SUGADAIRA MONTANE RESEARCH CENTER
UNIVERSITY OF TSUKUBA

Outline of the University of Tsukuba Sugadaira Montane Research Center

1. Objective and History

This research center was founded on October 12, 1934 as Sugadaira Montane Biological Laboratory of Tokyo University of Literature and Science (Tokyo Bunrika Daigaku) to study the biology and geography of cool plateau areas.

Initially, the laboratory aimed to conduct basic agrobiologic research at Sugadaira, which has similar weather conditions to the northeast region of China. This project was promoted by Dr. Nobumasa Yagi, who was a technician at the Ministry of Agriculture and a part-time lecturer at Tokyo University of Literature and Science. Upon its establishment, Sanada Town (Ueda-shi and Tobu-cho) Association donated the building site, and Mr. Harumi Matsuo, a businessman originally from the locality of Nagano Prefecture, donated the funds to construct the building. The laboratory was also used by the teachers of Tokyo Higher Normal School (Tokyo Koutou Shihan) for studies in other fields, such as zoology, botany, geography, and geology, and for students' field education and field tests.

In 1949, in accordance with an education reform, the laboratory was renamed Sugadaira Montane Biological Laboratory of the Faculty of Science, Tokyo University of Education (Tokyo Kyoiku Daigaku), and was later established as a government organization in 1965. Along with its renaming, the use of the laboratory as an educational research institute started. The number of the staff was fixed at 8 persons, comprised of 1 director (serving concurrently), 1 professor, 2 assistants, and 4 other staff members. In 1969, after experiencing the Matsushiro Earthquake Swarm, the current ferroconcrete laboratory (Laboratory A) and dormitory were built to further equip the laboratory for field education and research. The arboretum, developed since 1955, had grown to become a large forest, so it was initially opened to the general public in 1975.

Tokyo University of Education became the University of Tsukuba in October 1973, the control of the laboratory was transferred to the University of Tsukuba in April 1977, and the laboratory was renamed the Sugadaira Montane Research Center, University of Tsukuba. Along with the increasing number of students, a new laboratory (Laboratory B) was built in 1979, and the warehouse was rebuilt in 1981, resulting in the research center achieving its current size.

In Japan, there are very few educational research institutes that specialize in research on mountainous regions. Apart from the Sugadaira Montane Research Center, there is only Mt. Hakkoda Botanical Laboratory of Tohoku University, the Institute of Nature Education in Shiga Heights of Shinshu University, and Hikosan Biological Laboratory of Kyushu University. Among these institutes, the Sugadaira Montane Research Center is the largest both in terms of its size and organizational scale. Conveniently located in a cold highland region at an altitude of about 1,300 m in the middle of Honshu, Japan, the research center has fully utilized its large test site (the research center's test site is registered as the core test site of the Japan Long-Term Ecological Research Network "JaLTER"), grounds, facilities, and equipment, and has markedly developed as a place for education and research in fields related to environmental sciences, such as biology, earth science, and agriculture. Further, by opening up to other universities and research institutions as well as to the community as much as possible, the research center aims to contribute to the development of education and research in the field of environmental sciences, including interdisciplinary studies, and social education.

2. Location and Environment

The Sugadaira Montane Research Center is located roughly in the center of the Sugadaira plateau, Ueda-shi, Nagano Prefecture at an altitude of approximately 1,300 m. The Sugadaira plateau is located in the central part of Honshu, Japan (latitude 36°31'N, longitude 138°21'E). The Sugadaira plateau, together with the nearby Asama and Shiga-Kusatsu plateaus, is included in the Joshin'etsu Kogen National Park. It adjoins the Nagano basin (Zenkoji basin) in its northwestern region.

Sugadaira is comprised of the plateau area, which extends on the southwest slopes of Mount Neko and Mount Azumaya, the northeast slope of Mount Oomatsu on the west, and the basin-shaped marshland area, which extends between the slopes. This basin was previously a lake formed by the natural damming of a river caused by volcanic eruptions. In the middle of the basin is a marshy area called the Sugadaira marshland. The slopes of Mount Neko and Mount Azumaya are deeply carved by Daimyoujin-sawa and Nakano-sawa streams. These geographic features were formed by the Azumaya Volcano, which erupted in the Tertiary period about

2 million years ago. In areas with gentle slopes, volcanic ash is piled up thickly upon volcanic rocks. Highland vegetables are grown in the ando soil "Kuroboku-do", formed by detritus accumulating on top of the volcanic ash layers.

The annual mean temperature in Sugadaira between 1971 and 2000 was 6.5°C, close to the that of the districts along the shore of the Sea of Okhotsk. However, the climate of Sugadaira is an inland climate with large temperature fluctuations between the day and night. It is very cold in winter. Every year, midwinter days with subzero temperatures persist from December to March. The snow starts falling from around late November and continues until around early April (the average number of continuous snow cover days is 118). Although the average number of days with snow is high, the amount of snowfall is small, because the snow is dry. At the coldest time, the temperature in this area set a record of -29°C. The summer days are mostly cool and dry. The daily maximum temperature rarely exceeds 25°C. With a mean annual precipitation of about 1,100 mm, this is an area receiving a relatively small amount of rain in Japan.

It is considered that this area used to be covered by a deep forest of Japanese beech (*Fagus crenata*), which is a summer-green broad-leaved tree, before people started living in Sugadaira. The virgin forests of *F. crenata* were later lost through deforestation and forest fires. Currently, many areas in Sugadaira are covered with Japanese oak (*Quercus crispula*), Japanese red pine (*Pinus densiflora*), Asian white birch (*Betula platyphylla* var. *japonica*), and Erman's birch (*Betula ermanii*) forests. The section where these forests had been cut down has become a Japanese pampas (*Miscanthus sinensis*) grassland. The turf grasslands seen at skiing grounds and meadows were formed by cattle grazing in the *M. sinensis* grassland. However, the turf grasslands would turn back to their former state of *M. sinensis* grasslands soon if cattle stopped grazing. If the *M. sinensis* grassland is left as it is, it would turn into *P. densiflora* and *B. platyphylla* var. *japonica* forests. Flat areas other than marshlands are used as lettuce, cabbage, and Chinese cabbage fields. Areas with steep slopes and high elevations are used as skiing grounds. Other areas are used as meadows, grounds, and a Japanese larch (*Larix kaempferi*) plantation.

The Sugadaira marshland is comprised of the area on the lower reaches where a moist forest of Japanese alders (*Alnus japonica*) and Japanese ashes (*Fraxinus mandshurica*) grow, and the area on the upper reaches with a marshland in which sedges, such as *Carex rhynchophysa* and blister sedge (*Carex vesicaria*), grow. In the moist forest, rare northern trees, such as *Crataegus chlorosarca*, Miyabe's maple (*Acer miyabei*), *Acer miyabei* f. *shibatae*, *Lonicera vidalli*, and Amur honeysuckle (*Lonicera maackii*), grow.

The valley that carves the mountain slopes is thickly wooded by a deciduous broad-leaved forest of *Q. crispula*, Japanese linden (*Tilia japonica*), Siberian alder (*Alnus hirsuta* var. *sibirica*), and Japanese horse chestnut (*Aesculus turbinata*). At the forest edge, rare plants, such as an alpine wild rose (*Rosa marretii*) and *Triosteum sinuatum*, grow.

As you climb Mount Neko and Mount Azumaya, many *B. platyphylla* var. *japonica* that cover them are replaced by *B. ermanii* from an altitude of about 1,500 m. Then, *B. ermanii* also become sparse when you reach a place with a carpet of short cowberries (*Vaccinium vitis-idaea*), black crowberries (*Empetrum nigrum* var. *japonicum*), and bog bilberries (*Vaccinium uliginosum*). Although this altitude is fit for subalpine coniferous forests, such forests have not yet grown on Mount Neko and Mount Azumaya. However, if you climb further and reach near the crest, you can see coniferous trees, such as Christmas tree (*Abies veitchii*) and Japanese hemlock (*Tsuga diversifolia*). You can also see some grassland, where plants, such as *Orchis aristata*, *Patrinia triloba*, and *Adenophora nikoensis* grow, and butterflies, such as the alpine clouded yellow (*Colias paraeno*) and Japanese argus (*Erebia niphonica*), are present.

As a characteristic of the vegetation in Sugadaira, there are many relic species originating from cold areas. These species were distributed throughout the Japanese islands in the last ice age, but as the ice age came to an end, their distribution narrowed. Currently, they can be seen only in high-latitude and high-altitude regions, such as Sugadaira. In Sugadaira, the relic species that originate in cold areas includes the aforementioned *L. vidalli*, *L. maackii*, *R. marretii*, *A. miyabei*, *A. miyabei* f. *shibatae*, *C. chlorosarca*, and *T. sinuatum*.

The forests and grasslands of Sugadaira are inhabited by many mammals, such as the hare (*Lepus brachyurus*), Japanese squirrel (*Sciurus lis*), dormouse (*Glirulus japonicus*), Japanese bear (*Selenarctos thibetanus japonicus*), Japanese raccoon dog (*Nyctereutes procyonoides*), Japanese fox (*Vulpes vulpes japonica*), marten (*Martes melampus melampus*), Japanese weasel (*Mustela sibirica itatsi*), Japanese ermine (*Mustela erminea nippon*), Japanese badger (*Meles meles anakuma*), and Japanese serow (*Capricornis crispus*).

The birds in Sugadaira include the Japanese nutcracker (*Nucifraga caryocatactes japonica*), north China alpine accentor (*Prunella collaris erythropygia*), and Japanese golden eagle (*Aquila chrysaetos japonica*). In the summer, this place is filled with the songs of the Japanese cuckoo (*Cuculus canorus telephonus*), little cuckoo (*Cuculus poliocephalus poliocephalus*), Himalayan cuckoo (*Cuculus saturatus horsfieldi*), and Chinese hawk cuckoo (*Cuculus fugax hyperythrus*). The Siberian blue chat (*Erithacus cyane*), Japanese blue flycatcher (*Muscicapa cyanomelana cyanomelana*), narcissus flycatcher (*Muscicapa narcissina narcissina*), Japanese brown thrush (*Turdus chrysolaus*), and woodpeckers nest in the plateau forests, while green pheasant (*Phasianus colchicus versicolor*), the Japanese stonechat (*Saxicola torquata stejnegeri*), and chestnut-eared bunting (*Emberiza fucata fucata*) nest in the grasslands. In winter, rosy finches and duck come during their migration. Over one-hundred bird species have been recorded in Sugadaira. The Sugadaira marshland is inhabited by Japanese black salamanders (*Hynobius nigrescens*), while the stream is inhabited by Japanese clawed salamanders (*Onychodactylus japonicus*).

Among insects, beetles, such as horned dung beetles (*Copris ochus*), which swarm about the cow dung in the meadow and rubus fritillary butterflies attract attention. In addition to the aforementioned *C. paraeno*, you can also see insects that are rare in view of their geographical distribution, such as the snowfly (*Chionea* sp.), stoneflies such as *Allocapniella tikumana* (related to *Eocapnia nivalis*) and *Scopura longa*, and Grylloblattodea.

3. Management and Organization

The Sugadaira Montane Research Center is managed by its director in accordance with the decision made by the management committee (comprised of 7 committee members). The staffs are comprised of the following members (as of October 2009):

1 director/professor (serving concurrently)	1 research associate
1 associate professor	1 chief secretary
2 assistant professors	2 technical staff members
1 research worker	7 part-time staff members

4. Facilities and Equipment

Facilities: The gross area of 35 hectares, which is divided into an arboretum (4.5 ha), grassland section (6 ha), Japanese red pine forest section (8.5 ha), summer-green broad-leaved forest section (14 ha), and facility section (2 ha), are maintained and managed for educational and research use.

The buildings in the research center are comprised of Laboratory A (968 m^2) and a dormitory (634 m^2), which were built in 1969, Laboratory B (639 m^2), which was built in 1979, and a warehouse, which was built in 1981.

Equipment: As the equipment for education and research, there are 20 anemometer-anemoscopes, 20 Assmann aspiration psychrometers, 10 self-recording thermometers, an integrated meteorological data acquisition system, 30 pairs of binoculars, 5 field scopes, 40 student microscopes, 40 student stereomicroscopes, TV-microscope systems, an image analysis system, an intelligent universal microscope for research, 10 biological microscopes for research, 10 stereomicroscopes for research, a scanning electron microscope with an integrated light microscope, a transmission electron microscope with an integrated light microscope, a fluorescence stereomicroscope, a photosynthesis-measuring system, a CN coder, low temperature baths, a profile projector, clean benches, a multipurpose bioreactor, a carbon dioxide analyzer, a flame photometer, a DNA sequencer, 3 DNA amplification systems, incubators, an automatic acid rain/snow analyzer, an air sampler, a herbarium, and an insectarium. For field investigation and field work, there are 2 cars with four-wheel drive, a field work vehicle, and a tractor.

The research center's library houses 2,500 foreign books, 1,700 Japanese books, 30 magazines (6 Japanese and 24 foreign), 6,500 donated documents, and 5,000 animal morphology documents.

5. Educational/Research Activities

Educational Activities: Lectures, field education, and field tests in biology, earth science, and related fields. Guidance on graduation theses in biology and related fields. Guidance on studies in master's and doctor's

courses in biology and earth science. Because of the limited number of facilities for field education in Japan, this research center is also used for field training by universities other than the University of Tsukuba. As a part of social education, the arboretum in the research center is open to the general public. Every year, around the summer, about 2,000 people visit the arboretum. The research center also aims to become more accessible to the community by holding open seminars for non-students as well as high school students.

Research Activities: The research is conducted mainly by the lecturers and graduate students who belong to the research center. In the biodiversity field, systematic studies from the viewpoint of the comparative embryology and morphology of insects and systematic studies of fungi are conducted. In the field of ecology/ environmental science, ecological studies at the levels of population, community, and ecosystem are conducted. This research center is open not only to researchers of the University of Tsukuba, but also to researchers of other universities and research institutions in Japan and abroad. Fully utilizing its favorable location, this research center is used for a wide range of studies related to biology (such as systematic studies and ecology), earth science (such as meteorology, human geography, and hydrology), and agriculture. As the research center's basic operation, a weather survey is continuously conducted, and the data are utilized as basic research material. As part of the research activities, this research center invites researchers from Japan and abroad to hold seminars, workshops, and symposiums, and issues Bulletin of the Sugadaira Montane Research Center University of Tsukuba. Making biology-related materials, earth science-related materials, such as meteorological data, and expert knowledge open to the community and society is also one of the important activities of this research center.

Between 4,000 and 5,000 people use this research center annually for education and research.

6. Test Site Maintenance

For this center to be fully operational as a place for education and research on natural history, the research center's site is divided into that of an arboretum, and a grassland, a Japanese red pine forest, and a summer-green broad-leaved forest, and each section is maintained according to its objective.

Arboretum: The construction of the arboretum started in 1955 on ground previously used as farm land. The arboretum has grown into a large forest with over 200 species of trees. To restore the Japanese beeches *Fagus crenata* forest that used to be in Sugadaira, young *F. crenata* trees have been planted on the forest floor of the *Betula platyphylla* var. *japonica* forest and the changes during the growth of *F. crenata*, such as those in the biota, micrometeorological data, and soil, have been recorded, and the site is managed so that it is available for field education and research.

Grassland: Plants, such as Japanese pampas grass (*Miscanthus sinensis*), bracken (*Pteridium aquilinum*), bush clover (*Lespedeza bicolor*), burnet (*Sanguisorba officinalis*), feather columbine (*Thalictrum aquilegifolium* var. *intermedium*), and gypsy rose (*Scabiosa japonica*), grow in this typical grassland of mountain areas in Honshu, Japan. If left as it is for 5 or more years, *P. densiflora* and *B. platyphylla* var. *japonica* would start to grow and turn the grassland into a forest. To prevent this and maintain the pampas grassland test site, these trees are removed.

Japanese red pine forest : As mentioned above, if the grassland is left alone in Sugadaira, it would become a Japanese red pine (*P. densiflora*) forest. In this section, *P. densiflora* trees are maintained in different phases after developing in the grassland, from their status as young adult trees, to mature *P. densiflora*, to the subsequent development of *Quercus crispula*, thus providing an ideal place for various researches.

Summer-green broad-leaved forest: This valley forest is comprised of *Q. crispula*, *Tilia japonica*, and *Aesculus turbinata* which have developed along the Daimyoujin-sawa stream flowing through the site east and west. This is the most nature-rich section of the site and is also one of the most well-preserved valley forests in the Sugadaira area. It is inhabited by many animals and plants. This very useful site for educational training and research on biology and environmental sciences has been preserved and maintained with the utmost care.

7. History

1933
- Dr. Nobumasa Yagi (a part-time lecturer at Tokyo University of Literature and Science), who belonged to the Agricultural Research Institute of the Ministry of Agriculture, started a movement to establish a basic test site for the Manchurian reclamation project.
- Sanada Town (Ueda-shi and Tobu-cho) Association donated an area of approx. 30 hectares.

1934
- Although the required funds were not yet available, the construction project's first phase was started with a donation by Mr. Harumi Matsuo, a businessman originally from the locality of Nagano Prefecture. The construction was completed in 1938 (with a donation of 15,000 yen).
- The Sugadaira Biological Laboratory of Tokyo University of Literature and Science was founded for basic research and field education on plateau biology.

1939
- The laboratory installed 5 telephone lines via the Sugadaira office (Sugadaira office No.2).

1941
- A labor service corps was organized and land development of the site involving a student labor service started.

1948
- The laboratory made available 5 hectares of reclaimed land to Sugadaira Agricultural Committee.

1949
- According to the enactment of the National School Establishment Law, Tokyo University of Literature and Science became Tokyo University of Education, and the laboratory was attached to the Faculty of Science of the new university.

1952
- A problem occurred due to pollution from the Daimyoujin-sawa sulfur mine. The area was designated a national park, and the mining was stopped.

1953
- Prof. Tomoo Miwa was inaugurated as the first director.

1954
- The 5 hectares of land that were made available to the farmers in the neighboring districts were returned to build an arboretum.

1955
- Construction of the arboretum started.

1962
- Prof. Kozo Hayashi was inaugurated as the director.

1963
- The Society for the Research of Sugadaira was established.

1964
- Prof. Hiroshi Ito was inaugurated as the director.
- The 30th anniversary was commemorated.
- The first dormitory for lecturers (Sugadaira dormitory No.1) was built.

1965
- The laboratory was renamed Sugadaira Biological Laboratory of the Faculty of Science, Tokyo University of Education.
- The Matsushiro Earthquake Swarm started on August 3. The swarm reached its peak in 1966, and damaged the Sugadaira Biological Laboratory.

1967
- The first phase of fencing construction was completed. (171 m)

1968
- Prof. Hiroharu Indoh was inaugurated as the director.

1969
- The construction of Laboratory A and the student dormitory (of the secondary school attached to the university) was completed.

1970
- The second phase of fencing construction was completed.

1971
- Prof. Kazutoshi Nishizawa was inaugurated as the director.
- Sugadaira Plateau Nature Museum was built by the local Sanada Town. Many specimens of insects and plants stored in the Sugadaira Biological Laboratory were donated to the museum.

1972
- The third phase of fencing construction was completed.

1973
- The University of Tsukuba was founded.
- Construction of the fencing and main entrance was completed.

1974
- The 40th anniversary was commemorated.
- The arboretum was opened to the general public.
- The rock garden was built.

1975
- Prof. Shun-ei Ichimura was inaugurated as the director.

1977
- The laboratory was renamed the University of Tsukuba Sugadaira Montane Research Center. The control of the dormitory was transferred from the attached secondary school to the research center.

1978
- Prof. Shun-ei Ichimura was inaugurated as the director of the Sugadaira Montane Research Center.

1979
- The construction of Laboratory B and fire prevention facilities was completed.

1980
- Prof. Mitsuo Chihara was inaugurated as the director.

1981
- The Sugadaira Montane Research Center's first open seminar (for teachers at primary and secondary schools in Nagano Prefecture) was held.

1982
- Prof. Shun-ei Ichimura was inaugurated as the director.
- The research center was severely damaged by the 10th typhoon of the season.

1984
- Prof. Hiroshi Ando was inaugurated as the director.
- The 50th anniversary of Sugadaira Montane Research Center was commemorated.

1985
- The research center site was measured.

1987
- Prof. Haruo Kurokawa was inaugurated as the director.

1988
- Prof. Masukichi Okada was inaugurated as the director.
- The Sugadaira Montane Research Center's fifth open seminar (for high school students) was held.

1989
- On the death of the Emperor Showa, the era name Heisei was adopted on January 8.

1990
- Prof. Tatsuaki Shibuya was inaugurated as the director.
- Localized torrential rainfall (A power failure occurred from 16:25 to 17:25. The amount of rainfall was 87 mm. The research center and its surroundings were severely damaged.)

1992
- Prof. Ichiroku Hayashi was inaugurated as the director.

1998
- Sugadaira Montane Research Center underwent third-party evaluation.
- The construction of an exercise ground (Sania Park Sugadaira) on the west side of the research center was completed.

2003
- Prof. Seiji Tokumasu was inaugurated as the director.

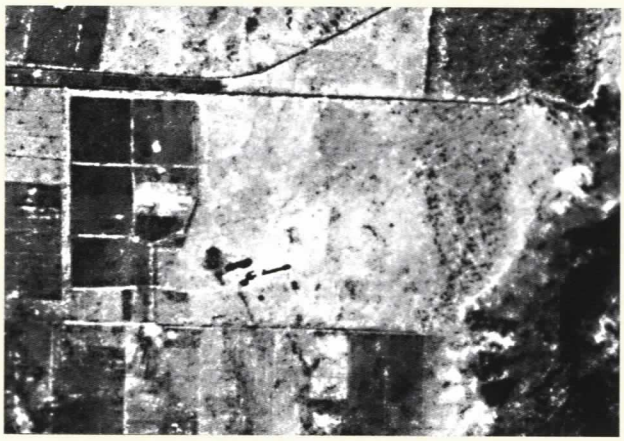
2004
- The research center became Sugadaira Montane Research Center, National University Corporation University of Tsukuba.

2008
- Prof. Osamu Numata was inaugurated as the director.

2009
- The 75th anniversary of Sugadaira Montane Research Center was commemorated on October 8.

Aerial photograph of Sugadaira Montane Research Center
(20, May, 2005)

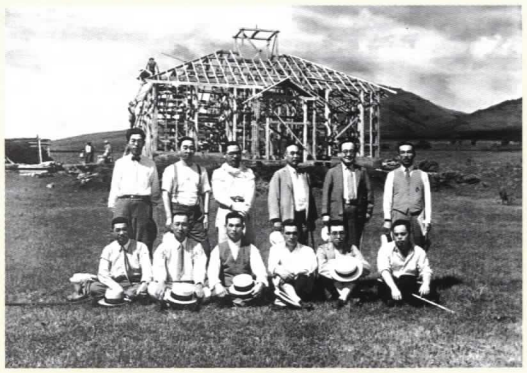
Approximately 1955



1965

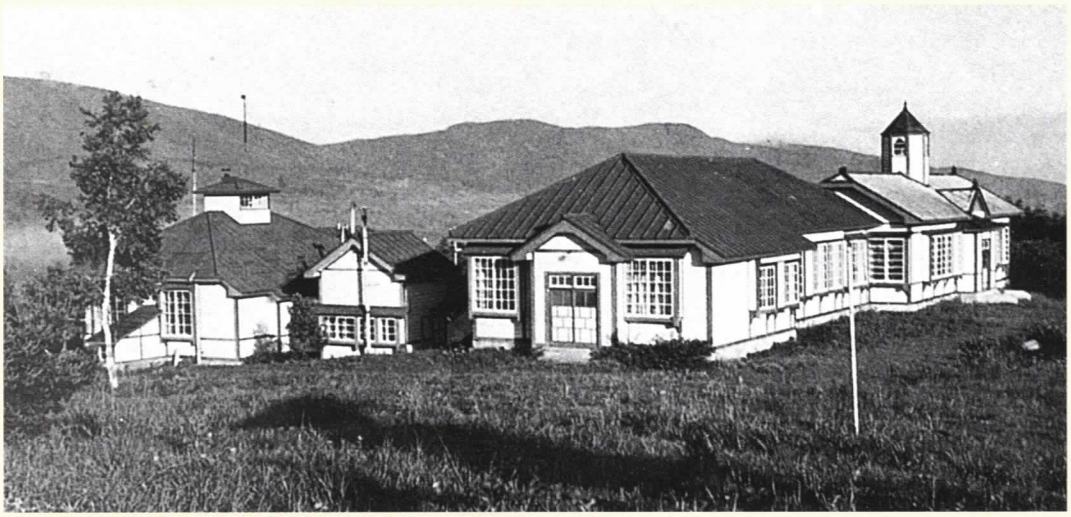
1979

Aerial photographs of Sugadaira Montane Research Center



The first phase of construction (1934)

The second phase of construction (1935)



Buildings at the time of the foundation

Main building and green house (right)

Shed

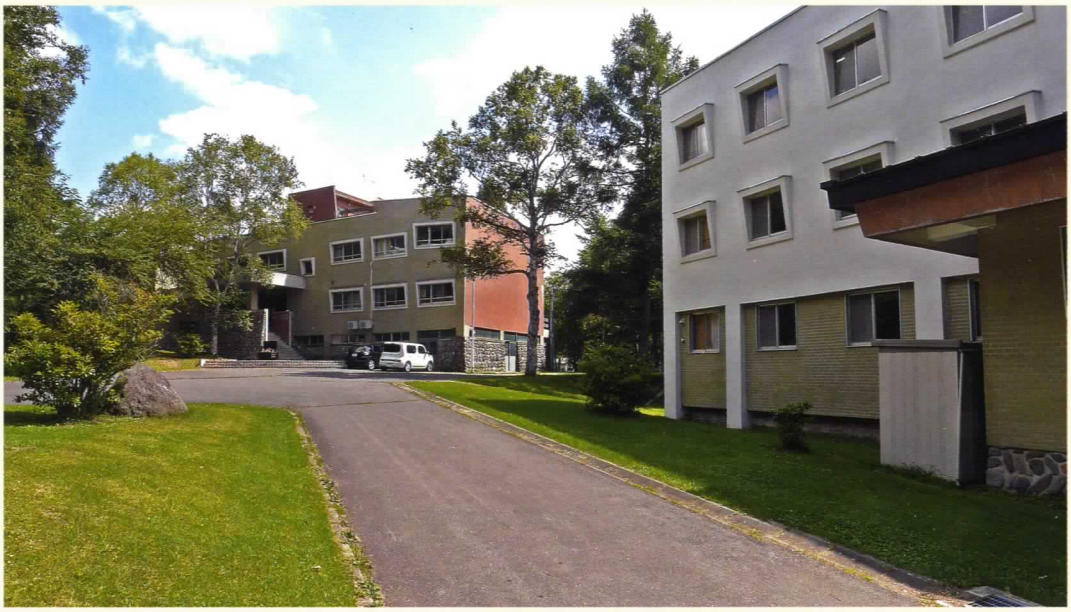
Laboratory A (left) and Student dormitory (right), constructed in 1969

The 40th anniversary ceremony (1974)

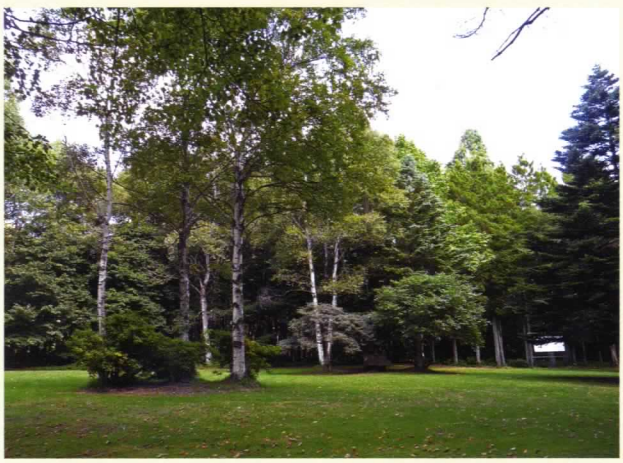
Laboratory B, constructed in 1979

Previous student dormitory (Daimyoujin-ryo) (1971)

Dormitories for lecturers (1980)



Laboratory and Student dormitory (2009)



Arboretum (2009)

Fruiting of planted *Fagus crenata* (2005)

Seedling of *F. crenata* (2009)

Farm before construction of arboretum
(harvesting scene of buckwheat) (approximately 1955)

Construction of a main gate (1961)

Early years of arboretum (1957)

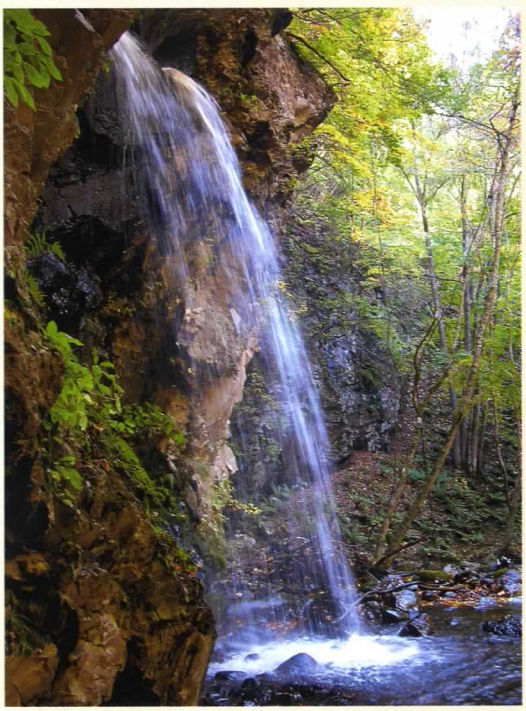
Arboretum, under construction (1969)

Row of *Larix kaempferi* trees and artificial miniature hill
(viewed from the place of student dormitory at the present)

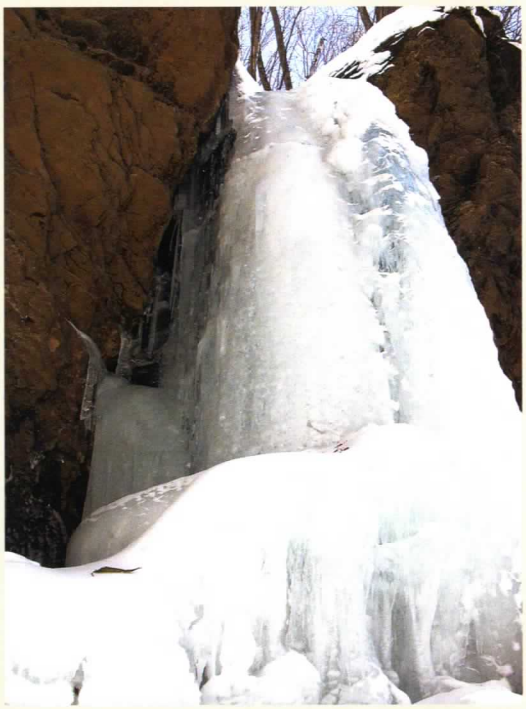
Young trees of *F. crenata* planted

Daimyoujin-sawa (waterfall can be seen in the center)
(approximately 1932)

A distant view of Daimyoujin-no-taki (waterfall)
(1932)



Daimyoujin-no-taki (waterfall) (2005)

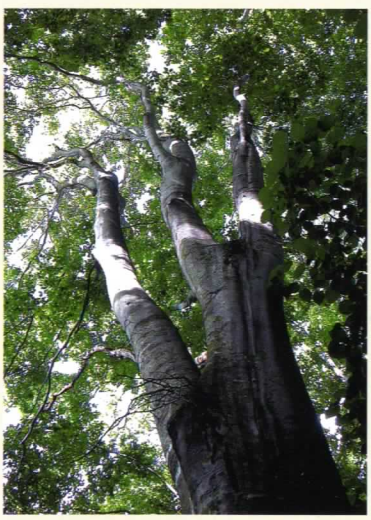


Frozen scene of Daimyoujin-no-taki (waterfall)
(2007)

Miscanthus sinensis grassland in the campus (2006)

Pinus densiflora forest in the campus (2005)

Summer-green broad-leaved forest in the campus (2005)



Fagus crenata tree of Oobora (2005)

Sugadaira marshland (1976)

Erigeron thunbergii

Pulsatilla cernua

Lilium leichtlinii var. *tigrinum*

Platycodon grandiflorus

Patrinia scabiosifolia

Triosteum sinuatum

Scabiosa japonica

Hemerocallis citrina var. *vespertina*

Sanguisorba officinalis

Parnassia palustris var. *multiseta*

Rhododendron degronianum

Rosa marretii

Lonicera maackii

Enkianthus campanulatus

Acer miyabei

Crataegus chlorosarca

Flower (left) and fruit (right) of *Vaccinium uliginosum*

Malus sieboldii tree in front of the laboratory

Acer saccharum tree planted in a memory of the late Dr. Ryuichi Matsuda

Macrolepiota procera

Phallus impudicus var. *togatus* (*Dictyophora duplicata*)

Amanita hemibapha

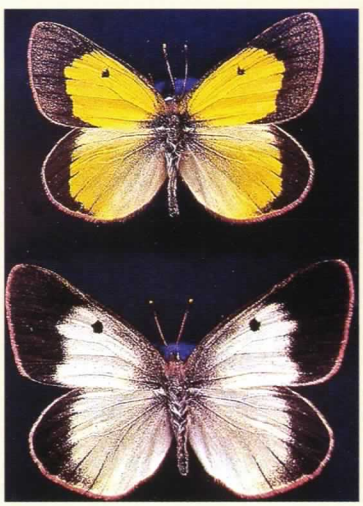
Amanita muscaria

Carpodacus roseus

Treron sieboldii

Capricornis crispus

Sciurus lis



Colias palaeno, male (top) and female (bottom)

Egg sacs of *Hynobius nigrescens*

Galloisiana yuasai

Chionea sp.

Scopura montana

Allocapniella tikumana

Laboratory and Field Studies in Plant Taxonomy, College of Biological Sciences, University of Tsukuba (Jul. 2006)

Laboratory and Field Studies in Animal Taxonomy, College of Biological Sciences, University of Tsukuba (Jul. 2006)

JTP (Junior Year at Tsukuba Program) Biological Seminar I, "Field Guide to Animals in Snow of Winter", College of Biological Sciences, University of Tsukuba (Mar. 2008)

Field training course on the ecosystem of highlands, for general high school students, held by College of Biological Sciences, University of Tsukuba (Aug. 2008)

General field training course for the "BS League (Biological Science League): Be a Biologist in the Future!" by the College of Biological Sciences, University of Tsukuba, under the JST Project "Fostering Next-Generation Scientists" (Dec. 2008)

Field training courses for the JSP Super Science High School (SSH) and JSP Science Partnership Project (SPP) (Oct. 2008)

Field training course for universities other than University of Tsukuba (Aug. 2008)

Guidance of the arboretum to the general public (Jul. 2008)

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