affiliation	Subject	Duration
China, Tokyo University of Agriculture and Technology	Application of the DNDC model to arable soil	Sep 14, 2011~ Sep 28, 2011
Peru, Tokyo University of Agriculture	Isolation and identification of allelochemicals	Oct 1, 2011~ Mar 31, 2012
Malaysia, University of Tsukuba	Isolation and identification of allelochemicals	Oct 1, 2011~ Mar 31, 2012
Malaysia, Tokyo University of Agriculture	Isolation and identification of growth regulating substance of plant	Oct 1, 2011~ Mar 31, 2012
Korea , Pukyong National University	Effect of climatic change on the production of rice	Jan 10, 2012~ Feb 16, 2012

Overseas Research and Meetings

1. Long-term Overseas Researches

Program	Delegated Institution	Research Subject	Duration
NIAES international response expense	Germany, Bonn University	Time-series land use map and suitability analysis of land use	Jul 4, 2010~ Aug 2, 2011
NIAES international response expense	France, University of Nancy	Identification of genes involved in the biosynthesis of furanocoumarins	Sep 6, 2010~ Sep 5, 2011

2. Overseas Meetings

Meeting	Venue	Date	Participants from NIAES
SETAC Europe 21st Annual Meeting, SETAC Europe	Italy	May 14-20, 2011	1
Expert meeting in Bangkok on APN funded project entitled: Strategic Rice Cultivation for Sustainable Low Carbon Society Development in South East Asia	Thailand	Jun. 1-4, 2011	1
FLUXNET and Remote Sensing Open Workshop: Towards Upscaling Flux Information from Towers to the Globe	USA	Jun. 6-12, 2011	2
2011 Taiwan-USA International Workshop on Children's risk	Taiwan	Jun. 14-16, 2011	1
4th International IUPAC Symposium on Trace Elements in Food	UK	Jun. 18-24, 2011	1
First International Conference on Food and Environment-The Quest for a Sustainable Future	UK	Jun. 19-26, 2011	1
Clean Energy and Technology	Malaysia	Jun. 26-30, 2011	1
11th International Conference on the Biogeochemistry of Trace Elements	Italy	Jul. 2-8, 2011	1
Participating and discussion in meeting of SP5 in CarboEastAsia Seminar	Korea	Jul. 10-16, 2011	2
2011 IEEE International Geoscience and Remote Sensing Symposium	Canada	Jul. 25-31, 2011	2
XVIII International botanical congress (IBC2011)	Australia	Jul.27-Aug. 1, 2011	1
Hennig XXX - Sao Jose do Rio Preto, State of Sao Paulo - Brazil	USA	Jul. 27-Aug. 5, 2011	1
1st Annual International Symposium of Mycology (ISM-2011)	China	Jul. 30-Aug. 1, 2011	1
2011 APS-IPPC Joint Meeting	USA	Aug. 5-12, 2011	1
Ecological Society of America The 96th annual meeting in Austin TX	USA	Aug. 5-14, 2011	1
14th Symposium on Insect-Plant Interactions	Netherlands	Aug. 12-19, 2011	1
The 8th International Association of Landscape Ecology World Congress	China	Aug. 18-23, 2011	1
1st International Symposium on Halogenated Persistent Organic Pollutants	Belgium	Aug. 21-27, 2011	1
NCEAS Working Group "Applying population ecology to strategies for eradicating invasive forest insects" 4th meeting	USA	Aug. 27-Sep. 2, 2011	1
International workshop on "Agricultural Model Inter-comparison and Improvement project"	China	Aug. 28-31, 2011	1
1st International Symposium Non-Conventional Yeasts in the Postgenomic Era	Ukraine	Sep. 9-17, 2011	1

Meeting	Venue	Date	Participants from NIAES
International Workshop on Soil Contamination and Bioremediation	China	Sep. 10-14, 2011	4
Workshop on Greenhouse gases mitigation allocation and countermeasures in agricultural sector	Korea	Sep. 15-17, 2011	1
3rd iLEAPS Science Conference Garmisch-Partenkirchen, Germany	Germany	Sep. 15-29, 2011	3
Effect of landscape structure and it changes on Japanese rural biodiversity	Indonesia	Sep. 19-24, 2011	1
23rd Asian-Pacific Weed Science Society Conference	Australia	Sep. 25-28, 2011	1
20th International Symposium on Environmental Biogeochemistry ISEB 2011	Turkey	Sep. 26-Oct. 3, 2011	1
Asia-Pacific Conference on Synthetic Aperture Radar 2011	Korea	Sep. 26-30, 2011	1
MARCO-FFTC International Seminar on Increased Agricultural Nitrogen Circulation in Asia: Technological Challenge to Mitigate Agricultural N Emissions	Taiwan	Sep. 26-Oct.1, 2011	4
The 32nd Asian Conference on Remote Sensing	Taiwan	Oct. 2-7, 2011	1
International Workshop on Sustainable Farming Strategies for Increased Resiliency of Asian Sloping Land Agroecosystems amid Climate Change	Philippines	Oct. 4-8, 2011	1
The 10th International Conference of the East and Southeast Asia Federation of Soil Science Societies	Sri Lanka	Oct. 8-15, 2011	7
The Agricultural Model Intercomparison and Improvement Project	USA	Oct, 12-17, 2011	1
ASA-CSSA-SSSA2011	USA	Oct. 15-22, 2011	4
Workshop on Agricultural Production and Environmental Adaptations for Coping with Climate Change	Taiwan	Oct. 24-26, 2011	1
GMCC2011 Coexistence 2.0: Achieving Coexistence of Biotech, Conventional & Organic Foods in the Marketplace	Canada	Oct. 25-30, 2011	2
2011 Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reductions	USA	Oct. 30-Nov. 6, 2011	1
Sixth International Symposium on Non-CO_2 Greenhouse Gases	Netherlands	Nov. 1-6, 2011	1
Asia Flux Workshop 2011	Malaysia	Nov. 8-17, 2011	5
2011 American Geophysical Union Fall Meeting	USA	Dec. 4-11, 2011	7
The 6th World Congress on Allelopathy	China	Dec. 15-19, 2011	2
The 52nd annual meeting of the Weed Science Society of America	USA	Feb. 6-11, 2012	1
Advancing the Science and Technology of Soil Information in Asia -Launch of the Global Soil Partnership	China	Feb. 7-12, 2012	1
Planet under Pressure 2012	UK	Mar. 25-31, 2012	1

Patents

1) Nocardioides FERM BP−10405 capable of degrading organochlorine pesticide PCNB
   United States Patent: 7629159
   Filing date: January 20, 2006
   Issue date: December 8, 2009
   Inventors: Kazuhiro Takagi, Naoki Harada and Yuuichi Yoshioka

Publications

1. Official publications

1) NIAES Annual Report 2011

2) NIAES Research Executive Summary (Japanese ed.) (Kenkyu seika joho), No.28

3) Annual Report of National Institute for Agro-Environmental Sciences (Japanese ed.) (Nogyo kankyo gijutsu kenkyusho nenpo), No.28

4) NIAES News (Japanese ed.)(No-kan-ken nyusu), No.91 - No.94

2. Research Papers published by the NIAES staff

Scientific journal papers	English	160
	Japanese	35
	Others	1
Proceedings (incl. Abstracts)	English	147
	Japanese	412
	Others	0
Others	English	12
(Review, magazine/newspaper articles)	Japanese	132
	Others	0

3. Research staff activities (English papers)

Author(s)	Title	Journal Title	Vol.(No.)	Pages	Year
Koga, N. Smith, P. Yeluripati, J.B. **Shirato, Y.** Kimura, S.D. Nemoto, M.	Estimating net primary production and annual plant carbon inputs, and modeling future changes in soil carbon stocks in arable farmlands of northern Japan	Agriculture Ecosystems & Environment	144(1)	51-60	2011
Itoh, M. **Sudo, S.** Mori, S. Saito, H. Yoshida, T. Shiratori, Y. Suga, S. Yoshikawa, N. Suzue, Y. Mizukami, H. Mochida, T. **Yagi, K.**	Mitigation of methane emissions from paddy fields by prolonging midseason drainage	Agriculture Ecosystems & Environment	141 (3-4)	359-372	2011
Hayashi, K. Matsuda, K. Takahashi, A. Nakaya, K.	Atmosphere-forest exchange of ammoniacal nitrogen in a subalpine deciduous forest in central Japan during a summer week	Asian Journal of Atmospheric Environment	5(2)	134-143	2011
Wagai, R. Mayer, L.M. Kitayama, K. **Shirato, Y.**	Association of organic matter with iron and aluminum across a range of soils determined via selective dissolution techniques coupled with dissolved nitrogen analysis	Biochemistry	−	10.1007/s 10533-011 -9652-5	2011

Author(s)	Title	Journal Title	Vol.(No.)	Pages	Year
Wang, Y. Fang, J. Y. Kato, T. Guo, Z. D. Zhu, B. **Mo, W. H.** Tang, Y. H.	Inventory-based estimation of aboveground net primary production in Japan's forests from 1980 to 2005	Biogeosciences	8	2099-2106	2011
Fushimi, A. **Wagai, R.** Uchida, M. Hasegawa, S. Takahashi, T. Kondo, M. Hirabayashi, M. Morino, Y. Shibata, Y. Ohara, T. Kobayashi, S. Tanabe, K.	Radiocarbon (14C) diurnal variations in fine particles at sites downwind from Tokyo, Japan in summer	Environmental Science and Technology	45(16)	6784-6792	2011
Inoue, Y. **Hiradate, S.** Sase, T. Hosono, M. **Morita, S.** Matsuzaki, H.	Using 14C dating of stable humin fractions to assess upbuilding pedogenesis of a buried Holocene humic soil horizon, Towada volcano, Japan	Geoderma	−	85-90	2011
Toyoda, S. Yano, M. Nishimura, S. **Akiyama, H.** **Hayakawa, A.** Koba, K. **Sudo, S.** **Yagi, K.** Makabe, A. Tobari, Y. Ogawa, N.O. Ohkouchi, N. Yamada, K. Yoshida, N.	Characterization and production and consumption processes of N_2O emitted from temperate agricultural soils determined via isotopomer ratio analysis	Global Biogeochemical Cycles	25 (GB2008)	doi: 10.1029/ 2009GB 003769-	2011
Tokida, T. Adachi, M. Cheng, W. **Nakajima, Y.** **Fumoto, T.** Matsushita, M. Nakamura, H. Okada, M. Samejima, R. **Hasegawa, T.**	Methane and soil CO_2 production from current-season photosynthates in a rice paddy exposed to elevated CO_2 concentration and soil temperature	Global Change Biology	17(11)	3327-3337	2011
Morimoto, S. **Hayatsu, M.** **Hoshino, T.Y.** Nagaoka, K. Yamazaki, M. Karasawa, T. Takenaka, M. **Akiyama, H.**	Quantitative analyses of ammonia-oxidizing archaea (AOA) and ammonia-oxidizing bacteria (AOB) in fields with different soil types	Microbes and Environments	26(3)	248-253	2011

Author(s)	Title	Journal Title	Vol.(No.)	Pages	Year
Hoshino, T.Y. **Morimoto, S.** **Hayatsu, M.** Nagaoka, K. Suzuki, C. Karasawa, T. Takenaka, M. **Akiyama, H.**	Effect of soil type and fertilizer management on archaeal community in upland field soils	Microbes and Environments	26(4)	307-316	2011
Shimomura, Y. **Morimoto, S.** **Hoshino, T.Y.** **Uchida, Y.** **Akiyama, .H** **Hayatsu, M.**	Comparison among amoA primers suited for quantification and diversity analyses of ammonia-oxidizing bacteria in soil	Microbes and Environments	27(1)	94-98	2012
Nishimura, S. **Akiyama, H.** **Sudo, S.** **Fumoto, T.** **Cheng, W.** **Yagi, K.**	Combined emission of CH_4 and N_2O from a paddy field was reduced by preceding upland crop cultivation	Soil Science and Plant Nutrition	57(1)	167-178	2011
Shirato, Y. **Yagasaki, Y.** Nishida, M.	Using different versions of the Rothamsted Carbon model to Simulate soil carbon in long-term experimental plots subjected to paddy-upland rotation in Japan	Soil Science and Plant Nutrition	57(4)	597-606	2011
Minamikawa, K. **Nishimura, S.** **Nakajima, Y.** **Osaka, K.** Sawamoto, T. **Yagi, K.**	Upward diffusion of nitrous oxide produced by denitrification near shallow groundwater table in the summer: a lysimeter experiment	Soil Science and Plant Nutrition	57(5)	719-732	2011
Minamikawa, K. **Hayakawa, A.** **Nishimura, S.** **Akiyama, H.** **Yagi, K.**	Comparison of indirect nitrous oxide emission through lysimeter drainage between an Andosol upland field and a Fluvisol paddy field	Soil Science and Plant Nutrition	57(6)	843-854	2011
Takata, Y. **Ito, T.** **Ohkura, T.** **Obara, H.** **Kohyama, K.** **Shirato, Y.**	Phosphate adsorption coefficient can improve the validity of RothC model for Andosols	Soil Science and Plant Nutrition	57(3)	421-428	2011
Mishima, S. Kimura, S.D. **Eguchi, S.** **Shirato, Y.**	Estimation of the amounts of livestock manure, rice straw, and rice straw compost applied to crops in Japan: a bottom-up analysis based on national survey data and comparison with the results from a top-down approach	Soil Science and Plant Nutrition	58(1)	83-90	2012
Hayashi, K. **Tokida, T.** **Hasegawa, T.**	Potential ammonia emission from flag leaves of paddy rice (Oryza sativa L. cv. Koshihikari)	Agriculture Ecosystems & Environment	144(1)	117-123	2011
Hasegawa, T. Ishimaru, T. Kondo, M. **Kuwagata, T.** **Yoshimoto, M.** **Fukuoka, M.**	Spikelet sterility of rice observed in the record hot summer of 2007 and the factors associated with its variation	Journal of Agricultural Meteorology	67(4)	225-232	2012

Author(s)	Title	Journal Title	Vol.(No.)	Pages	Year
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Sakurai, G. **Iizumi, T.** **Yokozawa, M.**	Varying temporal and spatial effects of climate on maize and soybean affect yield prediction	Climate Research	49(2)	143-154	2011
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Kamo, T. **Tokuoka, Y.**	Influence of the prey aphid Uroleucon nigrotuberculatum parasitizing Solidago canadensis on the larval and adult survivorship of the predatory ladybird beetle Harmonia axyridis	Ecological Research	26(2)	471-476	2011
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Sato, Y. **Mochizuki, A.**	Risk assessment of non-target effects caused by releasing two exotic phytoseiid mites in Japan: can an indigenous phytoseiid mite become IG prey?	Experimental and Applied Acarology	54(4)	319-329	2011
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Thuyet, D.Q. Watanabe, H. **Yamazaki, K.** **Takagi, K.**	Photodegradation of imidacloprid and fipronil in rice-paddy water	Bulletin of Environmental Contamination and Toxicology	86(5)	548-553	2011
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Duan, G. Kamiya, T. **Ishikawa, S.** **Arao, T.** Fujiwara, T.	Expressing ScACR3 in rice enhanced arsenite efflux and reduced arsenic accumulation in rice grains	Plant and Cell Physiology	53(1)	154-163	2012
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Inoue, Y.	Roles and impacts of biomass burning in slash-and -burn land use in tropical mountains: a case study in Laos	Global Environmental Research	15	21-30	2011
Kawamura, K. Watanabe, N. Sakanoue, S Lee, H. **Inoue, Y.**	Waveband selection using a phased regression with a bootstrap procedure for estimating legume content in a mixed sown pasture	Grassland Science	57(2)	81-93	2011

Author(s)	Title	Journal Title	Vol.(No.)	Pages	Year
Hossen, M.S. **Mano, M.** **Miyata, A.** Baten, M.D. Hiyama, T.	Surface energy partitioning and evapotranspiration over a double-cropping paddy field in Bangladesh	Hydrological Processes	26(9)	1311-1320	2011
Kim, W. Cho, J. Komori, D. Aoki, M. **Yokozawa, M.** Kanae, S. Oki, T.	Tolerance of eddy covariance flux measurement	Hydrological Research Letters	5	73-77	2011
Sakamoto, T. Wardlow, B.D. Gitelson, A.A.	Detecting spatiotemporal changes of corn developmental stages in the U.S. corn belt using MODIS WDRVI data	Ieee Transactions On Geoscience and Remote Sensing	49(6)	1926-1936	2011
Cho, J. Miyazaki, S. Yeh, P.J.-F. **Kim, W.** Kanae, S. Oki, T.	Testing the hypothesis on the relationship between aerodynamic roughness length and albedo using vegetation structure parameters	International Journal of Biometeorology	56(2)	411-418	2011
Sprague, D.	Land use configuration under traditional agriculture in Japan: a historical GIS analysis	International Journal of Geographical Information Science	−	−	2012
Shibayama, M. **Sakamoto, T.** Kimura, A.	Exploring the applicability of field measurements of mid-infrared reflectance using a portable band-pass filter type radiometer to assess paddy rice yields	International Journal of Remote Sensing	32(13)	3589-3609	2011
Abdullah, H.M. Akiyama, T. **Shibayama, M.** Awaya, Y.	Estimation and validation of biomass of a mountainous agroecosystem by means of sampling, spectral data and QuickBird satellite image	International Journal of Sustainable Development and World Ecology	18(5)	384-392	2011
Sakamoto, T. **Shibayama, M.** Kimura, A. Takada, E.	Assessment of digital camera-derived vegetation indices in quantitative monitoring of seasonal rice growth	Isprs Journal of Photogrammetry and Remote Sensing	66(6)	872-882	2011
Kiyono, Y. Saito, S. Takahashi, T. Toriyama, J. Awaya, Y. Asai, H. Furuya, N. Ochiai, Y. **Inoue, Y.** Sato, T. Sophal, C. Sam, P. Tith, B. Ito, E. Siregar, C.A. Matsumoto, M.	Practicalities of non-destructive methodologies in monitoring anthropogenic greenhouse gas emissions from tropical forests under the influence of human intervention	JARQ-Japan Agricultural Research Quarterly	45(2)	233-242	2011
Kim, W. Komori, D. Cho, J.	The characteristic of fractional uncertainty on eddy covariance measurement	Journal of Agricultural Meteorology	67(3)	163-171	2011

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Yonemura, S. **Shibaike, H.** **Iwasaki, N.** Kawashima, S. **Ushiyama, T.** **Du, M.**	A system model for estimating regional cross-pollination rates between GM and non-GM rice considering actual meteorological conditions and field distributions	Journal of Agricultural Meteorology	67(2)	57-64	2011
Watanabe, S. Komori, D. Aoki, M. **Kim, W.** Boonyawat, S. Tongdeenok, P. Prakarnrat, S. Baimoung, S.	Estimation of daily solar radiation from sunshine duration in Thailand	Journal of the Meteorological Society of Japan	89A	355-364	2011
Ferrio, J.P. Pou, A. Florez-Sarasa, I. Gressler, A. **Kodama, N.** Flexas, J. Ribas-Carbó, M.	The Péclet effect on leaf water enrichment correlates with leaf hydraulic conductance and mesophyll conductance for CO_2	Plant Cell and Environment	35(3)	611-625	2012
Shibayama, M. **Sakamoto, T.** Takada, E. Kanda, E. Tanaka, H. Gomi, K. Kimura, A.	Multi-band spectrum camera (MBSC) for automatic fixed-point reflectance image collection in a crop field	Plant Production Science	14(4)	391-397	2011
Shibayama, M. **Sakamoto, T.** Takada, E. Inoue, A. Morita, K. Yamaguchi, T. Takahashi, W. Kimura, A.	Regression-based models to predict rice leaf area index using biennial fixed point continuous observations of near infrared digital images	Plant Production Science	14(4)	365-376	2011
Sakamoto, T. Gitelson, A.A. Wardlow, B.D. Arkebauer, T.J. Verma, S.B. Suyker, A.E. **Shibayama, M.**	Application of day and night digital photographs for estimating maize biophysical characteristics	Precision Agriculture	13(3)	285-301	2011
Sakamoto, T. Gitelson, A.A. Wardlow, B.D. Verma, S.B. Suyker, A.E.	Estimating daily gross primary production of maize based only on MODIS WDRVI and shortwave radiation data	Remote Sensing of Environment	115(12)	3091-3101	2011
Cho, J. Oki, T. Yeh, P. J.-F. **Kim, W.** Kanae, S. Otsuki, K.	On the relationship between the Bowen ratio and the near-surface air temperature	Theoretical and Applied Climatology	108 (1-2)	135-145	2011
Ito, M. **Sato, I.** **Koitabashi, M.** **Yoshida, S.** **Imai, M.** **Tsushima, S.**	A novel actinomycete derived from wheat heads degrades deoxynivalenol in the grain of wheat and barley affected by Fusarium head blight	Applied Microbiology and Biotechnology	–	DOI: 10. 1007/s 00253-012 -3922-6-	2012

Author(s)	Title	Journal Title	Vol.(No.)	Pages	Year
Osawa, T. Mitsuhashi, H. Niwa, H. Ushimaru, A.	The role of river confluences and meanderings in preserving local hot spots for threatened plant species in riparian ecosystems	Aquatic Conservation-Marine and Freshwater Ecosystems	21(4)	358-363	2011
Osawa, T. Mitsuhashi, H. Uematsu, Y. Ushimaru, A.	Bagging GLM: Improved generalized linear model for the analysis of zero-inflated data	Ecological Informatics	6(5)	270-275	2011
Sato, I. **Ito, M.** **Ishizaka, M** **Ikunaga, Y.** **Sato, Y.** **Yoshida, S.** **Koitabashi, M.** **Tsushima, S.**	Thirteen novel deoxynivalenol-degrading bacteria are classified within two genera with distinct degradation mechanisms	Fems Microbiology Letters	327(2)	110-117	2012
Shinohara, H. **Yoshida, S.** Enya, J. Watanabe, Y. Tsukiboshi, T. Negishi, H. **Tsushima, S.**	Culturable bacterial communities on leaf sheaths and panicles of rice plants in Japan	Folia Microbiologica	56(6)	505-517	2011
Osawa, T.	Management-mediated facilitation : Miscanthus sinensis functions as a nurse plant in Satoyama grassland	Grassland Science	57(4)	204-210	2011
Koitabashi, M. **Yoshida, S.** **Tsushima, S.**	Labor-saving preservation of powdery mildew of strawberry by sterilized seedling culture	JARQ-Japan Agricultural Research Quarterly	45(4)	405-409	2011
Yoshitake, H. Sato, T.	Occurrence of Tapeinotus sellatus (Fabricius) (Coleoptera, Curculionidae, Ceutorhynchinae) in Japan	Japanese Journal of Systematic Entomology	17(2)	347-350	2011
Yoshitake, H. Fujisawa, T. Goto, J. Chiba, T.	A new ceutorhynchus species (Coleoptera, Curculionidae) attacking field-cultivated wasabi (Brassicaceae) in Northern Japan	Japanese Journal of Systematic Entomology	17(2)	293-299	2011
Takata, Y. Tani, M. Kato, T. Koike, M.	Effects of land use and long-term organic matter application on low-molecular-weight organic acids in an Andisol	Journal of Soil Science and Environmental Management	2(10)	292-298	2011
Tsuji, M. Ushimaru, A. **Osawa, T.** Mitsuhashi, H.	Paddy-associated frog declines via urbanization: A test of the dispersal-dependent-decline hypothesis	Landscape and Urban Planning	103	318-325	2011
Yoshimatsu, S.	Taxonomic review of Mythimna (Mythimna) simillima (Walker) and its close Asia-Oceanian relatives (Lepidoptera, Noctuidae, Hadeninae) with description of a new species	Lepidoptera Science	63(1)	18-24	2012

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Bao, C. **Ikunaga, Y.** **Matsushita, Y.** **Morimoto, S.** **Takada-Hoshino, Y.** **Okada, H.** **Oba, H.** **Takemoto, S.** **Niwa, S.** **Ohigashi, K.** Suzuki, C. Nagaoka, K. Takenaka, M. Urashima, Y. Sekiguchi, H. Kushida, A. Toyota, K. Saito, M. **Tsushima, S.**	Combined Analyses of Bacterial, Fungal and Nematode Communities in Andosolic Agricultural Soils in Japan	Microbes and Environments	27(1)	72-79	2012
Haruyama, N. **Mochizuki, A.** **Sato, Y.** Naka, H. Nomura, M.	Complete mitochondrial genomes of two green lacewings, Chrysoperla nipponensis (Okamoto, 1914) and Apochrysa matsumurae Okamoto, 1912 (Neuroptera: Chrysopidae)	Molecular Biology Reports	38(5)	3367-3373	2011
Takata, Y. **Kuwagata, T.** **Kohyama, K.** **Obara, H.**	Delineation of Japanese soil temperature regime map	Soil Science and Plant Nutrition	57(2)	294-302	2011
Leon, A. **Kohyama, K.** **Mishima, S.** **Ohkura, T.** **Shirato, Y.** **Takata, Y.** **Taniyama, I.** **Obara, H.**	Factors controlling organic amendment application rate and long-term change in application rate in Japanese paddy field using longitudinal questionnaire survey dataset (the Basic Soil Environment Monitoring Project, Stationary Monitoring, 1979–1998)	Soil Science and Plant Nutrition	58(1)	104-120	2012
Zhao, P. Kakishima, M. **Uzuhashi, S.** **Ishii, H.**	Multigene phylogenetic analysis of inter- and intraspecific relationships in Venturia nashicola and V. pirina	European Journal of Plant Pathology	132(2)	245-258	2011
Inoue, K. Tsurumi, T. **Ishii, H.** Park, P. Ikeda, K.	Cytological evaluation of the effect of azoxystrobin and alternative oxidase inhibitors in Botrytis cinerea	Fems Microbiology Letters	326(1)	83-90	2012
Katoh, H. Yamada, A. Akimitsu, K. **Ishii, H.**	Cloning and sequence analysis of endopolygalacturonase genes in Venturia nashicola and Venturia pirina	JARQ-Japan Agricultural Research Quarterly	45(4)	423-432	2011
Ishii, H. Miyamoto, T. Ushio, S. Kakishima, M.	Lack of cross-resistance to a novel succinate dehydrogenase inhibitor, fluopyram, in highly boscalid-resistant isolates of Corynespora cassiicola and Podosphaera xanthii	Pest Management Science	67(4)	474-482	2011

Author(s)	Title	Journal Title	Vol.(No.)	Pages	Year
Oono, Y. Kawahara, Y. Kanamori, H. Mizuno, H. Yamagata, H. Yamamoto, M. Hosokawa, S. Ikawa, H. **Akahane, I.** Zhu, Z. Wu, J. Itoh, T. Matsumoto, T.	mRNA-seq reveals a comprehensive transcriptome profile of rice under phosphate stress	Rice	4(2)	50-65	2011

Financial Overview FY2011

1. Budget in the FY 2011 (Million yen)

Operational Budget	3,097
Facilities Maintenance Subsidy	138
Project Research Budget	1,013
Miscellaneous Income	4
Incidental Income	-
Total	4,252

2. Staff Numbers

Personnel	Number
President	1
Vice President	1
Auditor	2
Administrators	43
Researchers	124

(Number of persons of Jan. 1, 2012)

NIAES Annual Report 2012

Published by

National Institute for Agro-Environmental Sciences

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