

**FORMATH AKITA 2014**  
**Program: March 8 (Sat) - 9 (Sun)**

Date	March 8, 2014		
9:00 ~ 9:30	<b>Registration</b>		
9:30 ~ 10:20	Project Meeting on Forest Spatial Problems	Coordinator: Asante & Takata	University of Alberta Akita Prefectural University
10:20 ~ 10:35	<b>Coffee Break</b>		
10:35 ~ 11:25	Project Meeting on Social Forestry Issues in Developing Countries	Coordinator: Chhetri	Tribhuvan University
11:25 ~ 12:25	<b>Lunch Break</b>		
12:25 ~ 12:40	<b>Sessions Opening Remarks</b>	Katsuhiko Takata	Akita Prefectural University
<b>1.</b>	<b>Economics and Social Studies</b>	Coordinator: Hiroshima	University of Tokyo
12:40 ~ 13:20	Forest Environmental Income and Its Role in Welfare Outcomes: An Empirical Evidence from Rural Nepal	Khanal Chhetri	Tribhuvan University
13:20 ~ 14:00	Sustainable Finance for Sustainable Forestry: Is Cooperation Possible among Nations?	Kenan Ok	Istanbul University
14:00 ~ 14:40	Management Support for Cultural Ecosystem Services in Northern Okinawa, Japan: from Public Preferences Assessment Till Mapping	Diana Surová	ISM
14:40 ~ 14:55	<b>Coffee Break</b>		
<b>2.</b>	<b>Forest Operations</b>	Coordinator: Surovy	ISM
14:55 ~ 15:35	Utilizing an Enhanced Forest Inventory to Assess Hydrologic Response of Two Stage Understorey Protection Harvesting Systems	Patrick Asante	University of Alberta
15:35 ~ 16:15	Possibility of 3-m Bucking and Fixed Price Business of All Logs in Takahara Forest Owners' Co-operative, Tochigi Prefecture, Japan	Kazuhiro Aruga	Utsunomiya University
16:15 ~ 16:55	Potential and Possibility of People's Involvement in Tree Plantations in Indonesia	Naoto Matsumura	Mie University
16:55 ~ 17:45	<b>Poster Session &amp; Coffee Break</b>	Coordinator: Konoshima	University of the Ryukyus
18:30 ~ 20:00	<b>Reception Dinner</b>		

Date	March 9, 2014		
9:00 ~ 9:30	<b>Registration</b>		
9:30 10:15	Review on the First Day Discussion	Atsushi Yoshimoto	ISM
10:15 10:30	<b>Coffee Break</b>		
<b>3.</b>	<b>Growth Model</b>	Coordinator: Mitsuda	University of Miyazaki
10:30 ~ 11:00	Comparison with RSS-Based Model Selection Criteria for Selecting Growth Functions	Fukui Keisuke	Hiroshima University
11:00 ~ 11:40	Reconstruction of Stem Surface Using Terrestrial Close-Range Photogrammetry	Peter Surovy	ISM
11:40 ~ 13:00	<b>Luncheon Workshop on 3D Technique</b>	Peter Surovy	ISM
<b>4.</b>	<b>Carbon Issues</b>	Coordinator: Takahashi	FFPRI
13:00 ~ 13:40	Development of a Carbon Budget Simulation Model Using Woody Biomass Supply Chain in South Korea	Hee Han	Seoul National University
13:40 ~ 14:20	Carbon Sequestration and the Optimal Forest Harvest Decision under Alternative Carbon Stock Baselines	Patrick Asante	University of Alberta
14:20 ~ 15:00	<b>Coffee Break</b>		
15:00 ~ 15:20	<b>Closing Discussion &amp; Remarks</b>	Atsushi Yoshimoto	ISM

### *Poster Sessions*

P01	Extraction of Collapse Risk Factors for Operation Road	Masashi Saito	Shinshu University
P02	Estimating Annual Availability of Logging Residues using Forest Management Records at Aggregated Stands of Nasushiobara City in Tochigi Prefecture, Japan	Uemura, R., Aruga, K. & Kanetsuki, K.	Utsunomiya University
P03	Effects of DEM Resolution on the Design of Forest Road Alignment	Hiroaki Shirasawa	Kyoto University
P04	Developing a Site Index Mmodel using the National Forest Inventory Data in Kyushu Island	Yasushi Mitsuda	University of Miyazaki

March 8 (Sat), 2014

**Session 1: Economics and Social Studies**

12:40~13:20

**Forest Environmental Income and Its Role in Welfare Outcomes: An Empirical Evidence from Rural Nepal**  
*Khanal Chhetri (Tribhuvan University, Nepal)*

The paper empirically examines the contribution of forest-environmental income, and its role in coping with shocks and change in well-being perceptions among the forest dependent households in rural Nepal. The results are based on a one-year survey of 303 households that included the detailed information on household demographics, income and assets and exposed to shocks ex-post. To capture likely non-linear dynamics of well-being status, several regression models are tested. Households reporting an improvement in well-being were primarily dependent on transfer income, whereas households dependent on forest and environmental, crop, and wage income were significantly less likely to become better-off. The perception of well-being was also related to shock exposure and households' endowments to cope with shocks. In particular, households exposed to several consecutive shocks (two or more severe shocks) over the course of five years significantly reported to be worse-off. The limited role of forest in improving the well-beings of the households is associated with their limited access to the resources. Identification of income groups, their expected wealth status, and asset and access constraints that limit economic advance are used to suggest appropriate targets of intervention.

13:20~14:00

**Sustainable Finance for Sustainable Forestry: Is Cooperation Possible among Nations?**  
*Kenan Ok (Istanbul University, Turkey)*

Countries in the world may be classified under different definitions regarding forestry characteristics of them such as Small Island Developing States, Low Forest Cover Countries, Rich Forest Cover Countries, forest product exporters, forest product importers, donors, etc. While some countries can generate income from forests, some of them have to spend money to sustain forests in the country. The countries in the world have rights and responsibilities for sustainable forest management in country and global scales. Although some mechanisms were generated by international institutions to support countries need aids for sustainable forest management, the suitability of them is under discussion in international meetings. The aim of the study is to develop a method or approach to compute the financial contribution levels for cooperation of the countries which have different characteristics deal with forest and forestry activities regarding common values of the forests for human. An equation consists of different variables deal with responsibilities and rights of the countries is introduced in the study.

14:00~14:40

**Management Support for Cultural Ecosystem Services in Northern Okinawa, Japan: from Public Preferences Assessment Till Mapping**  
*Diana Surová (ISM)*

Cultural services are non-material benefits obtained from ecosystems through recreation, spiritual enrichment and aesthetic experiences. A concept of cultural services is relatively new and across scientific community there is recognized a need to develop methods bringing useful knowledge for management of these services. The present study deals with assessment of landscape preferences in the way to facilitate their mapping. For the assessment of public preferences, the survey with photo-questionnaire was applied to people practicing recreation activities in northern Okinawa. The photographs represented principal vegetation types in the study area. Respondents evaluated each vegetation type for different recreation activities using a Likert scale and data were analyzed using the non-parametric statistical methods. Subsequently, the results from the survey were visualized on available vegetation maps. These results can contribute to current management of cultural ecosystem services in the way to spatially localize vegetation areas preferred by public for recreation activities.

## **Session 2: Forest Operations**

14:55~15:35

### **Utilizing an Enhanced Forest Inventory to Assess Hydrologic Response of Two Stage Understorey Protection Harvesting Systems**

*Patrick Asante (University of Alberta, Canada)*

Sustainable forest management requires water related values be integrated into the planning process. In Alberta, Canada, this has typically been assessed post timber supply analysis and the development of the harvest schedule. The use of an enhanced understorey inventory provided the linkage between the forest-level and tactical level plans which was required to the influence of a two stage understorey protection system on indicators of water quantity. A coarse filter cumulative hydrologic-disturbance model was developed and integrated into a linear programming model used for timber supply. Results indicated increases in water yield change being dependent on harvesting regime, watershed species composition and local climate. Timber supply favors the development of timber from stands that recover leaf area at faster rate. Evidence is provided for the use of understorey protection or harvesting systems that retain a substantial amount of conifer to alleviate the effects of concentrated harvesting schedules on increases in water yield while maintaining a conifer harvest flow.

15:35~16:15

### **Possibility of 3-m Bucking and Fixed Price Business of All Logs in Takahara Forest Owners' Co-operative, Tochigi Prefecture, Japan**

*Akaike, N., Uemura, R., & Aruga, K. (Utsunomiya University)*

This study investigated commercial thinning operations by normal bucking of the forest owners' co-operative near Nakagawa sawmill. Then, productivities and economic balances of 3-m bucking were estimated based on investigation of normal bucking to examine possibility of 3-m bucking and fixed price business of all logs. Extracted rate with 3-m bucking was estimated as 85% which was significantly increased from that with normal bucking, 38%. Therefore, extracted volumes with 3-m bucking were also significantly increased to 148 m<sup>3</sup>/ha from that with normal bucking, 67 m<sup>3</sup>/ha. Productivities of strip road construction, felling and processing with 3-m bucking were increased according to the increased extracted volumes whereas productivities of bunching, forwarding, and transportation with 3-m bucking were assumed to be same as those with normal bucking. Total costs per m<sup>3</sup> with 3-m bucking were reduced whereas total costs per ha with 3-m bucking were increased according to the increased extracted volumes. Extracted volumes of grade A, B, and C with normal bucking were estimated as 40, 20, and 7 m<sup>3</sup>/ha. Revenue per m<sup>3</sup> with normal bucking was estimated as 10,000 yen/m<sup>3</sup>. On the other hand, extracted volumes of grade A, B, and C with 3-m bucking were estimated as 59, 44, and 44 m<sup>3</sup>/ha. Revenue per m<sup>3</sup> with 3-m bucking was reduced to 8,400 yen/m<sup>3</sup>. Totally, economic balances per m<sup>3</sup> with 3-m bucking were reduced according to the increased volumes of lower quality logs whereas economic balances per ha with 3-m bucking were increased by double according to increased extracted volumes.

16:15~16:55

### **Potential and Possibility of People's Involvement in Tree Plantations in Indonesia**

*Naoto Matsumura (Mie University)*

The establishment of tree plantations in Indonesia has involved local people either in state forest lands or in private ones. A study on people's involvement in tree plantation will be conducted in a state forest plantation to gain information of the potential of community-based tree plantation (CBTP). The study will be carried out on Perum Perhutani (a state owned forestry company) forest plantation areas managed with a CBTP called PHBM (collaborative forest management with local people). A research site will be selected in West Java Province. Types of tree plantation found in the research site will be identified. The types might be categorized based on different species, or different group of species, or different management. Primary data will be gathered through interviewing respondents, including local people who are and/or are not involved in a CBTP and local officers of related institutions (e.g. Perum Perhutani and Forest Service). Direct visit to plantation areas will be done to cross check interview data and to gather additional ones. Barrier of local people's involvement, e.g. problem, constraint, and reason to involve as well as not to involve and cost and revenue of the farming system in the tree plantation are reported and analyzed.

March 9, 2014

### **Session 3: Growth Model**

10:30~11:00

#### **Comparison with RSS-Based Model Selection Criteria for Selecting Growth Functions** *Fukui Keisuke (Hiroshima University)*

A growth curve model used for analyzing a growth data is characterized by a mathematical function having time variables, called the growth function. Several growth functions have been proposed, and results of analysis from of the growth curve model depend strongly on which growth functions are used for the analysis. The selection of growth function is important. The choice of growth function based on the minimization of a model selection criterion is one of the major selection methods. Since the RSS-based model selection criterion is an estimator of the risk function assessing the mean square error of prediction, we can expect that the accuracy of the growth will be improved by using the RSS-based model selection criterion. In this paper, we compare the performances of these criteria (e.g., Mallows' Cp criterion) by conducting numerical experiments.

11:00~11:40

#### **Reconstruction of Stem Surface Using Terrestrial Close-Range Photogrammetry** *Peter Surový(ISM)*

Objective of this work is to evaluate current techniques in close range terrestrial photogrammetry for reconstruction of the stem surface. The morphology of stem is important in forestry not only because of the production potential, but also because of the stability of stands, resistance to the wind, snow disturbances and so on. Current knowledge in automatic reconstruction of 3D models by means of photography, for example using SIFT methods, allows visually perfect reconstruction of stems and partially forest stands. However the accuracy of these techniques is difficult to evaluate. In this work we use magnetic motion tracker to digitize points on the stem surface, because the magnetic field allows acquisition of points with positions related to one source [0, 0, 0] with high accuracy from among all stem. We describe the process of image acquisition and processing in order to obtain final mesh of the stem and we evaluate the accurateness of this mesh comparing with data obtained through digitization.

### **Session 4: Carbon Issues**

13:00~13:40

#### **Development of a Carbon Budget Simulation Model Using Woody Biomass Supply Chain in South Korea** *Hee Han (Seoul National University, Korea)*

Utilization of woody biomass has emerged as a key strategy for addressing a variety of environmental and energy issues in South Korea. Woody biomass has the potential to provide significant amounts of wood products, as well as feedstock for bioenergy production, which can be used to mitigate climate change by reducing carbon emissions. Harvested wood products (HWPs) and other logging-and-mill residues may play an important role for reducing carbon emission by partly replacing fossil fuels in many places in the world. In order to assess the effects of woody biomass utilization on reducing carbon emissions, we simulated woody biomass supply chain activities and analyzed the effects of various use of biomass in terms of carbon absorption and emissions at a stand level. The simulation model assesses carbon absorption and emission by estimating stand growth affected by thinning regimes and takes into account supply chain activities from stump to mill. The model consists of the following four modular simulators: a distance-free/independent tree growth simulator, a logging operations simulator, a log conversion simulator, and a carbon accounting simulator. We applied the model to a study forest in South Korea to analyze the effects of thinning regimes on carbon absorption, as well as the effects of logging operations, log conversion and end-use processes on carbon emissions. We assumed the logging operations include timber harvesting and transportation, and logs would be processed into lumber while residues are converted into pellets for generating energy.

13:40~14:20

#### **Carbon Sequestration and the Optimal Forest Harvest Decision under Alternative Carbon Stock Baselines** *Patrick Asante (University of Alberta, Canada)*

The choice of a baseline against which to evaluate changes in carbon stocks is a critical component of any forest carbon offset market. In this paper we use a discrete dynamic programming model and data from a lodgepole pine (*pinus contorta*) stand in northeastern British Columbia, Canada, to demonstrate that given the same conditions, the alternative baselines examined have little effect on optimal harvest decision, but can have a large effect on the amount and timing of carbon offsets attributable to forest management. This is important because the choice of the baseline has little real effect on management activities and resulting carbon sequestration, but can have a large effect on the amount of carbon credits that can be claimed.

## *Poster Session*

### **P01: Extraction of Collapse Risk Factors for Operation Road**

*Masashi Saito (Shinshu University)*

It is necessary to place the road network at high density to mechanized forestry. Above all, establishment of operation road is important. Construction method of operation road is different from the forest road. Surface processing and creation of retaining walls is not performed almost to construct at a low cost. Therefore, the risk of collapse due to rainfall increases. Factors that cause the collapse of the forest road previous studies have clarified, although factor is not known for operation road. Therefore we tried to extract the operation road collapse risk by referring to the study of forest road. First, we conducted a field survey in order to grasp the terrain conditions and geometry (Slope height, slope angle, width, etc.) of the operation road. Then, we extracted the factors collapse at high risk from the terrain conditions and geometric structure of the collapse point based on the operation road patrol record. The numerical value between 0~1 expressed danger in the judgment of collapse risk using the concept of fuzzy theory. About the factor analysis, we asked for the degree of importance of each factor using mathematical quantification theory class II. We were able to grasp the point of high risk of collapse routes that was established current by utilizing the results.

### **P02: Estimating Annual Availability of Logging Residues using Forest Management Records at Aggregated Stands of Nasushiobara City in Tochigi Prefecture, Japan**

*Uemura, R., Aruga, K. & Kanetsuki, K. (Utsunomiya University)*

Using forest management records from 2005 to 2010, supply potentials and available amounts of logging residues from profitable aggregated stands of Nasushiobara city, Tochigi prefecture were estimated and compared those from profitable sub-compartments in this study. Supply potentials from precommercial, commercial thinning and final felling operations were 39,584 tons, 10,376 tons, and 3,385 tons, respectively. Available amounts with 3,000, 6,000, and 10,000 yen/ton were estimated at 2,920 tons, 3,495 tons, and 13,334 tons from profitable sub-compartments and 2,628 tons, 5,143 tons, and 29,940 tons from profitable aggregated stands, respectively. Considering subsidy, available amounts with 3,000, 6,000, and 10,000 yen/ton were increased to 22,084 tons, 35,601 tons, and 46,017 tons, respectively.

### **P03: Effects of DEM Resolution on the Design of Forest Road Alignment**

*Hiroaki Shirasawa (Kyoto University)*

The practical applicability of forest road network layouts designed by optimization techniques has been increasing in recent years because of increased accessibility of high resolution DEMs (digital elevation models) from LiDAR (light detection and ranging) data. We investigate effects of DEM resolution on the design of forest road alignment through computational experiments. The study area, where road alignment is designed, is a forested and mountainous region at Kyoto University's Ashiu Forest Research Station. Airborne LiDAR data, which has a density of at least 20 points/m<sup>2</sup>, were acquired over the area. DEMs for the experiments are generated from the LiDAR data. In the experiments, edge-weighted graphs representing potential road networks are created on DEMs of different resolutions (grid sizes of 1, 5, 10 and 50 m). We assume road construction costs as earthwork volumes, and so the edges are weighted by the earthwork volume which occurs in the construction of the edge (road segment). Then a minimum cost alignment connecting two given points is designed by solving the shortest path problem on each graph. In comparison with the designed alignment, the difference of DEM resolution has an effect on the shape of alignment, road construction costs and road lengths. The results suggest the importance of using high resolution DEMs in designing forest road network layouts.

### **P04: Developing a Site Index Mmodel using the National Forest Inventory Data in Kyushu Island**

*Yasushi Mitsuda (University of Miyazaki)*

This study aims to develop a site index model of sugi (*Cryptomeria japonica*) planted forest in Kyushu Island, which is defined as a prediction model for spatial distribution of site index using geographic factors. In Japan, National Forest Inventory (NFI) has started at 1999 and been continuing. In 2013, NFI data has been opened for all researchers; therefore we tried to utilize the NFI data for modeling site index. The most severe difficulty in modeling site index is measuring the site index for a stand. As the site index is defined as the height of dominant trees at a reference age (40 years is commonly used in Japan), it is often difficult to acquire sufficient data for modeling site index by measuring the height of dominant tree in stands at the reference age. In NFI data, there are many plots of target species; however there are few plots where stand age is equal to reference age. Therefore we combined the site index model and the height curve model as a function of stand age, and then parameterized using these data source by Markov chain Monte Carlo methods. The site index model parameterized in this study can predict the spatial distribution of site index of sugi for this study area.