

# Ashiu Forest Research Station

The university field site with distinctive climatic, geological, and ecosystem features.



Hitsukura-dani valley

*University Forest Research Stations provide an important field for studies and educations in forest and ecosystem science. Results obtained from these study areas can contribute to our understanding of the problems of climate change and environmental degradation facing modern society.*

*Kyoto University has four Forest Research Stations, one each in Kyoto, in Wakayama and two places in Hokkaido. Of these, Ashiu Forest Research Station, formerly called Ashiu University Forest, is the biggest and the oldest, dating back to 1921. Currently under the management of the Field Science Education and Research Center, Kyoto University, this forest is used by national and international researchers for its distinctive environmental features and biodiversity. Other visitors are also drawn to the beauty of the forest.*

THE ASHIU Forest Research Station (AFRS <sup>12</sup>), Field Science Education and Research Center (FSERC) preserves a wide area of natural forest, protecting it from human activities. AFRS is located in a boundary area with Shiga and Fukui Prefecture in the northeast part in Kyoto Prefecture. The Yura-gawa River, which flows into the Japan Sea, has its riverhead in this area. The administrative office of AFRS is in Ashiu village. Although this village is only approximately 35km by the linear distance or a 2-hour drive, from the center of Kyoto City, it is surrounded by unpopulated land. Ashiu has high precipitation and humidity throughout the year, due to being under Pacific climate in the summer and the Japan Sea climate during the winter.

The AFRS has an area extending to approximately 4,200 hectares, with altitudes ranging from 355 to 959m above the sea level. The administrative is located at the lowest point, and the highest point is the summit of Mt. Mikuni-dake, the third highest mountain in Kyoto Prefecture. Two-thirds of the area is at more than 600m above the sea level.

## Japan's Leading Diversity of Vegetation

The AFRS has a wide diversity of vegetation, because this area includes zones from warm-temperate to lower cool-temperate, and contains plants suitable to the Pacific climate and the Japan Sea climate. So far, around 240 species of woody plants (including subspecies), more than 530 species of herbaceous plants, and eighty five species of ferns have been identified.

Broad-leaved plants grow according to the vertical distribution of the forest. At altitudes up to 600m above the sea level, this area is mainly warm-temperate deciduous forest, whereas the areas above 600m above the sea level are primarily cool-temperate deciduous forest dominated by *Buna*: Siebold's Beech (*Fagus crenata*) and *Mizunara*



Trunk of Siebold's Beech

1) Ashiu-sugi is famous for its asexual reproduction mechanism whereby a root originates from the tip of the branch that eventually touches the ground (e.g., branches drooped by the weight of snow or branches of a tree blown down by a storm). According to *Genshoku Nihon-Jumoku Zukan*, edited by Shiro Kitamura and Shogo Okamoto (Osaka: Hoikusha Pub. Co., Ltd., 1959), Ashiu-sugi is a Japanese cedar variant, and its taxonomic name is attributed to Dr. Takenoshin Nakai.



(*Quercus mongolica* var. *grosseserrata*). Cool-temperate deciduous forest, which occupies a major part of AFRS, is dominated by Ashiu-sugi (*Cryptomeria japonica* var. *radicans*)<sup>1)</sup>, a variety of Sugi: Japanese Red Cedar specific to the Japan Sea side.

Among herbs and ferns, Zenteika (*Hemerocallis dumortieri*), Ashiu-tennanshō (*Arisaema robustum* var. *ovale*), and Ryūkinka: Marsh-Marigold (*Caltha palustris* var. *nipponica*) should be noted for geographic distribution and scientific interest. Ashiu is believed to be the southern limit for Zenteika, a relict. The other two species are sparse and localized in a narrow range of distribution. In addition, Hime-komayumi (*Euonymus alatus* var. *microphyllus*), a species distributed in a very limited area, has also been found in the AFRS.

### Animal Inhabitants of the Forest

Thanks to the rich flora, a various of animals inhabit the AFRS, with many of the large animals living in Honshu having been found there. In addition, Kurohōhigekōmori: Frosted Myotis (*Myotis mystacinus*), Mizuramogura (*Euroscaptor mizura*), and other endangered or valuable species have been identified.

To date, 111 species of birds belonging to thirty

three families have been documented, including Kumataka: Japanese Hawk-Eagle (*Spizaetus nipalensis orientalis*) and Ōtaka: Japanese Goshawk (*Accipiter gentilis fujiiyama*). For reptiles and amphibians, Ōsanshōuo (*Megalobatrachus japonicus*), a nationally protected rare species, was detected at the waterhead of the Yura-gawa River, as well as Hida-sanshōuo (*Hynobius naevius kimurae*), Moriaogaeru (*Rhacophorus arboreus*), and Kajikagaeru (*Rhacophorus buergeri*). Shiromadara (*Dinodon orientalis*), arguably the most beautiful among snakes native to Japan, has also been reported.

The AFRS is also rich in small animals including Gunbaitonbo (*Platycnemis foliacea sasakii*) and Moiwasanae (*Davidius moiwanus*) dragonflies, and Gifuchō (*Luehdorfia japonica*), Hisamatsu-midori-shizimi (*Chrysozephyrus hisamatsusanus*), and Ōmurasaki (*Sasakia charonda*) butterflies. Some of these are rare in other parts of Kyoto. Ants of both southern origin and northern origin have been observed, including rare species, such as Kebukatsuyaoari (*Camponotus nipponensis*). Many rare and precious Long-horned beetle species have also been observed in the AFRS.





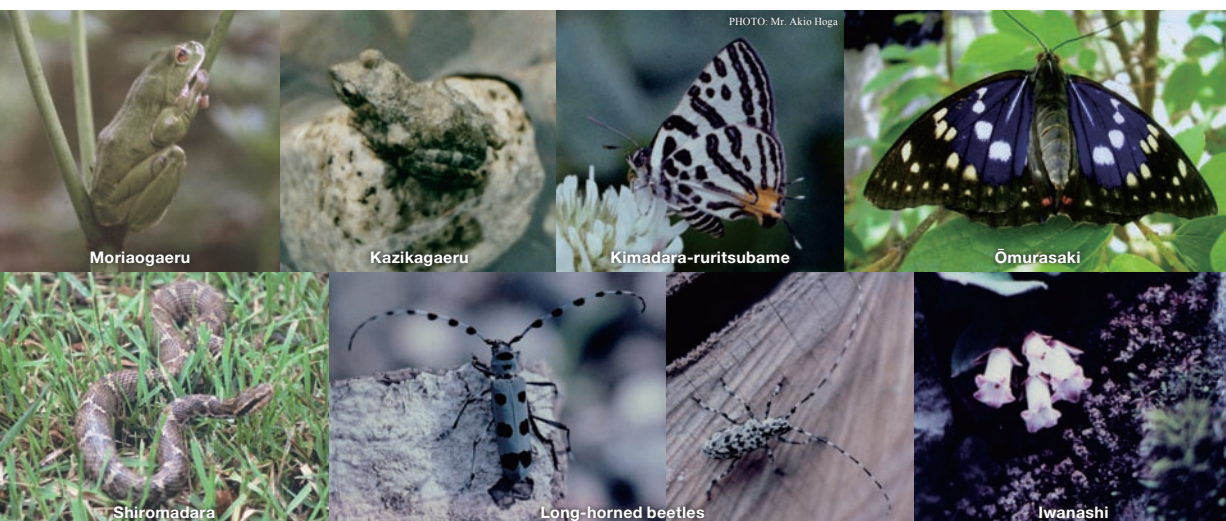


PHOTO: Mr. Akio Hoga

Moriaogaeru

Kazikagaeru

Kimadara-ruritsubame

Omurasaki

Shiromadara

Long-horned beetles

Iwanashi

## Four Seasons

Along with Ashiu's rich diversity of species, some of which were mentioned above, the rotation of the four seasons contributes to the beauty of the scenery.

Early April every year, when the remnant snow patches start to disappear around the administration office, the AFRS hosts a ceremony to mark the first day of entering the mountains that had been locked with snow during the winter. In this ceremony, staff members pray for safety during their activities in the coming season. While the hilltops are still covered with snow, ridges show a terrain of snow-free land, due to the power of the sunlight. Snow starts to melt around the roots of trees and exposed rocks. Mountain streams, though covered with a thick layer of snow, carry forth gushing icy water, powerfully melting the frozen snow.

As the snow starts to retreat, flowers begin to bloom. Although many mountain flowers may seem unspectacular from afar, they are neat and appealing on a close look. In early spring, Tamushiba: Willow-leaved Magnolia (*Magnolia salicifolia*) displays white flowers around the ridges against a backdrop of needle-leaved trees such as Asiu-sugi, Momi: Momi Fir (*Abies firma*), Tsuga: Japanese Hemlock (*Tsuga sieboldii*), Hinoki:

Hinoki Cypress (*Chamaecyparis obtusa*), and Akamatsu: Japanese Red Pine (*Pinus densiflora*), and evergreen broad-leaved trees such as Urazirogashi (*Quercus salicina*). Pretty yellow flowers belonging to Dankōbai (*Lindera obtusiloba*), Maruba-mansaku (*Hamamelis japonica* var. *obtusata*), and Kibushi (*Stachyurus praecox*) appear as well. Kinki-mamezakura (*Prunus incise*) produces pretty pinkish flowers, waiting to catch the eye of the careful observer. As the snow melts and disappears from the ground, San'in-shirokanesō (*Isopyrum nipponicum*), Nekonomesō: some species of genus *Chrysosplenium*, Iwanashi (*Parapyrola asiatica*), Iwauchiwa (*Shortia uniflora*), Ōiwakagami (*Shortia soldanelloides* var. *magna*), Miyama-kikeman (*Corydalis pallida* var. *tenuis*), Hime-enkogusa (*Corydalis lineariloba* var. *capillaris*), and many different species of Violet (genus *Viola*).

Siebold's Beech is among the trees with the earliest flush of new leaves in the spring. Its yellow-green leaves delight the observer. One may argue that early spring is the most colorful and vivid period within the year in the AFRS. Many species of Kaede: Maple (genus *Acer*), Shide: Hornbeam (genus *Carpinus*) and Nara: deciduous Oak (genus *Quercus*), and Katsura:

## Ashiu Forest Research Station's Office



The cover of this issue features one of the most distinctive buildings of Kyoto University's Ashiu Forest Research Station. Located close to its entrance, the building is currently used as the station's office. It was originally built as a research laboratory in 1931, and a small railway starting in front of the office and leading into the forest serves as a popular hiking course.

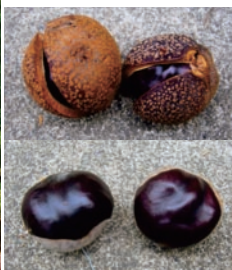
Painter: **Kiyoko Yamaguchi, PhD**

Alumnae of Kyoto University [kiyoko-yamaguchi.com/](http://kiyoko-yamaguchi.com/)





Tochinoki



Nameko (*Pholiota microspora*)

Katsura tree (*Cercidiphyllum japonicum*) complete flushing of new leaves by early May, following Siebold's Beech. In mid May, Shakunage (*Rhododendron japonheptamerum*) start to bloom along streams, and the mountains gradually turn a lush deep green.

The arrival of May heralds the beginning of full-blown research season with increasing numbers of researchers visiting the AFRS. Towards the end of autumn, undergraduate and postgraduate students of Kyoto University stay for days in the AFRS to participate in field training and education. Many former students have spoken of the experience as an unforgettable memory long after leaving school. During this lively period of the year, AFRS attracts a large number of visitors who participate in a variety of activities, such as field training programs for students from other colleges, extension courses for public audiences, open days for local families, and seminars and field tours for the private sector.

After the termination of the college field training programs, the atmosphere gradually becomes quiet, and the leaves of Tochinoki: Japanese Horse Chestnut (*Aesculus turbinata*) start to color. Autumn leaf color reaches the peak at the end of October. People driving along the hilly road may feel dazzled by the wide spectrum of colors from different types of trees, causing excessive visual stimulation. Those on foot may be able to enjoy the autumn leaf colors in a more relaxed manner. In the autumn, the forest provides a significant amount of fungi and other edible natural foods, such as Kuri: Japanese Chestnut (*Castanea crenata*) and Onigurumi: Japanese Walnut (*Juglans mandshurica*). Local people collect Japanese horse chestnuts and use them to make a type of rice cake called tochi-mochi through the painstaking process of removing their bitterness by drying, grinding, and rinsing them with running water for several days, before mixing them

with mochigome, a short grained japonica glutinous rice. The bitter taste of Horse chestnut is specific to regional traditional slow food.

As December settles in, Ashiu sees the first snowfall, a sign to wrap up the mountain work of the year. During winter, the snow is generally one meter high at the administrative office, and two to three meters high at high altitude places. The AFRS remains locked under snow until early April.

### Global Warming and Damage by Animal

Global warming is influencing the conditions of the AFRS, as for other forests worldwide. The mean annual temperatures in Ashiu were in the range of 11.0 to 11.3°C in the 70s and 80s, but rose to 12.7°C in the 90s. A 100-m difference in altitude is equivalent to a difference of 0.5 to 0.6°C in temperature. Therefore, a temperature increase of 1.5 to 2.0°C is equivalent to an elevation of 300 or more meters in altitude. The habitat of Siebold's Beech is currently located at altitudes of 600 meters and above. However, if the current trend in rising temperatures continues, Siebold's Beech will only grow at altitudes exceeding 900 meters a decade from now, and the proportion of Japanese beech forest in the AFRS will decrease sharply from the current level of



Winter season of the AFRS



80% to 1%. In fact, recently, large dead Siebold's Beech trees have been frequently observed, although the cause of the death remains unknown.

In addition to the long-standing problem of Tuginowaguma: Asian black bear (*Ursus thibetanus*) stripping the bark of Ashiu-sugi, Sika (*Cervus nippon*) have caused severe damage to Sasa: Bamboo grass (*Sasa kurilensis*), Haiinugaya (*Cephalotaxus Harringtonia* var. *nana*) and other understory vegetation since mid-1990s. From around 2000, mass mortality of Mizunara trees was occasionally noted, which was attributable to a pathogenic fungus (*Raffaelea quercivora*) vectored by Kashinonagakikumushi (*Platypus quercivorus*).

### AFRS Activities Shift With Social Needs

Since its inception in 1921, the AFRS has supported research in a wide range of scientific areas including plant and animal ecology and taxonomy, forestry and forest science, meteorology, and geography. Noteworthy early works include the publication of the *University Forest Outline* (1928), which presented the results of investigation carried out to provide a basis for subsequent management of this area. This report provided detailed data on stand quality and growing stock of the entire field, and is an important asset in simulating the course of development of this natural forest. Dr. Tomitaro Toyama, former research associate who stationed at the site from 1934 to 1944, published his research on the genetic profiles of Ashiu-sugi. His work triggered a stream of study on the distribution of cedar in Japan.

In recent years, research on the plant damage caused by Sika and its prevention gradually increased

in volume due to the reasons mentioned above. Ongoing projects include the large-scale and long-term study of the dynamics of natural forest tree species that was initiated in the 1990s and the monitoring study of acid rain and other environmental pollutants, a joint research project with other experimental forests across Japan.



Two academic and twelve administrative staff members are routinely stationed at the AFRS for forest research, management, and conservation. In 2014, 1,808 and 2,149 individuals (faculty and students) visited for research and education purposes, respectively, in addition to 7,045 visitors for non-research purposes. One of Japan's early leading taxonomists, Dr. Takenoshin Nakai<sup>2)</sup> praised the AFRS, saying that "Ashiu Experimental Forest (now, AFRS) is a must visit for every botany student" in 1941. More than seventy years after this remark, the AFRS continues to attract the attention of domestic and international scientists and the general public.

(This article was prepared by the Editorial Department of *Research Activities* based on the interview with Assoc. Prof. Makoto Ando. Most picture in this article are presented by Dr. Hiroyuki Watanabe, Prof. Emeritus of Kyoto University)

**From the Editor** AFRS has a lodging facility that can accommodate a maximum of forty four visitors. The research station also has a Museum, with displays explaining the vegetation, geography, and climate of this area, along with a collection of Asian black bear, Japanese serow (*Capricornis crispus*), and other large-scale animals. AFRS is a fascinating place to visit for anyone interested in Japan's forest environment.

**WEB** [fserc.kyoto-u.ac.jp/asiu/](http://fserc.kyoto-u.ac.jp/asiu/) (AFRS web site, Japanese only)

2) Takenoshin Nakai (1882-1952), plant taxonomist and former professor at Tokyo Imperial University, served as the director at the Koishikawa Botanical Garden (Tokyo, Japan), the Bogor Botanic Garden (Bogor, Indonesia), and the National Museum of Nature and Science (Tokyo, Japan).



## Historic Photograph Database of Kyoto University's Forest Research Stations

Kyoto University's Field Science Education and Research Center manages a database of historic photographs including pictures of the Ashiu Forest Research Station (see Link 1), Kitashirakawa Experimental Station, Kamigamo Experimental Station, and the former Karafuto Experimental Forest Station (see Link 2). Another university database, the Kyoto University Digital Archive System (KUDAS) holds various historic photographs and 16-mm film footage, including experimental forests in Taiwan, Korea, and Karafuto (now, Sakhalin) that the university owned prior to 1945 (see Link 3: Kyoto University Forests Collection, 1928-1986). By accessing these two databases online, users can browse through many historic images of the university's earlier days.



**LINK 1** [fserc.kyoto-u.ac.jp/zp/archive/asiu1950/](http://fserc.kyoto-u.ac.jp/zp/archive/asiu1950/) **LINK 2** [fserc.kyoto-u.ac.jp/zp/archive/](http://fserc.kyoto-u.ac.jp/zp/archive/) **LINK 3** [das.rra.museum.kyoto-u.ac.jp](http://das.rra.museum.kyoto-u.ac.jp)