Proceedings of
SNU – UTokyo Joint Workshop on Long-term Monitoring and Data Analysis of Forest Resources and Environment

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Organized by

Department of Forest Sciences, Seoul National University

University Forests, Seoul National University

The University of Tokyo Forests, The University of Tokyo

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Contents

Opening Address

Professor Naoto Kamata, a project leader of the JSPS Core-To-Core Program, and

Distinguished guests, ladies and gentlemen!

I would like to sincerely welcome all distinguished participants for attending the Joint Workshop on Long-term Monitoring and Data Analysis of Forest Resources and Environment, organized Seoul National University and the University of Tokyo. This workshop would include numbers of advanced topics regarding local and global issues in climate changes, forest hydrology, ecology, and forest management. This workshop will provide us not only essential knowledge but also a great opportunity to share experiences through university forests.

Seoul National University Forests manages about 17,000 hectares of forest located in three local experimental forests. University Forests have programs to support field practices of undergraduate and graduate students and forest-related research for diverse topics. All the research and management policies are driven to develop advanced forest management techniques and field operation skills to realize a new global paradigm of sustainable forest management.

Today's joint workshop is a very meaningful event where we can share experiences of the education and research activities in university forests. Now and in the future, Asian university forests will continue to forge very practical cooperative relationships with the JSPS Core-To-Core program. Through this international collaboration, SNU University Forests will be able to contribute even more to the promotion of research capacities in long-term monitoring program.

I would like to thank all participants who could join this workshop and share fruitful results today. I would also like to give my sincere appreciation to all the contributors who have organized or have helped to organize this workshop.

We warmly welcome you again.

IM, Sangjun
Director of University Forests,
Seoul National University

Welcome Address

Distinguished speakers, ladies and gentlemen,

It is a great pleasure and opportunity to address all of you on this occasion "SNU-UTokyo Joint Workshop on Long-term Monitoring and Data Analysis of Forest Resources and Environment".

On behalf of all the member of Seoul National University Forests, I warmly welcome you for attending this joint workshop. I would like to express my sincere thanks and congratulations to Professor Naoto Kamata, a project leader of the JSPS Core-To-Core Program, Professor Sangjun Im, director of Seoul National University Forests, and members of organizing committee of this workshop.

The Asian University Forest Consortium was first organized in 2002, Japan, for providing the opportunity to exchange experiences and promoting collaboration between university forests in Asian countries. Since then, the symposium has been held in several countries, and contributed to improve the relationship of Asian university forests.

Several experts and students from the University of Tokyo, National Taiwan University, Kasetsart University, and University Malaysia Sabah are joining this workshop. I am sure that this workshop will give valuable chance for experts and students to discuss about long-term data on climate, hydrology, LTER study plots and plantations. After two-day discussion, participants will visit LTER study plots of Nambu University Forest, Taehwasan University Forest, and Gwangneung experiment forest. Two day excursion will bring us more productive and joyful time.

Finally, I do hope all of you have a valuable time and your stay here will be interesting and enjoyable.

Thank you for your attention.

Jyung, Chyul-Young
Dean, College of Agriculture and Life Sciences,
Seoul National University

Outline of Schedule

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Workshop Programs

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11:00 - 12:00	**Poster Presentation**	
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Plenary Presentation

Introduction of the JSPS project and long-term monitoring and inventory data at The University of Tokyo Forests

Naoto KAMATA[1]

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Abstract

Under changing environments, long-term monitoring and inventory data are important to detect temporal changes in environments and ecosystems. The University of Tokyo Forests (UTF) has adopted the research exchange project entitled “Developing a network of long-term research field stations to monitor environmental changes and ecosystem responses in Asian forests” for the JSPS Core-to-Core Program. This project is implemented in collaboration with core institutions in five countries (Japan, Korea, Taiwan, Thailand, and Malaysia). It aims to promote the development of long-term research field stations for stable and continuous monitoring, and to establish a multilateral research cooperation network between core institutions through close collaboration. The UTF has accumulated long-term ecological and meteorological data that are available for our forest management and researches: LTER plots, other stand plots, meteorological and hydrological data, bird community, plant and vertebrate inventory, and others. I will present two fruitful outcomes that were obtained from our long-term data.

Strengthening capacity of forest education and research in University forests in South Korea

Woo-Shin LEE[1], Pil Sun PARK[2], Ji-Min PARK[3] and Kyu-Suk KANG[4,*]

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Abstract

To strengthen forestry education and research, the Korea Forest Service launched a new project in 2015. This will initiate a short-term process to strengthen Korea's forest research system, improve the system of forestry education, and facilitate the extension of research finding. Also, it will contribute to growth in the forestry education and research sector that are consistent with priorities for biodiversity monitoring, conservation and sustainable management of forest resources. This project will continue for six years (3+3 years) with a fund of about 500 million Korean won each year.

In 2017, there are mainly two subjects. The first component is the establishment of the foundation of monitoring in University forests, and the major components are to survey the fauna and phenology of terrestrial vertebrate (bird breeding timing, leaf phenology), to investigate the emergency and community structures of lepidopteran insects using light trap, the monitoring of boring insects using kairomone, to monitor and characterize the watershed hydrology, and to analyze the local people's demands and review the management strategy of the University forests.

The second components consist of the survey of test plantations and the study on the growth condition of plantation species. The major researches are to investigate the current condition of experimental plantations, to analyze stand structure and environments in test plantations, to analyze growth of major plantation species, and to examine morphological traits of plantation species through genetic analysis. Also, a research on the genetic variation of Hinoki provenance is collaborated with Japan, Korea and Taiwan research teams under the consortium of Asian University forests.

From the project, we are expecting to contribute as a base line for excavation of biotic resources and development of forestry extended education system, to improve public benefits of University forests and develop the management plan in which local people's demands are reflected, and to identify opportunities for student and faculty

exchanges and collaborate research and education among University forest partners in the near future. In the presentation, more details on the status of Korea's University consortium and the project plan will be given and discussed.

Research Group 1

Hydrological data for comparative study of hydrological response along with forest recovery in Korea and Japan

Koichiro KURAJI

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Abstract

To compare hydrological response along with forest recovery in Korea and Japan, hydrological data observed in The Tokyo Imperial University Forest in Jeollanam-do was found in the Laboratory of Erosion Control Engineering, Department of Forest Science, The University of Tokyo in 2016. The data includes daily recording chart of siphon type automatic rain gauge at Chusan meteorological observation field from 2 June 1928 to 31 July 1935, and the table results of reading water level recording charts at the No.1 and No.2 experimental watershed gauging station in Chusan from 1 April 1930 to 31 November 1941. Although these data is incomplete, collaborative research to compare hydrological response along with forest recovery in Korea and Japan may be possible by SNU and UTF researchers.

Climatic Classification and Mapping: A Proposal for Asian Experimental Forests

Yen-Jen LAI[1], Ching-Feng Li[2], Fang-Hua CHU[12] & Ming-Jer TSAI[12]

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[2]School of Forestry and Resource Conservation, National Taiwan University, TAIWAN

Abstract

Climate is one of the most important factors for formatting the ecosystem types. Climate zoning would help us to understand the basic characteristics of habitat. Similar research has been done on a global scale, but it is hard to classify zones under the small spatial scale due to the limitations of the ground-truth microclimate stations.

This proposal proposes that the first phase of the JSPS Core-to-Core RG1 would consider to generate the map of the climatic zones for Asian experimental forests, in order to clearly understand the differences between each and the representative percentage of the total classification. Additionally, we could use the IPCC AR5 climate data to predict future change. For this purpose, the maps of the monthly mean temperature and the monthly accumulated precipitation under 1-km spatial resolution are suggested to be established. The monthly mean temperature maps could be generated based on the relationship between the 15-years' MODIS land surface temperature datasets and the long-term monthly mean temperature of each forest. The monthly accumulated precipitation maps could use the free-download Worldclim database. A similar idea has been preliminary tested in NTUEF (Lai et al., 2012), and is potentially viable for expanding the use of the experimental forests in the JSPS Core-to-Core project. Furthermore, the results could integrate/cooperate with RG2/RG3 members at the second phase to further explore the various forest/vegetation types on the lowest/highest bounds and the distribution of plants.

Moisture content measurements of floor litter using the near infrared spectrometry

Sangjun IM[1], Ye-eun Lee[2], Ghiseok KIM[3] and Qiwen Li[2]

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[3]Department of Biosystems & Biomaterials Engineering, Seoul National University, KOREA, ghiseok@snu.ac.kr

Abstract

Forest floor, which is usually covered by tree litter, acts an interface between the soil and the atmosphere. Floor litter can influence the water dynamics of forest ecosystem. It reduces evaporation from soil layers by physically covering the soil surface and limits the amount of water that can infiltrate into the underneath soil. Floor litter refers an important pool of carbon, nitrogen and other biogeochemical substances. Forest floor has significantly different from arable lands. Direct measurement of litter moisture would be very difficult, mainly due to technical limitation, and spatial and temporal variations. And, high porosity in litter layer causes electrical bias with intact electrical sensors such as TDR. Thus, in this study, we developed the non-contact sensing technology that measures quantitatively the moisture content in a floor litter using the near infrared (NIR) spectometry. NIR spectrometer is first designed to scan the diffuse reflectance spectrum from sample litters. NIR spectra of different leaf litters (taken from deciduous and coniferous litters) are also analyzed compared to identify the influences of leaf physiology and morphology on spectral reflectance values. And, the calibration models for determining moisture content in the forest litter are established based on NIR data analysis.

* This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (NRF-2015R1D1A1A02061769)

Long-term monitoring of ecohydrology for evaluating hydrological consequences following the Japanese oak wilt

G. G. T. CHANDRATHILAKE[1,2], Nobuaki TANAKA[3], Takanori SATO[3], Mie GOMYO[4] & Naoto KAMATA[5]

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[5]University of Tokyo Hokkaido Forest, The University of Tokyo Forests, Graduate School of Agricultural and Life Sciences, The University of Tokyo, JAPAN, kamatan@uf.a.u-tokyo.ac.jp

Abstract

Ecohydrology Research Institute (ERI) of The University of Tokyo Forests has two small forested catchments where the water balances (i.e., rainfall and runoff) have been monitored for more than 60 years. In order to investigate interactions of the water balances with changing forest status, ERI established a long-term ecological research (LTER) plot with an area of 2.67 ha such that the LTER plot fully encompasses the two catchment areas. In recent years, an oak-dominated secondary forest, which covered the catchments, has been disturbed by the Japanese oak wilt (JOW). The JOW disturbance progression was well documented in the LTER plot.

Comparison and modelling of water and carbon flux between temperate natural mixed broadleaved and coniferous planation forest in Mt. Taehwa, Korea

Sungsik CHO[1], Hoontaek LEE[2], Juhan PARK[2,3], Minjee PARK[2], Minseok KANG[3] & Hyun Seok KIM[1,2,3,4]

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Abstract

The intensely managed plantation forests are considered as the solution to increasing productivity and reducing the water use. However, the assumptions on plantation forests' high efficiency in carbon assimilation and water use are still in debate. To answer these questions, we compared the carbon assimilation and water use between two nearby and similar aged forests (young natural mixed broadleaved forest (TMK) vs. properly managed 50-year-old *Pinus koraiensis* (TCK). We compared the seasonal changes of water and carbon flux and their use efficiencies. To compare net ecosystem carbon dioxide and water vapor exchange between to different forest, eddy covariance (EC) system and sap flow data collected at the both KoFlux site. As a result, annual sum of evapotranspiration (ET) in 2015 and 2016 were 471.6, 453.7 mm in TMK and 387.9, 402.5 mm in TCK. The annual net ecosystem CO_2 exchange in 2015 and 2016 were 571, 677.9 gC m^{-2} $year^{-1}$ in TMK, 430.4, 421.3 gC m^{-2} $year^{-1}$ in TCK. The water use efficiency (WUE) of TMK were 3.36, 4.13 gC Kg^{-1} H_2O in 2015 and 2016. TCK were 4.68, 4.7 gC Kg^{-1} H_2O in TCK, respectively. This study show the total amount of ET of coniferous plantation was lower than natural mixed forest in both years. In contrast to the WUE of plantation forest were higher than though of natural forest in both years. As results, the WUE of managed plantation forest were higher than nearby natural mixed forest. This study will provide key information on plantation forests' efficiency be comparing the nearby and similar aged natural and well-managed plantation forest. In addition, we localized and evaluated the Joint UK Land Environment Simulator (JULES) model for future estimation of water and carbon flux from these forests.

Research Group 2

Bark and ambrosia beetles fauna in Japan and Asian countries: Latitudinal gradient in seasonal cycles and host-insect relationship

Naoto KAMATA[1]

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Abstract

Bark and ambrosia beetles are found in subfamilies Scolytinae and Platypodinae of the family Curculionidae, which include plenty of forest and timber pests. To determine the fauna, EtOH-baited traps and bait logs (branches) of different orders of plants were set in forests. In temperate forests, there is a seasonal gap in winter when no species are active. However, in tropics and subtropics, the insects are captured whole a year. Seasonal occurrences by the EtOH-baited traps were compared among boreal (Hokkaido, Japan), cool-temperate (Chichibu, Japan) and seasonal tropical forest (Chiang Mai, Thailand). Species composition by the EtOH-baited traps was compared with those by bait logs. Similarity and dissimilarity among the latitudinal gradient will be discussed. I have started the survey by the same protocol at tropical rain forest in Sabah, Malaysia with UMS. I will introduce my future plan to start the same experiment in Korea and Taiwan under collaboration with SNU and NTU.

Identification and field attraction test of aggregation pheromone of *Monochamus saltuarius*, insect vector of pine wood nematode in Korea

Hyo-Rim Lee[1], Sung-Chan Lee[1], Dong Ha Lee[2], Won-Sil Choi[3], Chan-Sik Jung[4], Jae-Ho Jeon[5], Jeong-Eun Kim[1] and Il-Kwon Park[1,6]

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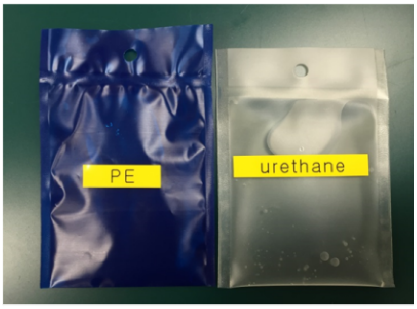
Abstract

In this study, we isolated and identified an aggregation pheromone from *Monochamus saltuarius*, the major insect vector of the pine wood nematode in Korea. Adult male of *M. saltuarius* produces 2-undecyloxy-1-ethanol, which is known to be an aggregation pheromone in other *Monochamus* species. We performed field experiments to determine the attractiveness of the pheromone and other synergists. More *M. saltuarius* adult beetles were attracted to traps baited with the pheromone than to unbaited traps. Ethanol and (-)-α-pinene interacted synergistically with the pheromone. Traps baited with pheromone+(-)-α-pinene+ethanol were more attractive to *M. saltuarius* adults than traps baited with pheromone, (-)-α-pinene, or ethanol alone. Ipsenol, ipsdienol, and limonene were also identified as synergists of the aggregation pheromone for *M. saltuarius* adults. Our results suggest that a combination of aggregation pheromone and synergists could be very effective for monitoring and managing *M. saltuarius.*



Funnel traps (left) and polyethylene and urethane lures (right) used in field experiments

A preliminary study on the fauna of Hemiptera insects in Tataka alpine ecosystems of Taiwan

Hsin-Ting YEH[1], Chien-Yu CHIANG[2], Chiun-Cheng KO[2], Ping-Chun JOU[2], Fang-Hua CHU[1,3] & Ming-Jer TSAI[1,3]

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[3]School of Forestry and Resource Conservation, National Taiwan University, REPUBLIC OF CHINA

Abstract

Many hemipteran species are phytophagous insects; their community structures should vary with the composition of host plants over space and time. The hemipteran insect communities within the understory of alpine ecosystem in the central Taiwan is studied. The native spruce forest (*Picea morrisonicola*), hemlock forest (*Tsuga chinensis*) and Yushan-cane meadow (*Yushania niitakayamensis*) are dominant plant communities near the Tataka area. A Malaise trap is set up in each of the foregoing dominant plant communities for collecting insects, and the gathering bottles of Malaise trap are replaced once a month. All the hemipteran adult insects are categorized to family or superfamily level. From July 2016 to January 2017, totally 3,076 hemipteran insects which belonged to 16 families/ superfamilies are recorded. The Cicadellidae species have predominant quantity in the three sampling plots. The relationships among diversity of hemipteran insects and dominant plant communities will be further discussed in the future.

MONITORING SPECIES DIVERSITY OF BIRDS IN MONTANE EVERGREEN FOREST PERMANENT PLOT AT HUAI KOG MA BIOSPHERE RESERVE, CHIANG MAI PROVINCE

Supalak Siri[1], Dokrak Marod[2] & Prateep Duengkae[2]

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[2]Department of Forest Biology, Faculty of Forestry, Kasetsart University, THAILAND

Abstract

The monitoring species diversity of birds in montane evergreen forest permanent plot was conducted monthly from December 2011 to March 2017. Direct observation and mist-net method were placed in a 16 hectare permanent plot for comparison between closed canopy and forest gap. This study recorded 95 species consisting of 31 families, and 7 orders. There were 90 species at the closed canopy localities and 82 species at the forest gap localities. The Shannon-Wiener indices (H') at the closed canopy and at the forest gap were 3.75 and 3.67 respectively. The H' of closed canopy was non significantly more than the forest gap ($P>0.05$). From this result appear that forest disturbance from natural causes such as gap formation affects species diversity but natural effects are not too severe when compared with forest disturbance causes by human activity. Hence, forest gaps are an important resource for many forest birds.

On the development of fundamental data on vertebrates in the University of Tokyo Forests

Dai FUKUI[1] & Naoto KAMATA[1]

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Abstract

Inventories of the fauna and flora at a site are essential for subsequent long-term monitoring. The UT Forests began compiling such species lists in the early 2000s. So far 23 mammal and 156 bird species have been recorded in the UT Forests using direct observation and camera traps. However, rodents and bats, which are the first and second most diverse groups of mammal, were not initially included in the lists, because they are difficult to identify to species using only direct observation or photos. Since 2013 we have conducted surveys of bats, which can be important as bio-indicators, by catching them. We have also started to develop reference collections of echolocation calls which will be used for future long-term acoustic monitoring.

In this paper we present the results of faunal surveys to date, describe the echolocation call library, and discuss the importance of bats as bio-indicators and possible future work.

Distribution of Black flies (Diptera: Simuliidae) in Ranau and Tambunan District, Sabah.

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Abstract

Black flies play an important role in organic matter processing of freshwater ecosystem and are also bio-indicator for water quality. This study investigates the relationship between black flies diversity and the physiochemical parameters. There were 12 data sets collected over a period of 12 months (October 2015 to September 2016). A total of 13305 black flies pupa collected from nineteen species which belongs to subgenus *Simulium*, *Nevermania* and *Gomphostalbia*. Biodiversity index score shows that the species diversity in the rivers sampled were low which ranged from 0.45 to 1.68 and dominance index ranged from 0.23 to 0.98 indicates the species were not evenly distributed in all study sites. Principal Component analysis (PCA) indicates two principal component that have eigenvalues >1.0 and accounted 69.8% of the total variability of physiochemical condition. pH was strongly positively correlated with the total pupa number (r_s = 0.611, p = 0.01). There was a strong, negative correlation between temperature and total pupa number (r_s = -0.55, p = 0.03). Total dissolve solid also show a strong, negative correlation with total pupa (r_s = -0.741, p = 0.03).

Research Group 3

The long-term study sites in Nambu University Forest of Seoul National University, Korea

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Abstract

Nambu University Forest of Seoul National University was established in 1912 and consists of two mountain areas. One is located in Mt. Jiri, and the other is located in Mt. Baekwoon. The majority of Nambu University Forest in Mt. Jiri are natural forests. Mt. Baekwoon has plantations of various species. In 1910–1920s, plantations of *Pinus koraiensis, P. thunbergii, Picea abies, Chamaecyparis obtusa, Chryptomeria japonica, Abies firma, Quercus acutissima*, and *Quercus variabilis* were established in Nambu University Forest to investigate species growth characteristics and adaptability to the region. Among them, *C. japonica* and *A. firma* showed the best height growth. *P. koraiensis, A. firma* and *P. abies* showed the best diameter growth. However, the growth varied depending on the species and sites. Currently, most of plantations established in 1920s had the senescing trees and understory was occupied by native species from adjacent natural stands. We launched two year monitoring projects in the research plantations in 2016, aiming to advance the monitoring projects to the second phase from 2018.

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Forest management and experimental forest plantation during the Japanese occupation in South Korea

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Abstract

Much of Korea's forests began to be destroyed in the early 15th century. Historical records from the late 19th century described their conditions as: all the mountains across the country were barren, except the ones that were left untouched by humans because of their remote location. This situation continued until the late 20th century. During the 600 years of Joseon Dynasty (1392-1910), all the mountains of Korean peninsula were owned and directly managed by the Dynasty (state). People were allowed to cut tress for wood consumption without any restriction. There was indiscriminate use of forest resources and no one recognized the need for reforestation. During this period, Korean people utilized woods as a source of energy to prepare food, to feed livestock and to heat home for long winter. Wood was also the main material used for construction at that time. Making the consumption was inevitable, and this gradually disappeared trees in the forests.

At the beginning of Japanese occupation in 1910, the Japanese conducted on the survey of Korea's forests and natural resources. At that time, the forest cover was about 71%. Dance forests were largely concentrated in the northern regions that are difficult to access as they are very mountainous regions. Around capital and middle part of Korea indicated that forests were in the poor conditions. At the southern part, there was bare of any trees. The depletion of Korea's forests in 1910 was very severe. The Japanese designated all the mountains that were previously owned by Joseon Dynasty as national forests and established regional forest offices to manage the national forests nationwide. They also gradually predated the remaining virgin forests. The 36-year long occupation (1910-1945) and the Second World War further devastated forests in Korea. Records show that a total of 63 million m^3. Full-fledged exploitation of virgin forests began after the Second World War, with the ultimate goal of supplying was resources. Key target areas included national forest areas that were controlled by the regional forest office. Regional forest offices were installed by Japanese in the national forests to facilitate mass forest exploitation. Although Japanese destructed Korea's forests, they established and

implemented forest policies. For instance, they initiated fuel-wood forest establishment and erosion control project, but failed to carry out any large scale of reforestation efforts.

In 1911, Japan designated two sites for experimental forests (106,300 ha) in South Korea. One was in Jiri mountain area (79,700ha) and the other one was in Geumgang mountain area (26,600ha). In the Jiri mountain area, Kyoto University, Kyushu University and Tokyo University were in charge of the establishment of experimental forests. Kyoto University forests had an aim of the research on the relationship among forestry and agriculture, and Kyushu University forests carried mainly out the research on the relation between forestry and erosion control plantation. In Tokyo University forests, a broad range of forest experiments were performed. The criteria to select the experimental forest sites were 1) the places that were not possible to manage because of high elevation, 2) the forest that had a public important such as watershed conservation and land security function, 3) the land that was not clear on ownership and 4) exclusion of the land that could be good for village forest management in the future.

SUGI AT NTU EXPF: ITS PAST, PRESENT, AND FUTURE

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Abstract

Introduced to NTU Experimental Forest (EXPF) in 1909, sugi (*Cryptomeria japonica* D. Don) was one of the preferred plantation species until 1990, the last year the species was planted. Currently, EXPF has close to 2,300 ha of sugi plantations still standing, with stand ages ranging from about 30 to more than 100 years. Because of the climate, the species grew relatively fast in the first 15 years, then diameter growth started to decline rapidly when stand age reached around 20 years, and stand growth became stagnant at stand age around 50 years. Due to high labour cost and low timber price, sugi is no longer harvested in large acreage. Replacing with native conifer species such as *Taiwania*, understory planting of shade-tolerant native broad-leaved species, and restoring to native late-successional state vegetation are among the options being considered at EXPF to replace the aging sugi plantations.

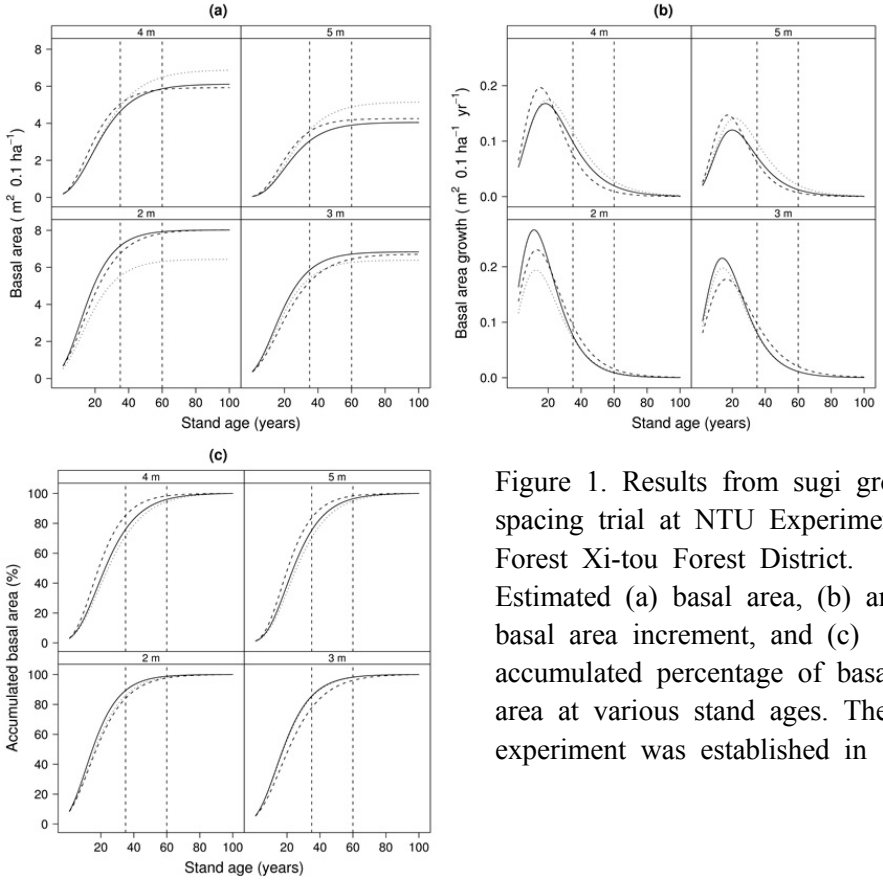

Figure 1. Results from sugi growth spacing trial at NTU Experimental Forest Xi-tou Forest District. Estimated (a) basal area, (b) annual basal area increment, and (c) accumulated percentage of basal area at various stand ages. The experiment was established in 1950.

Bringing long-term growth records of *Cryptomeria japonica* plantations for collaborative research

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Abstract

Cryptomeria japonica D. Don (Japanese cedar; 'sugi' in Japanese) is one of the important plantation species in East Asia including South Korea, Taiwan, and Japan. Seoul National University, Taiwan National University, and The University of Tokyo (UTokyo) have established experimental plots in *C. japonica* plantations since the early 20thcentury. Long-term growth records on the se plots are valuable to model forest growth and yield, to quantify the effects of silvicultural interventions (e.g., thinning), and to assess the ability to sequester carbon. The geographical variation can provide an opportunity to investigate the species' response in tree growth along environmental gradients. It is desirable to promote international collaborative research focusing on long-term *C. japonica* growth. As a Japanese representative, I briefly present the growth records and key research findings from *C. japonica* plantation plots at UTokyo Chichibu Forest. I also review *C. japonica* growth studies using long-term experimental plots in north-eastern Japan.

Coniferous plantation and long-term experimental plots in the UTokyo Chiba Forest

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Abstract

The UTokyo Chiba Forest, established in 1894, had encouraged artificial planting of coniferous tree species, finally establishing approximately 700ha of planted Sugi (*Cryptomeria japonica*) and Hinoki (*Chamaecyparis obtusa*) forest with various stand ages. Utilizing this research resources, various studies related to the growth and treatment of coniferous plantation have been conducted by Chiba forest and external researchers. Among them, the oldest and most typical study is a set of 10 long-term experimental plots, where size of each tree has been monitored mainly since 1916. Seven of them are even-aged Sugi stands and the others are Hinoki. Some of the data collected there have been summarized and published mainly in “Miscellaneous Information” and “Bulletin” of the University of Tokyo Forests, and was also used as a core data of the basic research of “LYCS”, a flexible model to create yield tables.

Photo1 Growth measurement of 116-year-old Sugi forest of Ninodai plot in 2016

Introduction of the computerized yield table construction system in Japan

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Abstract

This study introduces the Local Yield Table Construction System (LYCS), a computer program to predict managed-stand growths of major planting species in Japan. LYCS embodies a set of relationships among growth-and-yield models of tree number, DBH, height, site index, diameter distribution, self-thinning ratio, etc. and provides estimates of future-stand development given initial stand conditions and specified thinning regimes of interval, intensity and type of thinning (low-, crown- and free-thinning). Three major planting species of Japanese cedar (*Cryptomeria japonica*, known as sugi), Japanese cypress (*Chamaecyparis obtusa*, known as hinoki) and Japanese larch (*Larix kaempferi*) are known to have different growth parameters among the regions in Japan owing to the differences of climate and local cultivar (sub-species), and LYCS is localized to consider such differences and can be applied to various regions in Japan, e.g. Japanese cedar for 17 regions, Japanese cypress for 10 regions and Japanese larch for 4 regions.

Climatic effect on tree growth of highland plantation at Angkhang Royal project Chiang Mai province

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Abstract

The effect of climatic factors, including temperature, rainfall, and relative humidity, on growth of tree species in highland plantation was investigated using dendrochronological techniques. Sample cores of *Pinus kesiya*, *Cunninghamia lanceolate*, *Cryptomeria japonica*, *Chamaecyparis obtusa* and *Prunus cerasoides* were obtained using increment borer.

The results showed that *C. obtusa* and *P. cerasoides* didn't pass the relationship test by software named COFECHA; thus, only 3 species passed the test at the significant level of 0.05. *P.* kesiya chronology showed a significantly positive correlation with the maximum temperature, minimum temperature, and average temperature in November and average monthly humidity in July and September. *C. lanceolate* chronology showed a significant negative correlation with the minimum temperature and total rainfall in July, and average temperature in May. *C. japonica* chronology showed a significant negative correlation with the maximum temperature, and average temperature in September and had positive correlation with the total rainfall in August.

Use of remote sensing to support forest resources monitoring in forest management unit and plantation forests

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Abstract

Forest management units (FMUs) and plantation forests cover more than 2 million hectare in Sabah, Malaysia. Forest resources monitoring in these areas such as timber resource, biodiversity, forest carbon and forest fire damage require accurate, timely and cost-effective assessment. Remote sensing technology offers such capability with two major advantages of large spatial and multi-temporal assessment. Three main sensor types can be utilized; namely optical sensor, light detection and ranging (LiDAR), synthetic aperture radar (SAR) which all can be deployed either space-borne or airborne platforms. Each type of remote sensing data provides different information and resolution depending on sensors' type and altitude with different cost. The recent development of unmanned aerial vehicle (UAV) together with structure from motion (SfM), where three-dimensional information in dense points now can be derived, open up new opportunity of cost-effective approach under certain conditions for forest resources monitoring in FMUs and plantation forests.

Poster Session

Salt-dilution Velocity Prediction in Naturalized Channels

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Abstract

Despite the significance of velocity prediction in mountain streams, it is barely studied due to complexity and diverseness of natural streams. Velocity is a major factor in characterizing the flow and thus necessary for designing hydrologic structures that greatly reduce flood damage. We measured discharge and velocity in natural channels using the salt-dilution method. We categorized the channels located in Seoul National University into step-pool or plane and riffle types, and surveyed their geomorphological properties such as streambed slope, streambed materials, and the channel cross-section. In order to measure the discharge, sudden-injection method that measured conductivity in downstream every second after pouring certain amount of brine in upstream was used in this study. And velocity was calculated by employing statistical method using a harmonic means suitable for averaged velocity estimation. As a result of the relationship between the discharge and velocity, it can be seen that the exponent value was about 0.6 in velocity-discharge relation regarding channel types, which is consistent with derived value from the relation between velocity and discharge through dimensional analysis from the hydraulic point of view. And the value is almost close to 1 so we can find that the correlation between velocity and discharge is very high. Unlike the plain/riffle channel, the step-pool channel can be seen to have a smaller velocity because it has more hydraulic flow resistance. Since the prefactor value differs, moreover, according to the channel shape, more data will be collected in other different channel type and velocity prediction modeling will be done in time. We expect to model the flow velocity with geomorphological factors and discharge when more field data are collected, which can be generalized to predict flow characteristics in natural streams.

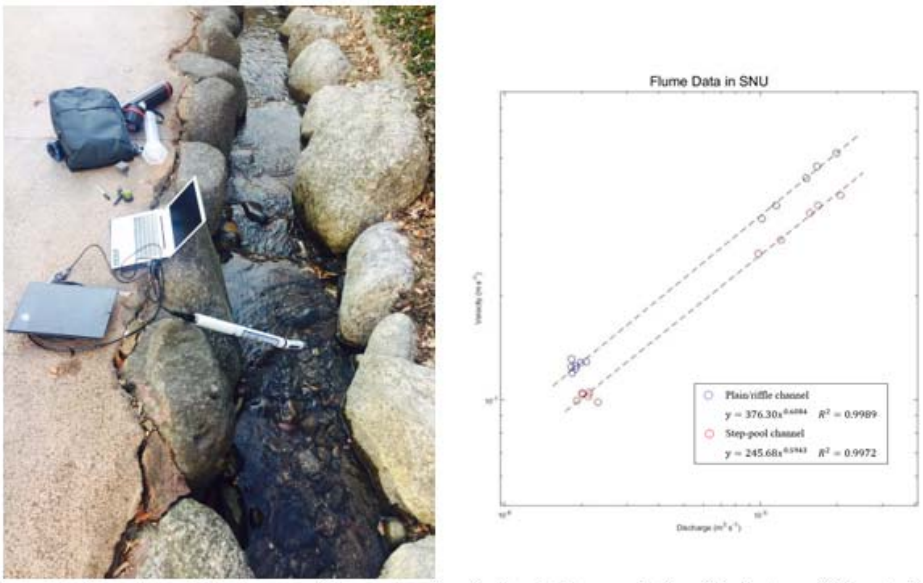

Figure 1 : Experiments in step-pool channel and velocity-discharge relationship in two different channel

Partitioning of rainfall into throughfall, stemflow and interception between Larch and Oak forests in Korea

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Abstract

A role of rainfall interception was a canopy water balance between watershed and plant ecosystem. It is important to know effects of forest type, ground cover and climate on partitioning of rainfall into throughfall, stemflow and interception (e.g., Crockford and Richardson, 2000). Water during rainfall-runoff events fell down from atmosphere to forest and deposited on the surface area of leaf and branch of forest within a catchment. Water was also returned from forest to atmosphere by evaporation on the surface area of leaf and branch within forested catchment. Thus, it needs to consider the variety and reliability of measurement techniques to be used, and interpret the results of interception studies in relation to methodological, vegetational and climatic factors (i.e., Crockford and Richardson, 2000). In this study, we approached comparing process of rainfall interception by forest types and analyzing effects of rainfall characteristics on the canopy interception. The study was conducted in Oak and Larch forests in the forested catchment, Hwacheon. The precipitation, throughfall and stemflow were monitored in 10m X 10m plots installed in each forest (Oak and Larch forests) from January 1 to October 16 in 2016. The mean annual precipitation is 1,347 mm and mean annual temperature is 11℃. The throughfall was similar both in the Larch (62.5%) and Oak (61.9%) forests. The stemflow of the Oak forest (12.1%) was greater than 2.1% of the Larch forest. Rate of rainfall interception was 35.4% in the Larch forest, while the interception was 26.1% in the Oak forest, due to the difference of canopy structure on interception loss.

These results were derived from relatively short-term observations. However, it can be not clear whether the effects would still be similar in the long-term observations (i.e., Gerrits et al., 2010; Ufoegbune et al., 2010). However, our study can provide useful information for understanding the changes in interception processes induced by forest types (i.e., coniferous and/or broadleaf forest). It is possible that there would be affected by

environmental changes with various forest types (e.g., Hill 1979; Thomas et al. 1999). Furthermore, effects on rainfall interception during the long-term periods will be needed to understand the relationship between coniferous and broadleaf forests.

Characteristics of event suspended solid concentration with turbidity in a coniferous plantation catchment

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Abstract

To estimate event suspended solid concentration, we collected data by ISCO automated water samplers in a 2.0 ha coniferous plantation catchment, Gyeonggi-do, Korea. The study was conducted during limited storm events concentrated summer season from 2012 to 2013. For measurement of suspended solid concentration during the storm events, sampling streamwater was started when the rainfall intensity exceeded 10 mm/hr and continued every hour for a day (i.e., as storm event samples). Intakes of samplers were located in the inlet of the gauging station of the catchment. For identifying response of changes in discharge and suspended solid concentration, we approached a hysteresis pattern (e.g., clockwise and/or anti-clockwise hysteresis patterns) during the rainfall- runoff events. Next, we applied for turbidity data based on rising and falling limbs of the hydrograph. The time differential of runoff (dQ/dt) was related with runoff and turbidity. These methods can imply the hysteresis patterns are influenced by areal distribution, runoff amount, and floodwater travel distance within a forested catchment, particularly storage-mobilization-depletion process of available suspended solid materials (i.e., Williams, 1989). Moreover, information of suspended sediment is an important for sediment routing and delivery, and in the construction of catchment sediment budgets (Dietrich and Dunne, 1978; Walling and Webb, 1983). Thus, there is a need to identify sediment sources using hysteresis analysis and radionuclides tracers in other to implement appropriate strategies to control sediment transport and subsequent siltation of stream channel (Carter et al., 2003).

Correlation analysis was conducted between suspended solid concentrations and potential parameters (i.e., rainfall, runoff, and turbidity). Suspended solid concentrations in the rising limbs positively correlated with rainfall, runoff, and turbidity ranged from 0.57 to 078 of correlation coefficients (p<0.01). In addition, suspended solid concentration in the falling limbs positively correlated with rainfall, turbidity (correlation

coefficient: 0.65-0.89; $p<0.01$), except for runoff (correlation coefficient: 0.19; $p=0.06$). After that, we used a regression equation for estimating suspended solid concentration from correlation analysis. The regression analysis was statistically significant which 0.531Rainfall + 2.740Runoff + 0.330Turbidity –1.654 ($R^2=0.87$;$p<0.01$) for the rising limb, and -0.022Rainfall – 1.275Turbidity –0.148 ($R^2=0.89$;$p<0.01$) for falling limb.

This study indicates that event suspended solid could be estimated by rainfall, runoff, and turbidity, which was related with hydrological connectives and/or processes of forest floor within unmanaged coniferous plantation catchment.

Key Land Use and Land Cover Change Identification using Google Earth and Landsat images: Case Study Debremarkos-Blue Nile Basin, Ethiopia.

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Abstract

In this study the analysis of land use land cover changes(LULCCs) enables us to view the past and present resource conservation level in a case study of Debremarkos-Blue-Nile Basin (DMBN-basin), Ethiopia. The LULCCs comes around from human population growth and related demand activities, although the attitudes toward conserve of the natural resource and also the conservation depends on the level of government extension program and community acceptance to rehabilitation level through the basin. The LULCCs in this area are diverse within a short agro-climatic range from 3960 m.a.s.l upper catchments, the dominant land afro-alpine ecosystem to lower catchment about 880 m.a.s.l with woodland ecosystem a total flight distance around 78 kilometers. To identify this diverse land use and land cover and its changes(LULCCs) by using Google Earth(GE) as a source of data to export and train to Landsat 7 ETM+ and Landsat 8 and the LULC classification in this area identified in this method are categorized into nine classes. The changes detected by fifteen-year time period difference from 1999 to 2014 have shown gain and loss. The method also tries to maximize LULC classification accuracy from freely available Landsat images by using Google Earth image as a source of training data. This study analyzes the rates, trend and cause of LULCCs and also areas either under gain or losses categories, the main areas of the basins are agriculture, forest, afro-alpine vegetation, plantation, woodland, shrubs, grassland, water-body and settlements. This gives information about the past and current, of natural resources conversion activity and progress in the basin.

The land use and land cover change after many years of clearing of woody vegetation coverage for settlement and agriculture are common in many areas. This is due to the level of community perception conserving and utilizing degraded resource mainly influences soil erosion consequences further effect on productivity as shown in

many studies. Although in this area the vegetation coverage shows an increasing coverage of planting Eucalyptus tree because of Eucalyptus plantation has been practice widely per private level. This Eucalyptus plantation was chosen by the community due to fast growing species, commercially favorable for selling and also the main source of domestic consumption for construction and fuel wood. This benefits of Eucalyptus are valuable not only for in local but also throughout the country as stated in many kinds of literature. This Eucalyptus adverse impact on changing the agricultural land, the allopathic effect of pioneers as well as neighboring agricultural crops and less effective in protecting soil erosion. The main issue in paper only to raise the LULCCs within fifteen years its consequence on soil erosion will be the upcoming study. Finally, the objective to fill gaps for resource managers how to identify the past degraded resource, the current and the past trends. This monitoring the trend, causes and rate of change also advance method within short period rather doing ground explorations, with maximum accuracy and list cost but it needs to train expertise, internet access and soft wears. The broad significance to improve the data shortage by using remote sensing data for experts as well as decision makers for prepare future development plan and decision making in the area after appropriate training to solve undeveloped resource conservation practices.

Entomofauna of boring-insects in Taehwa mountain

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Abstract

This study was conducted to evaluate the entomofauna of boring insects (Scolytidae, Cerambycidae, Curculionidae) at broad-leaved forest (Quercus mongolica stand) and coniferous forest (*Pinus koraiensis* and *Larix caempferi* stands) in experiment forest of Seoul National University, Taehwa mountain. We used the multi funnel traps baited with two kairomones [(-)-α-pinene and ethanol] from April to October in 2015.

Total 5,527 individuals in 72 species of boring insects were collected. Among these groups, Scolytidae was the most dominant group with 5,041 individuals in 34species. Collected number of species was the most abundant in June, but collected insect number was the highest in May.

Multi funnel traps baited with ethanol alone were attractive to *Platypus lewisi*, *Cyclorhipidion pelliculosus*. More individuals of *Tomicus piniperda, Hylurgops longipillus*, *Shirahoshizo rufescens*, *Hylobitelus haroldi*, and *Peseudo japonicum* were attracted to the multi funel trap baited with ethanol + α-pinene.

Our results can be use as a fundamental data for the monitoring and control of boring insects in University Forest.

Estimating Water Uptaking Depth of *Chamaecyparis obtusa* and *Styrax obassia* by Stable Isotope Analysis

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Abstract

Understanding water uptaking dynamic of trees is important whether the trees can survive under soil drying conditions. In this study, we inspected changes of water-uptaking depth of *Chamaecyparis obtusa* and *Styrax obassia* by hydrogen (δ^2H) and oxygen ($\delta^{18}O$) stable isotope analysis for April 2016. Soil water of 5 depths (10, 30, 50, 100 and 120 cm) was extracted by lysimeter. At the same time, we also collected branches of the 2 tree species to extract water within xylem. We estimated the water-uptaking depth of each species by stable isotope ratio of soil water samples and xylem water samples and stable isotope mixing model. In results, the stable isotope ratio of soil water was increased from 10 cm to 30 cm, and then decreased gradually until 120 cm. *C. obtusa* used water from 10 to 30 cm depth. Meanwhile, *S. obassia'*s major water source was 30 cm depth of soil.

Size-dependency of leaf physiological characteristics and nitrogen allocation in *Robinia pseudoacacia* and *Cornus controversa*

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Abstract

Leaf functional traits in trees that change through ontogeny influence forest community structure and ecosystem function. However, the pattern of the size-dependent changes in leaf physiological traits has not been studied much. To investigate the patterns of size-dependent changes in the partitioning of total leaf nitrogen (N) between the different pools of the photosynthetic and structural apparatus of species with contrasting life-history strategies, sampling was conducted in Seoul National University Forest located in Mt. Taehwa, Gyeonggi Province, Korea. Within Mt. Taehwa, we chose two of the most dominant tree species: *Robinia pseudoacacia*, a light-demanding pioneer nitrogen-fixing species, and *Cornus controversa*, a shade-tolerant and late-successional species. The result shows that *R. pseudoacacia* has higher leaf N than *C. controversa* and the leaf N varies significantly with diameter at breast height (DBH). However, these patterns show second-order polynomial terms with significant difference between two species. Nitrogen allocated to the photosynthetic apparatus is greater in *C. controversa* than *R. pseudoacacia.* It decreases with DBH in *C. controversa,* though remains constant with DBH in *R. pseudoacacia.* The structural traits of two species are that *R. pseudoacacia* allocates much more nitrogen to cell wall protein than *C. controversa*, although there is no significant difference in leaf mass per area (LMA) in both species. Cell wall nitrogen shows marginally significant increase with DBH, and LMA also increases monotonically with DBH in both species.

Characteristics of long-term dynamics of tree species distribution in Korean mountain forests

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Abstract

The additive models were developed to understand the underlying processes behind the distribution and change of species diversity along topographical environment gradients over the 15 years across Mt. Jiri and Baegun of South Korea. The topographic drivers included are latitude, longitude, elevation, slope, topographic wetness index (TWI), curvature, aspect, and soil type. The additive models showed that the distribution of species diversity is significantly related to topographical gradients, including elevation, latitude, longitude, slope, TWI, and curvature throughout time. Among the topographical variables, elevation was the most significant driver of species diversity distribution across 130 plots, followed by latitude and longitude. In particular, species diversity along the elevation gradient did elucidate pronounced humped-back distribution with high diversity at intermediate elevations. It is also noteworthy that at our site, the change in the distribution of species diversity over time was only significantly influenced by a geographical location (i.e. longitude and latitude).

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Habitat characteristics of Korean clawed salamander (*Onychodactylus koreanus*) in Mt. Baekun, Korea

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Abstract

This study was conducted to clarify the habitat characteristics of the Korean clawed salamander (*Onychodactylus koreanus*) in Mount Baekun, Jeonnam province, Korea. We applied detection/non-detection method for appearance data with line transect in six streams, three in lowland and three in highland with 60m interval during daytime and nighttime from March to August 2015. We sampled 62 points, first to sixth order streams, each surrounded by deciduous forest habitat. Measurements of 186 attributes of the forest and stream environment were recorded in conjunction with area-constrained aquatic sampling for salamanders. We found 16 points with adults(58), 23 points with tadpoles(253) in study area. The detection/non-detection data were used to identify micro-environmental parameters related to the presence of the species and to produce a descriptive habitat model. We modelled the habitat characteristics based on seven environmental parameters for adults, six for tadpoles selected by logistic regression analysis. Results from discriminant and logistic regression analyses indicated that in this species, adults are associated with soil pH, soil humidity, overstory cover. Tadpoles are associated with dissolved oxygen, stream with, water pH, pebble and cobble cover in stream. The models, through the analysis of habitat environment, may contribute to provide basic information for conservation planning. Further researches is required to collect additional data of Korean clawed salamander for conservation and proper management plans.

Physiological response of Native Tree species in Korea under elevated atmospheric CO_2 concentrations

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Abstract

In this study, we investigated physiological responses of trees planted in open top chamber to understand the adaptation of four native tree species under increased atmospheric CO_2 concentration environment. The chambers consisted of three different treatments (ambient(400_{ppm}), ambient 1.4x(~550_{ppm}) and ambient 1.8x(~700_{ppm}). We selected four native species of Korea (*Pinus densiflora, Fraxius rhynchophylla, Sorbus alnifolia and Quercus acutissima*) and measured leaf morphological (Leaf Mass per Area, LMA) and physiological characteristics (maximum electron transport rate; J_{max}, maximum carboxylation rate; V_{Cmax}) in 2016. The LMA of *F. rhynchophylla* and *S. alnifolia* were increased according to CO_2 concentration, but there were no significant differences in LMA of *S. alnifolia* ($p>0.05$). *Quercus acutissima* showed the highest photosynthetic rates (J_{max}, V_{Cmax}) at 400_{ppm}.J_{max} of *Pinus densiflora* is higher in ambient 1.8x (~700_{ppm}) than other treatments. *Sorbus alnifolia* and *Pinus densiflora* were not statistically significant in three different treatments. Therefore, we suggest that long-term studies on the physiological changes of various species due to increased [CO_2] are needed.

Impact of forest ecosystem services on local livelihoods The case of SNU Nambu University Forest

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Abstract

As the population in rural area is aging and decreasing, rural community is faced with various social problems. Especially, mountain villagers who live in marginal areas have poor infrastructure for their income generation. Annual average income of forestry households is about 86.5 percent of agricultural households' income. Forestry households also keep higher poverty rate than other types of households. Thus, this study aims to identify income structure of mountain villagers and analyse the impact of forest ecosystem services on their income. Survey was conducted in 5 villages near Seoul National University (SNU) Nambu University Forest located in Gwangyang-si and Gurye-gun, Jeollanam-do, in the southern part of Korea. SNU Nambu University Forest has contributed to local people's income by providing them with non-timber forest products (NTFPs) such as maple sap. Face-to-face interviews were administered to 153 households in August 2015 and 2016. The policy of SNU improving local livelihoods using forest ecosystem services was suggested by this study.

Relationship between body condition and breeding performance in Varied Tits (*Sittiparus varius*)

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Abstract

Reproduction in birds is an immensely energy-consuming process. Like many other bird species, body condition in Varied Tits (*Sittiparus varius*) affects breeding parameter throughout many different stages. The purpose of this study is to investigate how this relationship between body condition and breeding parameter functions in the Varied Tit, and artificial nextboxes were used in Mt. Baekwoon, Korea. The body condition of parents was measured before and at the end of the breeding of 2016 using both the Body Condition Index (BCI) and the level of glycated hemoglobin (HbA1c). Breeding parameter was derived from the laying date, clutch size, breeding success, and chick condition and growth rate. The level of HbA1c of females before the breeding was positively correlated to chick weight, which seems to be a result of higher energy reserve, egg quality and possibly foraging for chick rearing and possibly better foraging ability. The relationship between the BCI of parents and breeding parameter was different by sex at the end of the breeding, and this is thought to be the result of different breeding strategies ii between the sexes. The BCI of females showed negative correlation with chick condition at the late stage, while chicks of males in better condition grew faster. While the decrease in BCI of females seems to represent direct investment of energy for chicks, the BCI of males seems to represent the resource holding potential and further increased foraging for chicks which influences the growth rate of chicks. Early start of breeding resulted in larger chicks at first, but the gap among nests was mitigated possibly due to intensive parental care of late breeders. No significant relationship was found between the HbA1c and the BCI, and the HbA1c of parents measured at the end of the period was not significantly correlated to any of the breeding parameter variables. In this study, the body condition of Varied Tits showed various correlations with breeding parameter. HbA1c could be used as an index to represent a bird's body condition before or at the early stage of breeding, while at later stages of breeding, conventional measurements such as the BCI seem to be more reliable in representing the body condition of parents and reflecting breeding parameter.

Introduction of experimental research in Seoul National University Forests, Korea

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Abstract

Seoul National University Forests (SNUF) was founded for dealing the matter regarding an experimental research on forests science, supporting educational practices and sharing the research outcomes through university forests. Among them, research activity is the primary role of the university forest. In this study we reviewed the trends of research carried out at the SNUF since 2000, in terms of temporal trend and diversity on three branches of SNUF. The recent researches on SNUF have been conducted in the Nambu University Forests which carrying out long-term ecological studies in the permanent plot. According to yearly trend, more than 20 papers were published in 2002 and 2006, while only one and four were published in 2012 and 2013, respectively. As a result of analyzing the research topics on 10 major fields such as ecology & physiology, wildlife, hydrology, genetic & breeding, taxonomy, entomology, management, economy, engineering and pharmacology, the ecology & physiology studies were mostly studied, with 55.6% of total publication, wildlife and hydrology followed. In recent years, pharmacology and entomology have been sprouted as major research contents of our university forests, which is new challenge for university forests activities.

Introduction of University Forests, SNU

Seoul National University Forests

The Seoul National University Forests (SNUF) was established in 1913 in order to contribute to education and research of forest science and forestry in Korea. We own three university forests in mid and southern part of South Korea, namely; Chilbosan, Taehwasan, and Nambu University Forest. The forests cover 17,130 ha in the temperate zone. Each forest has unique nature containing various species of plants and animals. University Forests has provided forests field and facilities to support education for students and researchers who study forest sciences. Moreover, SNUF supports the research and experiment to develop mountain villages and local community.

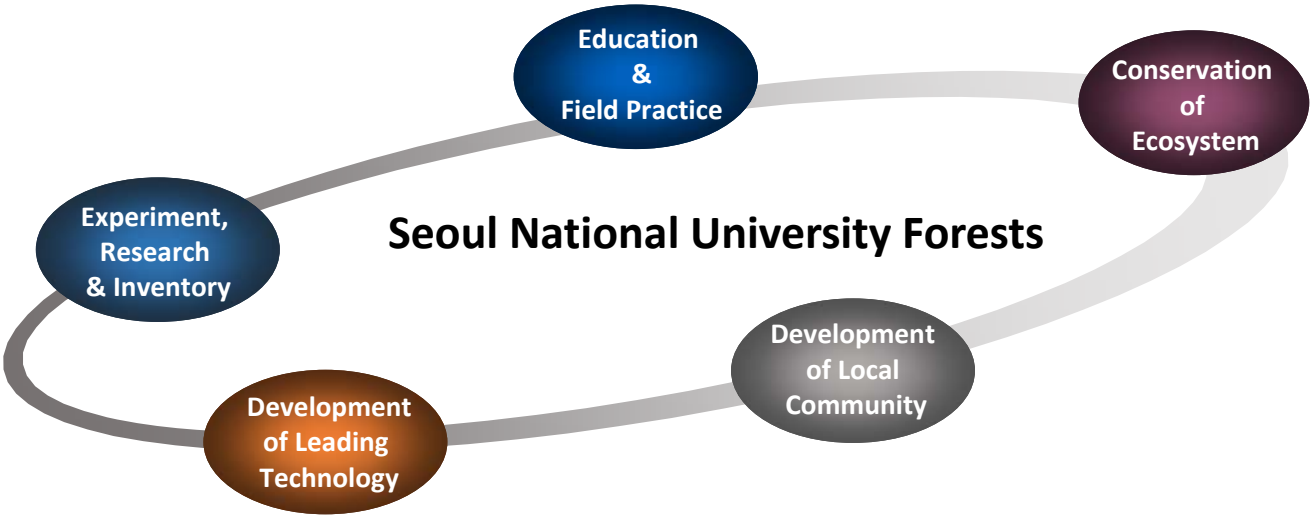

Figure 1. The Mission in SNUF

	Chilbosan-	Taewhasan-	Nambu-
Establishment year	1928	1979	1912
Longitude Latitude	N 37° 16~17' E 126° 55~56'	N 37° 18~20' E 127° 17~20'	N 35° 10~21' E 127° 22~37
Area(ha)	118(0.7%)	796(4.6%)	16,218(94.7%)
Sea level(m)	50~234	150~641	100~1,732
Climate region	Temperate	Temperate	Temperate
Average temperature	12.7℃	11.5℃	14.7℃
Mean annual precipitation	1,500m~1,600m	1,625m~1,725m	1,500m~1,800m

Table 1. Site Descriptions of SNUF

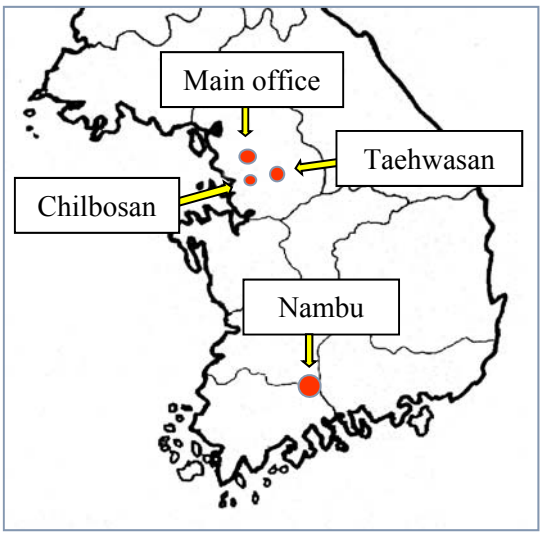

Figure 2. The Location of SNUF

Chilbosan University Forest

Chilbosan University Forest started as a name of Suwon Experimental Forest, which was established in 1913. In 1928, Chilbosan University Forest was founded in 1928 with an area of 66.44 ha as public forest located in Gyeonggido. Currently Chilbosan University Forest consists of 103 ha of forested areas and 15 ha nurseries. Chilbosan University Forest was degraded land of sandy soil originally, so the volume stocking was poor and there was mainly conducted forestation for erosion control and stream stability with Pitch pine (*Pinus rigida*) and *Alnus japonica*. Coniferous forest with Pitch pine as the main species makes up of about 80 % of the whole area while deciduous forest accounts for 20%. The dominant species of the deciduous forest include *Quercus acutissima, Quercus mongolica, Quercus dentata, Robinia pseudoacasia, Sorbus alnifolia,* among others. The dominant species found in the under-layer of the deciduous forest are *Rhododendron mucronulatum, Lindera obtusiloba, Smilax china*, and *Lespedeza bicolor* among others.

In the nursery, 60,570 trees of 71 species and 150,000 saplings of 20 species are being raised. Selection for mother trees are carried out in seed orchards of Chilbosan University forest in order to obtain high quality seeds.

▷ Location

Located in Suwonsi and Hwaseongsi, Gyeonggido. It is 6 kilometers west far from old Suwon campus of Seoul National University. It is situated at E125° 55‘-56' and N37° 16‘-17‘. It belongs to the temperate zone, and has Mt. Chilbo (238 m) as its main peak.

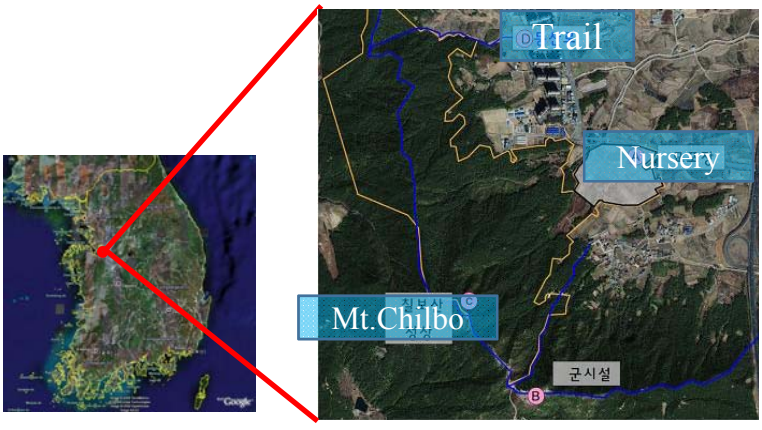

Figure 3. The Location of Chilbosan University Forest

▷ Research & Education

Chilbosan University Forest installed automatic weather station for long-term ecological research and utilize the weather data. Also, it develops the technologies for raising seedlings and species suitable for revegetation for urban environment. It is used not only as field practice site by professor and student concerning forestry, ecology, and environmental sciences but also as the field of education for the youth and the public.

Figure 4. Nursery in greenhouse

Figure 5. Field practice for student

Taehwasan University Forest

Taehwasan University Forest is established in 1979 by land exchange between 196 ha Gwanaksan Experimental Forest and 803 ha public forests owned by Gyeonggido. Taehwasan University Forest is a beautiful forest consisting of plantation forests of *Pinus koraiensis* and *Larix kaempferi* and natural forests dominated by oaks. The area consists deciduous natural forests of 497 ha and coniferous plantations of 300 ha. Chestnut tree gardens were established with various chestnut varieties. Most of its natural forest is dominated by oaks (*Quercus acutissima, Quercus variabilis,* and *Quercus mongolica*). Other species are *Fraxinus rhynchophylla, Styrax obassia, Betula davurica, Prunus sargentii,* and *Cornus controversa*. The plantation forest is composed of *Pinus koraiensis* and *Larix kaempferi*.

▷ Location

Taehwasan University Forest is located in Gwangjusi, Gyeonggido situated at N°17′16″- 37°19′26 and E127°16′45″ - 127°19′51″. It belongs to the temperate zone, and has Mt. Taehwa (642 m) as its main peak.

Figure 6. The Location of Taehwasan University Forest

▷ Research & Education

Field practices such as forest ecology, wildlife management, plant pathology and so on are performed every year. And over the 1,000 students, professors and staffs visit Taehwasan University Forest. Researches about soil moisture, insect fauna, effects of thinning in *Pinus koraiensis* etc. are conducted now. In particular, atmospheric observation towers are installed in Mt. Taehwa. by the National Institute of Environmental Research in May 2010 to observe carbon dioxide fluxes in forest areas. As the role and importance of urban forests are emphasized, the demand suburban research is expected to increase.

Nambu University Forest

Nambu University Forest was established and had been managed by the the University of Tokyo since 1912. In 1946, Nambu University Forest was established as Experimental Forest and had acquired the public forests of 15,647 ha in Jeollanamdo. Nambu University Forest is located between N35˚21′- 35˚58′ and E127˚30′-127 ˚45′ in Jeollanamdo, the most southern part of Korea (Nambu means 'southern'). It comprised two sections, Baekwoonsan (10,945.58 ha) and Jirisan (5,284.97 ha). The forest is characterized for the highest peak of SNUF, the Banyabong (1,751 m). Mt. Jiri is located within the Jirisan National Park which is the first national park in Korea. Two Ecosystems and Landscape Regions for Conservation (ELRC) were established in the Jirisan and Baekwoonsan areas in 1989 and 1993, respectively. Nambu University Forest belongs to the southern temperate zone which shows a vertical distribution of forest zones with diverse vegetations. The dominant species of the natural forest of Nambu University Forest are Oaks (*Quercus serrata, Quercus mongolica,* and *Quercus variabilis*), *Carpinus laxiflora, Fraxinus mandshurica, Acer palmatum,* and *Pinus densiflora*.

▷ Location

Nambu University Forest is located in Gwangyangsi and Guryegun, Jeollanamdo. The area is huge and a part of the forest borders on the Gyeongsangnamdo and Jeollanamdo. It's located in N35°21′ ~ 35°58′, E127°30′ ~ 127°45′ in Mt. Baekwoon and Mt. Jiri.

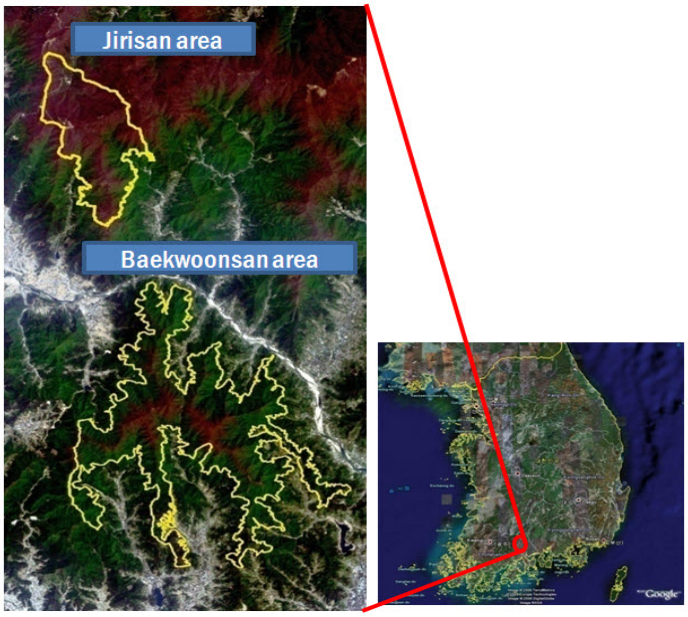

Figure 7. The Location of Nambu University Forest

▷ Research & Education

Nambu University Forest established 880 permanent plots to investigate vegetation changes of natural forest, and to figure out the structure of forest community to realize sustainable forest management. In addition, forest vegetation surveys are conducted to understand the structure of forest community for conservation and revegetation in Beakwoonsan area. Nambu University Forest investigates the flora of Jirisan and Baekwoonsan area to grasp biodiversity and to found the conservation strategies. The current status of vascular plant's distribution and information about habitat is surveyed. Local species distribution surveys are also conducted to get information about habitat and distribution for the rare and endemic species which have high conservation value. The Forest conducts various researches such as Long-term Ecological Research, hydrological measurement, revegetation and monitoring of degrade land. Nambu University Forest made the various specimen forests. Observation garden is one of the specimen forests. Its area is 10 ha and it has 13 thematic gardens. Observation garden has 64 families 314 species 6,350 trees (coniferous: 6 families 38 species, deciduous 58 families and 276 species), and 31 families 96 species plants. Beside, chestnut variety garden, hibiscus garden, and arboretum is built up. With these observation gardens, Nambu University Forest has been supporting local community students with forest experiment program since 2014.