

# FORMATH HIMEJI 2023

## Program: March 16 (Thu) - 17 (Fri)

**March 16, 2023**

<b>09:20 ~ 09:30 Opening Remarks</b>		Dr. Matsumura	
<b>1.</b>	<b>Session 1</b>	Coordinator: Dr. Asante	
<b>09:30 ~ 10:00</b>	Urbanization, Land use and Rural-Urban Linkages in Pokhara Metropolitan City, Nepal	Bir Bahadur Khanal Chhetri	Tribhuvan University, Nepal
<b>10:00 ~ 10:30</b>	Impact of Men's Out-migration on Women Participation in Community Forestry: Insights from Rural Nepal	Narayan Prasad Gautam	Tribhuvan University, Nepal
<b>10:30 ~ 10:50 Break</b>			
<b>2.</b>	<b>Session 2</b>	Coordinator: Dr. Ribeiro	
<b>10:50 ~ 11:20</b>	Value Adding to Plywood Products	Phongxiong Wanneng	National University of Laos, Laos
<b>11:20 ~ 11:50</b>	Profitability of Coffee Farming Systems in the Buffer Zones of Bukit Barisan Selatan (BBS) National Park, Sumatra-Indonesia	Bustanul Arifin	University of Lampung, Indonesia
<b>11:50 ~ 13:30 Lunch</b>			
<b>3.</b>	<b>Session 3</b>	Coordinator: Dr. Takahashi	
<b>13:30 ~ 14:00</b>	Calculation of Forest Carbon Densities to Serve the Implementation of REDD+ in Vietnam	Nguyen Dinh Hung	Forestry Inventory and Planning Institute, Viet Nam
<b>14:00 ~ 14:30</b>	Plot-level 3D Modeling and Stem Volume Estimation Based on Under Canopy UAV-SfM-MVS Survey Approach in Subtropical Forest of Okinawa Island, Japan	Fu Shimabuku	University of the Ryukyus, Japan
<b>14:30 ~ 15:00</b>	Application of Modern Lidar Data in Forest Resource Assessment. Current Status and Opportunities from Area-Based Approach to Close-Range Techniques.	Peter Surovy	Czech University of Life Sciences Prague, Czech Republic
<b>15:00 ~ 15:50</b>	<i>Coffee break talk with Mr. Yamaguchi from Mapri, Japan</i>	TBA	Mapri, Japan
<b>4.</b>	<b>Session 4</b>	Coordinator: Dr. Surovy	
<b>15:50 ~ 16:20</b>	Sustainable Management of Degraded Forests Based on the Combination of Inter-Planting of Nitrogen Fixation Tree Species and Thinning	Sokh Heng	Institute of Forest and Wildlife Research and Development, Cambodia
<b>16:20 ~ 16:50</b>	Cocoa Beans Export-Import of Indonesia and Exchange Rate: An Evidence from Vector-Correction Model	Warsono	University of Lampung, Indonesia
<b>16:50 ~ 17:20</b>	Functional Planning of Western Anatolian Forest Ecosystems based on Economic Values	Mehmet Ergin	Central Anatolia Forestry Research Institute, Türkiye

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**March 17, 2023**

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<b>5.</b>	<b>Session 5</b>	Coordinator: Dr. Konoshima	
<b>10:00 ~ 10:30</b>	Optimizing Timber Production for Sustainable Economic and Public Functions of National Forest in S. Korea	Hee Han	Seoul National University, Korea
<b>10:30 ~ 11:00</b>	Carbon Pricing Mechanisms and the Optimal Forest Harvest Age	Patrick Asante	Ministry of Forests, BC, Canada
<b>11:00 ~ 11:30</b>	Mixed Integer Programming Models for Land Use Management Concerning Pollination Services	Atsushi Yoshimoto	ISM, Japan
<b>11:30 ~ 13:30 Lunch</b>			
<b>6.</b>	<b>Session 6</b>	Coordinator: Dr. Han	
<b>13:30 ~ 14:00</b>	New modelling challenges of intensive monitoring plots in forest ecosystems: The study case of structural-functional approaches in cork oak forest systems	Nuno de Almeida Ribeiro	University of Evora, Portugal
<b>14:00 ~ 14:30</b>	Estimating Temporal Trend of Height-Diameter Curves in the Even-Aged Plantation Forest	Tetsuji Tonda	Prefectural University of Hiroshima, Japan
<b>14:30 ~ 15:00</b>	Statistical Approach for Selecting Height-Diameter Curves	Kenichi Kamo	Sapporo Medical University, Japan
<b>15:00 ~ 15:30</b>	<b>Business Meeting</b>	Dr. Konoshima	University of the Ryukyus, Japan
<b>15:30 ~ 15:40</b>	<b>Closing Remarks</b>	Dr. Yoshimoto	ISM, Japan

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March 16 (Thu), 2023

09:30~10:00

**Urbanization, Land use and Rural-Urban Linkages in Pokhara Metropolitan City, Nepal**

***Bir Bahadur Khanal Chhetri (Tribhuvan University, Nepal)***

Urbanization in a country alters land use in and around cities and the flow of ecosystem services between urban and rural areas. In many rural areas, there are more ecological resources that are not being used well for economic production, leading to migration of people from rural to urban areas for economic reasons. This study explores the extent of urbanization in Pokhara valley and how urbanization is affecting on land use and rural-urban interdependence. The study was conducted at the core city area of Pokhara Metropolitan and its peripheral rural areas. Desk review of secondary literature and stakeholder consultation workshops were carried out to collect and verify the secondary sources of data. Landsat satellite image analysis was carried out to see the land use pattern. The household survey and key informant interviews were conducted to understand the ground reality. The study showed that the population of Pokhara has increased by three folds after 2000. The study clearly showed the expansion of urban/built-up areas at the cost of agricultural land. Among 33 wards 11 wards, especially those in the vicinity of the highway, lost more than 50% of agricultural land while 10 wards, especially those in rural/peri rural area underwent more than 30% of agricultural land into forest. Rapid expansion of built-up areas after 2000 at the cost of agricultural land is causing a rapid decline in food production at Pokhara. Results further show that there occur limited resource flows between rural and urban areas, which is one of the “worrying concern” to maintaining urban-rural linkage for a sustainable city. A holistic and joint comprehensive and collaborative planning and cooperation between rural and urban areas is necessary to address the issues of current food production and interdependence between rural and urban areas.

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March 16 (Thu), 2023

10:00~10:30

**Impact of Men's Out-migration on Women Participation in Community Forestry: Insights from Rural Nepal**

*Narayan Prasad Gautam (Tribhuvan University, Nepal)*

The trend of men's out-migration has been increasing in recent years, resulting in an additional workload on women in the rural communities of Nepal. The consequent impact of such out-migration on community-based forest management is weakly known. In this context, this study attempts to determine the effect of men's out-migration on women's participation in forestry activities and the factors that affect the participation level. The study results are drawn from household surveys, focus group discussions, key informant surveys, and village meetings in the Dhodsing community forest user group of Sundarbazar municipality-8, Lamjung District of Nepal. The finding shows that despite having less technical knowledge, women's involvement in forest conservation increased after men's out-migration. The main factors behind this were women's exposure to social and conservation works. Household type, adult men in the house, type of adult men, mother-in-law in the house, self-employment status, affiliation with a political party, having kids below five years, a place to migrate for remittance, and primary occupation are the factors that affect women's participation in forestry activities. However, the duration of migration and the distance to fetch water do not affect the level of participation. Men's out-migration has increased the women's workload but has contributed to the household economy in the study area. We suggest that community forest user groups embrace women's participation as an opportunity to empower by providing them with appropriate practical forestry skills and building women's ownership in the community forestry decision-making process.

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March 16 (Thu), 2023

10:50~11:20

**Value Adding to Plywood Products**

***Phongxiong Wanneng (National University of Laos, Laos)***

Value adding to plywood products from processing methods made from eucalyptus camaldulensis and Eucalyptus deglupta (known as K7). The aims were to test the quality of plywood products based on the different length of hot press and to analyze the production cost of plywood with different hot press methods. This research focused on testing the quality of low-cost plywood production based on the length of hot press 10 minutes, 12 minutes and 14 minutes under the temperature of 120 degrees Celsius. The results showed that the quality test of plywood from three different conditions of hot pressing (10 minutes, 12 minutes and 14 minutes) were found no significant difference in terms of plywood quality. For instance, the glue bound was found in the range of 56 to 65 % (known as level 6). The average production cost of plywood based on first condition was 96,494.83 kip per unit, the second condition was 97,125.27 kip per unit and the third condition was 97,616.83 kip per unit. The results indicated that the production based on the first and the second conditions increased the value of plywood products up to 1,122 kip per unit and 491.56 kip per unit by comparing to the 3rd condition. This implied that hot-pressing process of plywood applied 10 minutes, 12 minutes and 14 minutes produced the same quality of wood products. However, considering of the production cost was found that the first condition of applying only 10 minutes hot-pressing can add higher benefit.

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March 16 (Thu), 2023

11:20~11:50

**Profitability of Coffee Farming Systems in the Buffer Zones of Bukit Barisan Selatan (BBS) National Park, Sumatra-Indonesia**

***Bustanul Arifin (University of Lampung, Indonesia)***

This study examines the profitability of coffee farming system of in the buffer zones of Bukit Barisan Selatan (BBS) National Park, in Sumatra-Indonesia. Farm-household survey was conducted from December 2020 to January 2021 using a proportional random sampling. Face-to-face interviews were conducted with total samples of 320 farm-households who stay inside and outside the park and in forest area not part of the park. Farm-economic analysis was employed to measure the profitability of the farming system, complemented by poverty status, conservation performance, details of value chain, etc. Profit function was also employed to estimate the determinants of farm income of coffee farmers in the study sites. Land holding ranges from 0.25 to 2.50 hectare, including in a steep slope of the park. The profitability of coffee farming outside the park is the highest, followed by that in forest area outside the park, and inside the park. Coffee bean is sold to middlemen and/or forwarders as farmers' groups do not have drying and storage facility. The poverty level of coffee farmers in forest area outside the park is the lowest, followed by those inside and outside the park. Sustainability certification as a component of global value chain is not easy to implement in the study sites as coffee farmers have legal problems of their lands. Nevertheless, coffee smallholders should be encouraged to organize as a group, to ensure monitoring system and traceability of coffee value chains. Coffee forwarders should be involved in the implementation of sustainability certifications, along with coffee corporations and exporters.

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March 16 (Thu), 2023

13:30~14:00

**Calculation of Forest Carbon Densities to Serve the Implementation of REDD+ in Vietnam**

***Nguyen Dinh Hung (Forestry Inventory and Planning Institute, Viet Nam)***

REDD+ is an international initiative to reduce emissions and/or enhance removals of greenhouse gases from forest related activities, such as deforestation, forest degradation and forest carbon stock enhancement. To be able to receive result-based payment from REDD+, developing countries need to calculate the amount of emission reduction and/or removal enhancement of the reporting period compared to the reference period and submit to the United Nations Framework Convention on Climate Change (UNFCCC). In this work, the forest carbon densities in 2019 and their associated uncertainties for each forest type and ecological region were calculated using the plot data in 2350 clusters taken from the National Forest Inventory, Monitoring and Assessment Project period 2016-2020. The results of this work have been used to calculate the forest-related CO<sub>2</sub> emission reduction and removal enhancement period 2010-2020 to facilitate the result-based payment for REDD+ implementation in Vietnam.

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March 16 (Thu), 2023

14:00~14:30

**Plot-level 3D Modeling and Stem Volume Estimation Based on Under-canopy UAV-SfM-MVS Survey Approach in Subtropical Forest of Okinawa Island, Japan**

*Fu Simabuku, Masashi Konoshima, Ikuo Ota (University of Ryukyus, Japan)*

Growth/yield projection and current inventory assessment of a forest stand are essential tasks for successfully conducting sustainable forest management. However, much is still unknown about the amount and distribution of forest resources in the subtropical island of Okinawa, Japan. Therefore, there is an urgent need to develop an effective and efficient measurement system to evaluate various forest inventory parameters such as tree diameter, tree height, and tree volume for intricately shaped tree species common in subtropical areas. In recent years there has been an increasing interest in the so-called UAV-SfM-MVS survey approach, which processes image data captured by UAVs and develops 3 D models to efficiently estimate various forest inventory parameters of standing trees without altering the surrounding environment. However, application of the UAV-SfM-MVS survey approach in subtropical areas is scarce. In this research, with the aim of establishing a relatively simple but still accurate forest measurement method that allows us to efficiently collect data of broad-leaved tree species common in subtropical forests, we conducted field experiments and acquired video data from a drone that flew under the tree canopy. Then, we developed 3 D models using the SfM-MVS technique and estimated tree diameter and volume. Finally, we compared the results of the proposed method with ground truth measurements. We found that our approach was able to estimate tree diameters and stem volumes in our surveyed plots with high accuracy within a shorter survey time. Although modeling of the tree crown and the parts where understory vegetation blocks the camera's view of the trunk remains a topic for future research, we demonstrate that the under canopy UAV-SfM-MVS survey approach is relatively simple but still a highly accurate measurement of standing trees in subtropical forests without altering the surrounding environment.



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March 16 (Thu), 2023

14:30~15:00

**Application of Modern Lidar Data in Forest Resource Assessment. Current Status and Opportunities from Area-Based Approach to Close-Range Techniques.**

***Peter Surovy (Czech University of Life Sciences Prague, Czech Republic)***

Active sensors especially LiDAR (Light detection and ranging) are recently being intensively developed and in last years many new and powerful sensors appear on the market. New techniques of scanning and new scanning wavelengths and their combination bring many exciting opportunities for research and for forest status assessment. One of the biggest advantages of active sensor, apart of more dense scans and point clouds, is the ability to be deployed in low visibility conditions (evening or nights) when the wind and other weather conditions are more stable. Simultaneously with evolution of scanning and sensing techniques is markable an ongoing research in processing and analysis of the data. Machine learning or artificial intelligence brings many possibilities for data evaluation. In this presentation we are going to demonstrate capability of correct combination of analytic technique and combination of lidar data for assessment of dead trees in lidar scans, and the influence of different lidar wavelength on the analysis.

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March 16 (Thu), 2023

15:50~16:20

**Sustainable Management of Degraded Forests based on the Combination of inter-planting of nitrogen fixation tree species and thinning**

***Sokh Heng (Institute of Forest and Wildlife Research and Development, Cambodia)***

After years of continued over-exploitation and deforestation, Cambodia faced degradation and decline of the forest resources. Around a half million hectare of these degraded forests have been handed over to the local communities to manage and use. However, with limited knowledge and technical skill, these communities can hardly make benefits from their community forests. To tackle this problem, the Cambodian Forestry Administration has reached out for support from its partners via development and research projects. Among them, there was a project which established a pilot demonstration in the degraded forests in Siem Reap province in Cambodia to demonstrate the restoration techniques. The goal of the project is to increase the level of forest restoration and promote forest sustainable management in Cambodia through the establishment of demonstration forests, technical personnel training and also improving the livelihoods of local people through non-forestry livelihood activities.

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March 16 (Thu), 2023

16:20~16:50

**Cocoa Beans Export-Import of Indonesia and Exchange Rate: An Evidence from Vector-Correction Model**

***Warsono (University of Lampung, Indonesia)***

COCOA BEANS EXPORT-IMPORT of INDONESIA AND EXCHANGE RATE: AN EVIDENCE FROM MULTIVARIATE VECTOR ERROR-CORRECTION MODEL Abstract By Warsono, Hanung Ismono, and Dian Kurniasari The cocoa bean is one of the main agricultural commodities that has an important role in economic activity in Indonesia. The main purpose of this study is to discuss the dynamic behaviour of the relationship of export, import, and exchange rate of Cocoa Beans in Indonesia. In order to achieve this purpose, we utilized vector error-correction model (VECM). Based on VECM analysis, the result show that there is cointegration among export, import, and exchange rate variables.

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March 16 (Thu), 2023

16:50~17:20

**Functional Planning of Western Anatolian Forest Ecosystems based on Economic Values**

***Güven Kaya (Marmara Forestry Research Institute, Türkiye), Kenan Ok (İstanbul University Cerrahpasa), Mehmet Ergin (Central Anatolia Forestry Research Institute), Ersin Yılmaz (West Mediterranean Forestry Research Institute), İsmail Şafak (Aegean Forestry Research Institute), Abbas Şahin (Marmara Forestry Research Institute), Niyazi Özçankaya, Hadiye Başar (Aegean Forestry Research Institute), Mehtap Koç (İstanbul University Cerrahpasa), Seda Saranay (Central Anatolia Forestry Research Institute)***

This study aimed to integrate decision-making processes and valuation technique of ecosystem services for forest allocation of Caldede Forest (5083.85 ha) in Turkey. It was questioned which functions of the forests in the area could be planned by surveying the priorities of the stakeholders, and resulted that biodiversity protection, water production, erosion prevention, carbon sequestration, and wildlife improvement were the most important functions of the forest. The economic values of the selected forest functions were estimated at 21249.01, 922.40, -142.45, 608.34, and 11365.20 TL/ha, respectively, by the choice experiments method. Then, it was sought how many hectares of forest area could be allocated to each function to produce maximum benefit under ecological, economic, and social constraints by using the linear programming method. The strategy “producing as much biodiversity, wildlife, and water values as possible, with minimal erosion control while producing wood at the breakeven point” achieved the maximum benefit as 27.97 million TL. To generate value as 27.97 million TL, forests has to allocated as 2606.94 ha for carbon sequestration and wood production, 1476.74 ha for wildlife, 498.6 ha for water production, 400 ha for biological diversity and 101.57 ha for soil protection and erosion prevention. Maps of functions were produced at the compartment level concerning the allocation levels computed and criteria sets on functional suitability. As a result, it was determined that although society gives the highest value to biodiversity, it may not be necessary to allocate the most forest to biodiversity in order to maximize the total value that forest can produce. Keywords: forest planning, function priorities, ecosystem services, choice experiments, economic values, linear programming, land allocation, mapping

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March 17 (Fri), 2023

10:00~10:30

**Optimizing Timber Production for Sustainable Economic and Public Functions of National Forest in S. Korea**

*Hee Han (Seoul National University, Korea)*

National forests in Korea suffer from an age-class imbalance, with most of the forest consisting of over 31-year-old stands. This raises sustainability concerns, necessitating systematic management planning to ensure long-term viability. This study aims to estimate the optimal timber production of national forests by considering economic and public functions. The study first analyzed areas suitable for timber production in Korea's national forests. A forest management planning model was then developed using multi-objective linear programming to handle multiple goals. The economic function was assessed through timber production, while the public function was evaluated based on carbon storage, water conservation, and air purification. The study determined the optimal timber production by applying the model to the national forest timber production area over a 100-year long-term management plan. The study found that the national forest timber production area has a high timber supply capacity, with a total timber production of 200 million m<sup>3</sup> over the planning period, averaging 2 million m<sup>3</sup> per year, accounting for 44% of Korea's domestic supply.

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March 17 (Fri), 2023

10:30~11:00

**Carbon Pricing Mechanisms and the Optimal Forest Harvest Age**

***Patrick Asante (Ministry of Forests, BC, Canada)***

Abstract: Although managing for both carbon and timber has become an important tool in the forest management tool box in British Columbia, the provincial government is still searching for ways to equitably and fairly credit carbon. This study compares returns from managing for timber only with managing for both timber and carbon. Since dead organic matter (DOM) is abundant in the boreal forest, the study also evaluates the impact of starting DOM on the optimal economic decision to harvest. In addition, the study evaluates forest management responses to different carbon markets. The study concludes that accounting mechanisms that penalize carbon losses can lead to huge reductions in forest land value.

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March 17 (Fri), 2023

11:00~11:30

**Mixed Integer Programming Models for Land Use Management Concerning Pollination Services**

*Atsushi Yoshimoto (ISM, Japan)*

Based on the studies of pollination service (PS) in the literatures, its score in a parcel has been calculated by two kinds of distance between the target parcel and its surrounding parcels for nesting and foraging possibility induced in the land use option on the parcels. The score changes not only by the distance from the surrounding parcels, but also the land use option for nesting and foraging. As a result, the score of PS is often formulated by nonlinear function of these two distances and land use options. Although the distance is continuous, the land use is the choice decision by a binary variable. We propose three types of linear transformation constraints from its nonlinear function to construct the mixed integer programming models to resolve land use management problems considering PS.

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March 17 (Fri), 2023

13:30~14:00

**New modelling challenges of intensive monitoring plots in forest ecosystems: The study case of structural-functional approaches in cork oak forest systems**

***Nuno de Almeida Ribeiro (University of Evora, Portugal)***

In the last five decades the forest ecosystems stability is being compromised by a combination of abiotic and biotic events that are altering regeneration, growth and survival patterns frequently used in the calibration of silvicultural models, that are becoming inadequate for sustainable management of forest stands. The abiotic modifications are mainly due to climate change events that are altering the site quality during the rotation periods creating the need for new structural functional growth models with higher sensitivity to environmental variables. To respond to the new modelling needs intensive monitoring plots are being installed with continuous monitoring systems of radiation absorption, interception of precipitation, evapotranspiration, nutrient uptake, photosynthesis, respiration, allocation, senescence and mortality summing to the holistic tree dendrometric data. In the present work it is presented the results of data collected in an intensive monitoring of water supplied plot of cork oak, where radial growth, meteorological parameters and water supply volume were measured every 15–30 days over four years. The results show that weather, tree size, debarking and trees intra-competition had a significant effect on radial increments. Water supply significantly enhanced growth during summer drought and decoupled radial increments from air vapor pressure deficit constraints, showing not only the importance of this factor as well the adaptation capacity of cork oak to the Mediterranean conditions.



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March 17 (Fri), 2023

14:00~14:30

**Estimating Temporal Trend of Height-Diameter Curves in the Even-Aged Plantation Forest**

***Tetsuji Tonda (Prefectural University of Hiroshima, Japan)***

Height-Diameter curve is a function that defines the relationship between diameter at breast height and tree height. It is the mean trend on a scatter plot that shows the relationship between diameter at breast height and tree height. This curve shifts to the upper right corner as the tree ages in the even-aged plantation forest. Hence, it is commonly used to estimate the parameters of a model that describes the height-diameter curve by tree age. The transition in height-diameter curve with age can be interpreted as a change in the parameters of the model over time. However, the behavior of the parameters estimated independently from age-specific data may not accurately capture the features in the transition of the height-diameter curves, due to the variabilities of observations within each age of a forest stand. Against this background, in this paper, we introduce varying coefficients into the regression model for height-diameter curve to describe the transition of height-diameter curves as a function of time. The proposed method is then applied to a forest growth data of sugi (*Cryptomeria japonica*) stand in a village in Hoshino, Japan.

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March 17 (Fri), 2023

14:30~15:00

**Statistical Approach for Selecting Height-Diameter Curves**

***Kenichi Kamo (Sapporo Medical University, Japan)***

In this presentation, we focus on the height-diameter curve (HDC), which characterizes the relation between tree height and diameter at breast height (DBH). These variables are typical ones in the monitoring of forest growth. The relationship between height and DBH is modeled by HDCs. In practice, an appropriate HDC is determined by paired [DBH, height] data from representative trees for which height measurement is relatively easy, and the curve is then applied to the entire DBH-measured tree to obtain the average height. In this presentation, we focus on the statistical analysis process for HDC, especially on the problem of selecting a suitable HDC. The selection of optimal HDC is a topic that can contribute to improving the accuracy of volume estimation. In order to select an appropriate HDC among multiple candidates, empirical rules or mathematical approaches based on the residual sum of squares have been applied in the past. We apply the cross-validation (CV) criterion, which is used in the model selection in regression models, for selecting the HDC. For the analysis of real data, we also show the results for analyzing the data for Sugi (*Cryptomeria japonica*) in Japan by preparing five candidates of HDC.