国際イノベーション農学コース

International Innovative Agricultural Science Course

東京農工大学

Tokyo University of Agriculture and Technology

大学院農学府

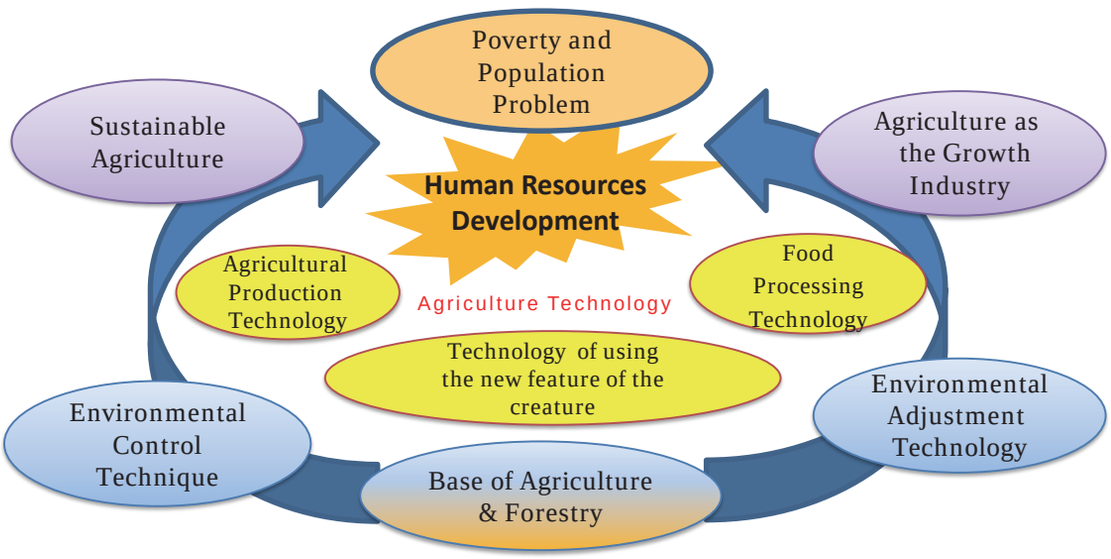
Graduate School of Agriculture

Mission of the Integrated Department

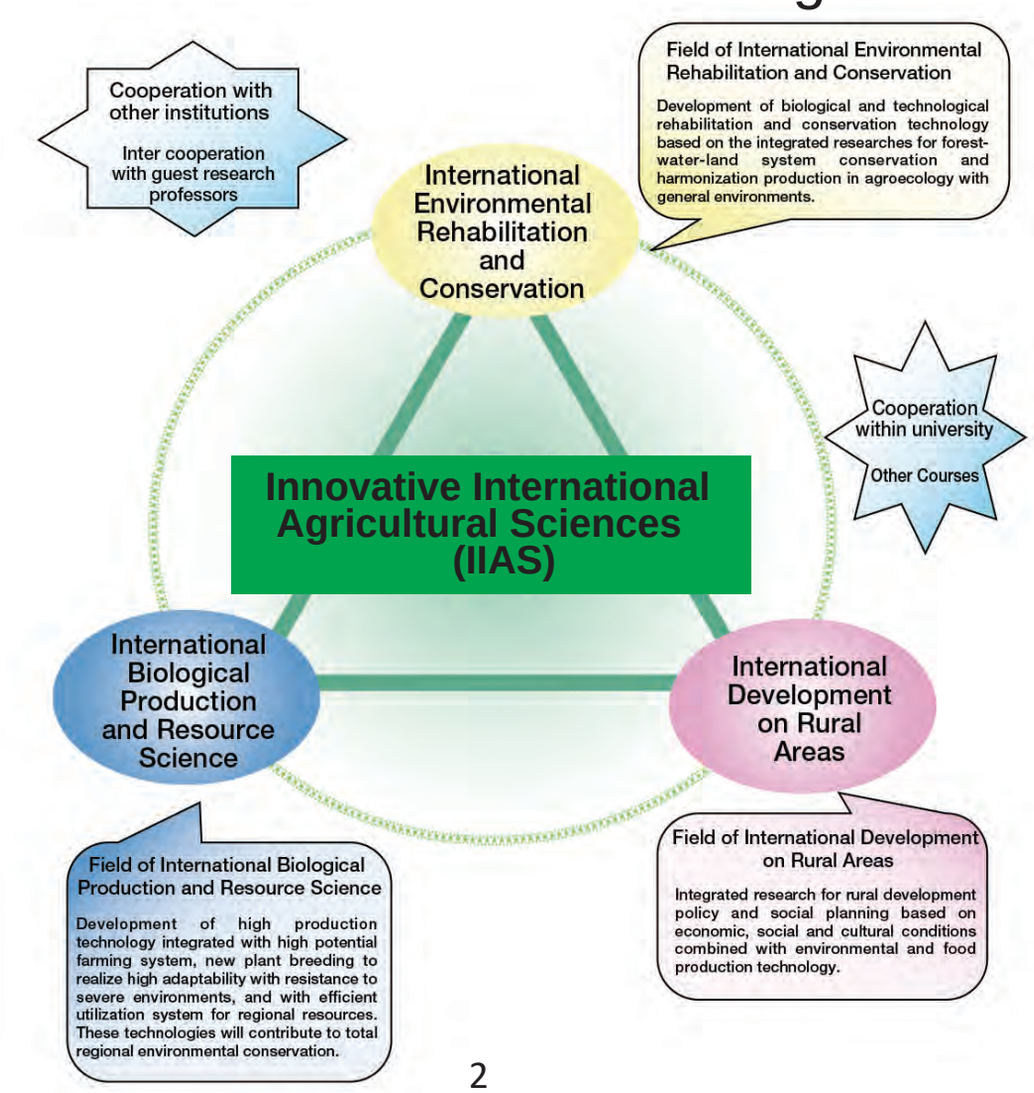
Tokyo University of Agriculture and Technology (TUAT) promotes the creation of new knowledge through “mission-oriented research” varying from basic inquiries to technology applications in the fields of agriculture, engineering, and the integration of both as mainstays supporting human society. Through education and research activities that foster a healthy development of science and technology in TUAT, "International Innovative Agricultural Science Course (IIAS)" strengthens academic and cultural exchange with foreign countries to construct a sustainable and global symbiotic society, with an aim to contributing to maintaining resources management and agriculture productions. In our society, changes in climate by global warming and regional and local development induces both global and local scale environmental problems and agricultural issues. Changes in life style and populations link to the issues of agriculture production and sustainable resource uses. Wide ranges of problems have been raised include air pollution, flood and drought, acid rain, desertification, the destruction of tropical forests, soil erosion, and water pollution. Food shortages due to an increased population as well as adapting climate changes is necessary issues for provide specific solution for ensuring a sustainable food supply.

In order to deal with these issues and explore solutions sustainable to the globe, promotion of a holistic environmental science is required. Attempts should be made to restore and conserve the environment. Creation of a high-level food production plan and new productions which does not negatively impact the environment is an imperative task. Resilient resources management and community development is a key for achieving Sustainable Development Goals (SDGs) among local, regional, and global scales. For overcome environmental and agricultural issues, Department of International Environmental and Agricultural Science (IEAS) was developed in 1999. IEAS has achieved for educating leaders in environmental and agricultural sectors and academia around the worlds. For tackling the newly developed problems and developing innovations in agricultural science and related applied fields, we now introduce "International Innovative Agricultural Science Course (IIAS) " in 2019. New IIAS program aims at purification, restoration, and conservation of the environment, for development of high level agricultural production based on innovative idea and mind. This is the basic area of study for those goals. The result is the establishment and continuance of a long-term comprehensive and interdisciplinary view of issues. In addition to the original research and teaching field for reactivation, agricultural production, and regional development in IEAS, IIAS has two addition field for applied animal science and applied life science. In this program, using international cooperation and area development, we will look at current individual research projects and technical advances related to the fields of agricultural sciences and related disciplinaries in a holistic interconnected way. At the same time, we will take these results and apply solutions that are ecologically, culturally and socially workable in practical ways in developing regions. Therefore, we do not only simply aim to train uniform, specialized technicians in their field. It aims to train a new type of developmental specialized young leaders of related sectors who carries the aforementioned view of "International Innovative Agricultural Science Course".

Innovative International Agricultural Sciences IIAS



Structure and Linkages



Outlines of the Integrated Cource

The International Integrated Course in Environmental and Agricultural Science is a multi-disciplinary postgraduate course designed to train students and researchers to be at the forefront in the development of the limited natural resources around us while maintaining the vitality of the environment. In recent years, intense human activities such as rapid industrialization and overexploitation of natural resources are causing severe global environmental problems. These problems include environmental pollution, global climate change, acid rainfall, desertification, degradation of tropical forests, soil erosion, water pollution, and evnironmental hormones. In addition, the exponential population growth coupled with global food shortages are some of the most pressing issues which demand utmost attention.

To tackle these problems, a holistic approach to sustainable development is indispensable. It is essential to develop appropriate policies for maximizing food production, to improve the quality of human life, while avoiding the depletion and degradation of the limited natural resources around us, and maintaining and ecological balance. there is an increasing global awareness for environmentally-friendly methods of food production. The faculty recognizes that the success of such methods depends on the integration of concepts and technologies from diverse disciplines, and that only a multi-disciplinary approach can ensure such sustainable development.

The program aims at optimization of food production, conservation of the environment, and the restoration and purification of degraded resources. Emphasis will be on integrating the technical merits of the various disciplines to develop holistic methods of resource development. This will be done through international cooperation. Ecologically, culturally, and socially effective strategies developed in these studies will then be applied to actual rural problems through technology transfer. The program also aims at training engineers and scientists who have broader international view of "Environmental and Agricultural Science" and wider knowledge in several disciplines such as sociology, ecology, agronomy, and engineering.

1. Field of International Environmental Rehabilitation and Conservation

For the educational programs, we emphasize environmental changes of agriculture and forestry ecosystem, investigation methodology for environmental deterioration, interaction between biological and human activities, and restoration and preservation of regional environment and natural resources.

Research activities include: (a) Establishing strategies and technologies for management, conservation, and remediation of agro-ecosystems based on investigations of the effects of human activities on natural and managed land; (b) Investigating the causes and processes of air, water, soil, and pollution movement in natural and managed land; and (c) Developing of technologies and methodologies for the remediation of degraded natural resources and the management of sustainable agriculture and forestry ecosystems.

2. Field of International Biological Production and Resource Science

Education and research are performed for increase of food production and recyclic use of biological resources by using biological high potentiality for metabolism under the aspect of sustainable agriculture for regional and global environmental conservation.

(a) Education and research are performed for increase of highly productive agricultural technology improved by cropping, farming and breeding systems, which are cohesive with regional environments.

(b) Education and research are performed for development of efficient recyclic utilization technology of regional biological resources, which are adaptable for regional environmental conservation.

3. Field of International Development of Rural Areas

Education and research of performed for sustainable social development and planning of social communities under the aspects of economic, social and population sciences combined with natural environmental technology and food production technology.

(a) Education and research are performed for comparative research on economics, culture and social communities, and planning for sustainable development adaptable to regional circumstances.

(b) Education and research are performed for sustainable development strategy, development policy and international cooperation with consideration for regional, economic, cultural and social circumstances.

Educational Curriculum IIAS

Curriculum	Credits	
	Credit	Required
(General study subjects)		
Overview for Agricultural Production Sciences I	1	
Overview for Agricultural Production Sciences II	1	
Overview for Applied Biological Chemistry I	1	
Overview for Applied Biological Chemistry II	1	
Overview for Environmental Science and Natural Resources I	1	
Overview for Environmental Science and Natural Resources II	1	
Overview for Agricultural Engineering and Agro-Food Informatics I	1	
Overview for Agricultural Engineering and Agro-Food Informatics II	1	
Overview for Sustainable Societies I	1	
Overview for Sustainable Societies II	1	
Overview for International Innovative Agricultural Science I	1	4
Overview for International Innovative Agricultural Science II	1	
Introduction for Science of Agriculture and Technology	1	
Special lecture for 21st century's agriculture science	◎1	
Multicultural comunication and transmission	2	
Advanced lecture of Green, Food, and Life science	1	
Arts of Intercultural Communication	2	
Advanced lecture on Agriculture Science I	1	
Advanced lecture on Agriculture Science II	2	
Japanese I	2	
Japanese II	2	
(General exercise subjects)		
Exercise for Methods of Agricultural Experiment Planning and Statistical Analysis I	1	
Exercise for Methods of Agricultural Experiment Planning and Statistical Analysis II	1	
Field and Laboratory Safety and Research Ethics I	1	
Field and Laboratory Safety and Research Ethics II	1	
Management and operation of intellectual property	1	
Exercise for Spatial Information Analysis	1	
Subject Exercise for Agricultural Research	1	
Practical Exercise for Agricultural Research	1	2
International Research Presentation I	○1	
International Research Presentation II	○1	
Exercise for Agricultural Science I	1	
Exercise for Agricultural Science II	1	
Exercise for Agricultural Science III	1	
Exercise for Agricultural Science IV	1	
Exercise for Agricultural Science V	1	

◎compulsory subjects, ○optional compulsory subjects

Educational Curriculum IIAS

Curriculum	Credits	
	Credit	Required
(Special field subjects)		
International Environmental Rehabilitation and Conservation I	2	4
International Environmental Rehabilitation and Conservation II	2	
International Biological Production and Resource Science I	2	
International Biological Production and Resource Science II	2	
International Life and Biological Chemistry I	2	
International Life and Biological Chemistry II	2	
International Rural Development and Rural Area I	2	
International Rural Development and Rural Area II	2	
International Applied Animal Science I	2	
International Applied Animal Science II	2	
Special Lecture on International Innovative Agricultural Science I	2	
(Thesis-related subjects)		
Special Research in Agricultural Science I	◎4	6
Special Research in Agricultural Science II	○1	
Research expansion in Agricultural Science I	○1	
Research expansion in Agricultural Science II	○1	
Special Research in Agricultural Science III	◎4	
Special Research in Agricultural Science IV	○1	
Research expansion in Agricultural Science III	○1	
Research expansion in Agricultural Science IV	○1	
Special Exercise in Agricultural Science I	◎4	4
Special Exercise in Agricultural Science II	◎4	
Special exercise for Publication Review I	◎2	2
Special exercise for Publication Review II	◎2	

◎compulsory subjects, ○optional compulsory subjects




Outline of Lecture

General study subjects	Outline
Overview for Agricultural Production Sciences I	This lecture is primally focusing on the overview of "plant protection" and related studies including biological and chemical knowledge for the growth control of individuals (plants, insects, microbes, viruses, etc.). This lecture also focused on interactions between organisms and ecology for agriculture production.
Overview for Agricultural Production Sciences II	We will talk about the overview for the problems of production environment science, plant production science and animal production science. This lecture also provide the overview for research methodology of agriculture production.
Overview for Applied Biological Chemistry I	This lecture focuses on overview on the disciplines of applied life science and biomolecular chemistry to acquire the basic knowledge necessary to applied life science, chemistry, and biomolecular chemistry.
Overview for Applied Biological Chemistry II	This lectures provide basic knowledge necessary to understand the disciplines of applied life chemistry and physiology and biochemistry, lectures on the disciplines of applied life chemistry and physiology and biochemistry.
Overview for Environmental Science and Natural Resources I	This lecture introduces the overview knowledge of characteristics of wood and wood material, methods for environmental activity such as utilization of natural resources and those for environmental enlightenment.
Overview for Environmental Science and Natural Resources II	Basics and latest topics of biology and chemistry relevant to materials cycle and environmental sciences are provided in this lecture.
Overview for Agricultural Engineering and Agro-Food Informatics I	This lecture provide the overview of agriculture engineering related to measurement environment required for agricultural environment and crop cultivation management, which is the place of crop production.
Overview for Agricultural Engineering and Agro-Food Informatics II	This lecture focused on the overview for the development of measurement technology related to agriculture and environment and the development of information infrastructure. In this course, students will understand the basic theory and technological elements of information technology and acquire related skills.
Overview for Sustainable Societies I	This lectures will provide the overview of socioecomic researches too learn the fundamental theories and the research methods of humanities and social sciences for making sustainable and co-existent society and civilization.
Overview for Sustainable Societies II	
Overview for International Innovative Agricultural Science I	This class will provide the series of lectures for understanding various issues of global and local scales related to agriculture, environmental science, life science and applied animal sciences. Topics from local , regional to global scales will be discussed as identifications of problems and developing the solution. Lecture on omnibus forms on fundamental knowledge and techniques in each specialized areas such as agriculture, environmental studies, humanities sociology, life sciences, and applied zoology.
Overview for International Innovative Agricultural Science II	Review the history and current state of agriculture and rural society around the world, referring to initiatives of producers, manufacturers, distributors and consumers for agricultural innovation, and discuss their potentials and challenges related to global food value chain development.
Introduction for Science of Agriculture and Technology	This lectures will provide the innervation between agriculture science and engineers for food and energy systems science.
Special lecture for 21st century's agriculture science	Agriculture and its related fields have an important role in the stable supply of food, land conservation, and local economy. But there are common problems to be solved in the world, such as decrease and aging of people involved in agriculture, forestry and fisheries, difficulty in the maintenance of ecosystem management and the agricultural infrastructure under a variable environment. On the other hand, the change of lifestyle, the expansion of the world food market, and the change in the agricultural field are opportunities to realize new agricultural innovations. This lecture will provide the lasted scientific knowledge's related to agriculture science.
Multicultural comunication and transmission	The objective of this course is to increase students' awareness of their own communication styles and cultural diversity issues, and cultivate their ability to conduct intercultural communication. We explore various themes that demonstrate the unique value of each culture, and examine cultural differences and similarities from a variety of perspectives. At the same time, the students are provided with opportunities to reconsider their own cultures.
Advanced lecture of Green, Food, and Life science	This lecture will be provided by top scientists visiting in TUAT around the worlds. We have an opportunities for learning about world class knowledge's and updated scientific findings.
Arts of Intercultural Communication	This lecture "Understanding Societies and Cultures in Asian and African Regions" will be the lecture omnibus by teachers of Tokyo University of Foreign Studies. Expecting the cases where you will communicate with local people while conducting re- search, development assistance and others in developing and emerging counties, this lecture will give an outline of existing conditions, languages, cultures, customs and religions in various regions of Asia and Africa.
Advanced lecture on Agriculture Science I	The objective of this class is to obtain the basic knowledge on the current status and issues in agriculture. Guest lecturers provide lectures on current issues on agriculture and related fields.
Advanced lecture on Agriculture Science II	This lecture will discuss current constraints and opportunity in agriculture, technological advances, and technology transfer in the tropics, with special attention to rice cultivation. The course includes lecture, questions & answers, group discussion, oral presentation, and etc.
Japanese I	This course is designed for the students who have little or no experience of studying Japanese. It helps learners acquire basic communication skills needed in Japanese academic life during their stay in Japan. The participants are also expected to learn general knowledge about Japan and skills for further Japanese study.
Japanese II	

Outline of Lecture

General exercise subjects	Outline
Exercise for Methods of Agricultural Experiment Planning and Statistical Analysis I	This lecture will provide basic and applied statistical analysis related to agriculture sciences. To acquire basic knowledge of statistical processing that is necessary when reading experiments and field surveys in related fields. Some practical exercise will also be performed using statistic software.
Exercise for Methods of Agricultural Experiment Planning and Statistical Analysis II	
Field and Laboratory Safety and Research Ethics I	Students will understand basic concepts and framework of research ethics. Then students think about the subjects of research ethics related to agriculture sciences. Then student will be able to organize the issues for ethics related to their special subjects of master thesis. In the second half of this class, student will understand the principle for safety operation and risk management of the in laboratory experiment and fields works. Student will learn about practical handling of laboratory instruments and analytical instruments. Then student will also have knowledge about safety management in the field.
Field and Laboratory Safety and Research Ethics II	
Management and operation of intellectual property	Understand the basic knowledge of intellectual property required by engineers and researchers in agriculture and related fields, learn about the importance of intellectual property in agricultural field development and innovation, and what is protection. We look over the process of acquiring patents, study the protection of technical creation such as patents and utility models, learn the procedure of patent application, handling, risk management such as patent infringement.
Exercise for Spatial Information Analysis	The purpose of this course is to understand the techniques using geoinformatics (remote sensing and GIS) that can effectively process, display and analyze spatial information that is important in the field of agriculture and environmental field research, and acquire the basic technology.
Subject Exercise for Agricultural Research	This course provide case studies of latest researches in agriculture and related fields around the worlds and within Japan. Students focusses on identify the problems and developing the solution in both science and social aspects. Updated topics for solving and concerning issues such as environment, food, life science, and rural society can be included.
Practical Exercise for Agricultural Research	This course provide case studies of latest researches in agriculture and related fields around the worlds and within Japan. Students focus on identify the problems and developing the solution in both science and social aspects. Updated topics for solving and concerning issues such as environment, food, life science, and rural society can be included.
International Research Presentation I	Base on individual research topics related to the master thesis, background, objectives, research methods, and preliminary results and discussion will be presented, focused in the purposed of each project. Based on the progress of the research, schedule and plan for achieving the master thesis will also be explained. In particular, students will prepare contents using professional knowledge and analytical techniques for developing the in-depth research. Based on the presentations, students will also learn communication skill for explaining their researches in their own specialized field as well as outside of specialized areas. Through such processes, presentation ability as graduate students will be improved.
International Research Presentation II	Base on individual research topics related to the master thesis, background, objectives, research methods, and preliminary results and discussion will be presented, focused in the purposed of each project. Based on the progress of the research, schedule and plan for achieving the master thesis will also be explained. In particular, students will prepare contents using professional knowledge and analytical techniques for developing the in-depth research. Based on the presentations, students will also learn communication skill for explaining their researches in their own specialized field as well as outside of specialized areas. Through such processes, presentation ability as graduate students will be improved.
Exercise for Agricultural Science I	This lectures will be provided for double degree program
Exercise for Agricultural Science II	
Exercise for Agricultural Science III	
Exercise for Agricultural Science IV	
Exercise for Agricultural Science V	

Outline of Lecture

Special field subjects	Outline
International Environmental Rehabilitation and Conservation I	This course will focus primarily on hydrologic and geomorphic processes (soil erosion, landslide, debris flow) at the watershed scales. Linkages among hydrologic and geomorphic processes are emphasized, as are the effect of regional land use. Issues of scales related to hydrological/geomorphic response and system behavior are explored, as well as timely topics related to sustainable land management and natural hazard assessment. Emphasis will be places on hydrologic and geomorphic processes in steep terrain. Students will be encouraged to contribute to discussions on catchment processes and land management for regional environmental planning in this course.
International Environmental Rehabilitation and Conservation II	The objectives of the this course is understand the current international issues in water resources and aquatic environment and to gain broad knowledge and concept which can be applied for the investigation and assessment of the environmental risk associated with the inorganic as well as organic pollutants such as nutrients, pesticides and heavy metals in the aquatic environments such as streams, rivers and lakes and paddy fields.
International Biological Production and Resource Science I	This class aims to learn basic knowledge and current problems on sustainable use of biological resources. Participants examine the case studies on sustainable use of organic resources responding to the environmental conditions of different regional ecosystems.
International Biological Production and Resource Science II	Study about recent research trend in bio-resource utilization in agriculture. Practice basic statistical analysis which is popular in agricultural experiment. The lecture is provided with active learning.
International Life and Biological Chemistry I	The basic knowledge and latest topics in biochemistry, physiology, biomaterial chemistry, plant biology, organic chemistry and food science fields are lectured
International Life and Biological Chemistry II	Applied knowledge's and updated findings for life science, applied biochemistry for improving our health and food will be lectured.
International Rural Development and Rural Area I	In this course, learn the international rural development and rural area. In this field multidisciplinary approaches are important. We introduce the relationships between rural development and environmental science.
International Rural Development and Rural Area II	We aim to deepen participants' understanding on policies and project planning for sustainable agricultural and rural development, and how to disseminate technology, with reference to case studies in developing regions. Discuss the factors that influence development approach such as natural environment, available resources and population, and government and economy, and the outcomes and issues of development activities.
International Applied Animal Science I	This class provides the series of lectures for understanding various issues related to animal breeding technology and animal rearing technology on a global scale. Topics are the structure, function, behavior and evolution of animals based on molecular biology and genetic knowledge. Lectures also include measures to control international infectious diseases and animal diseases related to public health concerning chemical substances and pathogenic microorganisms related to animal diseases.
International Applied Animal Science II	This class will provide a series of lectures related to important diseases in companion animals, targeting at the causes, pathophysiology and diagnoses/treatments. Based on the understanding of the diseases, each class focusing on a particular topic will discuss application of recent research advances obtained in veterinary and human medicine and other biological fields, and refer to the actual clinical cases whenever applicable. This class aims at teaching students fundamental knowledge of above-mentioned diseases for the goals of contribution to the progress in the fields of animal health, human medicine and biology in the global scale.
Special Lecture on International Innovative Agricultural Science I	The objective of this class is to deepen the understanding of current status and issues in agriculture, agricultural and rural development, food and nutrition security, environmental conservation, poverty reduction, international cooperation, etc. through comparative review of case studies in Asia and Africa.

Thesis-related subjects	Outline
Special Research in Agricultural Science I	This subject is the main part of master program. Students perform gathering information, conducting laboratory experiment, and field experiments for obtaining related data and information as well as conducting experiments and field investigation to preparing master's thesis. Then, outlines, arrangements, methodology, analysis, discussion based on their results will be conducted. At the same time of obtaining the research results, students develop ability for performing researches particularly related to their special fields under the guidance of the main supervisor.
Special Research in Agricultural Science II	
Research expansion in Agricultural Science I	This subject is the main part of master program. Students perform gathering information, conducting laboratory experiment, and field experiments for obtaining related data and information as well as conducting experiments and field investigation to preparing master's thesis. This subject is planned and performed by sub-supervisor. At the same time of obtaining the research results, students develop ability for performing researches particularly related to their special fields.
Research expansion in Agricultural Science II	
Special Research in Agricultural Science III	
Special Research in Agricultural Science IV	
Special exercise for Publication Review I	Students collect and analyze information from the latest researches on international environmental agricultural sciences from papers, textbooks, reports, web in both specialized and related fields. Based on the information, students obtain information for research trends, issues, analytical methods, results, validation of findings, and validity of interpretation. This processes make clear the novelty of research and train the logical thinking of students.
Special exercise for Publication Review II	



Special Graduate Program

The influence of industrialization and agricultural production, coupled with human lifestyle and activities, have caused global scale environmental problems to grow more serious. These problems include environmental pollution, global climate change, acid rain, desertification, the destruction of tropical forests, soil erosion, water pollution and environmental hormones.

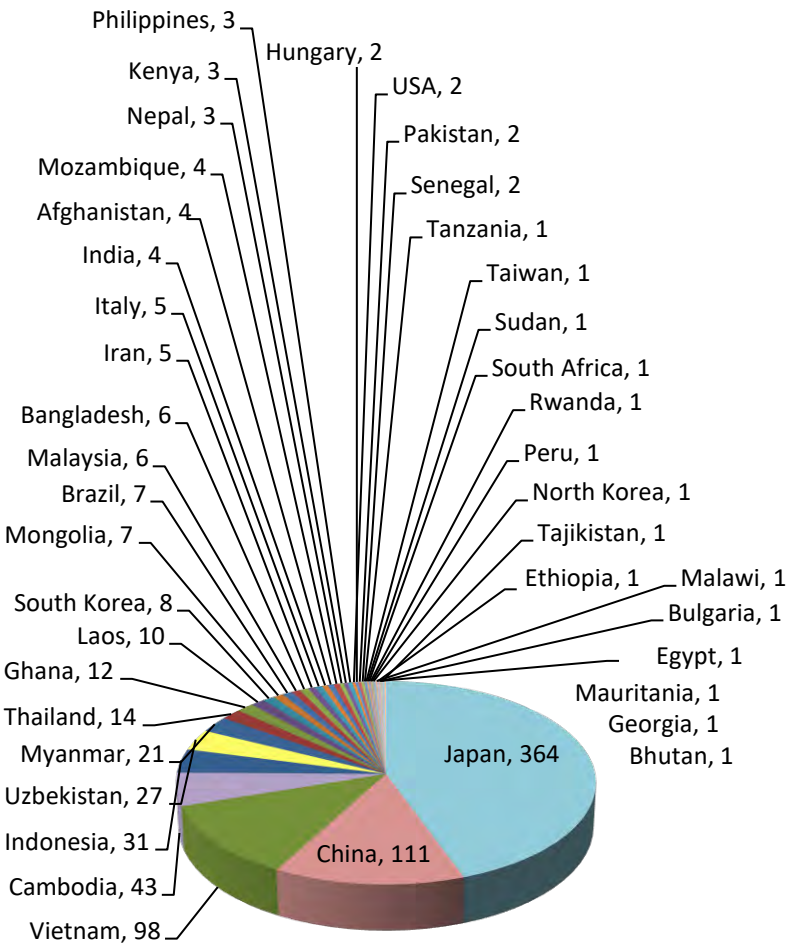
On the other hand, faced with global food shortage due to an ever increasing population, ensuring a sustainable food supply is a problem that demands a solution. In order to deal with these issues and explore solutions sustainable to the globe, promotion of a holistic environmental science is required. Attempts should be made to restore and conserve the destroyed environment. Creation of a high level food production plan which does not negatively impact the environment is an imperative task.

This new program, "International Innovative Agricultural Science," is created with the goal of treating these issues. Currently, environmentally friendly food production development research is progressing in some areas. However, that research focus is mostly independent, fragmented research for which the goal of reducing environmental loading is the only focus. The resulting evaluation is entrusted to a short-term viewpoint.

The "International Innovative Agricultural Science" program aims at purification, and conservation of the environment, for development of high level agricultural production. This is the basic area of study for those goals. The result is the establishment and continuance of a long term comprehensive view of issues. We will look at current individual research projects and technical advances related to the fields of agricultural and environmental science in a holistic interconnected way. At the same time, we will take these results and apply solutions that are ecologically and socially workable in practical ways in developing regions. This program aims to educate young leaders capable of this task. This special graduate program does not aim to train uniform, specialized technicians in their field. It aims to train a new type of developmental specialized technician who carries the aforementioned view of "International Innovative Agricultural Science".

IEAS/IIAS Students around the World (1999 to 2023)

Country	No. of students
Japan	364
China	111
Vietnam	98
Cambodia	43
Indonesia	31
Uzbekistan	27
Myanmar	21
Thailand	14
Ghana	12
Laos	10
South Korea	8
Mongolia	7
Brazil	7
Malaysia	6
Bangladesh	6
Iran	5
Italy	5
India	4
Afghanistan	4
Mozambique	4
Nepal	3
Kenya	3
Philippines	3
USA	2
Hungary	2
Pakistan	2
Senegal	2
Tanzania	1
Taiwan	1
Sudan	1
South Africa	1
Rwanda	1
Peru	1
North Korea	1
Mauritania	1
Malawi	1
Ethiopia	1
Egypt	1
Bulgaria	1
Tajikistan	1
Georgia	1
Bhutan	1
Total	819



Location and Address

Mailing Address: International Innovative Agricultural Science Course,
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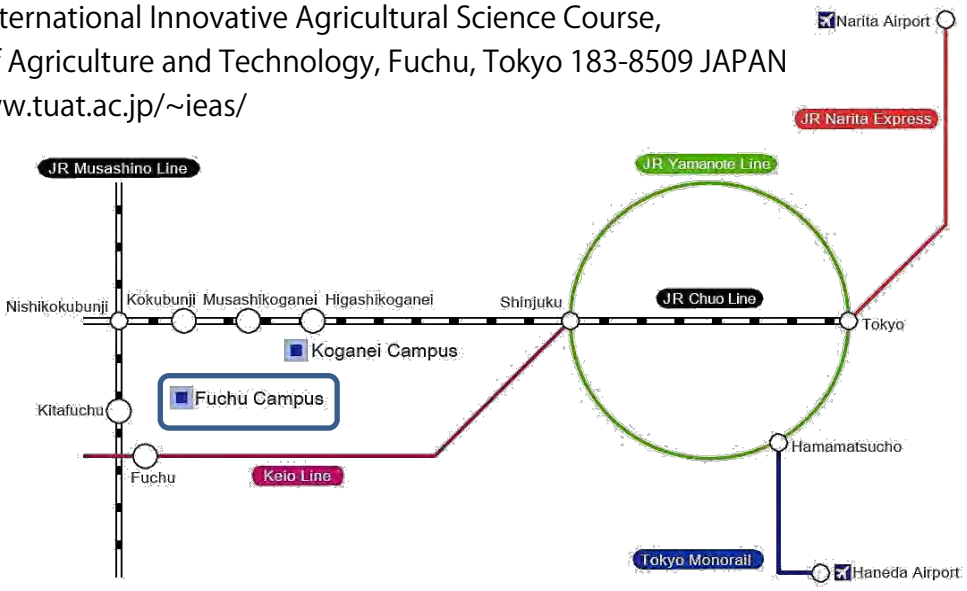

IIAS Faculty Members (as of May 2023)

◆Field of International Environmental Rehabilitation and Conservation

Hirozumi WATANABE
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Pollutant Fate and Transport

Monitoring and Modeling of Pollutant Behavior and Environmental Assessment

Research Topic: "The Non -point Source Pollution Control of the Pesticide". Since the 1960's, adverse effects on the aquatic environment resulting from intensive agrochemical usage have been a major issue for the agricultural communities. My research activity focuses on monitoring and modeling for the pesticide fate and transport in agricultural environments including upland fields and paddy fields

Objectives of my research are to study mechanisms of pesticide fate and transport, to develop and evaluate the best management practices for controlling pesticide discharges, and to develop better tools for investigating and evaluating pesticide fate and transport for improving agricultural environment.

Current ongoing projects are:

1. Plot scale monitoring and modelling of pesticide fate and transport in paddy fields.
2. Applications of Micro-Paddy Lysimeter for the evaluation of pesticide fate and transport in a paddy field.
3. Plot scale monitoring and modelling of pesticide fate and transport in upland fields.
4. Development and applications of Portable-Rainfall-Runoff-Simulator for the evaluation of pesticide fate and transport in a upland field.
5. River basin scale modeling of pesticide fate and transport for environmental assessment in aquatic ecosystem.

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Agricultural water use and conservation

Water Resources and Environment Management in Irrigation and Drainage **Watershed**

I mainly engage in water quality issues in agricultural area. Especially, nutrients (Nitrogen and Phosphorous) concentration in agricultural drainage is focused on because it causes eutrophication in enclosed water body, and it will be finally influenced and degraded to sustainability in rural society. To prevent this situation, irrigation and drainage planning or design is important technology, and model analysis and scenario forecast are quite useful as an decision support tool. The development of water quality model in agricultural area is difficult work because there is a complicated runoff mechanism in paddy fields. So then, in my laboratory, I would like to conduct below:

1) hydrological and water quality observation in paddy fields area
2) water quality model development in watershed scale
3) scenario forecast and evaluation on future counter measures
4) proposal on new irrigation and drainage technology toward sustainable society in water environmental aspect

http://kenkyu-web.tuat.ac.jp/Profiles/23/0002222/prof_e.html

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Large-scale hydrology and climate change impact assessments

Sustainable food-water-soil systems under climate change at the global scale

Achieving the Sustainable Development Goals (SDGs) depends on whether humankind is able to maximize synergies and resolve existing trade-offs between the SDGs. Using an interdisciplinary and large-scale (continental, global) modeling approach, I thoroughly investigate global environmental threats, with a focus on quantitatively identifying the impacts of climate change and anthropologic activities on water, soil, and agricultural systems. My research contributes to the assessment reports (AR) issued by the Intergovernmental Panel on Climate Change (IPCC) and to mitigation and adaptation actions taken by local, national, and international governments.

Concretely, my laboratory pursues to following research agenda:

1 Advancing large-scale hydrological modeling (integration of water quality, representation of agricultural systems)
2 Investigating transitions and transformations toward sustainable food-water-soil systems under climate change
3 Climate change impact analysis; in particular, investigate the trade-off involved between sustainable agricultural, population exposure to flood and flood damage under climate change

◆Field of International Biological Production and Resource Science

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Microbiology

Soil Microbiology (Molecular Analysis of Plant-microbe Interaction)

Plants are continually exposed to a variety of microbes. These microbes may be harmful such as pathogens that cause plant diseases; or may be beneficial such as symbionts help supplying various nutrients, confer disease resistance, or drought tolerance. To achieve sustainable agriculture we must harness these beneficial microbes instead of relying on chemical fertilizers and agricultural chemicals.
The work in our laboratory focuses on beneficial soil microbes such as rhizobium, arbuscular mycorrhizal fungi and endophytic bacteria. In addition to conventional analyses, genome and metagenomic analyses using next generation sequencers enable detection of beneficial genetic resources that have never been identified. We further analyze molecular interactions between plants and microbes using molecular and biochemical techniques and plant genetics. We then translate evidence derived from the above analyses into pockets of technologies such as bio-fertilizers, microbial inoculants or soil diagnostic kits to promote sustainable agriculture.

http://web.tuat.ac.jp/~okazaki/enindex.html

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Crop Production Science

Crop Science, Crop ecophysiology, Agronomy

When we think about crop production in the actual farmers' field, we have to understand that various factors, such as crop genotype, environment, crop management and interactions of these factors, affect crop productivity. Hence, it is necessary to have comprehensive approaches to improve crop productivity in field conditions. The objective of my research is to improve crop productivity in the actual farmers' field based on a crop ecophysiology with a wide perspective.

Research topics include improving the yield potential of rice, developing water-saving rice cultivation system, improving rice production in Africa, developing sustainable and high-yielding upland rice cultivation system in Laos, and so on. I'm endeavoring to observe crops grown in the field condition to find the problems or yield limiting factors. In addition, I would like to become a bridge between front-line science and crop field. I have research projects in many Asian and African countries.

https://sites.google.com/site/tuatcroplabeng/

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Sustainable Agriculture and Forestry in the Tropics

Improvement of Agroforestry Practices

Why and how have environmental degradations occurred in rural areas of the tropics? How are local people making efforts to solve the problems? How can we participate in their activities? To approach these subjects, I have been learning local knowledge and experiences, occasionally by participating in farm works.

I have been focusing on 1) mixed gardening with tree crops, 2) charcoal (biochar) making and its applications for improving farming systems and rural livelihoods, and 3) agricultural extension and education in the tropics. After returning to the university, I review the meaning of indigenous practices, technologies, and views that I learned from the people in the fields, by comparing with academic information, such as agricultural sciences, ecological studies, and area studies. Then, I approach the solution to share with people and collaborators of our counterpart organizations.

http://www.tuat.ac.jp/~tropical/

◆Field of International Development in Rural Area

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International Cooperation for Sustainable Agricultural and Rural Development

Since 2008, the annual official development assistance (ODA) of Japan has kept the 5th position after United States, Britain, Germany and France. Total annual budget of non-governmental development organizations (NGOs) of Japan does not reach 2% of ODA amount, but they have been providing careful support for people with difficulties in developing countries. In addition, since 2011, annual foreign direct investment of Japan is in the second place after that of the United States that has led to active economic development by the Japanese companies and migrants overseas. In particular, I am interested in agricultural development by the migrants and their descendants for their own survival and prosperity, and as a consequence of their economic activities, technology transfer to neighboring farmers. In the Americas, intensive production technology of Japanese farmers facilitated efficient utilization of land, water and wood resources, and realized increased farm income. For example, deforestation of the Brazilian Amazon since 1970s went by the ranch development of several hundred to a thousand and several hundred hectares, while the nikkei farmers earned equivalently in agroforestry of ten to twenty hectares of forest conversion. I will work on case studies of dissemination mechanisms of nikkei agriculture, and will compare it with Chinese migrant agriculture in Southeast Asia. On the other hand, I am organizing an interdisciplinary research for the improvement of nikkei agroforestry in the Amazon, agroforestry technology transfer to small farmers, and certification of their products by a JICA grassroots technical cooperation project.
http://www.fapesp.br/japanbrazilsymposium/pdf/2-4_Yamada.pdf
http://www.jsps.go.jp/english/e-fapespsympo/data/2-4_Yamada.pdf

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Water Resources in Arid Land
Global Environment in Arid Land

Humans have always inhabited two worlds. One is the natural world that preceded us and of which we are a part. The other is the world of social institutions and artifacts that we create for ourselves using science and Technology, and political organization. Both worlds are essential to our lives, but integrating them successfully causes enduring tensions.

Aral Sea Problem is one of the famous global environmental problems. I have been working for this problem. This is not only shrinkage of lake but also the change of aquatic conditions and living live around the lake. I focus the water pollution in this area including river water, ground water and drinking water, and evaluate the effect for humans.

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Population Sociology Developing Countries
Population Issues in Developing Societies

The world population reached 7 billion in 2011 and is expected to reach 9 billion by 2050. Population Studies examine the multifaceted issues facing communities in terms of both the sheer number of people and the makeup of the population. The questions we study are, for example, how does a community deal with an aging senior population as the labor force decreases? How can a country produce enough food when all its farmers have moved to the city? How do we empower women so they can have equal rights in the workforce or in the family? When a population of people move to another country how do they integrate and contribute to the community where they have chosen to settle. My fieldwork in China and neighboring countries has allowed me to explore these questions and focus on four main areas and how they relate to both population and the environment: Population Migration, Women, Aging Populations and the Silver Industry.
Previous research topics funded by grants have included “China’s Population and Environment - the Aging Population, and Social Security ,” and “The safety, security and health of populations from the perspective of women - how to empower women and improve their reproductive health and rights.” In addition to these important themes, my research is branching into other core themes. First, as I am a Chinese living in Japan, I'm deeply interested in studying ethnic Chinese who settle overseas especially in relation to population and environmental issues. Second, in researching aging populations, I recognized the need to analyze issues surrounding the provision and care for elderly left behind in rural areas while adult children work in the city. Finally, my research into aging populations also revealed that in countries such as China where the elderly population is exploding, the demand for senior care related products and services has created a whole new industry with massive market potential.

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Development Economics
Econometric Analyses on Agriculture and Rural Societies

Recently, international society has been disrupted by big events such as bankruptcy of Lehman Brothers, Syrian civil war, and COVID-19. These affect people over the world, especially socially vulnerable people with strong and sometimes irreversible damages. To understand why these socially vulnerable people affected strongly, it is necessary to consider the relationship between them and the societies they belong to.

My research topics are classified into the following two categories:
(1) Agriculture and rural societies in the Islamic areas
How environmental changes surrounding agriculture and rural societies affect farmers’ activities, especially female labor participation.
(2) Japanese rural societies in the interwar period
How were agricultural production and the farmers’ asset accumulation and consumption behaviors under the depression and war-time regime.

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