View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by Technische Universität Dresden: Qucosa

THE UNIVERSITY OF TOKYO FORESTS AND FOREST SCIENCE EDUCATION IN JAPAN

TOSHIAKI OWARI, NAOKI YASUMURA, SEIJI ISHIBASHI, SHIGEHIRO KAMODA, HARUO SAITO

Abstract
In-forest teaching is a vital element of forest science education at university level, and university forests play a critical role in this. In Japan, the University of Tokyo (UTokyo) owns the oldest university forest, which was established in 1894. This paper outlines how the University of Tokyo Forests (UTF) provide in-forest education for forest science. The UTF consist of seven branch stations with a total area of over 32,000 ha. Third- and fourth-year undergraduate students majoring in forest science attend field courses in these forests. Some undergraduate and graduate students are affiliated with the UTF, where they conduct field studies for their graduate theses. Since 2005, the UTF have expanded their educational activities by offering university-wide hands-on experience seminars with field experience for first- and second-year undergraduate students, although these courses are open to all students studying at UTokyo.

Keywords: field course, forest science education, graduate thesis, university forest, university-wide hands-on experience seminar

Introduction

In-forest teaching is an essential component of university-level education in forest science. Field-based training in many forestry programmes typically offers opportunities for experiential learning (Bragg and Tappe, 2015; Hix, 2015; Kanowski, 2015), and many students are excited about the ability to acquire practical skills in the field (McGown, 2015). Field programmes reinforce cognitive classroom concepts (i.e. better retention of information), while they also build skills (i.e. personal development) (Easton and Gilburn, 2012; Hoagland *et al*., 2017). In-forest learning and teaching deliver hands-on experiences, which cannot be replaced by other teaching tools, such as virtual reality (SILVA Network, 2017b).

University forests play an important role in in-forest education. The term "university forest" refers to large forested areas owned or controlled by a university and devoted primarily to its teaching and research programmes in forest science (Straka, 2010). In the United States, university forests are an integral component of most forestry schools, and they are distinguished features of many forestry programmes (Burkhardt *et al*., 1988). University forests also facilitate in-forest learning and teaching in Europe (SILVA Network, 2017b).

In Japan, a university having a forestry-related department must have a university forest (Enshu-rin in Japanese) as an attached facility for education and research, as prescribed in Article 39 of the Standards for the Establishment of Universities, an Ordinance of the Ministry of Education, Science, and Culture (Ministry of Education, Science and Culture, 1956). Currently, 75 university forests with a total area of ca. 130,000 ha are operated by 27 national, public, and private universities in Japan (Japanese Association of University Forests, 2017).

The oldest university forest in Japan was established in 1894, when the Imperial University, the predecessor of the University of Tokyo (UTokyo), established its University Forest in Chiba as an institution attached to the Faculty of Agriculture[6]. The land was transferred to UTokyo by the Ministry of Agriculture and Commerce for field practices and research in forestry (The University of Tokyo Chiba Forest, 2012). Dr Seiroku Honda, former Professor of Silviculture at UTokyo, initiated its establishment. He studied at the Forstliche Hochschule Tharandt and the University of Munich between 1890 and 1893, where he received his PhD. His experiences in Germany inspired him and he pushed for the establishment of university forests in Japan.

Following Chiba, additional branch stations of the University Forest have been established, and they are collectively called 'The University of Tokyo Forests (UTF).' As a site for education and research, the mission of UTF is to develop technology and human resources for the next-generation forests: (1) to provide suitable locations for forest education for undergraduate and graduate students; (2) to promote advanced research on the relationship between the natural environment and humans in forests; (3) to circulate environmental data to other research institutes; and (4) to establish an education system and practical field area for a wide variety of people outside the university, such as children, the elderly, and ordinary persons.

This paper describes how UTF provide in-forest education in forest science. First, we briefly introduce the branch stations of UTF and undergraduate studies in forest science at UTokyo. Then, we describe the educational activities at UTF for our students (field courses, graduate theses, and university-wide hands-on experience seminars). While the SILVA Network primarily aims to stimulate and facilitate educational co-operation in forestry in Europe (SILVA Network, 2017a), we also strive to contribute to cross-border discussions of how to strengthen the role of university forests by sharing our information and experiences through this paper.

[6] All information about curricula and university forests given below is from The University of Tokyo Forests (2017), if no other reference is given.

Introduction to the University of Tokyo Forests

UTF has seven branch stations in central and northern Japan (Figure 1), with a total area of 32,339 ha. Most of the area is directly owned, managed and financed by the university. As of December 2017, 26 faculty members (4 professors, 3 associate professors, 5 lecturers, 13 assistant professors, and 1

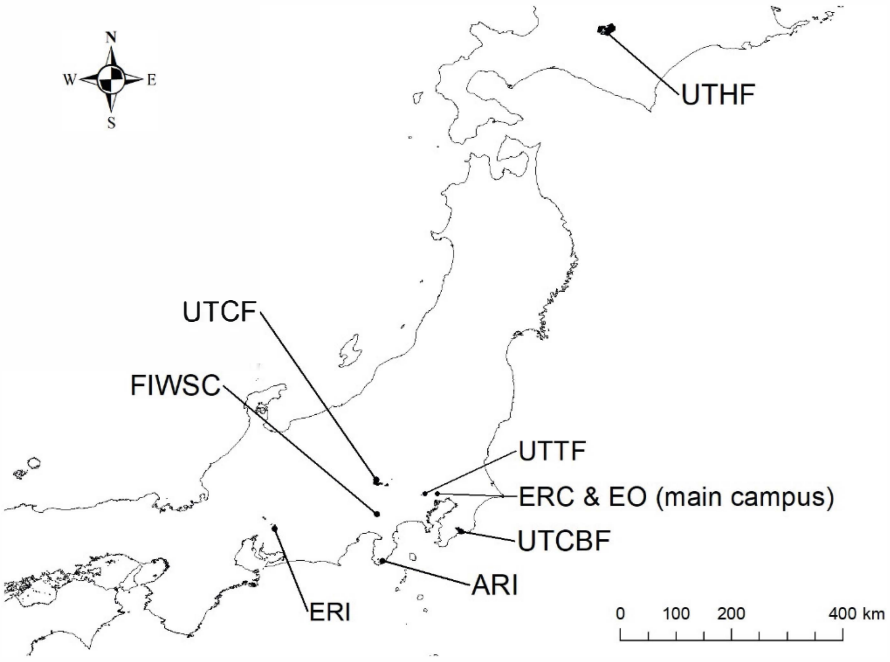

Figure 1: Locations of the University of Tokyo Forests. UTCBF: The University of Tokyo Chiba Forest, UTHF: The University of Tokyo Hokkaido Forest, UTCF: The University of Tokyo Chichibu Forest, UTTF: The University of Tokyo Tanashi Forest, ERI: Ecohydrology Research Institute, FIWSC: Fuji Iyashinomori Woodland Study Center, ARI: Arboricultural Research Institute, ERC: Education and Research Center, EO: Executive Office. Source: Geospatial Information Authority of Japan and the University of Tokyo Forests.

project assistant professor) and 58 technical staff were affiliated with UTF. The directorship of UTF is taken by a professor in the Department of Forest Science, and the senior faculty of UTF is appointed as Director of each branch station. They are responsible for the management and operations of UTF.

UTokyo Chiba Forest (UTCBF) was established in 1894 and is the oldest university forest in Japan. It is located in the south-eastern part of the Boso Peninsula, approximately 70 km southeast of Tokyo, and has an area of 2,226 ha. Although the area was initially mostly coppice forests comprising evergreen broad-leaved trees, two major plantation conifers (*Cryptomeria japonica* and *Chamaecyparis obtusa*) have been introduced since its establishment. The planted forests range from young

to very old stands. The Forest also contains various experimental plots, protected forest, and demonstration forests of indigenous and exotic tree species.

UTokyo Hokkaido Forest (UTHF) was established in 1899. It is located in central Hokkaido approximately 860 km north of Tokyo and has an area of 22,715 ha. It is situated in the Pan-mixed forest zone (Tatewaki, 1958), which is a transitional area from deciduous forests in the cool-temperate zone to coniferous forests in the sub-boreal zone. To study theories and methods of sustainable and adaptive forest management in the region, a business-scale study of a stand-based silvicultural management system (Rinbun Segyo-ho in Japanese) has been conducted for nearly 60 years, having started in 1958. The main silvicultural system in the Forest is a single-tree selection system and approximately 26,000 m^3 of trees are harvested annually.

UTokyo Chichibu Forest (UTCF) was established in 1916. It is located in the upper reaches of the Arakawa River watershed approximately 70 km northwest of Tokyo and has an area of 5,812 ha. The Forest is situated in the cool temperate zone and is surrounded by mountains over 2,000 m high. Since the Forest covers a wide range of elevations from montane to sub-alpine vegetation zones, a variety of tree species grow there. The Forest enables rapid and easy access to various natural forest stand types with diverse elevations and landforms, which is a great advantage for education and research in ecology.

UTokyo Tanashi Forest (UTTF) was established in 1929 as the Department of Forestry Tanashi Nursery for practical training courses in silviculture. It is located in the western part of metropolitan Tokyo and has an area of 9 ha. The demonstration forest and arboretum include a total of 244 tree species. It is approximately one hour from the main campus of UTokyo. Consequently, professors and students frequently visit it for educational and research purposes. The forest also provides a valuable green oasis in the city for the general public.

The Ecohydrology Research Institute (ERI) was established in 1922 as the University Forest in Aichi to conduct research and training in forest hydrology and erosion-control engineering. ERI has three research forests in Aichi Prefecture (approx. 250 km west of Tokyo), with a total area of 1,292 ha. When it was established, almost all of the research forests were degraded hill regions. As a result of restoration work over many years, the area is now covered with vegetation, with secondary and plantation forests. ERI currently focuses on interdisciplinary studies of the interactions between water cycle and ecosystems.

The Fuji Iyashinomiri Woodland Study Center (FIWSC) was established in 1925 as the University Forest at Yamanakako. It is located near Lake Yamanakako (approx. 90 km west of Tokyo), one of the most popular resort areas in Japan, and covers 38 ha. The forest is located in the upper cool temperate forest region. The area is partly covered by stands dominated by larch in the canopy layer, although the larch trees

are being replaced by native broad-leaved trees. FIWSC is used mainly for studies of the recreational and healing functions of forests.

The Arboricultural Research Institute (ARI) was established in 1943 to study the use of tropical and sub-tropical trees for non-wood forest products. It is located at the southern end of the Izu Peninsula, approx. 150 km southwest of Tokyo, and has an area of 247 ha. ARI includes an experimental forest and a greenhouse. The forest is situated in the warm-temperate evergreen broad-leaved forest zone, where *Castanopsis* and oak (*Quercus*) species dominate. Some areas have been planted with useful broad-leaved trees, such as *Cinnamomum, Eucalyptus, Acacia*, and *Vernicia* species. The greenhouse is heated by water from hot springs.

The Education and Research Center (ERC) and Executive Office (EO) are located on the main campus of UTokyo. The ERC functions as a human resources centre that supports future forests and forest science. Students affiliated with UTF are based there for their studies and to conduct research. The EO coordinates various activities in the seven branch stations and ERC and promotes cooperation among the branch stations and other organizations.

Undergraduate studies in forest science at the University of Tokyo

UTokyo has 10 Faculties, 15 Graduate Schools, 11 affiliated Institutes, 13 university-wide centres, and 2 special institutes (The University of Tokyo, 2017). A key feature of the undergraduate education system at UTokyo is that students spend their first two years (Junior Division) studying a broad spectrum of liberal arts courses in order to acquire fundamental skills. Then, they select one of the 10 Faculties for their third and fourth years (Senior Division) based on their preferences, aptitude, and performance. This basic educational strategy is referred to as "late specialization".

In the Faculty of Agriculture, the educational curriculum is designed as a three-layered structure with one faculty, three programmes, and 14 majors (The University of Tokyo, 2017). The three programmes offered are the Applied Life Science Programme, which covers the biological and life sciences; the Environmental and Resource Science Programme, which is concerned with field environmental sciences; and the Veterinary Medical Sciences Programme, which covers the medical treatment of animals (Figure 2). These three programmes are further divided into 14 specializations.

Undergraduate students who wish to study forest science typically major in Forest Life Science, one of the Applied Life Science Programme, or in Forest Environmental and Resource Science, one of the Environmental and Resource Science Programme (Department of Forest Science, The University of Tokyo, 2017). Students can also study forest science by majoring in Field Science (Laboratory of Forest Ecosystem Studies) or International Sustainable Agriculture

Development (Laboratory of Global Forest Environmental Studies), which are the Environmental and Resource Science Programme.

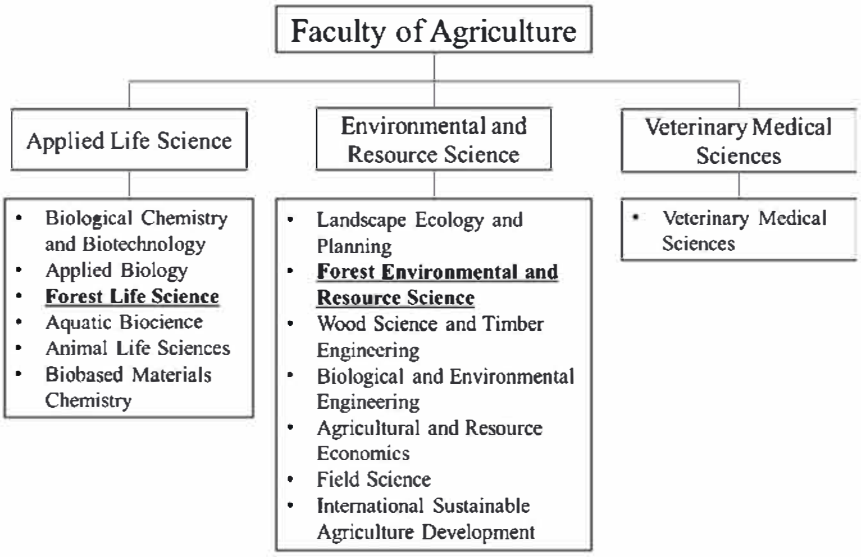

Figure 2: Undergraduate programmes and majors at the Faculty of Agriculture, the University of Tokyo. Source: Faculty of Agriculture, the University of Tokyo (2017).

The Department of Forest Science is responsible for most of the forest science education at UTokyo (Department of Forest Science, The University of Tokyo, 2017). The Department consists of eight laboratories (Forest Botany, Forest Zoology, Silviculture, Forest Management, Forest Policy, Forest Utilization, Forest Hydrology and Erosion Control Engineering, and Forest Landscape Planning and Design) (Figure 3). There are also two cooperative courses under the Department (UTF and Asian Natural Environmental Science Centre). Undergraduate students majoring in Forest Life Science or Forest Environmental and Resource Science are affiliated with one of the eight laboratories or two cooperative courses and complete a Bachelor thesis under the supervision of professors and associate professors.

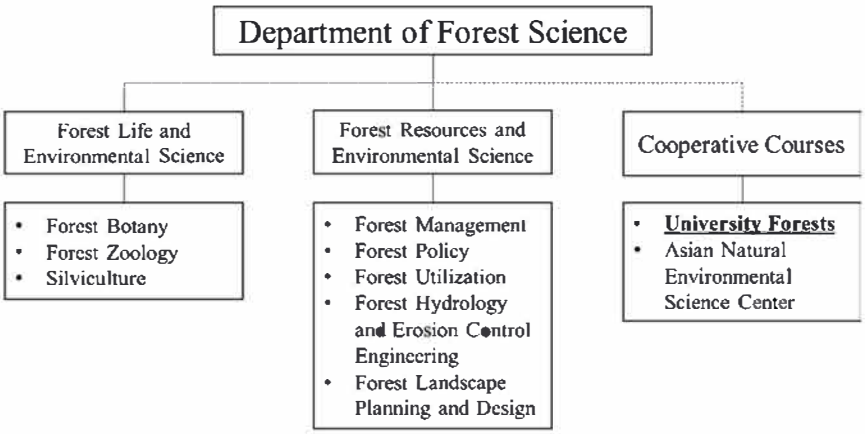

Figure 3: Laboratories and courses in the Department of Forest Science, the University of Tokyo. Source: Department of Forest Science, the University of Tokyo (2017).

Forest science education in the University of Tokyo Forests

Field practice courses for students majoring in forest science

The third- and fourth-year undergraduate students majoring in Forest Life Science or Forest Environmental and Resource Science visit UTF every year to take part in field practice courses. Currently, UTF offers ten such courses, of which seven courses are compulsory electives[7] and 3 courses are electives (Table 1). Each course lasts 2–5 days. Although the faculty in the Department of Forest Science are in charge of these courses, the faculty of UTF are jointly responsible as the course teachers. The technical staff of UTF support the coursework by students in the field.

In addition, undergraduate students majoring in Field Science and International Sustainable Agriculture Development can take three field practice courses offered at UTHF, FIWSC and ARI every year. The faculty of UTF also offer a number of courses (lectures, seminars, and field practice courses) for post-graduate students (Master's and Doctoral candidates) in three Departments (Forest Science, Ecosystem Studies, and Global Agricultural Sciences).

Bachelor, Master's, and Doctoral theses

A fundamental function of the university forests is to provide study sites for student theses (SILVA Network, 2017b). Some undergraduate students are affiliated with UTF and use them as study sites for Bachelor's theses (Table 2; Figure 4). These students are supervised by the faculty of UTF, and the technical staff can assist with on-site data collection. Post-graduate students are also affiliated with UTF. They conduct field research for their Master's and Doctoral theses in a variety of academic disciplines, such as botany, ecology, entomology, genetics, pathology, physiology, chemistry, silviculture, hydrology, management, informatics, landscape

[7] At least 6 courses (12 credits) have to be taken from 8 courses. One course (Practice in Forest Utilization) is offered outside of UTF.

planning, policy, and economics (Table 2; Figure 4). Many students affiliated with other departments, faculties or graduate schools, and even other universities may use UTF for their study sites with the support of the faculty and technical staff of UTF.

Table 1: Field practice courses offered at the University of Tokyo Forests in 2017.

Year	Course	Credit[8]	Location	Date	Duration
3	Experiments in Silviculture	2	UTCBF	5–9 Jun	5 days
	Experiments in Forest Botany	2	UTCBF UTCF	9–11 Jun 25–27 Jul	3 days 3 days
	Experiments in Forest Zoology	2	FIWSC	1–3 Aug	3 days
	Seminar in Forest Policy	2	FIWSC	28–30 Aug	4 days
	Practice in Surveying	2	ERI	21–25 Aug	5 days
	General Practice in Forest Science	1	UTHF	4–7 Sep	4 days
3/4	Practice in Forest Management	2	UTCBF	5–8 Dec /5–8 Jun	4 days
4	Experiments in Forest Soil Science	2	UTCF	12–14 Apr	3 days
	Practice in Forest Conservation	2	ERI	13–16 Jun	4 days
	Practice in Environmental Design	2	FIWSC	22–23 Jun	2 days

Table 2: Graduate theses completed by students affiliated with the University of Tokyo Forests in 2016.

Degree	Title
Bachelor	Regeneration of Phyllostachys bambusoides and tree species in a bamboo-felled site with different rhizome conditions
	Seedling dynamics in a cool temperate forest of Okuchichibu Mountains: An evaluation of deer fences for vegetation recovery
	Relationships between catchment topography and flood concentration time in mountain rivers
Master	Seasonal fluctuation of ambrosia beetles and factors influencing on colonization of ambrosia beetles
	Determinant factors affecting community assembly for folivorous Lepidoptera in a cool-temperate deciduous broad-leaved forest
	Actual use of firewood and forests as a source of firewood procurement in Yamanakako village, Yamanashi prefecture: From a viewpoint of differences in household attributes
Doctor	Influences of ambrosia beetle (*Platypus quercivorus*) attacks on evapotranspiration in a secondary warm-temperate forest

University-wide hands-on experience seminars and activities

Increasingly, forestry educators are reaching out to less traditional audiences, including some with very little formal forestry background (Bragg and Tappe, 2015). In Japan, UTF has expanded its educational activities since 2005, by holding

[8] One credit in Japan is equivalent to 45 hours of workload (Ministry of Education, Science and Culture, 1956).

university-wide hands-on experience seminars combined with field studies (Table 3; Figure 5). These seminars target first- and second-year undergraduate students and are open to students in all Junior Division Streams (Humanities and Social Sciences I, II, and III, and Natural Sciences I, II, and

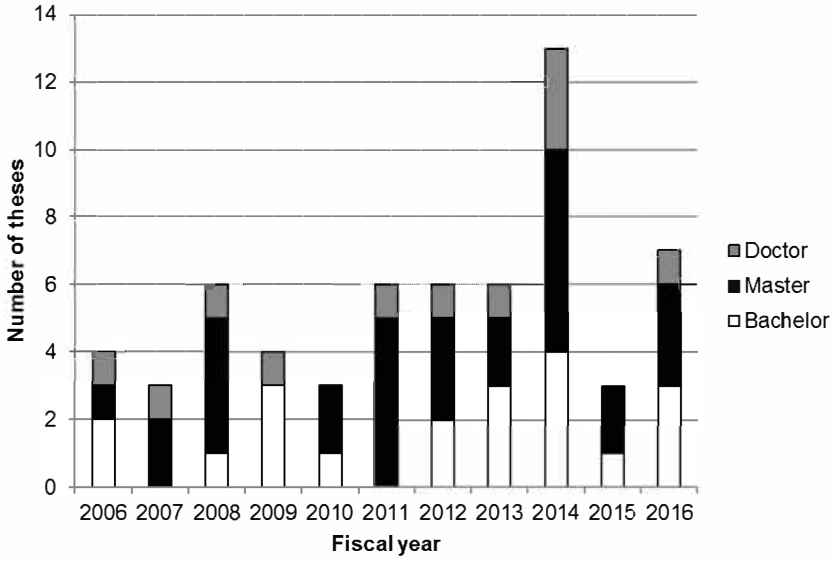

Figure 4: Number of graduate theses completed by students affiliated with the University of Tokyo Forests between 2006 and 2016. The fiscal year in Japan begins from April 1st and ends on March 31st.

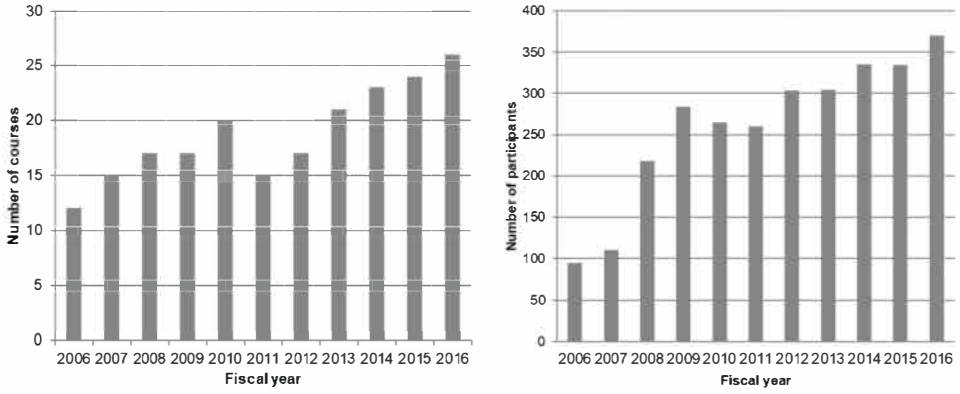

Figure 5: Number of courses and participants in the university-wide hands-on experience seminars offered by the University of Tokyo Forests between 2006 and 2016.

III). They are considered to play a strong role in building bridges between lower- and upper-level undergraduate courses and to offer opportunities for students to become familiar with specialized topics, while learning about a wide range of topics (The University of Tokyo, 2017). The faculty of UTF devote considerable effort to the seminars to promote basic understanding of forests and forestry through various

experiences in the field. The seminars often create a favourable impression of forest science in students, who then pursue studies in the Faculty of Agriculture.

The Hands-on Activity Programme is another university-wide educational activity offered by UTF. The programme was initiated in 2012 at UTokyo and is a specially designed project whose basic principle is to expose undergraduate student to lifestyles and sets of values different from their own (The University of Tokyo, 2014). In 2017, five branch stations (UTCBF, UTHF, ERI, FIWSC, and ARI) offered hands-on field work activities to undergraduate students.

Table 3: University-wide hands-on experience seminars offered by the University of Tokyo Forests in 2017.

Subject	**Location**	**Duration**
Knowledge of Dangerous Creatures (Spring)	FIWSC	2 days
	UTCBF	1 day
Excursion in Spring Oku-Chichibu	UTCF	2 days
		2 days
Forest Created and Managed by Human; from a Viewpoint of Forestry and Landscape Planning	ERI	2 days
Training Interpreters of Urban Green; Teach Children Nature Experience	UTTF	1 day
		1 day
		1 day
Do You Really Know about Cedar and Cypress?	UTCBF	2 days
Recreational Forest and Local Society (Summer)	FIWSC	3 days
Forest Environment Resource; Dam and Forest, Forest and Amenity, Final Stage of Forest	ERI	2 days
	FIWSC	2 days
	UTCBF	2 days
Considering Protection and Management of Wildlife at the Field	UTCBF	4 days
Feel, Think and Act in Izu[9] (Summer) 1	ARI	5 days
Feel, Think and Act in Izu (Summer) 2	ARI	5 days
Feel, Think and Act in Izu (Summer) 3	ARI	5 days
Feel, Think and Act in the Forest	UTHF	5 days
Knowledge of Dangerous Creatures (Autumn)	UTCBF	2 days
	FIWSC	2 days
Excursion in Autumn Oku-Chichibu	UTCF	2 days
		2 days
Mapping Fascinations of Forest; Creating Original Maps using GPS	FIWSC	3 days
Recreational Forest and Local Society (Winter)	FIWSC	3 days
Make Full Use of Forest Energy	UTTF	1 day
	FIWSC	3 days
Study about Forest and Life of Boso	UTCBF	4 days
Study at Snow Forest; the University of Tokyo Hokkaido Forest	UTHF	3 days
Dam, Sediment and Ocean	ERI	3 days
Feel, Think and Act in Izu 1	ARI	5 days
Feel, Think and Act in Izu 2	ARI	5 days
Feel, Think and Act in Izu 3	ARI	5 days
Feel, Think and Act in Izu; Tropical Plants Version	ARI	5 days
Feel, Think and Act in the Forest 2	UTHF	2 days

[9] The area in Shizuoka Prefecture, central Japan, where ARI is located (see Figure 1).

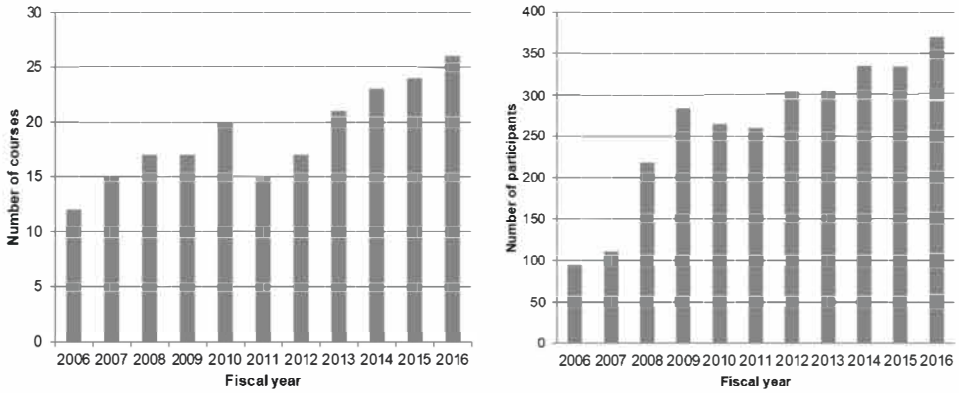

Figure 5: Number of courses and participants in the university-wide hands-on experience seminars offered by the University of Tokyo Forests between 2006 and 2016.

Discussion and conclusion

Throughout its 120-year history, UTF has served as an indispensable site for university-level forest science education in Japan. In close cooperation with faculty in the Department of Forest Science and other departments, each branch station of UTF offers students distinct in-forest teaching programmes that effectively use its natural and human resources. The experiential opportunities at UTF through field practices and graduate thesis fieldwork have provided both cognitive and affective learning outcomes to students majoring in forest science.

At UTokyo, the university forest is no longer an educational ground exclusively for forestry students. The Forest is open to all students with diverse academic interests. Although most incoming students have little to no understanding of forestry (McGown, 2015), UTF has been successful at attracting students to major in forest science through university-wide hands-on experience seminars. The field programmes offered at UTF have enabled students to develop personally and emotionally and to improve their communication skills (Hoagland *et al.*, 2017).

We, UTF, are willing to serve as an international educational ground for forest science (Kamata, 2018). We hope to exchange further information and experiences with the SILVA Network member universities in Europe and to conduct collaborative teaching programmes in the future.

Acknowledgements
The authors would like to thank three reviewers for their helpful comments on an earlier version of this paper.

References

Bragg, D.C. and Tappe, P.A., 2015: The many values of field-based education in forestry. Journal of Forestry, 113(6), 592-594.

Burkhardt, C.E., Straka, T.J. and Bullard, S.H., 1988: Forestland controlled by schools of forestry: characteristics and management. Journal of forestry, 86(1), 39-42.

Department of Forest Science, the University of Tokyo, 2017: Website. www.fr.a.u-tokyo.ac.jp/english.html, accessed on 30 December 2017.

Easton, E. and Gilburn, A., 2012: The field course effect: gains in cognitive learning in undergraduate biology students following a field course. Journal of Biological Education, 46(1), 29-35.

Faculty of Agriculture, the University of Tokyo, 2017: Website. www.a.u-tokyo.ac.jp/english/index.html, accessed on 30 December 2017.

Hix, D.M., 2015: Providing the essential foundation through an experiential learning approach: an intensive field course on forest ecosystems for undergraduate students. Journal of Forestry, 113(5), 484-489.

Hoagland, S.J., Miller, R., Waring, K.M. and Carroll, O., 2017: Tribal lands provide forest management laboratory for mainstream university students. Journal of Forestry, 115(5), 484-490.

Japanese Association of University Forests, 2017: Website. jauf.cambria.ac/, accessed on 15 December 2017. (in Japanese)

Kamata, N., 2018: Using university forests for international forest science education activities: the experiences of the University of Tokyo Forests, Japan. Pp 51-57 in Schmidt, P., Remes, J., Lewark, S. and Weber, N. (Eds.): Forests for university education: examples and experiences. This volume. SILVA Network Publication 15

Kanowski, P.J., 2015: Internationalizing forestry education. Journal of Forestry, 113(6), 574-578.

McGown, K.I., 2015: Student perspectives on North American forestry education. Journal of Forestry, 113(6), 585-586.

Ministry of Education, Science and Culture, 1956: Standards for Establishment of Universities.
www.japaneselawtranslation.go.jp/law/detail_main?re=&vm=04&id=1864, accessed on 29 December 2017. (in Japanese with English translation)

Straka, T.J., 2010: Public outcry increasingly becoming safeguard of university forests. Planning for Higher Education, 38(4), 52-60.

SILVA Network, 2017a: Website. www.silva-network.eu, accessed on 31 December 2017.

SILVA Network, 2017b: SILVA Network Prague communique 2017. www.silva-network.eu/PragueCommunique/ accessed on 29 December 2017.

Tatewaki, M., 1958: Forest ecology of the islands of the north pacific ocean. Journal of the Faculty of Agriculture, Hokkaido University, 50(4), 371-486.

The University of Tokyo, 2014: What are the Hands-on Activity Programmes? Tansei (The University of Tokyo Magazine), 14, www.u-tokyo.ac.jp/en/about/publications/tansei/14/discussion_handson_2.html, accessed on 30 December 2017.

The University of Tokyo, 2017: Website. www.u-tokyo.ac.jp/en/, accessed on 30 December 2017.

The University of Tokyo Chiba Forest, 2012: The 13th education and research plan of the University of Tokyo Chiba Forest. Miscellaneous Information of the University of Tokyo Forests, 51, 27-66. (in Japanese)

The University of Tokyo Forests, 2017: The University of Tokyo Forests 2017. 35pp, www.uf.a.u-tokyo.ac.jp/files/gaiyo.pdf, accessed on 30 December 2017. (in Japanese with English summary).