

Agro-Environmental Research and Consortium in Monsoon Asia

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Abstract: Asian countries are all blessed with a food production platform of paddy rice agriculture and an agro-ecosystem rich in the biodiversity that arises with rice paddies. But present rapid population growth and economic development give rise to concerns about the collapse of the agro-ecosystem due to causes including global warming, urbanization, pollution by hazardous chemical substances, and alien species. Under these circumstances, it is vitally important to disseminate techniques for assessing and managing risk in the agro-ecosystems of monsoon Asia. It is very significant for agro-environmental researchers from Asian nations to assemble with the results of their research, discuss the problems facing Asia's agro-ecosystems, and work to bring further depth to their research. It is hoped that this symposium will spark the formation of an Agro-Environmental Research Consortium for Asia's monsoon region. It is of the utmost importance to solving environmental problems in Asia, and thus for the entire globe, to build an Agro-Environmental Research Consortium with Asian countries and act in concert for purposes including holding international conferences, planning new international research projects and enhancing collaboration in existing research projects through interaction among experts, and setting up research focal points for individual themes.

Keywords: Agro-Environmental Research Consortium, Monsoon Asia, research network

1. Introduction

Asian countries are all blessed with a food production platform of paddy rice agriculture and an agro-ecosystem rich in the biodiversity that arises with rice paddies. But present rapid population growth and economic development give rise to concerns about the collapse of the agro-ecosystem due to causes including global warming, urbanization, pollution by hazardous chemical substances, and alien species.

The many indicators of environmental deterioration testify to the seriousness of Asia's environmental problems. Large-scale clearing of forests, shifting agriculture and other developments over the last quarter century have resulted in the halving of Asia's forests and the deterioration of one-third of its farmland. At least one in three Asians lacks access to safe drinking water, and it is anticipated that if the current trend continues, by 2025 an estimated 2.4 billion people will not have enough water. Every year throughout Asia at least 300 million tons of wastes and several million tons of hazardous substances are not properly disposed, of thereby contaminating groundwater and farmland and creating a food supply crisis for nearby areas. While on the one hand rapid economic growth and wealth have brought vitality, the movement of goods has brought the invasion of alien species, in turn causing the breakdown of native ecosystems and the loss of ecosystem diversity. Further, while there are expectations that genetically modified crops, whose cultivation has rapidly spread around the world, are one promising way to solve humanity's food problems, we need a fair evaluation of how their use will affect ecosystems.

The impacts of these Asian agro-environmental problems are not confined to Asia. Asia accounts for 24% of the world's land area but 60% of its population. Although Asia's per capita greenhouse gas emissions are only 5% to 10% of those in the developed world, Asia currently accounts for 20% of total world emissions, and it is anticipated that the percentage will quickly rise. Global warming, which is caused by increasing greenhouse gases, will surely have a heavy impact on world agricultural production. Solving the environmental problems affecting Asian agriculture must be an urgent priority if humanity is to achieve sustained economic growth and maintain social cohesiveness while maintaining ecosystem soundness. Under these circumstances, it is vitally important to disseminate techniques for assessing and managing risk in the agro-ecosystems of monsoon Asia.

It is very significant for agro-environmental researchers from Asian nations to assemble with the results of their research, discuss the problems facing Asia's agro-ecosystems, and work to bring further depth to their research. It is hoped that this symposium will spark the formation of an Agro-Environmental Research Consortium for Asia's monsoon region. It is of the utmost importance to solving environmental problems in Asia, and thus for the entire globe, to build an Agro-Environmental Research Consortium with Asian countries and act in concert for purposes including holding international conferences, planning

new international research projects and enhancing collaboration in existing research projects through interaction among experts, and setting up research focal points for individual themes.

2. Overview of the National Institute for Agro-Environmental Sciences

The National Institute for Agro-Environmental Sciences (NIAES) was created in 1983 by a reorganization of the National Institute of Agricultural Sciences, whose history goes back to 1893. Currently, the institute has a staff of 198 plus 249 part-time employees and guest researchers, working in seven research divisions and one Research Center. We have created fifteen research projects, which span multiple divisions, and our research proceeds under the following three major goals.

The first goal, “Assessing and managing agro-environmental risks”, involves research on assessing the agro-environmental risks of pesticides, heavy metals, alien species, genetically modified organisms, and other factors, and research on the development of risk-mitigation technologies. Specifically, while working on the development of environmental risk assessment methods for pesticides and persistent organic pollutants (POPs) that affect the agro-environment, NIAES also develops technologies for the chemical washing, phytoremediation, and bioremediation of soil contaminated by heavy metals and pesticides. To prevent impact on and damage to agro-ecosystems by alien species, we are working on ways to ascertain what kinds of damage alien species cause, how to predict their establishment, spread, and harm, and how to assess their risks. Our research on genetically modified organisms involves assessing the risk of the hybridization of genetically modified crops with related species by means including hybridization prediction models and maintaining isolation distance for the purpose of coexistence between genetically modified and non-genetically modified crops.

Our second goal, “Elucidating and managing the structure and function of agro-ecosystems to maintain and enhance the function of natural circulation”, involves research aimed at understanding the relationships between organisms in agro-ecosystems and the functions of organisms, and understanding the mechanism of agro-ecosystem change and then developing technologies to cope with it. Regarding the understanding of relationships between organisms in agro-ecosystems, our work entails assessing the impacts of agricultural activities and landscape changes on biodiversity, while our efforts to understand how biological functions are manifested in the environment entail research to elucidate the functional expression mechanisms of plant alleopathy, insect pheromones, microorganisms which degrade recalcitrant compounds. In connection with understanding the mechanism of agro-ecosystem change, NIAES is developing methods to predict the wide-area cycles and environmental impacts of nitrogen and phosphorus, and to predict fluctuations in food production caused by global warming and weather extremes, as well as developing technologies to reduce the emissions of greenhouse gases from farmland in order to stave off global warming.

Our third goal, “Basic studies to elucidate agro-ecosystem functionality”, entails gathering environment resources and data on them, which serve as the basis for agro-environmental research. For example, in order to detect quickly adverse impacts on agro-environments, we are conducting long-term monitoring of the flux of carbon dioxide, methane, and other greenhouse gases, while also monitoring concentrations of ^{137}Cs , ^{210}Pb , and other radioactive isotopes in crops and soil. We are also developing methods to analyze organic arsenic compounds and other trace chemical substances in crops and the environment. Our Agro-Environment Inventory Center gathers, preserves, and databases soil, insects, microorganisms, and other environment resources.

3. NIAES Collaboration and Initiatives with Other Asian Countries

Because environmental research is now vital global research conducted around the world, NIAES actively facilitates joint research with top-level researchers in other countries to elaborate and disseminate the research results gained through the initiatives described above. Over the recent three years of FY2003 through FY2005, we carried out 24 international research projects such as “International Joint Research on Water Quality Maintenance in Agro-Ecosystems and an Assessment of Its Impacts”. NIAES has especially important research partnerships with researchers from other Asian countries that share a paddy rice agriculture food production platform, and that have intimate cultural and landform connections.

NIAES has concluded memoranda of understanding (MOUs) with four other Asian research institutes. In 1999, we concluded an MOU with Indonesia's Southeast Asian Impacts Center and have been cooperating in research on "Impacts of the Emission and Absorption of Greenhouse Gases in Conjunction with Land Use Changes". A memorandum was signed in 2000 with the National Institute of Agricultural Sciences and Technology, Korea, and we are conducting joint research on "International Joint Research on Water Quality Maintenance in Agro-Ecosystems and an Assessment of Its Environmental Impacts". In 2001, NIAES signed an MOU with the Nanjing Institute of Soil Science, Chinese Academy of Sciences, and launched joint research on "Understanding the Dynamics of Greenhouse Gases" and "Predicting Changes in Food Production Due to Global Warming". In 2004, we concluded an MOU with The National Agriculture and Forest Research Institute of the Lao People's Democratic Republic, and we are conducting joint research called "Research in the Agricultural and Earth Sciences for the Control of CO₂ Sinks and Sources in Shifting Cultivation Ecosystems and for Enhancing Food Production Sustainability in Southeast Asia". In addition to these, NIAES is actively pursuing research exchanges and cooperation through programs and projects such as Japan-Korea Technical Cooperation in Agriculture, Forestry, and Fisheries; the Japan-China Agreement on Nature Protection Cooperation; Japan-China Technical Exchanges in the Agricultural Sciences; the JSPS Bilateral Exchange Program (Bangladesh); and the Ministry of Agriculture, Forestry, and Fisheries Foundational Project for Strategic International Agricultural Research (East Asia).

Based on these MOUs and agreements, NIAES held 16 international conferences over the five years from FY2001 through FY2005, including, in March 2006, the International Workshop on Monsoon Asia Agricultural Greenhouse Gas Emissions, and The 3rd International Workshop of the Japan-Korea Research Cooperation — Nitrogen Load in Agro-Ecosystems and Its Outflow to Water Bodies: Analyses with Monitoring and Modeling. The institute also actively invites and hosts researchers from other Asian countries. During the same five-year period, we hosted 257 foreign researchers under programs such as the JSPS Postdoctoral Fellowships for Overseas Researchers and the Environment Ministry Eco-Frontier Fellowship Program. NIAES also sends many researchers to other Asian countries. Over the three years from 2003 through 2005, we sent 283 people to Asian region.

Using these initiatives as a springboard, NIEAS is pursuing research by building research networks in certain areas of research with Asian research institutes. The main networks are as follows.

1. To monitor carbon flux such as that of carbon dioxide in Asia, Asia Flux links with projects including Asia Flux domestic committees, KoFlux (Republic of Korea), ChinaFlux (China), GAME (GEWEX Asia Monsoon Experiment), and GCP (Global Carbon Project).
2. For mitigating the economic and ecological damage by alien species in the Asia-Pacific region, the Asian-Pacific Alien Species Database (APASD) links Taiwan, Thailand, the Philippines, Vietnam, China, the Republic of Korea, Malaysia, and Indonesia.
3. Monsoon Asia Agricultural Greenhouse Gas Emissions (MAGES) provides for collaboration with China, the Philippines, Thailand, Indonesia, Malaysia, and India in research on the emissions of methane, nitrous oxide, and other greenhouse gases from farmland.

4. Specific Initiatives by the Asian Agro-Environmental Research Consortium

This international symposium and its workshops aims to create the "Asian Agro-Environmental Research Consortium" by consolidating and integrating the results from fields of research gained through long years of efforts such as those described above. We intend to strengthen the following initiatives with the aim of giving concrete form to the Consortium.

Some of the research projects now underway in Asia will continue through FY2007 and beyond. These include "International Joint Research on Water Quality Maintenance in Agro-Ecosystems and an Assessment of Its Impacts" and "Research on the Early Detection and Early Forecasting of Global Warming Using the Tibetan Plateau". For these projects, NIAES will actively endeavor to secure continued funding, thereby advancing and facilitating research projects in Asia. Even now, we host foreign researchers through such programs as the JSPS Postdoctoral Fellowships for Overseas Researchers and the Eco-Frontier Fellowship Program, but henceforth we would like to host even more researchers by using a variety of programs. Starting with this symposium, we plan to hold an NIAES international symposium every year. Further, we are working on holding symposia abroad and collaborating with

universities and other research institutes. We will provide information via the consortium website on these projects and fellowships, as well as on symposia and workshops held by related research institutes.

5. Benefits Expected from the Asian Agro-Environmental Research Consortium

Building a research network through the Asian Agro-Environmental Research Consortium will provide the basis for efforts to contribute both domestically and internationally.

To begin with, the international framework for addressing global and regional environmental problems will become increasingly vital because environmental problems are broadening and intensifying. For this reason, the network will provide for an organized contribution to international frameworks such as the Intergovernmental Panel on Climate Change, the International Geosphere Biosphere Programme, the World Trade Organization, the Organization for Economic Cooperation and Development, the Convention on Biological Diversity, the International Nitrogen Initiative, and the Stockholm Convention on Persistent Organic Pollutants. This holds promise that outstanding technologies and information from Asia will be used effectively and appropriately to facilitate worldwide environmental conservation, taking into account the internationalization of environmental problems, economic globalization, the continuing development of trade rules, and other factors.

In addition to this kind of international contribution, policy briefs in various world languages will be produced and distributed to relevant government agencies about consortium research achievements that can be incorporated into government policies while considering diverse international and regional situations. Further, websites and other means will be used to disseminate consortium achievements. The building of this research network through the consortium will be used to promote solutions for shared problems and facilitate incorporation into governments' policy measures.