Overview of the Graduate School / Faculty

The Graduate School of Agricultural and Life Sciences/Faculty of Agriculture undertakes education and research in the areas of agriculture, forestry, fisheries, the livestock industry, and the food industry, focusing on production, processing and logistics as well as in the socio-scientific conditions surrounding these sectors. We are also interested in factors essential to enhancing quality of life, for example, urban as well as rural landscape, and companion animals such as dogs and cats, etc.

Modern agriculture has helped save countless people from hunger by contributing to maintain a stable food supply. This was made possible by establishing a high-input, high-output agricultural system that boosts yields through the extensive utilization of chemical fertilizers and other agrochemicals. It is fair to say that agricultural science has achieved impressive results in this respect. However, the enormous impact that this kind of high-input agriculture and unrestrained agricultural development have had on the environment has become a huge problem, and there is now a growing demand for sustainable agriculture that takes the global environment into account. The Earth’s population, which currently stands at 7.2 billion people, is forecast to reach 9.7 billion by 2050. Ensuring a stable, safe food supply and safeguarding the global environment are the most significant issues facing humanity, and the role of agricultural science in developing technical and social countermeasures to address these issues is growing ever more important.

Agricultural science is an academic discipline that seeks to balance the utilization of various living organisms with the safeguarding of the global environment. It links a wide range of fields organically, from life sciences and environmental science to humanities and social sciences, both at the fundamental and the applied level. Living organisms possess an immeasurable range of functions, of which we are currently using only a tiny fraction. By elucidating the characteristics of organisms, agricultural science is expected to play a major role in building the future of human society. Discovering and making use of new organisational functions that can contribute towards resolving environmental and food issues is also an important task of agricultural science. Agricultural science could therefore be described as an academic discipline that contributes towards building a sustainable society by effectively exploiting biological functions.

The Graduate School of Agricultural and Life Sciences conducts research in order to enhance understanding and implementation of life; studies are conducted from the molecular level, the level of individual organism, to the level of community/colony, the ecosystem, and the biosphere. We engage in cutting-edge research in the laboratory and on the field both in Japan and overseas, targeting a wide range of organisms and their products, from microorganisms such as bacteria and yeast to animals and plants of higher hierarchy. And while aspiring to achieve an in-depth understanding of specialized fields, we are also working to expand our interdisciplinary educational programs designed to enable students to appreciate how agricultural science integrates multiple disciplines. With the AGRI-COCOON project (the Agricultural Research Incubator Community for Cooperative Network of Public, Administrative, Business and Academic Sectors), an educational program entailing cooperation between industry, academia, government and private institutions, we offer a solutions-driven educational program through activities undertaken in collaboration with business enterprises and government agencies. Under the Agricultural Bioinformatics Education and Research Program, we implement practical basic education in agriculture-related bioinformatics, along with individual research guidance. In addition, a World-leading Innovative Graduate Study Program (WINGS) for environmentally-friendly agricultural science was launched in the 2018 academic year. The goal of this program is to cultivate professionals capable of collaborating with a wide variety of stakeholders on sustainable biological production, minimizing the burden on the environment through a transition to data-driven production and distribution of foodstuffs and bio-resources.

The Faculty of Agriculture offers curriculum that enables students to learn agricultural science in a step-by-step, systematic manner, with the aim of nurturing both a solid professional expertise and a wide-ranging perspective. Besides lectures, seminars and researches relating to various specialized fields, the Faculty also provides classes with a broad view of agricultural science, on topics such as food and the environment, biodiversity, food production and distribution, and the future of agriculture.

The faculty and administrative staff of the Graduate School of Agricultural and Life Sciences/Faculty of Agriculture are working together to cultivate future professionals capable of responding flexibly to society’s needs, and to foster the advancement of agricultural science as an integrated science.

Message from the Dean

Nobuhiro Tsutsumi, Ph.D.
Dean of the Graduate School of Agricultural and Life Sciences and Faculty of Agriculture

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The faculty and administrative staff of the Graduate School of Agricultural and Life Sciences/Faculty of Agriculture are working together to cultivate future professionals capable of responding flexibly to society’s needs, and to foster the advancement of agricultural science as an integrated science.
### Chronology

**1874** The Agricultural Training School established.

**1877** The Agricultural Training School renamed as Agricultural School.

**1878** University Farm established.

**1880** Veterinary Hospital established.

**1882** The Agricultural School renamed as The Komaba School of Agriculture.

**1886** The Tokyo School of Agriculture and Forestry established.

**1890** The Tokyo School of Agriculture and Forestry became The College of Agriculture of The Imperial University consisting of three Departments: Agriculture, Forestry, and Veterinary Science.

**1893** Department of Agricultural Chemistry added.

**1894** The University of Tokyo Chiba Forest opened.

**1897** The College of Agriculture of The Imperial University renamed as The College of Agriculture of The Tokyo Imperial University.

**1909** Botanical Research Nursery established.

**1910** Department of Fisheries established in The College of Agriculture.

**1919** The College of Agriculture renamed as The Faculty of Agriculture of The Imperial University of Tokyo.

**1925** Department of Agricultural Economics and Agricultural Civil Engineering added.

**1935** Faculty moved from Komaba-cho, Meguro-ku, to its present location at 1-chome, Yayoi, Bunkyo-ku, Tokyo.

**1936** Fisheries Research Station established.

**1946** Part of Department of Agriculture merged with Department of Veterinary Science to form Department of Zootechnics.

**1947** The Faculty of Agriculture of The Imperial University of Tokyo renamed as The Faculty of Agriculture of The University of Tokyo.

**1948** Department of Agricultural Civil Engineering renamed Department of Agricultural Engineering.

**1949** Animal Resource Science Center established.

**1950** Department of Veterinary Science became independent from Department of Zootechnics. Experimental Station for Landscape Plants established.

**1955** Radioisotope (RI) Center established.

**1956** Department of Forest Products became independent from Department of Forestry.

**1957** Biotron facility setup.

**1964** Department of Agriculture renamed Department of Agrobiology. Department of Veterinary Science and Zootechnics reunited to form Department of Veterinary Medicine and Animal Sciences.

**1965** Agricultural Library established. Research Facility for Radiation Breeding opened.

**1966** Biotechnology Research Facilities established.

**1967** Course in Biotechnology introduced.

**1968** Department of Veterinary Medical Science reorganized.

**1969** Course in Animal Resource Sciences introduced.

**1970** Biotechnology Research Center established.

**1991** Special Doctoral Course in Agricultural Development introduced.

**1992** Graduate School of Agriculture renamed as Graduate School of Agricultural and Life Sciences.

**1995** Asian Natural Environmental Science Center established.

**1997** Department of Global Agricultural Sciences established.

**1998** Endowed Chair in Food-induced Bio-Signaling (Meiji Milk Products Co.) established (1998–2008).


**2001** Agricultural Library renamed as University Library for Agricultural and Life Sciences.

**2002** Ebbara-Donated Research Unit on Biomass Refinery established.


**2004** All National Universities, including The University of Tokyo, transformed into National University Corporations. Koishikawa Arboretum opened (former Botanical Research Nursery). Agricultural Bioinformatics Research Unit established.

**2005** AGRI-COCOON (Agricultural Research Incubator Community for Cooperative Network of Public,
Chronology

2006  Endowed Chair in Clinical Plant Science (Ikeda Scientific Co.) established (2006–2013), Technology Advancement Center and Research Center for Food Safety established.

2007  Veterinary Hospital renamed as Veterinary Medical Center.
       Endowed Chair in Governance-oriented Civil Engineering for Sustainable National Land Management (Maeda Co. and Kumagai Gumi Co.) established (2007–2009).
       Special Doctoral Course in Agricultural Development renamed as Special Course for Advancement of Agricultural and Life Sciences.

2008  Ninomiya branch of University Farm closed down.
       Construction of Yayoi Auditorium Annex completed.

2009  University Library for Agricultural and Life Sciences reopened after renovation.

2010  Institute for Sustainable Agro-ecosystem Services established.
       Construction of Food Science Building completed.
       International Program in Agricultural Development Studies (IPADS) introduced.

2011  Ecological Research Institute of Forest Therapy Research Institute established.
       Experimental Station for Landscape Plants closed down.
       Endowed Chair in Microbial Metabolic Potential (Institute for Fermentation, Osaka [IFO]) established.
       The University of Tokyo Forests Executive Office and Education and Research Center established.
       The University of Tokyo Tanashi Forest opened.

2013  Technical Staff Division established.

       Special Course for Advancement of Agricultural and Life Sciences renamed as Special Course for Sustainable Agriculture

       Social Cooperation Program in Breeding Genomics established (2016-2021)

2017  Isotope Facility for Agricultural Education and Research established.
       Social Cooperation Program in Health Nutrition established (2017–2021)
       Laboratory of microbial enzyme potential (Amano Enzyme) established (2017–2022)
       One Health Collaboration Research Organization established (2017-2027)

2018  Collaborative Research Institute for Innovative Microbiology established (2018–2026)
       Collaborative Research on Organization for Future Regional Society established (2018-2028)
       One Earth Guardians Educational Program established

2019  Bioethics Collaborative Research Organization established (2019–2029)
       Endowed Chair in Food Functionality Science established (2019-2024)
       Endowed Chair in Data Analysis for Animal Diseases established (2019-2022)

Overview of the Graduate School / Faculty

Undergraduate Courses

<table>
<thead>
<tr>
<th>Courses</th>
<th>Major</th>
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<tbody>
<tr>
<td>Biological Chemistry and Biotechnology</td>
<td>Applied Life Sciences</td>
</tr>
<tr>
<td>Applied Biology</td>
<td>Forest Life Science</td>
</tr>
<tr>
<td>Aquatic Life Science</td>
<td>Animal Life Sciences</td>
</tr>
<tr>
<td>Animal Life Sciences</td>
<td>Biobased Materials Chemistry</td>
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</table>

Environmental Resource Sciences

<table>
<thead>
<tr>
<th>Courses</th>
<th>Major</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landscape Ecology and Planning</td>
<td>Forest Environmental and Resource Science</td>
</tr>
<tr>
<td>Forest Science</td>
<td>Wood Science and Timber Engineering</td>
</tr>
<tr>
<td>Biological and Environmental Engineering</td>
<td>Agricultural and Resource Economics</td>
</tr>
<tr>
<td>Field Science</td>
<td>Biomaterial Sciences</td>
</tr>
<tr>
<td>International Sustainable Agriculture Development</td>
<td>Biomaterial Sciences</td>
</tr>
<tr>
<td>Veterinary Medical Sciences</td>
<td>Biomaterial Sciences</td>
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Graduate Courses

Agricultural and Environmental Biology

<table>
<thead>
<tr>
<th>Courses</th>
<th>Departments</th>
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<tbody>
<tr>
<td>Bioresource Development</td>
<td>Agricultural and Environmental Biology</td>
</tr>
<tr>
<td>Applied Agrobiology</td>
<td>Biological and Environmental Engineering</td>
</tr>
<tr>
<td>Aquatic Biological Resources</td>
<td>Applied Biological Chemistry</td>
</tr>
<tr>
<td>Field Production Science</td>
<td>Biotechnological Research</td>
</tr>
<tr>
<td>Environmental Resource Sciences</td>
<td>Biological and Environmental Engineering</td>
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</table>

Biotechnology

<table>
<thead>
<tr>
<th>Courses</th>
<th>Departments</th>
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</thead>
<tbody>
<tr>
<td>Biotechnological Research</td>
<td>Biological and Environmental Engineering</td>
</tr>
<tr>
<td>Molecular and Cellular Biologies</td>
<td>Biological and Environmental Engineering</td>
</tr>
<tr>
<td>Biotechnology Research</td>
<td>Biological and Environmental Engineering</td>
</tr>
<tr>
<td>Precious Science</td>
<td>Biological and Environmental Engineering</td>
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Forest Science

<table>
<thead>
<tr>
<th>Courses</th>
<th>Departments</th>
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<tbody>
<tr>
<td>Forest Life and Environmental Science</td>
<td>Biological and Environmental Engineering</td>
</tr>
<tr>
<td>Forest Resources and Environmental Science</td>
<td>Biological and Environmental Engineering</td>
</tr>
<tr>
<td>Asian Environmental Science</td>
<td>Biological and Environmental Engineering</td>
</tr>
<tr>
<td>Forest Ecosystem Science and Management</td>
<td>Biological and Environmental Engineering</td>
</tr>
<tr>
<td>Ecosystem Studies</td>
<td>Biological and Environmental Engineering</td>
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Aquatic Bioscience

<table>
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<tr>
<th>Courses</th>
<th>Departments</th>
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<tr>
<td>Aquatic Molecular Biology and Biotechnology</td>
<td>Biological and Environmental Engineering</td>
</tr>
<tr>
<td>Aquatic Production and Environmental Science</td>
<td>Biological and Environmental Engineering</td>
</tr>
<tr>
<td>Aquatic Life Science</td>
<td>Biological and Environmental Engineering</td>
</tr>
<tr>
<td>Marine Biotechnology</td>
<td>Biological and Environmental Engineering</td>
</tr>
<tr>
<td>Aquatic Life Science</td>
<td>Biological and Environmental Engineering</td>
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</table>

Agricultural and Resource Economics

<table>
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<tr>
<th>Courses</th>
<th>Departments</th>
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<tbody>
<tr>
<td>Agricultural Structure and Farm Business Management</td>
<td>Biological Systems Engineering</td>
</tr>
<tr>
<td>Development Policies and Economics</td>
<td>Biological Systems Engineering</td>
</tr>
<tr>
<td>Rural Development Finance</td>
<td>Biological Systems Engineering</td>
</tr>
<tr>
<td>Pan-Asian</td>
<td>Biological Systems Engineering</td>
</tr>
<tr>
<td>Sustainable Agro-ecosystem Economics</td>
<td>Biological Systems Engineering</td>
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Research and Education Programs

Agricultural Bioinformatics Research Unit

<table>
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<tr>
<th>Courses</th>
<th>Departments</th>
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<tbody>
<tr>
<td>AGRI-COCOON</td>
<td>Biological Systems Engineering</td>
</tr>
<tr>
<td>One earth Guardians</td>
<td>Biological Systems Engineering</td>
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Affiliated Institutions

<table>
<thead>
<tr>
<th>Courses</th>
<th>Departments</th>
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<tbody>
<tr>
<td>Institute for Sustainable Agro-ecosystem Services</td>
<td>Biological Systems Engineering</td>
</tr>
<tr>
<td>The University of Tokyo Forests</td>
<td>Biological Systems Engineering</td>
</tr>
<tr>
<td>Veterinary Medical Center</td>
<td>Biological Systems Engineering</td>
</tr>
<tr>
<td>Fisheries Laboratory (Aquatic Bioscience Research Center)</td>
<td>Biological Systems Engineering</td>
</tr>
<tr>
<td>Isotope Facility for Agricultural Education and Research Technology</td>
<td>Biological Systems Engineering</td>
</tr>
<tr>
<td>Advancement Center</td>
<td>Biological Systems Engineering</td>
</tr>
<tr>
<td>Research Center for Food Safety</td>
<td>Biological Systems Engineering</td>
</tr>
<tr>
<td>University Library for Agricultural and Life Sciences</td>
<td>Biological Systems Engineering</td>
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</table>
Number of Academic and administrative staff

Faculty Staff (As of May 1, 2019)

<table>
<thead>
<tr>
<th></th>
<th>Professor</th>
<th>Associate Professor</th>
<th>Lecturer</th>
<th>Assistant Professor</th>
<th>Total</th>
<th>Administrative Personnel</th>
<th>Technical Staff</th>
<th>Total</th>
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<tbody>
<tr>
<td>Graduate School/Faculty</td>
<td>78</td>
<td>67</td>
<td>3</td>
<td>60</td>
<td>228</td>
<td>65</td>
<td>365</td>
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<td>Institute for Sustainable Agro-ecosystem Services</td>
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<td>3</td>
<td>3</td>
<td>7</td>
<td>13</td>
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<tr>
<td>University Forests</td>
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<td>5</td>
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<td>25</td>
<td>13</td>
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<td>Animal Resource Science Center</td>
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<td></td>
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<td>2</td>
<td>8</td>
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<tr>
<td>Veterinary Medical Center</td>
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<tr>
<td>Fisheries Laboratory</td>
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<td>Technology Advancement Center</td>
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<tr>
<td>Total</td>
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<td>94</td>
<td>8</td>
<td>78</td>
<td>265</td>
<td>90</td>
<td>91</td>
<td>524</td>
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Center Staff (As of May 1, 2019)

<table>
<thead>
<tr>
<th></th>
<th>Professor</th>
<th>Associate Professor</th>
<th>Lecturer</th>
<th>Assistant Professor</th>
<th>Total</th>
<th>Administrative Personnel</th>
<th>Technical Staff</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Biotechnology Research Center</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>8</td>
<td></td>
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<tr>
<td>Asian Natural Environmental Science Center</td>
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<td>4</td>
<td></td>
<td></td>
<td>8</td>
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<tr>
<td>Total</td>
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<td>3</td>
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Required Units and Years for Degree

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<thead>
<tr>
<th></th>
<th>Units</th>
<th>Years</th>
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<tbody>
<tr>
<td>Bachelor Degree</td>
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<tr>
<td>Bachelor Degree of Veterinary Medical Sciences</td>
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<tr>
<td>Master’s Degree</td>
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<tr>
<td>Doctoral Degree</td>
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<td>3</td>
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<tr>
<td>Doctoral Degree of Veterinary Medical Sciences</td>
<td>32</td>
<td>4</td>
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</table>

*Depends on the course of the Junior Division students are admitted.

Enrollment of Students

Undergraduates (International students in parentheses) (As of May 1, 2019)

<table>
<thead>
<tr>
<th></th>
<th>3rd Year</th>
<th>4th Year</th>
<th>5th Year</th>
<th>6th Year</th>
<th>Research Students</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Applied Life Sciences</td>
<td>106(4)</td>
<td>15(1)</td>
<td></td>
<td></td>
<td>4(0)</td>
<td>267(5)</td>
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<tr>
<td>Environmental Resource Sciences</td>
<td>105(2)</td>
<td>126(2)</td>
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<tr>
<td>Veterinary Medical Sciences</td>
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<td>32(1)</td>
<td>26(0)</td>
<td>29(1)</td>
<td>117(2)</td>
<td></td>
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<tr>
<td>Total</td>
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<td>315(4)</td>
<td>26(0)</td>
<td>29(1)</td>
<td>4(0)</td>
<td>615(11)</td>
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</table>

Graduates (International students in parentheses) (As of May 1, 2019)

<table>
<thead>
<tr>
<th></th>
<th>Master’s Program</th>
<th>Doctoral Program</th>
<th>Research Students</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Agricultural and Environmental Biology</td>
<td>56(8)</td>
<td>25(11)</td>
<td>1(1)</td>
<td>82(20)</td>
</tr>
<tr>
<td>Applied Biological Chemistry</td>
<td>123(18)</td>
<td>47(25)</td>
<td>10(6)</td>
<td>178(49)</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>88(9)</td>
<td>36(16)</td>
<td>10(10)</td>
<td>134(36)</td>
</tr>
<tr>
<td>Forest Science</td>
<td>44(11)</td>
<td>35(15)</td>
<td>2(2)</td>
<td>81(28)</td>
</tr>
<tr>
<td>Aquatic Bioscence</td>
<td>66(13)</td>
<td>46(26)</td>
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<td>112(36)</td>
</tr>
<tr>
<td>Agricultural and Resource Economics</td>
<td>24(11)</td>
<td>17(9)</td>
<td>2(2)</td>
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</tr>
<tr>
<td>Biological and Environmental Engineering</td>
<td>28(4)</td>
<td>15(9)</td>
<td>2(2)</td>
<td>45(15)</td>
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<tr>
<td>Biomedical Sciences</td>
<td>52(5)</td>
<td>41(16)</td>
<td>1(1)</td>
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<tr>
<td>Global Agricultural Sciences</td>
<td>76(8)</td>
<td>36(23)</td>
<td>7(6)</td>
<td>119(39)</td>
</tr>
<tr>
<td>Ecosystem Studies</td>
<td>45(3)</td>
<td>16(3)</td>
<td>3(3)</td>
<td>64(9)</td>
</tr>
<tr>
<td>Animal Resource Sciences</td>
<td>25(2)</td>
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### Enrollment of International Students (Graduate students)

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<th>Personal funds</th>
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### Overseas Research Visits by Faculty Members

#### Number of overseas research visits by faculty members (by how expenses are borne)

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<th>FY 2017</th>
<th>FY 2018</th>
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<td>181</td>
<td>168</td>
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| Total | 520 | 571 | 599 | 599 |

#### Number of overseas research visits by faculty members (by region)

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<td>106</td>
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<td>Africa</td>
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<td>11</td>
<td>12</td>
<td>15</td>
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<td>51</td>
<td>49</td>
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</table>

| Total | 536 | 575 | 599 | 599 |

---

Above figures include following graduate students with "Student" visa status:
- Master's course and Doctoral course students
- International Research Students and Graduate Research Students (excluding Special Research Students)
Hosting International Researchers

Number of foreign researchers and other persons received (by how expenses are borne)

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<tr>
<th>Classification</th>
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<th>FY 2016</th>
<th>FY 2017</th>
<th>FY 2018</th>
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<tbody>
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<td>3</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>(3) Other</td>
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<td>35</td>
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<td>54</td>
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<td>5. Foreign government, research institute, or similar</td>
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<td>269</td>
<td>238</td>
<td>232</td>
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Number of foreign researchers and other persons received

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<th>FY 2017</th>
<th>FY 2018</th>
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</thead>
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<td>Central/South America</td>
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<td>7</td>
<td>6</td>
<td>6</td>
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<td>Europe</td>
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<td>Africa</td>
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<td>China</td>
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<td>South Korea</td>
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<tr>
<td>Total</td>
<td>269</td>
<td>238</td>
<td>232</td>
<td>250</td>
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International Academic Exchange Agreements

(As of September 18, 2019)

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<th>Started on</th>
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<td>May, 2013</td>
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<tr>
<td>Indonesia</td>
<td>Bogor Agricultural University</td>
<td>Oct. 1988</td>
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<td>Gadjah Mada University*</td>
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<td></td>
<td>Mulawarman University</td>
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<tr>
<td></td>
<td>Lampung University (Faculty of Agriculture)</td>
<td>Apr. 2014</td>
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<td>Seoul National University (College of Agriculture and Life Sciences)</td>
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<td>Sri Lanka</td>
<td>University of Ruhuna</td>
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### Countries and Regions

<table>
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*University-wide Agreement
**MoU on Student Exchange
Department of Agricultural and Environmental Biology

The Department of Agricultural and Environmental Biology deals with field crops, vegetables, fruit trees, flowers, insects, silkworm, and plant pathogenic microorganisms, and has made numerous contributions to the sciences related to plant production and environmental conservation. The Department studies issues to create comfortable human environments in the closed ecosystem of the Earth, such as 1) higher crop productivity and quality, and genetic crop improvements, 2) control of plant diseases and insect damage, 3) development of sustainable production systems, 4) development of analytical methods to handle the increasing complexity and volume of biological information, and 5) development of technologies to improve the environment by utilizing plants and insects.

http://www.ab.u-tokyo.ac.jp/aeb/index-e.html

Bioresource Development

- Plant Breeding and Genetics
  - Genetic and molecular studies on the regulatory mechanisms of important crop traits
- Insect Genetics and Bioscience
  - Genetics, genomics, developmental biology, virology, and molecular pathology of the silkworm and insects

Applied Agrobiology

- Crop Science
  - Carbon and nitrogen metabolism in relation to yield performance of various crop species
  - Mechanisms of environmental stress tolerance in crop plants
- Horticultural Science
  - Physiological and genetic studies on improving the quality of horticultural products

Basic Agrobiology

- Crop Ecology and Morphology
  - Ecological and morphogenetic basis for improving productivity and sustainability of plant production systems
- Plant Pathology
  - Molecular and biological studies to understand the pathogenicity mechanisms of plant pathogens and host plant resistance
- Plant Molecular Genetics
  - Structure, function, and evolution of genomes in higher plants
- Biometry and Bioinformatics
  - Biometric studies on DNA polymorphism, inheritance of quantitative traits, population genetic structure, and plant morphology

Nippon Gene-Endowed Chair

- Clinical Plant Science
  - Development of technologies to diagnose and control plant diseases toward establishment of a plant clinic network

Asian Biological Resources (Asian Natural Environmental Science Center)*1

- Environmental Stress Tolerance Mechanisms
  - Tolerance mechanisms of plants to environmental stresses and development of stress-tolerant plants
- Regional Resources Reassessment
  - Sustainable land use and agricultural production under fragile regional conditions
- Genomics of Plant Resources
  - Genomics and physiology of wide range of plant resources

Institute for Sustainable Agro-ecosystem Services (ISAS)

- Field Production Science*2
  - Studies on sustainable crop production and its impacts on agricultural resources and environment.

*1 Cooperative course. The laboratories and their staff belong to the Asian Natural Environmental Science Center.
*2 Cooperative course. The laboratory and its staff belong to the Institute for Sustainable Agro-ecosystem Services.
The Department of Applied Biological Chemistry carries out studies and education across a wide range of research fields related to biological chemistry. In addition to the basic research methodology of biological chemistry, which consists of biochemistry, organic chemistry, and cellular biochemistry, the Department is actively introducing new research methodologies and techniques such as genetic engineering, protein engineering, and cellular engineering. By applying these research methodologies and techniques to plant and animal research fields related to food production, the cellular functions of food-producing organisms, and food immunology, the Department seeks to discover new bioactive compounds and mechanisms supporting the environmental coexistence of human beings and living organisms, with the ultimate aims of advancing biological chemistry research methodology and the enhanced coexistence of human beings and all living things. The Department's efforts are part of a world network that is developing techniques in bioproduction and biological chemistry.

http://www.xyz.u-tokyo.ac.jp/english/xyz/

Biofunctional Chemistry
- Plant Molecular Physiology
  - Molecular and cellular biology of plant response and tolerance to environmental stresses
- Biological Function and Developmental Chemistry
  - Molecular cell biology, neurology of taste signaling, and biochemistry of food proteins

Agricultural Chemistry
- Plant Nutrition and Fertilizer
  - Plant nutrient transport, metabolism, responses to nutritional conditions, and nutrient stress-tolerance
- Biological Chemistry
  - Chemistry, molecular biology, and neuroscience of chemosensory signals and receptors in mammals, insects

Organic Chemistry
- Organic synthesis of bioactive natural products and their derivatives to elucidate bioactive functions and their practical application
- Development of new reactions realizing efficient synthesis of optically active substances
- Bioorganic Chemistry
  - Chemistry, biochemistry, and molecular biology of bioactive compounds regulating self-incompatibility and interspecies incompatibility in plants
- Soil Science
  - Soil microbiology for sustainable agriculture and environmental conservation
- Chemical Biology
  - Chemistry, physiology, and molecular biology for plant growth regulation

Food Science
- Nutritional Biochemistry
  - Nutrient regulation of gene expression Differentiation of mammalian cells
- Food Chemistry
  - Chemical and biochemical studies on small molecules, particularly regarding chemicals generated within our bodies and/or encountered in food and our environment, as ligands and triggers of reactions related to our health
- Food Biochemistry
  - Molecular and cellular biological studies on lifestyle-related diseases Search for food factors that prevent lifestyle-related diseases
- Analytical Chemistry
  - Bioinorganic chemistry of environmental science and biomineralization
- Food Biotechnology and Structural Biology
  - Biotechnology, structural biology and physicochemistry of proteins, enzymes and foods

Food Functionality Laboratory
- Functional Food Science
  - Molecular nutrition, taste science with omics technologies for food and health

Nissin Food Products Endowed Chair
- Taste Science
  - Investigation of the molecular logic of sensory events for application in food quality design

Social Cooperation Laboratory
- Health Nutrition
  - Molecular nutrition and functional genomics to improve quality of life
- Nutri-Life Science
  - Investigating molecular and cellular basis of skeletal muscle integrity to extend a healthy life expectancy

Morphology of the kobito (kbt) mutant of morning glory
The kbt mutant has a defect in the biosynthesis of brassinosteroids, a class of plant hormones, and shows conspicuous dwarf phenotype, demonstrating the importance of this hormone function. (left) Two-month-old kbt, (right) Seven-week-old kbt and wild-type plants.

A confocal microscope image of Arabidopsis root expressing GFP-tagged BOR1 borate transporter carrying mutation at Lys-590 (K590A). The mutant BOR1-GFP localizes in the plasma membrane and shows inward (stele-facing) polarity similar to the wild type, although high boron-induced endocytic degradation of BOR1 is completely blocked by this mutation.
Department of Biotechnology

The Department of Biotechnology maintains high educational and research standards across wide-ranging areas of biotechnology. Employing DNA technology, protein engineering, and cell/tissue culturing techniques in combination with recent advances in biomolecular structure determination, genomic information, and bioinformatics, the Department elucidates the basic mechanisms of a variety of biological functions. Furthermore, the Department is applying these findings to contribute to the prosperity and happiness of human beings.

Biomolecular Research

- Molecular and Cellular Breeding
  - Analysis and improvement of useful genes in microorganisms
- Bioinformation Engineering
  - Computational biology, computational chemistry, and bioinformatics
- Molecular Biotechnology
  - Structure, function, and localization of biological molecules

Biofunctional Research

- Fermentation and Microbiology
  - Molecular microbiology, biosynthesis of natural products
  - Applied Microbiology
    - Application of diverse microbiological functions
- Enzymology
  - Structure-function relationship of enzymes and proteins
- Microbiology
  - Fungal physiology, yeast genomics and chemical genomics, and cell-cell communication
- Cellular Genetics
  - Regulation of macromolecular biosynthesis in microorganisms

Cooperative Course

- Environmental Biochemistry
- Cell Biotechnology
- Plant Functional Biotechnology
- Microbial Metabolomics (Endowed course)
- Microbial Membrane Transport Engineering (Endowed course)
- Microbial Metabolic Potential (Endowed course)
- Brewing Microbiology (Endowed course)
- Yeast and Fermentation (Endowed course)

Forest Resources and Environmental Science

- Forest Management
- Research on integrated management and utilization of forest areas
- Research on forest inventory and monitoring techniques using remotely sensed data
- Forest Policy
- Studies on policies to manage and utilize forests
- Social scientific studies on relationship between human beings and forests

Department of Forest Science

Our comfortable life is dependent on advanced science and technology and generates major environmental load. Environmental problems on a global scale, such as extreme weather and extinction of species, have become apparent. Degradation of the environment is a serious problem as it relates to humankind. Forests are the biggest terrestrial ecosystems on earth, accounting for about 80% of plant production. They play a major role in hydrological and carbon cycles on a global scale and help conserve the global environment. Extensive human activity leading to deforestation and forest degradation is a cause of deterioration of the global environment. Moreover, forests bring various benefits such as wood resources, pure water, and a comfortable environment, and the use of forests is indispensable to our lifestyles and livelihoods. Forest science is a discipline that helps us to sustainably enjoy the benefits of forests by harmonizing forest ecosystems with human activities.

Practical student exercise in a mountain village
Department of Aquatic Bioscience

The Department of Aquatic Bioscience has the following major aims: 1) find ways to preserve aquatic ecosystems given the global scale of environmental havoc wreaked by humankind, 2) develop self-sustaining fisheries, and 3) investigate ways to contribute to human well-being including food production using knowledge and expertise from other research fields such as biotechnology. The Department’s laboratories, including the Fisheries Laboratory on Lake Hamanako and those in the Atmosphere and Ocean Research Institute, are tackling these problems and have achieved many encouraging results. However, the ocean, which has spawned and nurtured life since the Earth’s formation, is vast and as yet only partially understood. There is a real need to once again observe biological phenomena in the ocean from a fresh viewpoint and with an open mind.

http://www.a.u-tokyo.ac.jp/english/departments/D-AB.html

Aquatic Life Science

- Aquatic Animal Physiology
  - Mechanisms of reproduction and environmental adaptation in aquatic animals
- Aquatic Natural Products Chemistry
  - Search for biologically active substances from marine invertebrates
  - Characterization of biosynthetic pathways of aquatic natural products
- Marine Biochemistry
  - Functional diversity of metabolic pathways in aquatic organisms

Aquatic Molecular Biology and Biotechnology

- Development and function of aquatic animal muscles
- Molecular response to environmental stress
- Protein engineering

Aquatic Production and Environmental Science

- Fisheries Biology
  - Management of fisheries resources and ecosystems
  - Biology, ecology, and life history of fish
- Fish Disease Research
  - Pathology of infectious diseases of fish and shellfish
  - Biology and ecology of pathogens
  - Host defense mechanisms
- Aquatic Biology and Environmental Science
  - Ecology of marine organisms and related environmental changes

*1 Cooperative course. The laboratories and their staff belong to the Asian Natural Environmental Science Center.
*2 Cooperative course. The laboratories and their staff belong to the University of Tokyo Forests.

Departments
Department of Agricultural and Resource Economics

How can we meet the global need for foodstuffs and agricultural materials under the growing constraints of natural resources and the environment as well as deficiencies in food distribution, systems, including reconciling production in coexistence with the environment while preventing hunger and ensuring satiation? This challenging issue should be addressed in consideration of fundamental socio-economic elements, e.g., unsustainable development and resource depletion, enlargement of poverty and social inequality, and economic and institutional conflicts among developed and developing countries.

Our department embodies the following two key principles of graduate education and academic research for the new age of agricultural and resource economics.

(1) Global perspective: Our research concerns have become broader and more internationalized beyond traditional agricultural economics to include intergenerational resource conservation, multifunctionality of agriculture, the global food system, harmonization of international trade systems, and rural development and communities, while encompassing new disciplines of other applied economics such as development economics, environmental economics, and institutional economics.

(2) Local perspective: We pay attention to the reality of rural communities and individuals. Our fieldwork approach, through which we have accumulated academic knowledge and established research networks, is one effective method to achieve our aim of comparing Japanese and overseas agricultural economies. We continue to offer intensive seminars and classes for graduate students, which deepen their professional insight and enhance their communication abilities. In addition, we intend to strengthen intellectual collaboration with other natural science disciplines. One of the keys to solving the aforementioned complex problems is technological progress owing to developments in bioscience and information technology. As a department of Graduate School of Agricultural and Life Sciences, we have an excellent opportunity and favorable position from which to engage in academic dialogue and scientific discussion for the future.

Agricultural Structure and Farm Business Management

- Farm Business Management and Rural Development
  - Management and analysis of farm business
  - Management for regional and environmental resources
- Agricultural Structure and Policy
  - Comparative studies on agricultural structure
- Agricultural History
- Comparative studies on agricultural development
- History of agricultural sciences

Development Policies and Economics

- Agricultural and Development Economics
  - Political economy of agriculture
  - Development economics
- Agricultural trade
- Food and Resource Economics
  - Food system economics
- Resource and environmental economics

Rural Development Finance

- Rural Development Finance
  - Risk and agriculture
  - Agricultural productivity and technology adoption
  - Agricultural market development
  - Rural organization

Pan-Asia*

- Economic Development in Asia
  - Social and cultural changes in Asia
* Cooperative course. The laboratory and its staff belong to the Institute for Advanced Studies on Asia.

We seek consistency between efficient agricultural production and favorable rural environments.

Department of Biological and Environmental Engineering

The Department of Biological and Environmental Engineering (BEE) deals with the creation and preparation of favorable environments in rural areas and production control of living things. Technologies in this field are essential for appropriate management of natural and biological resources sustaining human beings on the Earth. The Department consists of the six branches of Rural Environmental Engineering (REE), Biological Systems Engineering (BSE), Biological and Environmental Information Engineering (BEIE), Ecological Safety Studies (ESS), Sustainable Agro-ecosystem Engineering (SAE), and Radio Environmental Technology (RET). REE seeks advances in modern technologies associated with the engineering of land resources, water resources, soil conditions, plants, and air resources. It aims to encourage efficient food production and to conserve the Earth’s environment, especially in rural areas, by harmonizing production with natural ecological systems. BSE aims to develop advanced techniques and research in bioengineering, biological process control, controlled environment plant production, biosensing and robotics, bioenergy production, and post-harvest technology by making greater use of biological functions. BEIE applies the latest information technology to contribute to the harmonious coexistence of living organisms and the environment as well as optimized food production. It also encompasses the effects of changes in the conditions of both the geosphere and food materials. ESS is an associated branch of the Department of BEE in the Institute for Agro-Environmental Sciences (NIAES), NARO which is located in the science hub of Tsukuba City. NIAES is the leading institute on environmental sciences in agriculture. ESS conducts interdisciplinary studies on atmosphere and soil environments, the material cycle in agro-ecosystems, and ecological statistics as the basis for such studies. SAE cooperative course in the Institute for Sustainable Agro-ecosystem Services (ISAS) at the Tanashi Campus. SAE conducts research on sustainable and effective use of ecosystem services. RET cooperative course is in the Isotope Facility for Agricultural Education and Research. RET conducts research on agricultural rehabilitation in areas polluted by radioactive materials.

http://www.a.u-tokyo.ac.jp/english/departments/D-BEE.html

Rural Environmental Engineering

- Land Environmental Engineering
  - Improvement of agricultural productivity and sustainability through farmland engineering
  - Assessment of sustainability of agricultural system in terms of materials, water and energy balance
  - Water and material circulation in the soil-plant-atmosphere continuum

Water Environment Engineering

- Development and application of hydraulic and hydrological models for large-scale irrigation systems to improve water management
- Quantitative valuation and demand-oriented provision of irrigation service
- Control of greenhouse gas emissions from paddy fields through on-farm water management
- Survey and analysis of water resources and environmental problems in Asian monsoon regions

Soil Physics and Soil Hydrology

- Unsaturated water and solute transport in soils
- Migration and remediation of metals in soils
- Carbon dynamics in soil and transport phenomena
- Climate change and soil physical conditions
- Erosion and conservation of low-pH soils
- Colloid and ne-bubble-facilitated transport of chemicals in soils

1. Lettuce production under artificial lighting
2. 3D image of forest measured by helicopter-borne scanning LiDAR
Laser scanning microscopic image clearly distinguishes between wood and complete wood usage and the application of knowledge and research methods based on material sciences to facilitate replacement of fossil resources. Wood, the most important biomaterial, is both renewable and clean. Promoting its beneficial utilization will help to preserve the environment and is essential for the continued existence of human beings far into the future. To constructively promote biomaterial utilization, we must strive for efficient and complete wood usage and the application of knowledge and research methods based on material sciences to biomaterials other than wood. The Department is advancing science and technology toward this goal.

**Department of Biomaterial Sciences**

We consume various kinds of raw materials to better our quality of life. As many of these materials are currently produced from fossil resources, the environmental impact of their excessive consumption is cause for concern. Development and introduction of biomaterials more in harmony with the environment is therefore desirable to facilitate replacement of fossil resources. Wood, the most important biomaterial, is both renewable and clean. Promoting its beneficial utilization will help to preserve the environment and is essential for the continued existence of human beings far into the future. To constructively promote biomaterial utilization, we must strive for efficient and complete wood usage and the application of knowledge and research methods based on material sciences to biomaterials other than wood. The Department is advancing science and technology toward this goal.

**Biological Systems Engineering**
- Bioenvironmental Engineering
  - Analyses of plant responses to light, gas, and water environments
  - Control and analysis of plant environments in greenhouses and plant factories
  - Development of advanced plant production technologies and experimental devices for plant-response research
  - Advanced technology utilization for plant production and plant-response research
  - Ecophysiology and biotechnology in advanced greenhouse horticulture
- Biological and Mechanical Engineering
  - Unmanned arboat for lake environment monitoring and management
  - Unmanned small mower for steep field
  - Efficient hydrocarbon production from microalgae
  - Ethanol production from lignocellulosic biomass
  - Sustainable biofuel from Jatropha in Mozambique
- Bioprocess Engineering
  - Storage of foods and agricultural products by application of both gas-hydrate formation and freezing
  - Non-destructive and real-time monitoring for food safety and quality
  - Evaluation of the dynamic properties of micro-/nano-bubble water for application in biosystems
  - Prediction of dynamic change in agricultural product quality
  - Studies on accumulation of functional compounds in fruits and vegetables during storage

**Biological and Environmental Information Engineering**
- Biological and Environmental Information Engineering
  - Remote sensing of biosphere functioning
  - Analysis and modeling of ecosystems
  - Analysis of impacts of global environmental changes on ecosystems
  - Image instrumentation for biomonitoring
  - Information engineering for biological and environmental systems

**Ecological Safety Studies**
- Ecological Safety Studies
  - Detailed mechanisms of trace-gas dynamic exchange
  - Environmental biophysics
  - Microbial interaction in soil ecosystems
  - Behavior of carbon and phosphorous in soils and ecosystems
  - Biodiversity and material flow in Japanese ecosystems
  - Theoretical and empirical study of methods for phylogenetic estimation from DNA and amino-acid sequence data
  - Geometric morphometrics of biological shapes and statistical analysis of shape variation

**Cooperative Courses**
- Sustainable Agro-ecosystem Engineering
  - Development of a fully controlled crop production system based on energy-efficient technologies
  - Physiological and genetic evaluation of climate change effects on horticultural crop production
  - Development of safe and comfortable farm work systems
  - Survey of agricultural technology history (management of agricultural museum)
  - Optimization of pre- and post-harvest food chain technologies, and QOL improvements for seniors through fusion of medicine, agriculture, and food
- Radio Environmental Technology
  - Analysis of agricultural rehabilitation in areas polluted by radioactive materials
  - Movement explication of radioactive materials in plants and soil
  - Heterogeneity of radium and stable cesium within the same field
  - Monitoring inspection for radionuclides in agricultural, livestock, forest, and fishery products in Fukushima Prefecture

**Structural Biomaterials Science**
- Adhesion Science and Bio-Composites
  - Relation between chemical structure or physical properties of polymer and adhesive performances
  - Surface and Interphase of adhesives
  - Penetration of adhesive into wood
  - New composite from renewable materials

**Material and Housing Sciences**
- Wood Physics
  - Physical and mechanical properties of structural biomaterials
  - Properties of wood for exterior uses
  - Wood-based Materials and Timber Engineering
  - Development of new wood-based materials and processing
  - Development of high-strength wooden joints for heavy timber construction
  - Evaluation of structural performance of timber construction
  - Environmental impact of wooden housing and recycling of wood resources
- Biomaterials and Cellulose Science
  - Preparation of new bio-based nanomaterials from cellulose and chitin through environmentally friendly processes including TEMPO-mediated oxidation
  - Efficient surface modification of TEMPO-oxidized cellulose nanofibrils for application in high-tech materials fields
  - Self-assembly behavior of bio-nanofibers and their structural Characterization in bulk and nanocomposite materials

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  - Information engineering for biological and environmental systems

**Evaluating Wooden Environments for Human Comfort**
- Timber drying and wood-water relationships
- Physical and mechanical properties of structural biomaterials
- Properties of wood for exterior uses
- Wood-based Materials and Timber Engineering
- Development of new wood-based materials and processing
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  - Detailed mechanisms of trace-gas dynamic exchange
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The Department of Global Agricultural Sciences (GAS) is committed to serving global society through education and research on sustainable ecosystem services such as foods, fibers, and other bioresources. GAS programs are issue-oriented rather than technology-oriented and are based on a strong combination of expertise across disciplinary and national boundaries. The associated programs offered by professors from institutions outside the university give further breadth to GAS education and research. Students are advised to join overseas training courses organized by GAS in collaboration with universities and institutes in the country. Students in the Master’s program are also encouraged to minor in another department to strengthen their expertise in the pertinent discipline. Students will thus become well prepared to navigate a globalizing and ever-changing world.

http://www.ga.u-tokyo.ac.jp/English/

Global Animal Production Sciences

Global Fisheries Science
- Interdisciplinary studies for sustainable fisheries and aquaculture including socioeconomic aspects of small-scale fisheries, consumer markets, food value chains, gender and poverty alleviation.

Global Animal Resource Science
- Epidemiological studies for risk assessment of animal diseases and antimicrobial use in animal production
- Epidemiological and parasitological study on fascioliasis
- Mucosal immunization to Leishmaniasis in mouse model
- Immunopathological study on Newcastle disease virus
- Vaccine development to Ascaris suum
- Development of edible vaccines

Global Plant Production Sciences

Plant Science for Sustainable Agriculture
- Vegetable production system using local plant materials
- Soil structure differences under different cultivation systems
- Sustainable food value chains for ecological agricultural practices
- Improved biodiversity and production diversity in urban agriculture

Global Plant Material Science
- Recovery and production of value-added products from agricultural wastes
- Development of functional carbon materials from lignocellulosic resources
- Aging mechanisms of wood, timber, and other lignocellulosic biomasses at the atomic level
- Relationship between humans and plant materials

Asian Natural Environmental Science Center

Sustainable Material Design

Wood Utilization System
- Economic, environmental and social impact evaluation on utilizing timber and wood products
- Timber and wood products marketing
- Policy, education, finance, human resource development and consumer perception for promoting wood utilization

1 Cooperative course. The laboratory and its staff belong to the Asian Natural Environmental Science Center.
2 Endowed Research Unit. The laboratory and its staff belong to the Asian Natural Environmental Science Center.
Departments

Global Biological and Environmental Sciences

- Monitoring forest environment using satellite remote sensing and GIS
- GNSS utilization in forest area
- Application of LiDAR and aerial photographs for forest biomass estimation and reconstruction of 3D forest structure
- Plant Biotechnology
- Cellular and molecular analysis of Fe-acquisition mechanisms in plants
- Molecular breeding of stress-tolerant crop plants
- Development of low-Cd plants
- Genetic improvement of plants for production of valuable chemical substances and edible vaccines

International Agricultural Development Studies

- Modeling studies for optimizing growing conditions of upland NERICA in Africa
- Analysis on the applicability of new phosphorus fertilizer in Burkina Faso using crop growth modeling analysis
- Decision support system for crop nutrition management
- Influence of rice paddy fields on iron dynamics in rivers and the structural features of humic substances in their sediments
- Influence of freshwater from terrestrial sources on iron concentrations in coastal areas
- Effective utilization of agricultural waste in Africa for environmental conservation

International Development and Agro-Environmental Sciences

- International Environmental Economics
  - Effects of global warming on world agriculture and forestry
  - System modeling to interpret global food supply and demand
  - Economic development and environmental problems in developing countries
  - Imperfect competition and roles of cooperatives in agricultural markets and trade
- International Agro-Informatics
  - Agriculture and soil information system using ICT/IT technology
  - Soil and water conservation in agricultural fields
  - Remediation and renewal of agriculture in Fukushima after nuclear power plant accident
  - Development of farmer-friendly quality evaluation systems for fresh produce
- Rural development studies on the distribution of agricultural products
- Food engineering analyses in the context of international agricultural development

- Global Forest Environmental Studies
- Biological Conservation
- Aquatic Conservation
- Ecosystem Management
- Bioresources Management

Department of Ecosystem Studies

The Department of Ecosystem Studies aims to develop sustainable global management schemes that value ecosystem mechanisms and allow human society and nature to exist in harmony. An important feature of the Department is a focus on fieldwork which is conducted in different ecosystems from forests to coastal environments. Based on an understanding of the mechanisms and existing problems of focal ecosystems, the Department aims to both integrate agricultural and life-sciences-related academic achievements and develop related principles and techniques while educating skilled professionals. The Department has two main divisions, Biological Conservation and Ecosystem Management, and the two associated divisions of Bioresources Management and Bioresources and Eco-Environmental Studies. The Bioresources Management associated division cooperates with the former two divisions in research and education and is composed of six facilities within the Graduate School of Agricultural and Life Sciences.

http://www.es.a.u-tokyo.ac.jp/ingles/EN/}

Biological Conservation

- Biodiversity Science
  - Studies on various aspects of biological diversity, from both pure and applied views
  - 1) Mechanisms maintaining biodiversity
  - 2) Conservation and management of biodiversity
- Conservation Ecology
  - Studies on the conservation and sustainable use of ecological ecosystems
  - Studies on the management of ecosystem services/goods in urban ecosystems
  - Studies for understanding the structures and dynamics of human-nature interactions

Ecosystem Management

- Landscape Ecology and Planning
  - Landscape ecological studies on global and regional environments, monitoring of changes in natural environments caused by human impact, and ecological land evaluation and its application in landscape and environmental planning
- Forest Ecosystem Studies
  - Genetic and ecological studies for the conservation of forests and surrounding ecosystems
  - Planning sustainable use of forest resources
  - Analysis and conservation of tree diversity, forest species interactions, population dynamics of animals and plants, and endangered species conservation

Bioresources Management

- Agricultural Field Ecology
- Aquatic Bioscience
- Forest Ecosystem
- Forest Functional Biology
- Forest and Human Society Relationship
- Forest and Water Resources Management

Bioresources and Eco-Environmental Studies

Ecological Safety Studies

*Cooperative Courses. The laboratories and their staff belong to the "1 the Institute for Sustainable Agro-Ecosystem services , "2 the Fisheries laboratory, and "3 the University of Tokyo Forest.

Baliinese rice terrace: Cultural landscape in Bali is registered as a UNESCO world cultural heritage since 2012

Satoyama, a traditional rural landscape of Japan

Riparian forest in Chichibu mountains, central Japan

Meadow steppe in Inner Mongolia, China
The primary aim of research and education at the Department of Animal Resource Sciences is to maximize the utility of various functions of animals, mainly mammals, by revealing mechanisms underlying diverse and complex life phenomena. To this end, the Department is working to elucidate life phenomena from a variety of perspectives, ranging from molecular biology to ethology. It also aims to improve the productive capability of animals and seeks effective ways to preserve valuable genetic resources by applying state-of-the-art biotechnologies that enable elicitation of the potentiality of animals and animal cells. At the same time, the Department has always placed high priority on fostering the potential of its students. Graduates from the Department occupy important positions not only in the field of animal resource sciences but also other fields including medical and pharmacological sciences.

http://www.ar.u-tokyo.ac.jp/pages/English/E_top.html

Bio-regulatory Systems

- Molecular Immunology
  - Studies on molecular mechanisms of immunity against protozoan infection
  - Development of diagnostic, therapeutic, and prophylactic technologies for protozoan diseases
  - Epidemiological studies on visceral leishmaniasis in the Old World
- Applied Genetics
  - Reverse-genetic analyses of mechanisms in mammalian oocyte growth, oocyte maturation, fertilization, and early embryo development
  - Molecular mechanisms of bi-directional communication between oocytes and surrounding somatic granulosa cells
  - Studies on animal remodeling by developmental biotechnology using artificial chromatin-targeting enzymes
- Cell Regulation
  - Signal transduction of hormones and nutrients, and its modulation under physiological/pathological conditions

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- Cell Regulation
  - Signal transduction of hormones and nutrients, and its modulation under physiological/pathological conditions

Functional Bioscience

- Cellular Biochemistry
  - Studies on molecular mechanisms underlying growth and differentiation of trophoblast lineage
  - Elucidation of the role of genomic DNA methylation in epigenetic control of cellular differentiation and mammalian development
  - Interplay between epigenetic regulation and RNA processing in higher eukaryotes
- Veterinary Ethology
  - Chemical communication via pheromones in mammalian species
- Clinical studies in veterinary behavioral medicine
- Animal Radiology
  - Studies on lipid signaling in inflammation (tumor, allergy, and tissue regeneration)

Cooperative course

- Animal Life Science and Biotechnology*1
  - Safety and risk assessment of feeds and animal-derived foods
  - Studies on the nutritional effects of amino acids in farm animals
  - Studies on reproductive function in farm animals
  - Studies on compost using ultra-high-temperature aerobic fermentation

*1 The laboratory and its staff belong to the Animal Resource Science Center.
Department of Veterinary Medical Sciences

Veterinary medicine encompasses a broad area of the life sciences, taking in not only animal medicine but also the biology of mammals and higher vertebrates. In the Department of Veterinary Medical Sciences, highly advanced research is being carried out at the molecular, cellular, and in vivo levels in order to fully understand the vital processes of normal and diseased animals. Veterinary medicine encompasses two aspects of science: basic science to understand the mechanisms underlying biological phenomena, and applied science to satisfy social demands for the maintenance and improvement of human well-being and the productivity of domestic animals. The department collaborates with the Veterinary Medical Center located on the Yayoi campus. The Center is equipped with the latest advanced medical instruments and plays an important role as an advanced veterinary hospital in the area.

http://www.vm.a.u-tokyo.ac.jp/eng/

Basic Veterinary Medicine

- Mechanisms regulating ovulation and follicular development in female mammals
- Pathophysiological mechanisms mediating suppressed gonadal activities under malnutrition
- Development of systems stimulating and suppressing reproductive function

Veterinary Anatomy

- Molecular and cellular analyses of mammalian gonadogenesis, testis/carcinogenesis, and spermatogenesis
- Roles of SOX (Sry-related HMG box) genes in mammalian embryogenesis and organogenesis

Veterinary Physiology

- Regulation of brain function by sex steroids and growth factors
- Regulatory mechanisms involved in growth, regeneration and aging of skeletal muscle
- Stress responses of the central nervous system to immune challenge

Veterinary Pharmacology

- Signal transduction in cells and its modification by drugs
- Pharmacological effects of bioactive natural products

Veterinary Microbiology

- Studies on the mechanisms of persistent infection and reactivation of animal viruses and protozoa
- Development of recombinant vaccines for animals

Veterinary Public Health

- Control of zoonotic bacterial and viral pathogens in humans, livestock, and foods
- Ecology and role of bacteria harboring in the intestines of humans and animals

Food and Physiological Models (Endowed chair)

- Molecular mechanisms of learning and memory
- Elucidation of Insulin/IGF signal transduction

- Establishment of animal models for food and feed additives
- Cellular Biochemistry
- Studies on molecular mechanisms underlying growth and differentiation of trophoblast lineage
- Elucidation of the role of genomic DNA methylation in epigenetic control of cellular differentiation and mammalian development
- Interplay between epigenetic regulation and RNA processing in higher eukaryotes
- Veterinary Ethology
- Chemical communication via pheromones in mammalian species
- Clinical studies in veterinary behavioral medicine
- Molecular Immunology
- Immunopathological understanding of the host-parasite relationship in protozoan diseases
- Development of drugs, vaccines, and diagnostics for parasitic diseases
- Ecology and biology of sandflies as the vector of Leishmaniasis

Applied Genetics

- Reverse-genetic analyses of mechanisms in mammalian oocyte growth, oocyte maturation, fertilization, and early embryo development
- Molecular mechanisms of bidirectional communication between oocytes and surrounding somatic granulosa cells
- Studies on animal remodeling by developmental biotechnology using artificial chromatin-targeting enzymes
- Animal Radiology
- Studies on the pathophysiological effects of low-dose radiation
- Studies on lipid signaling in inflammation (tumors, allergies, and tissue regeneration)

Clinical Veterinary Medicine

- Veterinary Pathophysiology and Animal Health
- Study on stress responses of animals from a preventive medicine perspective
- Pathophysiology of cardiorespiratory and autonomic nervous systems using basic research techniques

- Veterinary Pathology
- Comparative neuropathology
- Experimental and toxicologic pathology

- Veterinary Internal Medicine
- Molecular pathogenesis and diagnostics of lymphoid and hematopoietic malignancies
- Pathogenesis of gastrointestinal and liver diseases
- Association of body composition and canine diseases

- Veterinary Surgery
- Biological and translational research on tumors in small animals
- Regenerative therapy in veterinary medicine

A horse (Winnerscircle; left) at the stock farm of the Animal Resource Science Center, and his Holter electrocardiography recording in the early morning (blue dot, atrio-ventricular block; right)
Departments

Research and Education Programs

- Anesthetic, analgesic, and perioperative management in small animals
- Biomedical Science
  - Studies on infectious viral diseases in experimental animals
  - Establishment and analysis of animal models of disease
- Veterinary Clinical Pathophysiology
  - Basic and clinical research of cancer immunotherapy
  - Pathophysiology of renal, gastrointestinal, and allergic diseases
  - Kidney regeneration using xenotransplantation
- Infection Control and Disease Prevention
  - Studies on pathogenesis of slow infections including viral cancers
  - Studies on pathogen detection methods
  - Studies on vaccines for controlling infectious diseases
- Veterinary Emergency Medicine
  - Regeneration of bone tissue using artificial bone implants
  - Development of new treatments for osteoporosis
- Biological effects of trehalose
- Farm Animal Medicine
  - Pathophysiologic analysis and development of diagnostic methods of diseases with diagnostic difficulties in cattle
  - Studies on onset mechanism of bovine leukemia
- Global Animal Resource Science*
  - Veterinary epidemiology, import risk assessment of animals and animal products, and food-safety risk assessment
  - Vaccinology including the mucosal delivery system, edible vaccines, immunogen formulation, and host immunity

Bio-Animal Science

- Animal Life Science and Biotechnology*
  - Safety and risk assessment of animal-derived foods including evaluation of radioactive contamination of livestock and livestock products due to the Fukushima Daiichi nuclear power plant accident
  - Studies on regulation of microbial infection by sterilization of compost using ultra-high-temperature aerobic bacterial fermentation
  - Studies on the physiological characteristics of ovaries including research on molecular mechanisms of oocyte selection in mammalian ovaries
  - Studies on the nutritional effects of amino acids on infantile growth in farm animals

Food Safety and Science*

- Laboratory of Food-borne Pathogenic Microbiology
  - Surveillance of virulent Streptococcus suis strains among healthy pigs and retail meat in Japan
  - Functional analysis of cell-wall linked proteins in Streptococcus suis
  - Development of a new selective medium for isolation of genus Streptococcus from food and environmental samples
  - Search for source of Campylobacter infection in broiler chicken houses

Experimental Medicine*

- Laboratory Animal Research Center
  - Analysis of pathogenicity and species specificity of RNA viruses
  - Analysis of mechanisms of RNA-virus persistent infection
  - Development of novel treatments for emerging lethal virus infections
  - Development of new recombinant vaccines
  - Development of recombinant viruses as oncolytic virotherapy agents
- Molecular Virology
  - Strategic fundamental research aimed at developing a novel method of viral infection control by elucidating the mechanism underlying viral proliferation/pathology
  - Next-generation virology to reconsider viruses as a homeostasis factor and explore their significance, in addition to unraveling cells and physiological control mechanisms that cannot be elucidated by research on normal human hosts, using viruses as a biological probe

*1 Cooperative course. The laboratory and its staff belong to the Department of Animal Resource Sciences.
*2 Cooperative course. The laboratory and its staff belong to the Department of Global Agricultural Sciences.
*3 Cooperative course. The laboratory and its staff belong to the Animal Resource Science Center.
*4 Cooperative course. The laboratory and its staff belong to the Research Center for Food Safety.
*5 Cooperative course. The laboratory and its staff belong to the Institute of Medical Science.
AGRI-COCOON

AGRI-COCOON (AGricultural Research Incubator COmmunity for COoperative Network of Public, Administrative, Business, and Academic Sectors) is a research and educational community established in 2005 at the Graduate School of Agricultural and Life Sciences, the University of Tokyo. The primary mission of AGRI-COCOON is to develop and implement multidisciplinary programs for graduate students. The programs are designed to enable graduate students to conduct original, highly creative, and self-directed research projects by enhancing their skills in terms of:

- Information collection
- Problem assessment
- Academic communication
- Knowledge building
- Knowledge integration

AGRI-COCOON also contributes to the further advancement and enrichment of the Graduate School through collaborative interactions among academia, business, government, and private institutions. Graduate students of all majors and departments are welcome at AGRI-COCOON’s unique multidisciplinary workshops and seminars, with some academic courses open to undergraduate students since 2011. By building agro-science knowledge and developing a new agricultural research and education protocol, AGRI-COCOON aims to systemize mutual understanding and communications among various stakeholders related to agricultural sciences.

Throughout the academic year, AGRI-COCOON hosts many international symposiums and seminars that are open to all students and the general public.

Academic Curriculum

- Intensive lectures on natural and socioeconomic environments in developing countries
- Practices in Global Agriculture and Culture
- Practical training at Japanese farming sites and field trips to developing countries
- Topics in Biomass Utilization Research III
- Periodics seminars by UT Faculty members with guest lecturers on leading topics in biomass utilization, and fieldwork at biomass utilization sites in Japan
- Biomass Utilization Research Seminar VII
- Intensive practical training and fieldwork on biomass utilization
- Biodiversity and Agriculture
- Discussions and fieldwork on biodiversity of agricultural sites with local citizens, organizations, and researchers
- Training in Nature-Restoration Operational Monitoring
- Monitoring research of nature-restoration project sites in Japan

Educational Program

- Fundamentals
  - Introduction to Biological Sequence Analysis
  - Introduction to Genome Informatics
  - Introduction to Bioinformatics
  - Introduction to Structural Bioinformatics

- Methodology
  - Knowledge Information Processing
  - Sequence Statistics and Mathematical Biology
  - Molecular Modeling and Simulation
  - Omics Analysis
  - Functional Genomics
  - Introduction to Systems Biology
  - Field Informatics

- Advanced Topics
  - Special Lectures on Agricultural Bioinformatics I
  - Special Lectures on Agricultural Bioinformatics II
  - Special Lectures on Agricultural Bioinformatics III
  - Special Lectures on Agricultural Bioinformatics IV
  - Research Exercises on Agricultural Bioinformatics

Graduate students can obtain credits by attending these lectures and practical education toward professional certification. Besides these lectures and practices, several seminars and workshops are held every year.

Certification graduation ceremony

Agricultural Bioinformatics Research Unit

The Agricultural Bioinformatics Research Unit was established in 2004 with support from MEXT (Ministry of Education, Culture, Sports, Science and Technology) to conduct education and research on bioinformatics for graduate students who are studying agricultural and life sciences. The Unit’s educational program includes lectures, practical education, and seminars in advanced topics of bioinformatics and their agricultural applications. It also supports the research of master’s and doctoral students and presents practical education linked directly to each research topic.

The Unit aims to become a base of cooperation for experimental and computational studies as well as industry-university cooperation. The Agricultural Bioinformatics Research Unit was renewed in 2009 in order to enhance our activities by building upon past experience and to promote university-industry cooperation and international cooperation. So far (2004–2018 academic years), a total of 2017 students have completed the lectures and a total of 227 students have completed this program.
The One Earth Guardians Development Program, started in 2017, aims to foster human resources called “One Earth Guardians”. The Guardians are a network of scientists who will take actions aimed at securing the future of the Earth for the next 100 years as a place where all living beings, including humans, coexist in harmony. Since the beginning of human history, we have consumed unsustainable levels of various biological and non-biological resources, and our pursuit of economic efficiency and industrial prosperity has damaged our irreplaceable planet, “One Earth”. The planet will not be able to sustain our lives in the near future if we do not take action now! As individuals devoted to the field of agriculture, which is a combination of academic science and applied science covering various aspects of our daily life, such as food, clothing, housing and more, we are responsible for the establishment of scientific technologies for a sustainable future, by fostering future scientists, as soon as possible.

For the development of such technologies and human resources, the program takes advantage of collaboration with all the components of society, including companies, NPOs, governments, other academic institutions and even people who are not familiar with such global issues, to find and solve environmental and/or social problems happening now or in the future. This research and education program is designed to help us answer the question “What can we do for the Earth in the next 100 years?”

**ADMISSION POLICY**

1) Individuals who have paid attention to the issues the Earth faces and are passionate about solving the issues from a scientific perspective.
2) Individuals who are eager to solve global issues as cosmopolitans, with a flexible mind and respect for others.
3) Individuals who combine both core specialty expertise and a broad understanding of science, capable of generating scientific synergy among scientists.
The academic year at IPADS begins in September each year. Typically, students in MSc complete the coursework component of the program in their first six months whilst designing and preparing for their original research, and then engage in full-time research for the remaining 18 months. Throughout the program, students are actively involved in the School’s research community, participating in weekly seminars, thematic workshops and academic conferences. The professors have excellent academic career and wide experiences in international researches. IPADS also offers three-year, research-only PhD program.

CURRICULUM POLICY

Those admitted to the OEGs program will take classes in three categories, each of which is a necessary component to understand multilateral aspects of problems relating to the SDGs and to become One Earth Guardians, i.e., the leaders who drive the whole society toward the realization of the SDGs.

Category 1: Basic One Earthology
Classes in this category support basic understanding of biological organisms including animals, plants and microorganisms and how they play important roles in the achievement of the SDGs from the aspect of environment, food security and renewable bioresources.

Category 2: Applied One Earthology I
Classes in this category help OEGs candidates to gain skills in the area of problem defining and problem solving for reality, in order to do ‘Agriculture’, the applied science for sustainable society and lives.

Category 3: Applied One Earthology II
Classes in this category help OEGs candidates to gain skills needed to deliver scientific achievements to global society and in turn bring people together to solve issues relating to the SDGs in collaboration with one another.

International Program in Agricultural Development Studies (IPADS)

“Traditional and innovative”
“Wide spectrum of research activities”
“Make a difference in the modern, globalized industry of agriculture”
“Practical, relevant and challenging”

Inaugurated in the academic year 2010/2011, International Program in Agricultural Development Studies (IPADS) is an English-language MSc and PhD Program at the Graduate School of Agricultural and Life Sciences. Issue-oriented rather than methodology-oriented, this exciting international program offers its candidates the opportunity to develop the requisite expertise across discipline and country boundaries to tackle agricultural and environmental problems in developing countries around the world. Graduates will be well-equipped to make a difference in the modern, globalized industry of agriculture.

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RESEARCH COMPONENT

The research component of the MSc program and the entire PhD program are conducted under the supervision of one or more of the School’s faculty. Students have opportunities to work with suitable members of staff to satisfy their own requirements and research interest among eleven disciplines; Plant Science, Plant Material Science, Plant Biotechnology, Economics, Animal Science, Food Science, Agroinformatics, Forestry, Fisheries, Environmental Science, Ecology.

ZEF (University of Bonn) and IPADS Joint Coursework Initiative

The Center for Development Research (ZEF) is an institute of the University of Bonn, Germany. ZEF aims to find science-based solutions to development-related issues. IPADS and ZEF have established a strategic partnership in research and education. The exchange of students and professors plays a key role. In the beginning of 2016, two memoranda of understanding were signed: One between the Universities of Bonn and Tokyo and another between IPADS and ZEF.

Crop modeling: From theory to practice. Field experience for ZEF students during IPADS visit in spring. Good opportunity for the cultural exchange, too.
The Institute for Sustainable Agro-ecosystem Services (ISAS) was founded on April 1, 2010, by integrating the University’s Field Production Science Center (University Farm) and the Experimental Station for Landscape Plants. The Institute is also affiliated with the University of Tokyo Tanashi Forest for education and research in forest sciences.

With the integration of these research facilities, the Institute aims to conduct research for sustainable provision of foods, forest products, and other ecosystem services. Our scope also entails robustness and resilience of ecosystem services against natural disasters and human perturbations. The research toward these goals is done by three groups: the Education and Research Center, the Research and Education Center (ERC), and the Executive Office (EO). The role of the Office is to coordinate the various educational, research, public, personnel, financial, and inter-organizational affairs as well as to promote cooperation between the branches and other organizations.

The ISAS campus is located in Nishitokyo City and has a total area of 22 ha covering upland fields, rice paddies, greenhouses, and other research and education facilities. For more details, you may visit our website (http://www.isas.a.u-tokyo.ac.jp/index-e.html) or even better, visit our campus personally!

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**The University of Tokyo Chiba Forest (UTCF):** The University of Tokyo Chiba Forest has an area of 5,812 ha and is located in Chichibu-Tama-Kai National Park. It is in a cool-temperate zone with mountainous terrain. The vast majority of the UTCF (>85% of the total area) is covered with natural forest. The major tree species are Abies firma, Tsuga sieboldii, Fagus japonica, and Fagus crenata. Of the 28 Acer species in Japan, 20 are found in the UTCF.

**The University of Tokyo Hokkaido Forest (UTHF):** The University of Tokyo Hokkaido Forest, which has an area of 22,717 ha and is located in central Hokkaido, is dominated by boreal coniferous trees mixed with broad-leaved deciduous trees.

**The University of Tokyo Chichibu Forest (UTCF):** The University of Tokyo Chichibu Forest has an area of 5,812 ha and is located in Chichibu-Tama-Kai National Park. It is in a cool-temperate zone with mountainous terrain. The vast majority of the UTCF (>85% of the total area) is covered with natural forest. The major tree species are Abies firma, Tsuga sieboldii, Fagus japonica, and Fagus crenata. Of the 28 Acer species in Japan, 20 are found in the UTCF.

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**The University of Tokyo Tanashi Forest (UTTF):** The University of Tokyo Tanashi Forest is the nearest university forest in Japan. The forest has an area of 2,169 ha and is located in a warm-temperate forest zone. The area is covered with various tree types. Planted forest consists of Cryptomeria japonica and Chamaecyparis obtusa. Coniferous natural forest is mainly dominated by Abies firma and evergreen Quercus spp.

**Ecohydrology Research Institute (ERI):** Ecohydrology is an interdisciplinary field studying the interactions between forest and water, and their ecosystem services. The ERI manages the Azaku Research Forest (ARF, 745 ha), the Inuyama Research Forest (IRF, 442 ha), and the Ananomiya Experimental Forest (AEF, 77 ha) for various field researches and educations.

**Fuji Iyashinomori Woodland Study Center (FIWSC):** Fuji Iyashinomori Woodland Study Center is 40 ha in area and located on the eastern slope of Mt. Fuji. The area lies on the higher cool-temperate forest zones.

**Arboricultural Research Institute (ARI):** The Arboricultural Research Institute is 247 ha in area and located at the southern tip of the Izu Peninsula. It is in a typical warm-temperate forest covered with evergreen tree species. Field adaptation tests have been conducted over several decades to select locally adaptable Eucalyptus species. Further screening of candidate species is planned to identify better species in terms of tree growth.

**Executive Office (EO):** The Executive Office located on the Yayoi campus of the Graduate School of Agricultural and Life Sciences, the University of Tokyo. Students who belong to the UTF attend weekly seminars related to their research.

**Education and Research Center (ERC):** The Education and Research Center is located on the Yayoi campus of the Graduate School of Agricultural and Life Sciences, the University of Tokyo. Students who belong to the UTF attend weekly seminars related to their research.

1. Hands-on learning program for undergraduates to make chocolate using caoac nuts grown in the green house (photo by Arboricultural Research Institute)

2. Maintenance of Moso bamboo plantation site where mass flowering mechanism has been researched (photo by the University of Tokyo Chiba Forest)
Animal Resource Science Center

The Animal Resource Science Center, which was established in 1949 as a livestock farm for undergraduate and graduate student instruction, is located in Kasama, Ibaraki Prefecture, 90 km north of the main campus. One professor, one assistant professor, eight technical assistants including a veterinarian and staff with doctoral and master’s degrees, two management staff members, and two part-time assistants support teaching and research for veterinary medicine, animal life sciences, and animal biotechnology. Many of the graduate students affiliated to the research unit of animal resource sciences, investigate front-line topics in veterinary, animal and agricultural sciences.

The Center provides education in the form of numerous practical trainings and seminars for undergraduate and graduate students. In addition, many practical seminars on animal life sciences are offered for students at preschools, elementary schools, and junior high schools, and for the general public. The Center also serves as a social educational center for assessing animal food safety.

There are more than 40 pigs and 10 horses at the Center including Criollo horses, a gift from La Plata University, Argentina, which are employed in animal therapy. Around 30 dairy cattle and 100 native Japanese Shiba goats bred at the Center are used as experimental animals for studies on ruminants’ physiological processes. These farm animals are also supplied to many research institutes as experimental animals for veterinary medicine, animal resource sciences, agricultural sciences and medical fields.

Recent research areas of the Center are as follows: 1) evaluation of radioactive contamination of livestock and livestock products due to the Fukushima Daiichi nuclear power plant accident and developmental research for animal husbandry reconstruction; 2) researches on fundamental physiology of mammalian embryos and reproductive organs to improve pregnancy rate in farm animals; 3) studies on the nutritional effects of amino acids on prevention of mastitis in dairy cattle, and on infantile growth and gastric ulcers in farm animals; 4) neuroendocrine control of the reproductive function in pigs and identification of primer pheromones in ruminants; 5) studies on ultra-high-temperature (more than 110°C) fermentation for sterilizing disposal of livestock excretion using aerobic bacterial flora.

Practical exercises for animal resource science

Assessing radioactive contamination of livestock (piglets) and livestock products (cow’s milk) due to the Fukushima Daiichi nuclear power plant accident

Veterinary Medical Center

The Veterinary Medical Center (VMC) was established in 1880 and engages in education and research on clinical veterinary medicine. The VMC building is a 4-story and totally 3,000㎥ building and is equipped with advanced diagnostic imaging systems, such as color doppler ultrasonography, endoscopy/arthroscopy, computed tomography (CT), and magnetic resonance imaging (MRI) apparatus. A total of 20,000 animal patients are referred to VMC every year to receive advanced and high-level clinical services.

VMC plays an important role in educating undergraduate students. They receive practical clinical education from the academic staff of VMC as well as bedside education through clinical rotations. In addition, graduate students carry out researches at their affiliated clinical laboratories, utilizing information on diseases specialized to their fields. Current research projects at VMC include neoplastic diseases, various immune-mediated diseases, neurological diseases, hereditary diseases, orthopedic diseases and anesthesia/analgesia. Recently, collaborative researches with medical schools/medical hospitals, companies, and/or other institutions have been conducted, which may lead to novel techniques and drugs useful for both human and veterinary medicines. These translational researches should be one of the important roles of VMC.

Furthermore, VMC accepts 10 to 15 newly licensed veterinarians for clinical training every year. They work as residents/hospital staff in the clinical services of VMC to obtain advanced knowledge and techniques in small animal practices.

These activities of VMC are designed to satisfy the social demands for the maintenance and improvement of animal and human welfare and to fulfill the requirements for the education and researches in veterinary medicine.
The Laboratory is well situated for research and education regarding the genetics, physiology, development, and ecology of marine organisms. The facility can supply seawater as well as fresh water to more than 100 tanks and ponds of various sizes, ranging from 1 to 100 $m^3$. Moreover, state-of-the-art instruments for use in genomics, genetics, imaging, cell biology, and biochemistry enable researchers to study marine organisms at the molecular level. Currently, as part of our main research focus, we are investigating the genetic basis of phenotypic evolution of aquatic animals in order to help make fisheries and aquaculture sustainable. In the past few years, we have been making a strong effort to understand the genetic and immunological aspects of the fugu or pufferfish, the genome of which was the second vertebrate genome to be sequenced. The Fisheries Laboratory accepts both undergraduate and postgraduate students, including those from overseas.

Isotope Facility for Agricultural Education and Research

The Isotope Facility for Agricultural Education and Research (Isotope Facility) in the Graduate School of Agricultural and Life Sciences was reorganized in 2017. The use of isotope tracers in agricultural research began in the 1950s, mainly in the fields of plant nutrition and fisheries. Nowadays, laboratories that use isotopes are spread throughout all departments in the graduate school, and approximately 300 people annually register to use the Isotope Facility. To support the research activities, plant growth chambers, safety cabinet system, cryostat, analytical instruments such as GC-MS and SEM-EDX, as well as radiation measuring instruments such as NaI scintillation counters and imaging plates with image readers are equipped. Since 2011, more than 60,000 samples containing radiocaesium derived from the Fukushima Dai-ichi Nuclear Power Plant accident have been measured in the isotope facility.

Following strict regulations concerning radioisotope usage in Japan, the administrative office (located within the Isotope Facility) provides a radiation safety program for users, and all isotope users must be registered. All users are also required to attend two different lectures, which are provided by the University of Tokyo and the Graduate School of Agricultural and Life Sciences, respectively. Health checks and radiation exposure monitoring are also performed, and each user must have ID to enter the facility; administrative records are kept of the time users spend in the facility. There are several members of the academic staff at the Facility who, through their research and training, can advise researchers on how to use radioisotopes and provide new information about the application of radiation and radioisotopes.
Technology Advancement Center

Main facilities

- **Biotron**: As environmental conditions in agricultural field experiments are frequently affected by natural climate conditions, the accuracy and reproducibility of experimental data are occasionally limited. Such problems can be resolved to a certain extent by the use of the Biotron facility, where environmental conditions are kept constant and controlled year-round and different conditions can be set at the same time for comparative experiments. Laboratory animals, insects, and aquatic organisms as well as plants can be bred in our Biotron. The conditions of each room of the Biotron facility are as follows:
  - Bldg. No. 6
  - Chamber (for insects) 20-35°C
  - Rooms G1-G4 (natural light) 20-30°C
  - M (machine room)
  - Bldg. No. 7 (A) rooftop
  - Room G1 (natural light) D30-N25°C
  - G2 (natural light) 20°C (constant)
  - G3 (natural light) D25-N20°C
  - M1 (machine room)
  - M2 (for managing)
  - Bldg. No. 7 (B) rooftop
  - Rooms G1-G3 (natural light) 20-35°C
  - M1 (machine room)
  - M2 (for managing)
  - Life Sciences Research Bldg.
  - G1-G3 (natural light) 20-35°C

- **Koishikawa Arboretum**: Koishikawa Arboretum occupies about 0.6 ha of the northwest part of the Koishikawa Botanical Gardens, which belongs to the Graduate School of Science, the University of Tokyo. As an experimental nursery, since 1909 the Arboretum has provided plant materials for research on physiology, pathology, genetics, and breeding of plants. A rhizotron constructed in 2003 has provided valuable facilities for researchers and students studying symbiotic relationships between trees and fungi.

Research Center for Food Safety

The Research Center for Food Safety was established in November 2006 to meet the expectations and need for the development of food safety science and technology. The Center aims to conduct comprehensive research on food safety and dissemination of scientific information through close collaboration with national and international organizations.

The Center is devoted not only to research activities but also to providing scientific information to the public and government and private sectors. The Center also aims to develop leaders with high levels of knowledge and skills by training students, researchers, and government officials from Asian and other countries.

The Center is composed of four divisions, with representative research activities as follows:

- **Division of Radiological Sciences**
  - Analysis of radioactive substances in foods
  - Biological effects of radioactivity, including on the genome and epigenome

- **Division of Risk Assessment Science**
  - Risk assessment and control of bacterial pathogens in foods
  - Prevention of health problems caused by food contaminants
  - Pathological, toxicological, and pathophysiological studies of the mechanisms of health problems caused by food contaminants
  - Development of evaluation systems of food-related effects using experimental animals
  - Development of analytical methods for food contaminants

- **Division of Risk Control Science**
  - Control of intestinal immune response and food allergies
  - Maintenance and improvement of healthy livestock to provide food safety
  - Development of functional foods and low-risk foods

- **Division of Information Science and Economics**
  - Policies and economic issues relating to food safety
  - Risk perception and risk communication relating to food safety
  - Training and education of researchers, administrators, and other professionals in the field of food safety

These research activities of the Center are expected to promote the development of innovative science and technology for the advancement of food safety and contribute to fostering experts capable of dealing with food safety issues based on the most current knowledge in these fields.
The Faculty has its own library, which was established in 1965 with donations from alumni and the aid of the Rockefeller Foundation. Former libraries of the various departments were then consolidated into one library. The Library contains 440,000 volume of books and periodicals dealing with agricultural and other natural sciences. Currently about 1,700 periodical titles are received.

In 1977, the Library was designated by the Ministry of Education, Science and Culture (currently the Ministry of Education, Culture, Sports, Science and Technology) as the central library for foreign agricultural periodicals and functions as such by collecting foreign periodicals that are difficult to find in Japan and providing services to affiliates of other institutions.

In July 2009, the main building was reopened after seismic retrofitting.
Center for Biodiversity and Ecosystem Restoration in Mongolia

In response to threats posed by declining biodiversity from climate change and desertification, the Center for Biodiversity and Ecosystem Restoration in Mongolia was established at the Mongolian University of Life Sciences (formerly Mongolian State University of Agriculture) in 2003 as part of the Biodiversity and Ecosystem Restoration Research Project, a 21st Century COE Program headed by Professor Izumi Washitani of the Graduate School of Agricultural and Life Sciences, the University of Tokyo. This collaborative research continued even after the five-year program finished, and it was handed over to the Asian Conservation Ecology as Basis of Symbiotic Society, a Global COE Program, in 2008.

Mongolia has a harsh continental climate with high annual and diurnal temperature fluctuations and low levels of intermittent rainfall, which makes the ecosystem in the region very sensitive to climate change and anthropogenic disturbances. Moreover, political transition at the beginning of the 1990s in Mongolia, followed by livestock privatization and declines in infrastructure, caused a rapid increase in the concentration of livestock, which has resulted in land degradation. The missions of the Center are to understand such vulnerable arid ecosystems in relation to human activities, to effectively conserve grassland ecosystems, and to provide appropriate pasture management strategies to sustain ecosystem functions for future generations by taking the initiative in international and interdisciplinary research through exchanges of researchers, lecturers, and students, collaborative research, and holding lectures and symposiums.

Related Research Centers
Biotechnology Research Center

The Biotechnology Research Center is a University-wide center and plays a leading role in educational and research activities in biotechnology. The mission of the Biotechnology Research Center is to solve the problems associated with food shortage, environmental pollution, natural resource depletion, and human health, by utilizing plant and microbial biotechnology. All staff in the Center also participate in educational courses for graduate students in the Department of Biotechnology, Graduate School of Agricultural and Life Sciences. In addition, the Center supports researchers in other departments of the University by providing consultation and use of its facilities.

The Center was established as the Biotechnology Research Facilities in the Faculty of Agriculture, the University of Tokyo, in 1984. After several re-organizations, the Center currently has three core research divisions, Environmental Biochemistry, Cell Biology, and Plant Functional Biotechnology, two endowed research units, and three outside collaborative units.

<Core Divisions>

■ Laboratory of Environmental Biochemistry

The main focus of the research activities in this laboratory is as follows:

1) Analysis of novel metabolic capacities of bacteria for xenobiotics and their application to effective bioremediation of environmental pollution (Fig.1).

2) The elucidation of signal transduction pathways leading to activation of disease resistance in rice and their application in the development of agrochemicals conferring plant disease-resistance and rice cultivars resistant to pathogens.

■ Laboratory of Cell Biotechnology

The goal of the research in this laboratory is to understand the mechanistic principles and evolution underlying the biosynthesis of amino acids, cofactors, and biologically active natural products in microorganisms. Rapid change in metabolic flux response to environmental change is also one of our targets to study. The laboratory uses a variety of techniques to solve these problems including molecular biology, spectroscopy, enzymology, directed evolution, synthetic biology, and X-ray crystallography (Fig.2).

■ Laboratory of Plant Functional Biotechnology

This laboratory is studying molecular mechanisms underlying regulation of gene expression associated with nutrient assimilation pathways and signal transduction of nutrient signals in plants. Plant transcription factors are a focus of particular interest (Fig.3). The "omics" approaches, including functional genomics, proteomics, metabolomics, and phonomics, are employed to identify new mechanisms. This laboratory is also studying plant interaction with symbiotic microorganisms and the effects of rhizospheric microorganisms on plant growth.

<Endowed Research Units>

■ Laboratory of Microbial Metabolomics

This laboratory focuses on protein acylation in bacteria and investigates its biological functions and applications for metabolic regulation with proteomic, molecular biological, and structural biological approaches.

■ Laboratory of Microbial Membrane Transport Engineering

Membrane transport is important for the efflux of compounds synthesized in microbial cells. It is also essential for producing energy through respiration and photosynthesis. We investigate microbial channels and transporters using a unique microbial patch-clamp system developed in our laboratory and aim to improve the productivity of microbial cell factories through membrane transport engineering.

■ Collaborative Units>

■ Laboratory of Microbial Ecology

It is well known that the behaviors of microorganisms are quite different under laboratory conditions. This laboratory focuses on the elucidation of microbial behavior and functions in the natural environment, especially under oligotrophic and biofilm conditions.

■ Laboratory of Synthetic Biology

This laboratory aims to develop technologies for cloning biosynthetic gene clusters of bioactive natural products and for efficient production of them in genetically engineered microorganisms. Such technologies will enable the stable supply of bioactive compounds that could become leads in the development of new drugs.

■ Laboratory of Plant production systems engineering

The purpose of this research group is to elucidate mechanisms controlling plant productivity and development of innovative technology to improve plant productivity. This research group is currently engaged in investigation of plant-pathogen interactions and the nutrient-phytohormone interaction network.
Asian Natural Environmental Science Center

To achieve environmentally sustainable biological production, it is necessary to have a methodology that supports reasonable and feasible land use, as well as the efficient utilization of bioresources. At the same time, developing low-input technology for biological production is also required. These goals can best be achieved through the establishment of a new academic discipline that combines basic science and applied technology with the active implementation of international joint research.

The mission of ANESC is to establish such a foundation for sustainable biological production. Our aim is to achieve this through an integrated understanding of the continuum from forest to cropland and coastal ecosystems, while relating each ecosystem to its specific local environment and community. Our primary focus is on the Asian region where environmental problems are prominent due to the high utilization of bioresources. Moreover, ANESC promotes both advanced laboratory work and field work in cooperation with researchers and research institutes throughout Asia in order to conduct basic interdisciplinary research, with the goal of establishing new methods in field science that can serve as a focal point for the bioresources and environmental sciences in Asia.

ANESC is comprised of two fundamental divisions, the Division of Bio-Environmental Assessment and the Division of Biological Resources Development, both of which are staffed by tenured faculty. In addition, the Center includes the Interorganizational Collaboration Division of Resources and Environmental Management, staffed by adjunct faculty from international research institutes, and the Campus-wide Collaboration Division for Creative Research, staffed by tenured faculty of the university. One new research unit, the Wood Utilization System, was created in 2016 based on an endowment from The Norinchukin Bank. Tenured faculty, leading their own independent research laboratories, are involved in the education of graduate students in the Graduate School of Agricultural and Life Sciences, and they also supervise graduate students and post-doctoral fellows.

**Division of Bio-Environmental Assessment**
- Laboratory of Sustainable Material Design
- Laboratory of Coastal Marine Environment Assessment
- Laboratory of Regional Resources Reassessment

**Division of Biological Resources Development**
- Laboratory of Tree Physiology and Tropical Silviculture
- Laboratory of Environmental Stress Tolerance Mechanisms
- Laboratory of Forest Symbiology
- Laboratory of Tree Environmental Physiology
- Laboratory of Genomics of Plant Resources

**Interorganizational Collaboration Division of Resources and Environmental Management**

**Campus-wide Collaboration Division for Creative Research**

**Endowed Research Unit of Wood Utilization System**

To fulfill the mission of ANESC, the Center staff promotes the following international joint research programs in cooperation with researchers from other Asian countries: 1) environmental rehabilitation, aiming at the development of methods for restoring ecosystem function and increasing biological productivity applicable for the rehabilitation of degraded lands by utilizing stress-tolerant plants and symbiotic microorganisms, 2) solutions for global environmental problems, aiming at the development of basic technologies for sustainable land use and bioresource utilization as effective measures to mitigate climate change risks and conserve biodiversity, 3) regional resource utilization, aiming at the development of effective systems of regional resource utilization suitable and applicable in terms of socioeconomic and natural environments for sustainable development of local communities, and 4) genetic resource development, aiming at the exploration of useful genetic resources and the development of effective utilization methods for them to achieve sustainable biological production providing superior efficacy in terms of environmental restoration and conservation.

ANESC aims not only to be a research center for Asian bioresources and the environment at the University of Tokyo, but also to serve as a focal point for research activities designed to harmonize the utilization of biological resources and environmental conservation throughout Asia. Therefore, the ANESC staff regularly visit Asian regions to collaborate with local researchers and tackle serious local problems.

Fourty-one research institutes located in Asian and other countries are involved in international joint research activities.

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Division of Bio-Environmental Assessment
- Laboratory of Sustainable Material Design
- Laboratory of Coastal Marine Environment Assessment
- Laboratory of Regional Resources Reassessment

Division of Biological Resources Development
- Laboratory of Tree Physiology and Tropical Silviculture
- Laboratory of Environmental Stress Tolerance Mechanisms
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Interorganizational Collaboration Division of Resources and Environmental Management

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Locations of Affiliated Institutions

1. Yayoi Campus
2. Koishikawa Arboretum
3. Institute for Sustainable Agro-ecosystem Services (Nishitokyo Field)
   The University of Tokyo Tanashi Forest
4. The University of Tokyo Hokkaido Forest
5. Research Facility for Radiation Breeding
6. The University of Tokyo Animal Resource Science Center
7. The University of Tokyo Chichibu Forest
8. The University of Tokyo Chiba Forest
9. Fuji Iyashinomori Woodland Study Center
10. Arboricultural Research Institute
11. Fisheries Laboratory
12. Ecohydrology Research Institute