

Forests for Achieving Sustainable Development Goals and Carbon Neutrality—

2022 Virtual Symposium on Asian University Forests

SAUF2022

Nantou, Taiwan

SYMPOSIUM PROCEEDINGS

SPONSORS:



DATE: August 18 (Thu) (08:30–17:00 (UTC+8)) – August 19 (Fri)(08:30–13:55 UTC+8))

VENUE: Virtual Symposium

COMMITTEE: Prof. **Min-Jer TSAI**, the Experimental Forest, National Taiwan University

Prof. **Kohei KUBOTA**, the University of Tokyo Forests

Prof. **Hyun-Seok KIM**, Seoul National University Forests

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Dr. **Yen-Jen LAI**, the Experimental Forest, National Taiwan University

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Opening Address

Dear distinguished scholars and participants, our dean Prof. Hsu-Sheng LUR, Prof. Kohei KUBOTA and Director from University of Tokyo Forests, Prof. and Director Hyun-Seok KIM from Seoul National University Forests, Prof. Tsung-Su Ding and Head of School of Forestry and Resources Conservation, National Taiwan University, it is my pleasure to host this symposium entitled “Forest for Achieving Sustainable Development Goals and Carbon Neutrality”. This time we had collected more than forty papers including 25 oral presentations and 20 E-posters and 81 participants from the Asian University Forests including Taiwan, Japan, Korea, Malaysia, Indonesia and Pakistan. They will be presented in six categories including (1) Net-Zero: Forest Perspective, (2) Forest Biodiversity, (3) Forest Diversity, (4) Forest Sustainable Utilization and Circular Economy, (5) Smart Forestry and (6) Local Partnership and Co-prosperity in the following one and half days’ agenda.

In the past few years, National Taiwan University Experimental Forest (NTUEF) had promoted much effort on forest therapy, environmental education, co-prosperity program and understory economy to fulfill the University Social Responsibility (USR) and conservation of forest biodiversity, and we also had several contributions and won the affirmation of prizes. Facing the challenges for Zero Carbon Emission policy of Taiwan Government by 2050, NTUEF is required to take sustainable development to achieve the goal early by 2048 for NTU. On the basis and experience of past forest management, with the new technologies and the developments and related theories, smart forestry, green energy, circular economy and Harvest Wood Product (HWP) will be the major strategies. I will give a talk in the keynote speech to talk about it. With the above strategy and adaptable management, I think the sustainable development of forest resources will be fulfilled in the near future. Finally, I wish the success of this symposium and we may have more opportunity to share the mutual experiences, thank you!

Prof. Dr. Ming-Jer TSAI
Director of the Experimental Forest
National Taiwan University



**Forests for Achieving Sustainable Development Goals and Carbon Neutrality—
2022 Virtual Symposium on Asian University Forests
August 18-19, 2022**

Virtual Meeting Room:

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Programme

| Time (UTC+08:00) | Thursday, August 18 (Day 1) | |
|---------------------|---|--|
| | Opening ceremony | |
| 0830-0845 | <p>Opening Address</p> <ol style="list-style-type: none"> 1. Professor Huu-Sheng LUR, Dean of College of Bio-resources and Agriculture, National Taiwan University 2. Professor Ming-Jer TSAI, Director of the Experimental Forest, College of Bio-resources and Agriculture, National Taiwan University 3. Professor Kohei KUBOTA, Director of the University of Tokyo Forests, Graduate School of Agricultural and Life Sciences, The University of Tokyo 4. Professor Hyun-Seok KIM, Director of Seoul National University Forests, College of Agriculture and Life Sciences, Seoul National University 5. Professor Tzung-Su DING, Head of School of Forestry & Resources Conservation, National Taiwan University | |
| | Keynote speeches | <p>Moderator Dr. Yue-Hsing HUANG Former Director General, Taiwan Forestry Research Institute, Council of Agriculture</p> |
| 0845-0905 | <p>Human Life, Forests, and Green Transformation (GX): The Challenge of the University of Tokyo Forests</p> <p>Prof. Kohei KUBOTA, Director of the University of Tokyo Forests, Graduate School of Agricultural and Life Sciences, The University of Tokyo</p> | |
| 0905-0925 | <p>Leveraging Machine Learning for Ground and Airborne-based Tree Species Identification Using Bark and Upper Canopy Crown Images</p> <p>Prof. Hyun-Seok KIM, Director of Seoul National University Forests, College of Agriculture and Life Sciences, Seoul National University</p> | |
| 0925-0945 | <p>The Sustainable Development Strategy of the Experiment Forest, National Taiwan University</p> <p>Professor Ming-Jer TSAI, Director of the Experiment Forest, College of Bio-resources and Agriculture, National Taiwan University</p> | |
| 0945-0950 | Group photo | |

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| 0950-1010 | Break | |
| Forest Ecosystem Service I | | Moderator Prof. Kyu-Suk KANG Department of Agriculture, Forestry and Bioresources, Seoul National University |
| 1010-1025 | Exploration of Drought Tolerant Fungi Isolated from Rhizosphere of <i>Abies koreana</i> to See Their Effect on Capsicum Annuum Under Drought Stress | Fiza LIAQUAT (Program in Forest Environmental Sciences, Seoul National University) |
| 1025-1040 | Squirrel Impacts on the Forest Ecosystem and Atmosphere Interaction in Central Taiwan | Yen-Jen LAI (The experimental forest, National Taiwan University) |
| 1040-1055 | Effects of Surrounding Obstacles Around a Meteorological Station on Measured Air Temperature | Nobuaki TANAKA (The University of Tokyo Hokkaido Forest) |
| 1055-1110 | Monitoring of Ganoderma spp. on the Trees at Arboretum Universitas Gadjah Mada, Yogyakarta, Indonesia: Implications for Health Care Recommendation | Rahayu SARDULA (Faculty of Forestry, Universitas Gadjah Mada) |
| 1110-1125 | Storm Runoff Dynamics in a Tropical Montane Cloud Forest (TMCF) and a Tropical Lowland Rainforest (TLRF) Headwater Stream: Comparison of Hydrographs | Anand NAINAR (Faculty of Tropical Forestry, Universiti Malaysia Sabah) |
| 1125-1225 | Lunch break | |
| Forest Biodiversity | | Moderator Prof. Toshiaki OWARI The University of Tokyo Hokkaido Forest |
| 1225-1240 | Genetic Linkage Map Using GBS and QTL Identification in <i>Populus davidiana</i> | Kyu-Suk KANG (Department of Agriculture, Forestry and Bioresources, Seoul National University) |
| 1240-1255 | An Assessment of Understory Vegetation Composition and Richness after Rehabilitation Activities of <i>Cryptomeria japonica</i> Plantation with Mixed Deciduous-Coniferous Forest at Xitou | Chieh-Ting WANG (The experimental forest, National Taiwan University) |
| 1255-1310 | Possible Causes of the Absence of Japanese Oak Wilt Outside Japan | Naoto KAMATA (The University of Tokyo Chiba Forest) |
| 1310-1325 | A Preliminary Survey of Araceae of Taliwas River Conservation Area (TRCA), Lahad Datu, Sabah, Malaysia Borneo | Kartini SAIBEH (Faculty of Tropical Forestry, Universiti Malaysia Sabah) |
| E-Poster Session I | | Moderator Prof. Roland KIRSCHNER School of Forestry & Resources Conservation, National Taiwan University |
| 1325-1425 | 1. Degree of Decay and Fungal Communities of <i>Chamaecyparis obtusa</i> Damaged Parts Due to Bear Stripping | Jianping DAI (Department of Forest Science, The University of Tokyo) |
| | 2. A New Approach to Estimating Wet Canopy Evaporation in a Japanese cedar Forest in Xitou, Taiwan | Taro NAKAI |

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| | | (School of Forestry & Resources Conservation, National Taiwan University) |
| | 3. Extended Spring Drought Inhibited Soil Respiration in a Subtropical Forest | Po-Neng CHIANG (The experimental forest, National Taiwan University) |
| | 4. Influence of Mountaineering Activities on the Taxonomic and Functional Diversity of Dung Beetles (Coleoptera: Geotrupidae, Scarabaeinae, Aphodiinae) in a Mid-elevated Forest of Taiwan | Chun-lin LI (The experimental forest, National Taiwan University) |
| | 5. The Ginger Aphid, <i>Pseudoregma sundanica</i> (van der Goot), a Newly Recorded Aphid Species in Taiwan | Hsin-Ting YEH (The experimental forest, National Taiwan University) |
| | 6. <i>Debregeasia orientalis</i> and <i>Magnolia</i> sp., New Hosts of the Zonate Leaf Spot Fungus <i>Grovesinia moricola</i> (Helotiales) Worldwide and for Taiwan, Respectively | Roland KIRSCHNER (School of Forestry & Resources Conservation, National Taiwan University) |
| 1325-1425 | 7. The Taxonomic Revision of Dryopteris sect. Pallidae (Dryopteridaceae) in Taiwan | Wei-Ting LIOU (The experimental forest, National Taiwan University) |
| | 8. Endophytic Fungi Inhabit in the Root Nodules of <i>Palhinhaea cernua</i> | Jun-ichi Peter ABE (Faculty of Life and Environmental Sciences, University of Tsukuba) |
| | 9. Estimation of Breeding Values for Height Growth Considering Spatial Heterogeneity in Hybrid Larch Progeny Derived from a <i>Larix gmelinii</i> var. <i>japonica</i> × <i>L. kaempferi</i> Open-pollinated Seed Orchard | Shufen CHEN (Department of Ecosystem Studies, The University of Tokyo) |
| | 10. Effects of a Wind-disturbance on Reproduction and Voltinism of the Spruce Bark Beetles (<i>Ips typographus japonicus</i> NIIJIMA) | Kazunobu IGUCHI (The University of Tokyo Hokkaido Forest) |
| | 11. Transition in Sika Deer Density Estimation in the University of Tokyo Chiba Forest (UTCBF) | Yasuyuki TSURUMI (The University of Tokyo Chiba Forest) |
| | 12. Long-term Dynamics of Forest Structure and Carbon Stock in Large Scale Plots in the University of Tokyo Hokkaido Forest | Hitomi OGAWA (The University of Tokyo Hokkaido Forest) |
| Break | | |
| Net-Zero: Forest Perspective & Smart Forestry | | Moderator Prof. Hyun-Seok KIM Department of Agriculture, Forestry and Bioresources College of Agriculture and Life Sciences, Seoul National University |
| 1445-1500 | Soil Deposition Has Changed the Breast Height of Standing Trees for Several Centimeters Since the Start of Measurement About 100 Years Ago | Keisuke TOYAMA (The University of Tokyo Chiba Forest) |
| 1500-1515 | Predicting Wood Density of Dipterocarpaceae in Tropical Forest of Southwest Sabah | Ts. Jacqueline JOSEPH (Faculty of Tropical Forestry Universiti Malaysia Sabah/Faculty of Plantation & Agrotechnology, Universiti Teknologi MARA) |

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| 1515-1530 | A Smart Beehive System for Data-Driven Forest Beekeeping | I-Chen HO (Department of Biomechatronics Engineering, National Taiwan University) |
| 1530-1545 | A Novel Multi-scale Global Graph Convolution Networks Application Can Improve the Accuracy of Forest Type Classification Using Aerial Photographs: A Case Study in the University of Tokyo Chiba Forest | Huiqing PEI (Department of Global Agricultural Sciences, University of Tokyo Forests) |
| 1545-1600 | Digital Transformation of the Stand-based Silvicultural Management System at the University of Tokyo Hokkaido Forest, Japan | Toshiaki OWARI (The University of Tokyo Hokkaido Forest) |
| General Discussion/Social Gathering | | |
| 1600-1700 | Meeting room A: Forest Ecosystem Service & Forest Biodiversity Meeting room B: Net-Zero: Forest Perspective, Smart Forestry, Forest Sustainable Utilization and Circular Economy & Local Partnership and Co-prosperity | |
| Time (UTC+08:00) | Friday, August 19 (Day 2) | |
| | Forest Ecosystem Service II | Moderator Prof. Naoto KAMATA The University of Tokyo Chiba Forest |
| 0830-0845 | Health Effects of Forest Bathing on Cardiovascular Hemodynamics Among Tourists During Four Seasons in Xitou Experimental Forest | Tsung-Ming TSAO (The experimental forest, National Taiwan University) |
| 0845-0900 | <i>Uromycladium falcatarium</i> , the <i>Falcataria mollucana</i> Rust Fungus – Potential Bio Control Agent or Bio Security Threat for Some Leguminosae in the Pacific Islands? | Rahayu SARDULA (Faculty of Forestry, Universitas Gadjah Mada) |
| 0900-0915 | Visual Landscape Preference in Visitor and Potential Visitor Using Geotagged Visitor Employed Photography: The Case of the Takao Quasi-National Park, Tokyo | Yusuke MIZUUCHI (Ecohydrology Research Institute, The University of Tokyo Forests) |
| 0915-0930 | Long-term Changes in Relationship Between Water Level and Precipitation in Lake Yamanaka | Koichiro KURAJI (Executive Office, The University of Tokyo Forests) |
| 0930-0945 | The Debarking Effect on the Water Fluxes of Japanese Cedar Leaves Under the Rodent Damage in Xitou, Central Taiwan | Cheng-Ying YANG (School of Forestry & Resources Conservation, National Taiwan University) |
| 0945-1000 | Provisioning Services Dynamic Change in a Mountainous Protected Area Incorporating Expert Knowledge in Sabah, Malaysia | Kamlisa Uni KAMLUN (Faculty of Tropical Forestry, Universiti Malaysia Sabah) |
| 1000-1020 | Break | |
| | Forest Sustainable Utilization and Circular Economy & Local Partnership and Co-prosperity | Moderator Prof. Koichiro KURAJI Executive Office, The University of Tokyo Forests |
| 1020-1035 | Current Status and Problems of Private Forest Management from the Viewpoint of Regional Forest Planning | Shihao ZHA (Department of Ecosystem Studies, The University of Tokyo) |

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| 1035-1050 | Bending Properties of Glulam Made from Densified Fast-Growing Plantation Timber | Kang Chiang LIEW (Faculty of Tropical Forestry, Universiti Malaysia Sabah) |
| 1050-1105 | Implementation of Participatory Forestry Policies in the National Taiwan University Experimental Forest | An-Chi LOU (School of Forestry and Resource Conservation, National Taiwan University) |
| 1105-1120 | Accident Prevention Measures in Forest Recreation with Eating Behavior-From an Analysis of Food Poisoning Cases Caused by Natural Poisons from Plants | Seiji ISHIBASHI (The University of Tokyo Tanashi Forest) |
| 1120-1135 | Accumulation of Social Capital Around Fuji Iyashinomori Woodland Study Center, The University of Tokyo Forests | Haruo SAITO (Fuji Iyashinomori Woodland Study Center, The University of Tokyo Forests) |
| 1135-1235 | Lunch break | |
| E-Poster Session II | | Moderator Research Fellow, Chiang WEI Deputy Director of the Experiment Forest, College of Bio-resources and Agriculture, National Taiwan University |
| 1235-1315 | 1. Mosquito Larvicidal Activities of Essential Oils and Extracts from <i>Zelkova serrata</i> | Sen-Sung CHENG (The experimental forest, National Taiwan University) |
| | 2. Strength Properties of 5-Layers Cross-Laminated Timber Made from Three Conifer Woods in Taiwan | Chia-Ju LEE (The experimental forest, National Taiwan University) |
| | 3. Comparison of Chemical Composition and Carbonization Properties of <i>Cinnamomum burmannii</i> Segment Wood | Su-Ling LIU (The experimental forest, National Taiwan University) |
| | 4. Influence of Biomass Vinegar on the Growth of Tea Seedlings | Fang-Chih CHANG (The experimental forest, National Taiwan University) |
| | 5. Analyses of Volatile Organic Compounds Released from <i>Liquidambar formosana</i> Leaf and Leaf Essential Oil by Headspace Gas Chromatography-Mass Spectrometry | Yu-Yi CHANG (School of Forestry and Resource Conservation, National Taiwan University) |
| | 6. Antimelanogenesis Effect and Chemical Composition Analysis of <i>Juniperus chinensis</i> var. <i>kaizuka</i> Leaf Essential Oil | Ji-Yun CHANG School of Forestry and Resource Conservation, National Taiwan University |
| | 7. Exploring the Effectiveness of the Aboriginal Carpentry Training Course in the Co-Prosperity Plan of Experimental Forest, NTU - A Case Study of Life Utensils Design and Practical Performance by Using Thinning Wood | Min-Jay CHUNG (The experimental forest, National Taiwan University) |
| | 8. About the Image that the Shape of a Giant Tree Gives to Japanese People | Ningxin CAI (Department of Ecosystem Studies, The University of Tokyo) |
| 1315-1345 | General Discussion | |
| 1345-1355 | Closing Ceremony (Director Ming-Jer TSAI and Prof. Kohei KUBOTA) | |

Keynote speech

Human Life, Forests, and Green Transformation (GX): The Challenge of the University of Tokyo Forests

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Abstract

Green Transformation (GX) is often concisely defined as changes in industrial structure and socio-economic conditions that cater to the economic growth along with reducing greenhouse gas emissions that lead to climate change. In a broader sense, it is defined as a social change to prudently manage the global environment, which is the common property of humankind, and to pass it on to future generations. The University of Tokyo Forests is taking on GX challenges in the areas of forest management, forestry, and forest industry. Those challenges can be categorized as:

1) Development of forest carbon-fixation monitoring technology, including elaboration and visualization of carbon accumulation and fixation calculations.

2) Development of forest management technologies that promote carbon fixation, while considering organic matter decomposition, runoff, and soil carbon, and various possibilities not limited to clear-cutting and reforestation (rejuvenation).

3) Human resource development across disciplines necessary for a decarbonized society.

4) Promotion of “decarbonization of the University of Tokyo,” including construction of wooden buildings using timber from the University Forests and distribution of traceable wooden products (desks, chairs, and interior furnishings for classrooms, meeting rooms, and laboratories) within the University of Tokyo.

5) Joint creation of local decarbonization plans, including collaboration with local governments where each Regional University Forest is located.

Keywords: Green Transformation (GX), Carbon accumulation and fixation, Forest management technologies, Human resource development, Traceable wooden products

Keynote speech

Leveraging Machine Learning for Ground and Airborne-based Tree Species Identification Using Bark and Upper Canopy Crown Images

KIM, Tae Kyung¹, HONG, Jeonghyun¹, RYU, Daun³, KIM, Sukyung¹, BYEON, Si Yeon¹, HUH, Woojin¹, KIM, Kunhyo¹, KIM, Hyun Seok^{1,2,3,4,5,6*}

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² Department of Forest Sciences, Seoul National University, Republic of Korea

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Abstract

The significance of automatic plant identification has already been recognized by academia and industry. Previous studies mainly utilized images of vegetative and reproductive organs to identify species. However, the availability of these organs is highly limited on the season, phenological changes, and crown base height, especially in tree species. In this study, we investigated the feasibility of two identification features, namely barks and upper canopy crowns, that overcome these limitations. Regarding barks, we trained two convolutional neural networks (CNNs) with distinct architectures using a large-scale bark image dataset and applied class activation mapping (CAM) aggregation to investigate diagnostic keys for identifying each species. CNNs could identify the barks of 42 species with > 90% accuracy, and the accuracies showed a small difference between the two models. Diagnostic keys matched with salient shapes, which were also easily recognized by human eyes, and were typified as blisters, horizontal and vertical stripes, lenticels of various shapes, and vertical crevices and clefts. The two models exhibited disparate quality in the diagnostic features: the old and less complex model showed more general and well-matching patterns, while the better-performing model with much deeper layers indicated local patterns less relevant to barks. Regarding upper canopy crown images, we implemented a realistic 3D forest simulation using Blender to generate orthographic images of forest stands. Then, we trained another CNN model, based on Mask R-CNN architecture, that segments individual trees from upper canopy images. The model was successfully trained and converged, showing accurate instance segmentation of tree species.

Keywords: Species identification, Machine learning, Convolutional neural network (CNN), Tree barks, Class activation mapping, Upper canopy crowns

Keynote speech

The Sustainable Development Strategy of the Experiment Forest, National Taiwan University

Ming-Jer TSAI^{1, 2, 3}

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Abstract

Facing the national goal of Net Zero Carbon Emission for Taiwan Government by 2050 and 50% achievement by 2028 (Centennial of the founding of the university) for National Taiwan University, sustainable development strategy became crucial and challenging in the forest management. In the past few years, National Taiwan University Experimental Forest (NTUEF) had promoted much on forest therapy, environmental education, co-prosperity program and understory economy to fulfill the University Social Responsibility and conservation of forest biodiversity. Nowadays, with corresponding advanced technology, smart forestry become promising and feasible to improve the efficiency and carbon stock for the future forest management. Secondly, the carbon pool in NTUEF is estimated using the forest mensuration, together with carbon dioxide flux measurement and remote sensing from space. By the multi-sensors from forestland in NTUEF, all the information will be displayed smart situation room to provide decision-making for the director. In addition, the green energy such as solar energy will be set up in the upcoming months at Shuili Wood Utilization Factory to provide enough electricity for itself and export excess more to Taiwan Power Corporation. Furthermore, the complete utilization of logging from forestland, remaining of the logging in the field and leftover bits of wood processing can be more processed by granulator to produce wood pellets. Abandoned and recycled wood will also be processed to produce second generation wood product to satisfy the spirits of Circular Economy. With the promotion of domestic timber, the Harvest Wood Product (HWP) can be expected to increase in the next years. With the above strategy and adaptable management, the sustainable forest resources will be fulfilled in the near future.

Keywords: Net Zero Carbon Emission, Forest Therapy, Environmental Education, Co-Prosperity Program, Understory Economy, Smart Forestry, Green Energy, Circular Economy, Harvest Wood Product (HWP)

August 18 10:10-11:25 Forest Ecosystem service I

Exploration of Drought Tolerant Fungi Isolated from Rhizosphere of *Abies koreana* to See Their Effect on *Capsicum annuum* Under Drought Stress

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Abstract

In agriculture, broad management of drought tolerant plant growth promoting fungus (PGPF) is of great significance. The survival and adaptation of PGPF under drought conditions were investigated in this study. Ten fungal strains were identified from rhizospheric soil of *Abies koreana* in the Girisan mountain. Three of them were discovered to be extremely drought tolerant, as they were able to grow on Potato Dextrose Agar (PDA) medium supplemented with 10% PEG. On the basis of morphological and biochemical characteristics, isolated fungi were classified. For authentic identification, partial 18S-rRNA, Beta tubulin and Calmodulin genes of best strain showing better plant growth-promoting activity and the highest level of resistance to 10% PEG was amplified and sequenced. On the basis of molecular analysis, the most resistant strain was identified as *Trichoderma virens* and it was chosen to promote *Capsicum* growth under drought stress. Under drought stress, *T. virens* exhibited a positive effect on the biochemistry, physiology and antioxidant enzymatic activities of *Capsicum* plants. This study showed that the inoculation of PGPF improves the growth attributes for example photosynthetic pigments and relative water content under drought conditions. Moreover, plants which were treated with PGPF showed decreased accumulation. Proline is a non-toxic and protective osmolyte, a hydroxyl radical scavenger, a solute that protects macromolecules from denaturation, and a solute that decreases cell pH (Kishor et al. 1995). of malondialdehyde (MDA). PGPF inoculation increased enzymatic activity for the scavenging of reactive oxygen species (ROS). This PGPF also boosted synthesis of total soluble sugar and proline. On the basis of this data, it may be concluded that inoculating *Capsicum* seeds with *T. virens* can reduce the negative effects of drought on *Capsicum* plant.

Keywords: *Abies koreana*, Plant growth promoting microbes, Drought

Forest Ecosystem Service
Oral

Squirrel Impacts on the Forest Ecosystem and Atmosphere Interaction in Central Taiwan

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Abstract

Xitou region, as the epitome of the mid-elevation cloud forest ecosystem in Taiwan, possesses a rich diversity of flora and fauna and is a famous forest recreation area. Moreover, this region was dominated by plantations that were planted by one of the most major important species, *Cryptomeria japonica*. In 2008, a flux tower was built for observing the interaction and carbon exchange between the atmosphere and this forest ecosystem in Taiwan. After the system adjustments and troubleshooting stage in the first couple of years, the observed system of the Xitou flux site has gradually stabilized since 2010. This study comprehensively evaluates the observed data from 2010 to 2021. The results indicated the capability of forest carbon sink dropped dramatically since 2017, and it is most likely caused by squirrel widespread severe debarking and girdling of Sugi.

Keywords: Eddy covariance, Footprint, Squirrel damage, Bark girdling

Forest Ecosystem Service Oral

Effects of Surrounding Obstacles Around A Meteorological Station on Measured Air Temperature

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Abstract

Air temperature (T_a) is one of the most essential meteorological variables in forest sciences and the importance of the long-term T_a measurement has been increasing under the changing climate. T_a is usually measured at a certain height (e.g. 1.5 m) in an open site. However, particularly in forest science studies, surrounding environment around the open site can be altered during the long-term period due to growth of surrounding trees. The present study investigated T_a difference between two adjacent meteorological stations in the University of Tokyo Hokkaido Forest with contrasting openness, based on two-year long 6-min interval T_a data at the stations. On the 6-min basis, larger T_a at a station with low openness (SL) than that at a station with high openness (SH) was often observed under weak wind and strong solar radiation conditions, implying poor ventilation of heated air mass around SL. In contrast, night time T_a at SL was frequently lower than T_a at SH, suggesting stagnant cooled air by radiative cooling at SL. On a daily average basis, the larger T_a at SL often occurred on a day with strong solar radiation. Assuming that daily T_a at SH was not biased by surrounding obstacles, a correction method of T_a at SL was proposed in the presentation.

Keywords: Air temperature, Measurement, Meteorological station, Surrounding obstacles, Correction

Forest Ecosystem Service Oral

Monitoring of *Ganoderma* spp. on the Trees at Arboretum Universitas Gadjah Mada, Yogyakarta, Indonesia: Implications for Health Care Recommendation

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Abstract

The arboretum of Universitas Gadjah Mada (UGM), Yogyakarta, established on 1963, as a part of the urban forest ecosystem in Yogyakarta city, has a good collection of a variety of plants and trees originated from various regions of Indonesia. Since 2005, may do to change of management and climate change effect around the arboretum, there are often death and decline trees caused by *Ganoderma* sp. The aims of this research were to monitor and evaluate the *Ganoderma* sp. development on the living trees and to identify the trees species which often associated and attacked by *Ganoderma* sp. in Arboretum UGM. Completely census method was used for assessing the species trees infected by *Ganoderma* sp. The number of *Ganoderma* fruit body, position of the fruit body on infected trees also canopy performance and size of infected trees diameter were recorded and monitored every year from 2018 to 2022. The result showed that 3.9% trees with diameter more than 10 cm were infected by *Ganoderma* sp. since 2018, while 0.9% infected trees were still alive up to 2022. However, 3.0% were degraded, rooted and died gradually every year. The most species infected were *Adhenanthera favonian*, *Pterocarpus indicus* and *Pterygota alata*. Since the spread of *Ganoderma* were through infected root under the soil, thus early detection in order for health care recommendation in the future have to be conducted.

Keywords: *Ganoderma*, Universitas Gadjah Mada, Health care, *Pterygota* sp.

Forest Ecosystem Service Oral

Storm Runoff Dynamics in A Tropical Montane Cloud Forest (TMCF) and A Tropical Lowland Rainforest (TLRF) Headwater Stream: Comparison of Hydrographs

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Abstract

High altitudes, mountainous topography, thin soils, and frequent and high rainfall (including horizontal precipitation) in headwaters of montane forests are usually associated with high water yield and flashiness. Despite the growing awareness on the ecosystem and hydrological services afforded by tropical montane cloud forests (TMCF), existing studies are sporadic and yield in conclusive results. In this study, we compared hydrograph characteristics between a TMCF and tropical lowland rainforest (TLRF) catchment located along the Crocker Range of Sabah, Malaysia. In each catchment, rainfall and stream discharge data were recorded (10-minute intervals) by a tipping-bucket raingauge and a water-level sensor, respectively, connected to dataloggers. Between 2015 and 2020, 91 and 73 hydrographs were extracted from TMCF and TLRF, respectively, and compared. Water yield from storm events was 169% higher in TMCF than in TLRF. When excluding baseflow, stormflow itself was 382% higher in TMCF than in TLRF. However, responsiveness/flashiness was lower in TMCF than in TLRF – the time taken for the stream to respond to rainfall and the time to achieve peak discharge was 247% and 92% longer, respectively, in TMCF. Possible factors that govern responsiveness include catchment dimensions and topography. Further investigation is being done and results will be reported in a forthcoming article.

Keywords: Montane, Tropical, Forest, Streamflow

August 18 12:25-13:25 Forest Biodiversity

Forest Biodiversity
Oral

Genetic Linkage Map Using GBS and QTL Identification in *Populus davidiana*

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Abstract

Populus davidiana Dode is one of the fast-growing tree species with excellent environmental adaptability. It is also known to have excellent phytoremediation ability. The genome size of *P. davidiana* is relatively small compare other tree species, so it is easy to conduct genetic research. Construction of genetic linkage map and identification of quantitative trait loci (QTLs) have the advantage in the acceleration of tree breeding cycle, i.e., shortening the breeding generation required. In this study, artificial hybridization was performed with a mating of 2 parental trees selected based on growth characteristics in 2018. A total of 295 individuals were obtained and targeted to genotyping. Out of 295, 28 individuals were excluded due to the different genotypes to the parents. The high-density linkage map of *P. davidiana* was constructed using genotype-by-sequencing (GBS) technique, and the QTLs were identified for recovery from defoliator damage, diameter at root collar, and height measured at age 4. The genome wide assisted study (GWAS) analysis was additionally performed to search for genes involved in the traits. As a result, the high-density linkage map was constructed with the 2,129.5 cM of 19 linkage groups, and the QTLs were not identified for all traits. The GWAS analysis revealed the candidate gene that could be involved for the recovery from defoliator damage on the chromosome no.4. The linkage map constructed in this study could be used for future accelerated breeding studies of poplar species.

Acknowledgments: This study was supported by the R&D Program for Forest Science Technology (FTIS 2020185D10-2022-AA02) provided by Korea Forest Service.

Keywords: Poplar, Quantitative trait, Genotyping-by-sequencing, Defoliator damage

Forest Biodiversity Oral

An Assessment of Understory Vegetation Composition and Richness after Rehabilitation Activities of *Cryptomeria japonica* Plantation with Mixed Deciduous-Coniferous Forest at Xitou

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Abstract

Cryptomeria japonica plantations have been damaged by red-bellied tree squirrel at Xitou Nature Education Area for many years. They are gradually being rehabilitated to mixed deciduous-coniferous forests. A silvicultural experiment at Xitou was set up with the motivation to understand stand dynamics and development of mixed forests, and timber and non-timber services provided by this forest. Tree species *Michelia compressa* and *Cunninghamia lanceolata* were chosen because they are both classified as Grade 1 timber. The experiment factor was planting ratio of 1:1, 1:3, and 3:1 (*M. compressa* : *C. lanceolata*). The experiment was set up as a Randomized Complete Block Design with each site (block) having 9 experimental units. The three levels of planting ratio were randomly assigned to the 9 experimental units in each site. The experiment was established in 2020. Tree seedlings survival rate was monitored. The understory vegetation composition and richness was also monitored. Before rehabilitation activities, a total of 57 species were recorded, with the most dominant species such as *Ceratopodium* and *Serratia* species. The combination of the two important value indices (IVI) exceeded 50%, indicating that the understory is a humid environment. After massive thinning, a total of 47 species were recorded in the understory layer but the richness of all species were significantly reduced, and 17 species were not recorded after thinning. However, after continuous weeding, the number of species decreased slightly. The composition of species was very different from that before thinning. Follow-up observations will be continued.

Keywords: Rehabilitation, *Cryptomeria japonica*, Vegetation composition

Forest Biodiversity

Oral

Possible Causes of the Absence of Japanese Oak Wilt Outside Japan

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Abstract

Japanese oak wilt (JOW) caused by a fungus *Raffaelea quercivora*—an ambrosia beetle *Platypus quercivorus* complex has been prevalent for nearly three decades in Japan. *P. quercivorus* has been recorded from India, Indonesia, New Guinea, Thailand, and Taiwan. However, the JOW has been recorded only from Japan. The purpose of our project is to answer the query “Why does the JOW occur only in Japan?” There are two types of *P. quercivorus*, which are phylogenetically differentiated and will be described as independent species. More aggressive type was also found in some countries, such as Thailand, Vietnam, and Indonesia so that the types of beetles is unlikely involved in the absence of JOW. Virulence of *R. quercivora* to *Quercus serrata* differed greatly among the fungal isolates. An isolate from Taiwan showed stronger virulence than strong-virulent strain in Japan indicating that virulence of *R. quercivora* cannot explain the absence of the JOW. Significant difference in the spread of necrosis were found among the Fagaceae species native to Japan. Inoculation experiment of *R. quercivora* to six native Fagaceae species in Indonesia resulted in small necrosis in all the six species, indicating that susceptibility of plants to *R. quercivora* was most likely factor determining incidence of JOW although effects of environmental factors also need to be determined.

Keywords: *Platypus quercivorus*, *Raffaelea quercivora*, Fagaceae, Susceptibility, Necrosis

Forest Biodiversity
Oral

A Preliminary Survey of Araceae of Taliwas River Conservation Area (TRCA), Lahad Datu, Sabah, Malaysia Borneo

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Abstract

Taliwas River Conservation Area (TRCA) scientific exploration was carried out between 7th to 12th June 2022 at Lahad Datu, Sabah, Malaysia. Three subfamilies and seven genera comprising 10 species of Araceae were recorded along Bayur Trail and Magas Trail. The genera are Alocasia, Arisaema, Pothos, Rhipidophora, Schismatoglossis, Scindapus and Ooia.

Keywords: Aroids, Taliwas, Lahad Datu, Malaysia Borneo

August 18 13:25-14:25 E-Poster Session I

Forest Ecosystem Service E-Poster

Degree of Decay and Fungal Communities of *Chamaecyparis obtusa* Damaged Parts Due to Bear Stripping

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Abstract

In recent years, the bear stripping has become a major problem to Japanese forest. Physical damage control methods have been studied well, but biological control methods which can be used to prevent decay in damaged trees have been rarely studied. Therefore, we chose *Chamaecyparis obtusa* as our research target, one of the species which were severely affected. We first tried to clarify the relationship between the progress of decay in bear stripping damaged trees with the fungal communities, especially decay fungi. *C. obtusa* trees 1, 7 and 12 years after the damage were collected in the University of Tokyo Chichibu Forest, wood density and moisture content of the damaged part were measured. Fungal communities were analyzed, by amplicon sequencing of fungal DNA and fungal isolation.

One year after the damage, the decay had hardly progressed, but 7 and 12 years after, the lower the part, the more the decay progressed and the moisture content was higher. As a result of fungal flora analysis, damaged sapwood was dominated by decay fungi *Amylostereum* sp. (Stereaceae) and *Serpula* sp. (Serpulaceae) 1 year after the damage, Schizoporaceae and *Phanerochaete* sp. (Meruliaceae) 7 years after, and Schizoporaceae 12 years after. We also isolated *Amylostereum* sp. from the wood 1 year after the damage, *Phanerochaete* sp. 7 years after, and *Xylodon* sp. 12 years after, but little. Other than wood decay fungi, fungi such as *Trichoderma* spp. and *Biscogniauxia* sp. were also isolated, depending on different individuals.

Keywords: *Chamaecyparis obtusa*, Bear stripping, Decay fungi, Biological control

Forest Ecosystem Service
E-Poster

A New Approach to Estimating Wet Canopy Evaporation in a Japanese cedar Forest in Xitou, Taiwan

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Abstract

Wet canopy evaporation in Xitou was evaluated by the difference between actual evapotranspiration and the dry canopy evapotranspiration estimated by the Jarvis-type conductance model and the Penman-Monteith equation, showing a clear seasonality.

Keywords: Wet canopy evaporation, Dry canopy evaporation, Jarvis-type conductance model, Penman-Monteith equation

Forest Ecosystem Service E-Poster

Extended Spring Drought Inhibited Soil Respiration in a Subtropical Forest

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Abstract

Soil respiration (R_s), the second largest carbon flux in terrestrial ecosystems, dominates soil carbon pools and fluxes. The seasonal and annual variations in R_s in response to extreme events in monsoon forests remain largely uncertain. We used a continuous multichannel automated chamber system to observe the R_s variations for 3 years of drought events in an Asian monsoon forest in Taiwan. The aims of this study were to examine the responses of soil temperature and moisture on both autotrophic (R_r) and heterotrophic (R_h) respiration under drought events. The R_s and R_h values from 2019 to 2021 were decreased from $5.20 \pm 2.08 \mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ to $3.86 \pm 1.20 \mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ and from $3.36 \pm 1.21 \mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ to $3.15 \pm 0.98 \mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$, respectively. The mean R_r values in spring were significantly lower 29.3% in 2020 and 62.2% in 2021 than in 2019, respectively ($p < 0.05$). However, the mean spring R_h values exhibited no differences among these 3 years ($p > 0.05$). The inhibition effects of spring drought on R_r and the negligible effect of spring drought on R_h should be incorporated into models to improve predictions of the global carbon budget. The findings for spring drought provide new perspective to the effects of precipitation variation on soil respiration in Asian monsoon forests in Taiwan and possible have noteworthy implications for the soil and global carbon budgets under future climate change.

Keywords: Autotrophic respiration, Drought, Heterotrophic respiration, Soil temperature

Forest Ecosystem Service
E-Poster

Influence of Mountaineering Activities on the Taxonomic and Functional Diversity of Dung Beetles (Coleoptera: Geotrupidae, Scarabaeinae, Aphodiinae) in A Mid-elevated Forest of Taiwan

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Abstract

Mountaineering activities are one of popular recreation option in Taiwan and some of most-visiting localities may loaded hundreds of visitors everyday all through the year. Xitou, a famous forest recreation area in central Taiwan attracted more than 300 mountaineers everyday gathering around the top of trail and the impact of mountaineering activities on local natural ecosystems in unknown. Dung beetles are well-known taxonomic group in use of rapid ecological assessment by their highly sensitive to habitat disturbances. This study uses dung beetles as bioindicators investigating the effects of intensity of mountaineers on dung beetle assemblages in three sites with different load-carrying level (no mountaineer-NM, low mountaineers-LM and high mountaineers-HM) along the south ridge trail of Xitou. A total of 2530 individuals were collected in which Geotrupidae is the most abundant group by having 1478 beetles in 3 species, Scarabaeinae with 527 beetles in 14 species and Aphodiinae with 525 beetles in 7 species. *Phelotrupes taiwanus* and *Onthophagus potanini* hiurai were the most abundant tunnelers in HM sites where habitats with more resources and more competitive ability in need over the size of body showed a lower functional and taxonomic diversity. Alternatively, the only roller, *Panelus* sp., was restricted in NM site where mainly supported smaller dweller groups with less competitive ability.

Keywords: Dung beetle, Functional group, Impact, Resource

Forest Biodiversity
E-Poster

The Ginger Aphid, *Pseudoregma sundanica* (van der Goot), A Newly Recorded Aphid Species in Taiwan

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Abstract

The ginger aphid, *Pseudoregma sundanica* (belonging to Hemiptera, Aphididae, Hormaphidinae), is known to be distributed in Java, Malaya, Sumatra, and Philippines, and has introduced to Australia in recent years. The author first noticed the occurrence of this species in Taiwan in 2012, and subsequently found it in many places in central Taiwan. The host plants of *P. sundanica* in Taiwan are mainly *Alpinia* spp. This article provides the morphological and biological information of *P. sundanica* as a reference for identification.

Keywords: Cerataphidini, Zingiberidaceae, New record species, Snowbell-ginger soldier aphid

Forest Biodiversity E-Poster

Debregeasia Orientalis and Magnolia sp., New Hosts of the Zonate Leaf Spot Fungus *Grovesinia moricola* (Helotiales) Worldwide and for Taiwan, Respectively

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Abstract

Grovesinia moricola is recorded on the wild woody shrub *Debregeasia orientalis* (Urticaceae) in the Xitou Education Center of the Experimental Forest of National Taiwan University and on ornamental Magnolia cultivars in Shilin District, Taipei City. *Debregeasia orientalis* represents a new host genus for this fungus worldwide and Magnolia a new host genus for Taiwan. The fungus was identified based on anamorph morphology on the host and ITS rDNA sequence similarity. In both hosts, the *Hinomyces* anamorph was associated with symptoms of zonate leaf spot. On the Magnolia leaves, the sclerotium stage also developed. The degradation on Magnolia leaves progressed very quickly even when they were still attached to the trees, and may impact the carbon fixation efficacy of the tree. In Taiwan, zonate leaf spot caused by *G. moricola* is limited to comparatively cool conditions and may have the potential as bioindicator for climate changes. The fungus is widespread in America and Asia, including records on Magnolia spp. in Japan. The new host records, however, illustrate the principle lack of data for fungi so that global estimation of the role of fungal degradation in carbon cycling and climate change would be premature.

Keywords: Carbon cycling, New host, Plant pathogenic fungi, Zonate leaf spot

Forest Biodiversity
E-Poster

The Taxonomic Revision of *Dryopteris* sect. *Pallidae* (Dryopteridaceae) in Taiwan

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Abstract

Dryopteris is a major component of Taiwanese fern flora. Over 60 *Dryopteris* species were recorded from low-elevation mountain areas to the alpine rocky hill. In recent years, we collected several unknown taxa from mountain areas in Taiwan. Based on compared type specimens and protologues description, we checked one distinctive new taxon, two newly recorded taxa, and confirmed one doubt species. There are seven *Dryopteris* sect. *Pallidae* taxa we checked in Taiwan. In this report, we provide morphological description, distribution, and conservation status information for each other, and key to identify are also included.

Keywords: *Dryopteris*, sect. *Pallidae*, Taiwan

Forest Biodiversity E-Poster

Endophytic Fungi Inhabit in the Root Nodules of *Palhinhaea cernua*

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Abstract

The subtropical, tropical fern *Palhinhaea cernua* (syn. *Lycopodiella cernua*) is distributed world-wide mainly at higher elevations in subtropical mountain areas. In some countries this plant is used also as traditional medicine and for other diverse purposes. It is reported that the adult plants of *P. cernua* form root nodules on the tip of roots, which are 2-5 mm in diameters. These root nodules inhabit intercellular endophytic fungi, which hyphae never invade the cells of the root nodules, but the diversity and functioning of these fungi are not obvious. The aim of this study is to clarify the diversity and functioning of these endophytic fungi. Preliminary studies with living specimens from Japan (Owase, Hachijyojima, and Ishigaki Island) showed that not every plant formed root nodules, but all root nodules inhabited intercellular fungi, which were isolated and morphologically identified as *Chloridium* spp., *Pythium* sp. and some unidentified species of dematiaceous hyphomycetes. All plants with root nodules grown healthy. This suggests rather a mutualistic than parasitic interaction. These facultative nodules with fungal association may promote the plant growth. A more thorough investigation is needed for this unknown unique mycorrhizal association.

Keywords: New mycorrhizal association, Medicinal plant, *Chloridium*

Forest Biodiversity E-Poster

Estimation of Breeding Values for Height Growth Considering Spatial Heterogeneity in Hybrid Larch Progeny Test Plantation

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Abstract

The hybrid larch (*Larix gmelinii* var. Japonica × *L. kaempferi*) exhibits rapid growth and high resistance against field voles' damage. In breeding programs of forest trees, estimation of breeding values is important to choose candidate individuals as well as helpful for ranking parents. Therefore, accurate estimation of breeding value is very important for improving the efficiency of breeding. Generally, test plantation is spatially heterogeneous due to influence of micro-environmental factors, i.e., soil fertility, soil moisture, soil temperature, which may affect the accuracy of estimation of individuals' breeding values. However, some spatial models incorporating spatial coordinates information can be expected to estimate accurate breeding values of individuals. In this study, we measured height of 1-yr, 2-yr, 5-yr, 10-yr, and 15-yr in the progeny test plantation for analysis, attempting to examine suitability of spatial model. We compared the accuracy of breeding values by applying both BLUP model (non-spatial model) and BLUP+AR (autoregressive) model (spatial model) for 15-yr height data. The results suggested that the spatial model improved the accuracy of estimation of breeding values. Finally, this spatial model could be expected as an effective way to explain genetic effect of tree height in hybrid larch breeding programs.

Keywords: Breeding value, Spatial heterogeneity, Spatial model, Non-spatial model

Forest Biodiversity E-Poster

Effects of A Wind-disturbance on Reproduction and Voltism of the Spruce Bark Beetles (*Ips typographus japonicus* NIJIMA)

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Abstract

To properly control damages caused by the spruce bark beetle (*Ips typographus japonicus*), it is necessary to understand its life history in detail. It has been thought that the voltinism of *I. typographus japonicus* in central Hokkaido is basically univoltine (i.e. one generation per year), with bivoltism (two generations per year) only in years with high temperatures during the larval growth period. However, as most breeding surveys conducted to date have been after major wind disturbances, it is not clear how the reproductive status of *I. typographus japonicus* change between before and after a large wind disturbance, which provides abundant breeding habitat and causes to explosive increase in population density.

This study investigated the reproduction of the *I. typographus japonicus* in downed logs in a natural Ezo spruce forests (selectively logged and unmanaged stands) in the University of Tokyo Hokkaido Forest, central Hokkaido, before (the year of wind disturbance) and after (the year following wind disturbance) a wind disturbance in 1998.

The results showed that a large amount of downed logs as reproductive materials generated by the wind disturbance greatly affected egg gallery density and reproductive rate of the species. Further, the results suggested that not only climatic conditions but also an input of great amount of reproductive materials can be a key factors causing bivoltinism in *I. typographus japonicus*. These results provide a new view of the life history of the *I. typographus japonicus* in central Hokkaido.

Keywords: Spruce bark beetle (*Ips typographus japonicus*), Wind-storms, Amount of reproductive materials, Egg gallery density, Reproductive rate, Voltinism

Forest Biodiversity E-Poster

Transition in Sika Deer Density Estimation in the University of Tokyo Chiba Forest (UTCBF)

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Abstract

Sustainable forest utilization requires the adaptive management of Sika deer (*Cervus nippon*) populations that impact forest vegetation in Japan. For this purpose, it is important to estimate the deer population density. Damage to planted seedlings of Sugi (*Cryptomeria japonica*) and Hinoki (*Chamaecyparis obtusa*) due to feeding by Sika deer has been confirmed since the late 1980s in the University of Tokyo Chiba Forest (UTCBF). From 1991 onward, deer density surveys using the block-count method began to be conducted every winter. However, it was discontinued in 2014 due to various circumstances. Since 2018, we have estimated the deer density by employing the camera trap method using automatic cameras. The density in the entire UTCBF was estimated to be approximately 15 deer /km² in 1994, which was the highest density, and showed a declining trend thereafter. Since 2000, the density had been around 10 deer /km². Since 2018, the population density was estimated using the camera trap method as approximately 10 deer /km² or less.

Keywords: Block-count method, Camera trap method, Deer density survey

Forest Biodiversity E-Poster

Long-term Dynamics of Forest Structure and Carbon Stock in Large Scale Plots in the University of Tokyo Hokkaido Forest

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Abstract

The University of Tokyo Hokkaido Forest established two large scale forest plots, Maeyama Long-Term Ecological Research (LTER) plot with 36.25 ha and Iwanazawa LTER plot with 18.75 ha in early 1990s. Maeyama LTER plot is in an old-growth hemi-boreal conifer-broadleaf mixed forest dominated by conifers such as *Abies sachalinensis* and *Picea jezoensis* and broadleaves such as *Tilia japonica* and *Betula ermanii*, in which weak selective cutting had been conducted before 1930s. While, Iwanazawa LTER is in an old-growth riparian forest dominated by *A. sachalinensis* and *P. jezoensis* and broadleaves such as *Fraxinus mandshurica* and *Acer pictum*, in which selective cutting had been conducted until 1950s. All trees larger than 5 cm in diameter at breast height has been measured at 5- or 10-years intervals in both plots.

In this presentation, we will present long-term dynamics of forest structure and carbon stock in the two large scale plots based on recent censuses. We found gradual shifts in species composition in both plots. In Maeyama LTER, relative dominance of broadleaves had been increased, which contributed to accumulation of carbon stock, especially in crowded stands. In Iwanazawa LTER, although bark stripping by sika deer caused to steep decrease in abundance of some broadleaves, carbon stock of conifers and broadleaves was increased.

Keywords: LTER, Long-term monitoring, Hemi-boreal forest, Carbon stock

August 18 14:45-16:00 Net-Zero: Forest Perspective & Smart Forestry

Net-Zero: Forest Perspective
Oral

Soil Deposition Has Changed the Breast Height of Standing Trees for Several Centimeters Since the Start of Measurement About 100 Years Ago

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Abstract

In The University of Tokyo Chiba Forest, at the permanent plots of planted forest so-called Yoshida Plots where measurements had started mainly in 1916, horizontal lines had been painted on stems of standing trees at 4 "shaku" (121.2 cm) above the ground as breast height. Each breast height line (BHL) had been re-painted at the same height when measurements were conducted every five years. However, the changes of ground surface caused mainly by soil deposition have changed their height above the ground. We measured the current height of each BHL and analyzed using relevant data e.g. current DBH.

The average of current heights of BHLs in each plot was among 74.6 cm and 118.3 cm. In plots with steep gradient, estimated annual speeds of soil deposition were over 2 mm. Among measured 614 standing trees, 30.9 % had BHL at ≤ 100 cm height, and 7.5 % at ≤ 80 cm. 3.6% had BHL at ≥ 130 cm height.

Change of ground surface illustrated in this research has quantitatively limited, but wide effects on long-term estimation of forest stock and carbon sequestration through precise measurement technologies such as LiDAR.

Keywords: Breast height change, Soil deposition, Ground surface, Permanent plot, Planted forest

Net-Zero: Forest Perspective

Oral

Predicting Wood Density of Dipterocarpaceae in Tropical Forest of Southwest Sabah

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Abstract

Wood density (WD) profoundly contributes to confidently estimating forest above-ground biomass (AGB) and carbon stock. Obtaining a fixed value of WD would be promising for improving forest AGB estimation as WD is required to convert data on wood volume to biomass. This study aimed to predict the WD of Dipterocarpaceae. Interestingly, they are the keystone species in study areas and is regarded as an economically important species in Sabah. Firstly, one half-diameter drilling from bark-to-pith measurement was taken per tree using Rinntech Resistograph R650-ED at breast height. Meanwhile, 5.15 mm-diameter core was sampled at 1.30 m above-ground, with DeWalt DCF899HP2 20V impact wrench 950 Nm and Haglöf increment borer. WD was estimated for each core sample using a dimensional method. Drilling resistance (DR) profiles were processed using DECOM 2.38m1 Scientific (c), and several independent variables were extracted from the resistogram. All resistogram-derived variables were positively correlated with field WD ($R: 0.30 - 0.75$). The variability on WD in Dipterocarpaceae is predominantly explained by the intercept value of drilling resistance, (DRslope) in a regression model, making it one of the best explanatory variables in WD estimates modeling. Our research and discovery envisage more predictive WD models for tropical tree species soon, and continuous improvement is deemed crucial on existing WD estimate models derived from Resistograph variables.

Keywords: Wood density, Resistograph, Power drill-borer, Dipterocarpaceae, Resistance

Smart Forestry Oral

A Smart Beehive System for Data-Driven Forest Beekeeping

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Abstract

Forests are both environmentally and economically valuable. In addition to timber sales which is usually the main product of a forest, the development of non-wood products assigns greater value to sustainable forests management. Beekeeping is one of the suitable forest industries as bee foraging is not only profitable but also beneficial to the biology of forests. We went through the advantages of forest beekeeping including the low pesticide risk, the variety of nectar sources and blooming period, and its unique role in the ecosystem for being complementary to forest establishment itself. Compare to the normal beekeeping which usually switches location to ensure adequate nectar sources, forest beekeeping leverages the variability of blooming period in the forest and therefore usually tends to stay at one fixed location. To help with the long-term one-site beekeeping, we developed a multi-sensing smart beehive system to monitor the hive and support in decision making in the bee caring process. The system monitors various features of beehives, including temperature, humidity, weight, bee traffic, and acoustic signals. The collected data were transferred to the cloud platform and processed by machine learning algorithms to identify the beehive's health status. The study aims to promote the development of forest beekeeping and improve beekeeping quality. An overview of the technical architecture and the functionalities of the smart beehive system will be presented and discussed.

Keywords: Smart forestry, Forest beekeeping, Internet of things, Smart agriculture

Smart Forestry Oral

A Novel Multi-scale Global Graph Convolution Networks Application Can Improve the Accuracy of Forest Type Classification Using Aerial Photographs: A Case Study in the University of Tokyo Chiba Forest

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Abstract

Accurate classification of forest type is fundamental and critical for sustainable forest management. In this study, machine and deep learning methods of random forest (RF), U-Net, U-Net++ and multi-scale global graph convolutional neural network (MSG-GCN) were compared for the classification of natural mixed forest, natural broad-leaved forest and conifer plantation using very high resolution aerial photographs in the University of Tokyo Chiba Forest. The features of MSG-GCN method are: different scale of convolutional kernels were applied to the encoder part; local attention was replaced to the conventional U-Net++ skip connection; graph convolutional neural block was embedded into the very end layer of encoder module. The output features of different decoding blocks were up-sampled and then spliced to ensure the high- and shallow-level feature and it improved attribute decision ability for boundary cells. The result showed that: (1) MSG-GCN achieved the highest classification accuracy than the other methods. Natural mixed forest acquired relatively lower accuracy than natural broad-leaved and conifer plantation. (2) RF method produced serious salt-and-pepper noise. U-Net and U-Net++ methods produced frequent mistaken patches, and the edges between different forest types were rough and blurred, while MSG-GCN method produced relatively less misclassification patches and clear edges for different forest types. (3) Due to the undulating terrain, northwestern area of the study site was more susceptible to misclassification by all methods. The misclassified areas by MSG-GCN mainly happened in the edge areas, while misclassification patches distributed randomly by U-Net and U-Net++ models.

Keywords: Graph convolutional network, Forest type classification, Remote sensing, Aerial photo

Smart Forestry Oral

Digital Transformation of the Stand-based Silvicultural Management System at the University of Tokyo Hokkaido Forest, Japan

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Abstract

Digital transformation (DX) refers to “a fundamental change process, enabled by the innovative use of digital technologies accompanied by the strategic leverage of key resources and capabilities, aiming to radically improve an entity and redefine its value proposition for its stakeholders”. In recent years, DX has been progressing nationwide in the Japanese forest and forestry sector. In northern Japan, the University of Tokyo Hokkaido (UTHF) has actively introduced geospatial information technologies and digital devices since the late 2000s in the stand-based silvicultural management system (SSMS). As a unique implementation of forest and forestry DX in Japan, we present the latest technology and equipment actually used in the field of UTHF. Under the SSMS, the forests are classified into several management types according to stand characteristics and management objectives. Since 2021, our forest survey has been using a low-cost dual-frequency RTK-GNSS (real-time kinematic global navigation satellite system) receiver, which exhibits high and stable positioning accuracy. Airborne LiDAR (light detection and ranging) data and orthophotographs are currently available for the whole area of UTHF, and we also take recent aerial photographs using UAV (unmanned aerial vehicle) as needed. Forest types can be delineated while referring to various spatial information of the managed area. Consumer-grade GNSS receivers are also used for marking harvest trees under the selection system. The survey field notebook is produced in-house using relational database software, and field notebook entry is performed on-site using tablet terminals.

Keywords: Digital transformation, Global navigation satellite system, Stand-based silvicultural management system, Tablet device, Unmanned aerial vehicle

August 19 08:30-10:00 Forest Ecosystem Service II

Forest Ecosystem Service
Oral

Health Effects of Forest Bathing on Cardiovascular Hemodynamics Among Tourists During Four Seasons in Xitou Experimental Forest

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Abstract

Forest bathing may provide potential health benefits. The objectives of this study were to investigate whether walking exercise during four seasons affects cardiovascular functions (CVFs) in the Xitou Experimental Forest of National Taiwan University. We recruited 1761 adult volunteers with female (n=1233) and male (n=528) for an observational pilot study in forest. CVFs were assessed by measuring the arterial pressure waveform using an oscillometric blood pressure (BP) device. The results showed that BP components (i.e. systolic and diastolic BP, central end SBP (cSBP) and DBP, heart rate), cardiac function (i.e. Left ventricular dP/dt Max, cardiac output, stroke volume (SV)) were lower before and after walking exercise. BP components and cardiac function in sprint were significant differences before and after walking exercise than in other seasons. In order to estimate the health effects on CVFs after walking exercise, linear mixed effects models were used to adjust random effects of individual characteristics and controlling factors of age, gender, BMI, and season. Brachial SBP and cSBP of participants before and after walking exercise were significantly lower. The same we found that the heart rate, LV dP/dt max, LV contractility, cardiac output, cardiac index, SV, and SV index before and after walking exercise were significantly lower. The study provides evidence potential health benefits on CVFs after walking exercise during four seasons in a forest environment.

Keywords: Forest bathing, Cardiovascular function, Blood pressure, Walking exercise, Forest environment pressure

Forest Ecosystem Service
Oral

***Uromycladium falcatarium*, the *Falcataria mollucana* Rust Fungus – Potential Bio Control Agent or Bio Security Threat for Some Leguminosae in the Pacific Islands ?**

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Abstract

Uromycladium falcatarium is an rust fungus caused extremely damaging disease on sengon (*Falcataria moluccana*) in Indonesia. The rust gall fungus has spread across the commercial sengon plantations of Indonesia, Malaysia and the Philippines causing economically significant damage to timber production. The fungus causes growing tissues of sengon trees to form large twisted knots which can lead to the death of young trees and damaging of all ages. In the other hands *F. mollucana* were to be extremely invasive weed on the entire Pacific Islands and need to be suppress or control intensively in order to prevent the ecosystem changing. The research were conducted a series of experiments with this fungus on a suite of Fabaceae species from Hawaii. Plants were exposed to fungal spores under laboratory, greenhouse and natural field conditions. Although several non-target test plants showed signs of initial infection in the laboratory there was no disease progression in any plants other than the target *F. moluccana*. Galls and spores were only formed on the target plants in deliberately inoculated pathogen greenhouse conditions. Field tests are still ongoing but have not shown any signs of non-target impact. The results of these experiments suggest that this or other isolates of *U. falcatarium* may be suitable candidates for further research as potential biological control agents. We also discuss how our study can help address concerns about the biosecurity threats posed by *Uromycladium* species.

Keywords: Bio control, *Uromycladium falcatarium*, Fabaceae, Pacific islands

Forest Ecosystem Service Oral

Visual Landscape Preference in Visitor and Potential Visitor Using Geotagged Visitor Employed Photography: The Case of the Takao Quasi-National Park, Tokyo

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Abstract

An evidence-based understanding of visitors' landscape preferences is important for forest landscape planning and management. Although extensive research has been conducted to quantify and map the landscape preference and cultural ecosystem service including using crowdsourced data, especially user generated contents, the concept of the "Circle of Representation" to understand the relationship of photography and ways of seeing in visitors (and potential visitors), shows that there are still challenges that need to be solved in forest recreational area. We need to understand the sequence of recreational and photography events; 1) where and what types and landscape are taken to photographs by visitors on-site; 2) what types of landscape photographs are preferred by potential visitors; 3) what types of landscape photographs are made potential visitors wish to go the site. In this study, we conducted a survey by using geotagged visitor employed photography with to grasp the location and landscape photographs that visitors prefer in Takao Quasi-National Park. Then, a questionnaire survey using the photographs collected by the geotagged visitor employed photography survey to understand the landscape evaluation. GIS analysis was performed to understand popular locations and landscape photographs. Analysis of means were performed to understand what types of landscape photographs are preferred are made potential visitors wish to go the site by potential visitors. The findings were as follows: 1) nine popular locations of the site were identified, and 2) there were difference with types of landscape photographs that potential visitors preferred and made potential visitor wish to go the site.

Keywords: Visual landscape, Recreation, GIS, GNSS

Forest Ecosystem Service
Oral

Long-term Changes in Relationship Between Water Level and Precipitation in Lake Yamanaka

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Abstract

The water levels of lakes fluctuate owing to both natural and anthropogenic influences. Climate change can alter precipitation, driving fluctuations in lake levels. Extreme fluctuations can cause flooding, water shortages, and changes in lake water quality and ecosystems, as well as affecting fisheries and tourism. Despite the needs to predict future water level rises, especially in the context of climate change, long-term hydrological studies are scarce. Here, we analyzed 93 years of data from 1928 to 2020 to identify changes in the relationship between water level and precipitation in Lake Yamanaka, Japan. We found that the six-day maximum rise in water level for the same six-day maximum precipitation was significantly greater in the later period than in the earlier period; the difference increased with increasing precipitation. Particularly large increases in precipitation were sometimes caused by a single event or by multiple events occurring in succession.

Keywords: Lake water level rise, Lake Yamanaka, Maximum six-day precipitation

Forest Ecosystem Service
Oral

The Debarking Effect on the Water Fluxes of Japanese cedar Leaves Under the Rodent Damage in Xitou, Central Taiwan

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Abstract

The rodent damage in the Xitou Experimental Forest, central Taiwan had arisen for many decades. Debarking and girdling impacts by the increasing population of squirrels, the Japanese cedar trees (*Cryptomeria japonica* D. Don) in Xitou gradually turned partial leaves from green-colored into red-colored and the leaves finally became gray before they were fully withered. According to the flux data observed by the eddy covariance system, the evapotranspiration was decreased with the debarking damage. This study aims to figure out the water fluxes characteristics among three colored leaves by the portable leaf photosynthesis system. The results showed the stomatal conductance of healthy green-colored leaves presented the regular responses with the water vapor deficit. In contrast, the stomatal conductance of the damaged non-green-colored leaves dropped and stayed into the minimal detectable quantity of the measurement. Therefore, the water supply to the non-green leaves was insufficient since the debarking might damage the bark as well as the outer xylem where the sap flow took place, blocking water fluxes and transpiration through the leaves. The lack of water would induce the stomata to close and further influence the water flux between the atmosphere and the forest ecosystem.

Keywords: Debarking effect, Rodent damage, *Cryptomeria japonica*, Leaf gas exchange, Transpiration

Forest Ecosystem Service
Oral

**Provisioning Services Dynamic Change in a Mountainous Protected Area
Incorporating Expert Knowledge in Sabah, Malaysia**

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Abstract

Taliwas River Conservation Area (TRCA) scientific exploration was carried out between 7th to 12th June 2022 at Lahad Datu, Sabah, Malaysia. Three subfamilies and seven genera comprising 10 species of Araceae were recorded along Bayur Trail and Magas Trail. The genera are Alocasia, Arisaema, Pothos, Rhipidophora, Schismatoglossis, Scindapus and Ooia.

Keywords: Aroids, Taliwas, Lahad Datu, Malaysia Borneo

August 19 10:20-11:35 Forest Sustainable Utilization and Circular Economy & Local Partnership and Co-prosperity

Current Status and Problems of Private Forest Management from the Viewpoint of Regional Forest Planning

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Abstract

It's been a long time since the plantations in Japan started to be used, but the use has not expanded and there are problems such as stagnation of tree planting. The "Regional Forest Plan" clarifies the maintenance targets for each forest planning area organized under the "National Forest Plan". By analyzing the contents of the "Regional Forest Plan", it is thought that the reality and problems of forest conservation in private forests can be grasped. In addition, forest conservation trends can be estimated by comparing content consistency over time. Therefore, for all forest planning areas after 2000, the contents of the plan and the results of implementation were analyzed and examined over three phases. As a result of the investigation, the overall result of each operation deteriorated slightly over time, the progress of replanting of plantations in many areas was lower than the planned target, significantly lower than the other operations, and the new planned target is not rational given the results of the previous period and raises the question of whether the plan is feasible.

Keywords: Private forest, Regional Forest Plan

Forest Sustainable Utilization and Circular Economy Oral

Bending Properties of Glulam Made from Densified Fast-Growing Plantation Timber

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Abstract

Bending strength is one of the fundamental criteria when it comes to determining the allowable mechanical properties of timber for different purposes. Fast-growing plantation timbers have poor bending strength, which is mainly influenced by their low density. Nevertheless, densification technology proved to improve the bending properties of that particular timber group. *Paraserianthes falcataria*, a fast-growing plantation species, has the potential to be mechanically modified. The aim of this study was to investigate the Modulus of Elasticity (MOE) and Modulus of Rupture (MOR) of glulam made from densified *Paraserianthes falcataria* laminas. The laminas underwent densification treatment, which involved hot-pressing and cooling phase. Two different parameters were applied and denoted as D (densified) and UD (undensified/control). Three-layered glulam panels were manufactured and denoted as UD-glulam for control and D-glulam for densified. The panels were cut into test pieces and subjected to flatwise static bending test. The results indicated that both MOE and MOR of glulam made from densified laminas were higher with control, where significant differences were found between these two parameters. UD-glulam obtained MOE and MOR of 192.87 N/mm² and 10.60 N/mm²; while D-glulam recorded MOE value of 1596.85 N/mm² and MOR value of 30.67 N/mm². In summary, densification treatment significantly enhanced the bending properties of glulam made from *Paraserianthes falcataria* laminas.

Keywords: Densification, Fast-growing plantation timber, *Paraserianthes falcataria*, Bending

Local Partnership and Co-prosperity Oral

Implementation of Participatory Forestry Policies in the National Taiwan University Experimental Forest

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Abstract

In order to build up partnerships with local people and indigenous communities, the National Taiwan University Experimental Forest (NTUEF) implemented a series of program based on the community forestry program of adopted the Forestry Bureau, which included its own 1st and 2nd stage community forestry program and the Co-prosperity Programs. This study aims to analyse the effect of these participatory forestry policies by a qualitative approach. We reviewed 171 relevant project reports, publications and papers, got involved in 5 occasions by participant observation, and had interviews for 11 records from December 2020 to February 2022. The results showed that as tenure and land use restriction being the main source of conflicts with local people, NTUEF try to promoted local partnership by these participatory programs. It mainly provided economic incentives, and allowed local communities not only engaging in forest patrol and resource conservation, but also nurturing small-scaled environmental friendly development initiatives, such as ecotourism, bamboo craft, and tea culture. However, there was few considerations on local participating in forest governance for these programs by NTUEF.

Keywords: Participatory forestry, Economic incentive, Local development, Local participation, Partnerships.

Local Partnership and Co-prosperity Oral

Accident Prevention Measures in Forest Recreation with Eating Behavior - From An Analysis of Food Poisoning Cases Caused by Natural Poisons from Plants

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Abstract

In Japan, it is customary to pick and eat wild plants and mushrooms as seasonal food. In the past, wild plants and mushrooms were one of the ingredients that are eaten according to the seasons in daily life as “Yama-no-Sachi”. Nowadays, they are extraordinary foods and are picked and eaten as a traditional culture or a recreation. Therefore, it is mainly treated as a cultural activity. However, some of these edible wild plants and mushrooms contain toxic components. In order to enjoy forest recreation safely, it is necessary to take proper measures to prevent such accidental ingestion. In this study, we analyzed the tendency and characteristics of food poisoning accidents caused by wild plants and mushrooms, and considered whether there are more effective measures to reduce the occurrence of food poisoning accidents associated with forest recreation activities. As a result of the analysis, there is a difference in the change of the causal species between the case of higher plants and the case of mushrooms, the cause of accidental ingestion is mostly due to lack or misunderstanding of knowledge. And it was found that effective preventive measures could be taken by considering seasonality and regional characteristics.

Keywords: Food poisoning accident, Higher plant, Mushroom, Forest recreation

Local Partnership and Co-prosperity Oral

Accumulation of Social Capital Around Fuji Iyashinomori Woodland Study Center, The University of Tokyo Forests

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Abstract

Fuji Iyashinomori Woodland Study Center (FIWSC) have been engaged in a research project which aims to link local forest management and people's life, since 2011. The major feature of this project is to take "action research" approaches. FIWSC has planned and conducted participatory forest programs which invite local people to our research, education or forest management activities, as well as public seminars or events.

Not many, but some relationships between FIWSC and local individuals have been continued or revitalized after a hiatus. As a result, an exchange agreement was signed with the local municipality in 2017, a volunteer group was formed to work with FIWSC at the same year, and informal cooperation relationships with local individuals and groups have been established.

It can be concluded that, as a medium- or long-term effect, FIWSC's trials continued over 10 years are making a rich partnership between FIWSC and local communities. Further, it is considered that FIWSC have been able to accumulate social capital based on such partnership. Social capital, which consist of trust and network, is now strongly supporting FIWSC's research, education, outreach activities and forest management.

Keywords: Social network, Trust, Recreational function, Action research

August 19 12:35-13:15 E-Poster Session II

Forest Sustainable Utilization and Circular Economy E-Poster

Mosquito Larvicidal Activities of Essential Oils and Extracts from *Zelkova serrata*

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Abstract

Zelkova serrata is an excellent native tree species in Taiwan. It has extremely high economic value and an important broad-leaved species for the wood industry in Taiwan. The objective of this study was to evaluate the mosquito larvicidal activity of heartwood, sapwood, and bark essential oils and ethanolic extracts from *Zelkova serrata* against two mosquito species, *Aedes aegypti* and *Ae. albopictus*. Results demonstrated that the essential oil of *Z. serrata* heartwood had an excellent inhibitory effect against *Ae. aegypti* and *Ae. albopictus* larvae at 24 h with an LC₅₀ value of 43 µg/mL and 119 µg/mL, respectively. However, the ethanolic extracts of *Z. serrata* heartwood, sapwood, and bark had no toxic effect on the larvae of the two vector mosquitoes. The composition of the essential oil of *Z. serrata* heartwood was further analyzed by gas chromatography mass spectrometry (GC-MS). Its main component is a sesquiterpenoid, (-)-7-hydroxycalamenene (95.82%). In addition, the LC₅₀ values of (-)-7-hydroxycalamenene were 26 µg/mL and 45 µg/mL against the larvae of *Ae. aegypti* and *Ae. albopictus* at 24 h, respectively. Based on the results, it revealed that the heartwood essential oil and (-)-7-hydroxycalamenene from *Z. serrata* might be considered as a potent source for the production of fine natural mosquito larvicides.

Keywords: *Aedes aegypti*, *Aedes albopictus*, Essential oils, Mosquito larvicidal activity, *Zelkova serrata*

Forest Sustainable Utilization and Circular Economy E-Poster

Strength Properties of 5-Layers Cross-laminated Timber Made from Three Conifer Woods in Taiwan

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Abstract

In recent years, forest plantation tending and the reforestation of slope land have shown fruitful results. Thus, using thinning timbers for architectural and structural applications could increase the value of thinned wood and promote the effective use of forest resources. The purpose of this study is to investigate the effects of lamina and processing conditions of three species, *Taiwania cryptomerioides*, *Cunninghamia lanceolata*, and *Cryptomeria japonica*, on the bending and shear strength of real-size five-layer cross laminated timber (CLT). The results showed that after the bending test of CLT samples, the values of global modulus of elasticity (MOE_{Global}) and local modulus of elasticity (MOE_{Local}) have a linear relationship (R² value was 0.8747). Furthermore, the MOE and modulus of rupture (MOR) of CLT increased with the grade of lamina, and the presence or absence of edge-gluing has no significant effect on the bending properties of CLT. The symmetric composition of heterogeneous-grade CLT shows that the outer lamina grade has a more obvious effect on the strength properties than the inner lamina. Besides, the CLTs at different lamina size compositions show that thicker and narrower laminas have higher MOE and lower MOR. The trend of shear strength of CLT in different species is *C. japonica* > *T. cryptomerioides* > *C. lanceolata*. In addition, the failure modes of the CLT shear test material are two kinds of failure modes: rolling shear failure and tension side failure.

Keywords: Cross laminated timber (CLT), Modulus of elasticity

Forest Sustainable Utilization and Circular Economy E-Poster

Comparison of Chemical Composition and Carbonization Properties of *Cinnamomum burmannii* Segment Wood

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Abstract

In this study, biochars prepared with untreated, hot water and methanol extracted of sound wood and decay wood (recovered wastage of segment wood mushroom) of *Cinnamomum burmannii* at carbonization temperature 600°C. In addition, chemical compositions and pore development of biochars by untreated and solvent extracted were investigated. Results indicated that the composition of holo-cellulose was the highest of sound wood and decay wood by methanol extracted, on the other hand, α -cellulose and alcohol-toluene extractives appeared significantly different of sound wood by difference extracted. Compared with the carbon composition, sound wood and decay wood of *C. burmannii* with carbonization temperature at 600°C was higher than uncarbonized about 1.7 times, which the composition of hydrogen and oxygen have decreased clearly. The pH values almost tend to be alkalinity. The pore structure of all biochar by solvent extracted had better than untreated, indicating micropore was a major pore structure. From the values of Brunauer-Emmett-Teller (BET) surface area, the decay wood by untreated and hot water extracted had better than sound wood. Therefore, recovering the *C. burmannii* decay wood to prepare biochar could not only reduce forestry waste, but also achieve the goal of circular economy with renewable resources.

Keywords: *Cinnamomum burmannii*, Sound wood, Decay wood, Biochar, Pore structure

Forest Sustainable Utilization and Circular Economy E-Poster

Influence of Biomass Vinegar on the Growth of Tea Seedlings

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Abstract

In this study, biomass vinegar was prepared from biomass waste and evaluated its potential for regulating the growth of tea seedlings. The effect of biomass vinegar on the leaf photosynthesis and growth of tea seedlings was analyzed and investigated. The biomass vinegar was utilized to replace the use of pesticides to achieve the environmental sustainability goal of ecological organic tea gardens. Research results show that spraying tea seedlings with biomass vinegar could temporarily suppress pests (approximately one week), but pests such as aphids, small green leafhoppers, and thrips still appear after the rain (especially in the high temperature and rainy summer environment). The light response curve shows that the light saturation point of tea seedlings was between 400-800 $\mu\text{mol m}^{-2}\text{s}^{-1}$, while the photo-synthetic rate had a downward trend when the luminosity was higher than 1,000 $\mu\text{mol m}^{-2}\text{s}^{-1}$. Thus, it may be necessary to moderate shade in the planting environment. The relative ratios of caffeine and catechins in the tea soup that were conventional treated in autumn were 33.24% and 43.53%, while the ratios of the tea soup with diluted 400 times of biomass vinegar were 30.94% and 45.32%, respectively. The results of tea seedling growth and tea soup analysis showed that there was little difference in the growth of tea seedlings between spraying vinegar and conventional treatments.

Keywords: Biomass vinegar, Tea seedlings, Leaf photosynthesis, Tea soup, Conventional farming

Forest Ecosystem Service, Forest Sustainable Utilization and
Circular Economy
E-Poster

Analyses of Volatile Organic Compounds Released from *Liquidambar formosana* Leaf and Leaf Essential Oil by Headspace Gas Chromatography-Mass Spectrometry

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Abstract

Liquidambar formosana Hance (Formosan sweet gum, Altingiaceae) is distributed mainly in mixed deciduous forest in Southeast Asia. The objective of the study is to investigate volatile organic compounds (VOCs) released from *L. formosana* leaf and leaf essential oil by means of headspace gas chromatography-mass spectrometry (HS-GC-MS). The major constituents of VOCs from fresh leaves and leaf essential oil were characterized by monoterpenoids with p-menthane, thujane, and pinane skeletons. At both environmental temperatures (25°C and 50°C), sabinene (35.0-41.2%) predominated the VOCs released from *L. formosana* leaves and followed by γ -terpinene (14.0-17.3%), α -terpinene (12.1-15.2%), and α -pinene (10.9-11.1%); the intensity of the VOCs at 50°C was two times higher than that at 25°C. As for the VOCs of leaf essential oil, the major constituents were γ -terpinene (19.3%), α -terpinene (15.3%), *p*-cymene (14.1%), sabinene (13.2%), and terpinen-4-ol (10.9%) at 25°C; whereas the major constituents were terpinen-4-ol (33.4%), γ -terpinene (15.1%), *p*-cymene (13.0%) α -terpinene (10.2%), and sabinene (7.6%) at 50°C. These results are beneficial to characterize the phytoncides in the mixed forest dominated by *L. formosana* and promote the sustainable utilization of forest products.

Keywords: *Liquidambar formosana*; Essential oil; Volatile organic compounds; Headspace sampling; Gas chromatography-mass spectrometry

Forest Sustainable Utilization and Circular Economy E-Poster

Antimelanogenesis Effect and Chemical Composition Analysis of *Juniperus chinensis* var. kaizuka Leaf Essential Oil

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Abstract

Juniperus species (juniper) is an evergreen shrub or tree of the Cupressaceae, junipers are usually used in spices and folk medicines. *J. chinensis* var. kaizuka (dragon juniper) has become a common landscape plant in Taiwan because of its beautiful tree shapes. The aims of the study were to analysis the chemical composition of *J. chinensis* var. kaizuka leaf essential oil by using the gas chromatography-mass spectrometry (GC-MS), and to evaluate the antimelanogenesis effect of leaf essential oil against tyrosinase. 15 kinds of monoterpenoids and sesquiterpenoids were identified from leaf essential oil through GC-MS analysis, and the major constituents were limonene (32.75%), bornyl acetate (23.30%), β -elemol (15.95%), myrcene (7.99%) and sabinene (3.49%). Results from antityrosinase assay showed the *J. chinensis* var. kaizuka leaf essential oil exhibited tyrosinase inhibitory activity in both two substrates (L-tyrosine and L-Dopa) associated with the melanin formation. These findings revealed *J. chinensis* var. kaizuka leaf essential oil has the potential to be used as a natural antityrosinase ingredient for inhibit formation of melanin.

Keywords: Antityrosinase activity, Essential oil, *Juniperus chinensis* var. kaizuka, Melanin, Terpenoids

Local Partnership and Co-prosperity E-Poster

Exploring the Effectiveness of the Aboriginal Carpentry Training Course in the Co-Prosperity Plan of Experimental Forest, NTU - A Case Study of Life Utensils Design and Practical Performance by Using Thinning Wood

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Abstract

"Makaskas" carpentry workshop have been trained in carpentry skills by Wood Utilization and Practice Factory of Experimental Forest of NTU. In this study, results indicated that aboriginal trainees are still difficult to complete practical design works. This situation is not due to the lack of creativity and execution ability of the trainees. It mainly due to lack of design or practical process experiences. This study takes the curriculum of " Life utensils design and practical performance" as the development theme. The course content consists of the detailed design of composition and shape. The courses in addition to let trainees know the current situation of thinned wood utilizations in Taiwan, but also allows trainees to learn how to choose timber before planning, sawing, drilling and painting the wooden products. Finally, they completed the designed 5 kinds of life utensil. During the practical operation, trainees can learn about the natural characteristics of thinned wood. They also learned how to discuss and communicate with field professionals. Besides, this practical process will also help aboriginal trainees to improve their design and practical capability in the future. Results also show that the spirit of mutual prosperity, assistance and cooperation were existed between Experimental Forest of National Taiwan University and aboriginal people in the "Co-prosperity Plan".

Keywords: Co-prosperity, Mutual prosperity, Carpentry skills, Aboriginal trainees

Local Partnership and Co-prosperity E-Poster

About the Image that the Shape of A Giant Tree Gives to Japanese people

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Abstract

Enshrining a giant tree as a "holy thing" is considered to be one of the most primitive expressions of human belief. Even in Japan, many giant trees are worshiped and have legends and it can be seen that giant trees also affect people's lives and solidarity with the community. In order to understand why the giant tree has such a psychological effect in the community, it will need the characteristics of the giant tree from various aspects and clarify the image that the Japanese receive from the giant tree and the elements that make them feel "holy". In this study, we examined the image that the size of the tree height and diameter and the shape of the giant tree give to the Japanese. In addition to analyzing trends from basic information such as the tree species, trunk circumference and tree height of the target tree, features related to shape and appearance such as tree shape, trunk shape and the hollow of trunk are summarized. As a result of the analysis, the giant tree that Japanese people like often has not only the circumference of the trunk and the height of the tree, but also other elements that give a strong visual impression such as the shape and color of the leaves and flowers. By combining the size of the giant tree and the visual impression, it was found that there are many cases where the mysterious vitality and creativity of nature, mystery and rarity are felt.

Keywords: A giant tree, Community