FORMATH SHIGA 2016
Program: March 16 (Wed) - 17 (Thr)

(Name of presenter only. Please refer to abstract for co-presenters)

Date	March 16, 2016		
9:00 〜 10:00	**Registration & Coffee Refresh**		
10:00 〜 10:30	**Opening Remarks "Launching a department of data science in Shiga University"**	Dr. Matsumura Dr. Takemura	Mie University Shiga University
1.	**Ecosystem & Community**	Coordinator: Dr. Takahashi	
10:30 〜 11:00	Analyzing payment for ecosystem services (PES) in Rupa Lake area of central Nepal	Khanal Bir Chhetri	Institute of Forestry, Nepal
11:00 〜 11:30	Comparison of rural community activities in forest conservation in Japan and Indonesia	Septaris Bernadetta Parhusip	Mie Univ., Japan
11:30 〜 12:00	Community based forest fire management practice in Nepal	Shreekanta Sharma Khatiwada	Institute of Forestry, Nepal
12:00 〜 13:00	**Lunch Break**		
2.	**Statistical Analysis**	Coordinator: Dr. Mitsuda	
13:00 〜 13:30	Growth analysis by using the idea for nuisance baseline	Ken-ichi Kamo	Sapporo Medical Univ., Japan
13:30 〜 14:00	Estimation of emission/removal factors using sample plots for development of Vietnam's forest reference level	Nguyen Dinh Hung	FIPI, Vietnam
14:00 〜 14:25	**Coffee Break**		
14:25 〜 16:10	**Poster Session**	Coordinator: Dr. Konoshima	
3.	**Adaptive & Sensitivity Analysis**	Coordinator: Dr. Aruga	
16:10 〜 16:40	Adaptive management in Mediterranean forest systems: The challenges of managing anthropogenic forest systems in a climate change environment	Nuno de Almeida Ribeiro	Univ. of Évora, Portugal
16:40 〜 17:10	Best mixture of woody biomass heating facilities with regard to fuel type, facility size, and availability of regional resource: An approach by sensitivity analysis and life cycle assessment	Yasushi Suzuki	Kochi Univ., Japan
17:30 〜 19:00	**Dinner**		

Date	March 17 2016		
4.	**Renewal & Multiple Resources**	Coordinator: Dr. Tanaka	
9:30 〜 10:00	Land use change, food security and nutrition nexus: Case study from the Nam Ngum Watershed in Lao PDR	Sithong Thongmanivong	National Univ. of Laos, Laos
10:00 〜 10:30	International trade and each management of shared renewable resources	Takeshi Ogawa	Senshu Univ., Japan

10:30 〜 10:55 **Coffee Break**

5.	**Timber Production**	Coordinator: Dr. Chhetri	
10:55 〜 11:25	Analysis on maize production in northern Laos: A case study Huaphanh, Xiengkhouang and Oudomxay	Daovorn Thongphanh	National Univ. of Laos, Laos
11:25 〜 11:55	Assessing the impact of sustainable forest management (sfm) practices on plywood production in Peninsular Malaysia	Abdul Rahim Abdul Samad	Universiti Putra Malaysia, Malaysia

11:55 〜 13:00 **Lunch Break**

6.	**Forest Management & Operations**	Coordinator: Dr. Asante	
13:00 〜 13:30	Appling the optimal bucking method using terrestrial LiDAR to a clearcutting operation at the Funyu experimental forest, Utsunomiya University, Japan	Kazuhiro Aruga	Utsunomiya Univ., Japan
13:30 〜 14:00	Optimal log production for maximized timber sale profitability using a network model with demand constraints	Yoonkoo Jung	Seoul National Univ., Korea

14:00 〜 14:25 **Coffee Break**

7.	**Optimization Model**	Coordinator: Dr. Ribeiro	
14:25 〜 14:55	Stand-level forest management planning approaches	Patrick Asante	BC Ministry of FLNR Operations, Canada
14:55 〜 15:25	Effect of heterogeneous spread of disastrous events on an optimal landscape management	Atsushi Yoshimoto	ISM, Japan

15:25 〜 15:35 **Closing Remarks**   Dr. Yoshimoto   ISM

Poster Sessions

P01	39 years Growth of Picea Glehnii and Abies Sachalinensis low density stands	Masayoshi Takahashi	FFPRI, Japan
P02	A preliminary analysis of available forest resources based on thinning records and forest register database: Case study in Komono Town, Mie Prefecture	Yuki Hirose	Mie Univ., Japan
P03	Evaluating species characteristics of growth response to climatic conditions using the parameters of carbon balance model	Yasushi Mitsuda	Univ. of Miyazaki, Japan
P04	Sampling strategies for quantifying rainfall interception using a water balance method: case study from a bamboo stand	Miho Nagano	Prefectural Univ. of Kumamoto, Japan
P05	An Application of Photogrammetry for Estimating Stem Volume in Subtropical Forest Tree species	Yuki Tamaki	*Univ. of the Ryukyus, Japan
P06	Exploring the optimal aggregation patterns for thinning activities - A case study in Nasushiobara, Tochigi prefecture, Japan -	Kohei Hosaka	* Univ. of the Ryukyus, Japan

* the affiliation of the first author

March 16 (Wed), 2016
Session 1: Ecosystem & Community

10:30～11:00
Analyzing payment for ecosystem services (PES) in Rupa Lake area of central Nepal

Khanal Bir Chhetri (Institute of Forestry, Nepal)

The concept of ecosystem services is attracting increased attention as a way to communicate societal dependence on ecological systems. PES (payment for ecosystem services) is a channel payment for ecosystem services from beneficiaries to service providers. A similar scheme is adopted by the locals of Rupa Lake where the upstream dwellers are rewarded by downstream for supporting the lake conservation. The study examined how existing setup of PES like mechanism has contributed to local community and explored the factors affecting their satisfaction about the existing PES schemes in the Rupa Lake area. Data were collected using stakeholder interviews, focus group discussions and households survey of randomly selected 150 households. Discriptive statistics, logit regression model and Friedman test was employed in analyzing the data. The overall study shows that PES scheme could be an exemplary for the management of common pool resources at local scale. People with higher age and education are more satisfied towards the exiting payment mechanism. Major share for income is fishery which is the prime ecosystem service in the area. Though payment mechanism is voluntary, more than 5000 households are benefited through the ongoing development and conservation activities. Valuation of ecosystem services based on different hydrological parameters, capacity building, awareness program and development of formal rules and institutions are the things to be addressed for sustaining the existing PES mechanism. The paper discussed the economic efficiency of PES schemes at local level that, indeed, is crucial for informing policy debate in developing the national strategy in Nepal.

11:00～11:30
Comparison of rural community activities in forest conservation in Japan and Indonesia

Septaris Bernadetta Parhusip (Mie Univ., Japan)

This study is aimed at indicating differences of rural community activities towards forest conservation in Japan and Indonesia. High dependence of rural communities in Indonesia towards forest resources causes pressures to the forest. In the other hand, less interests of rural communities in Japan towards forest resources compared with other economic sectors causes less supports for forest conservation. Emerging ecotourism to increase the income of local people around the forest is important for forest conservation.

11:30～12:00
Community based forest fire management practice in Nepal

Shreekanta Sharma Khatiwada (Institute of Forestry, Nepal)

Nepal, a mountaineering country in Southern Asia where 15 percent land is covered by snow throughout the year and 85 percent area of hills and plain land of Terai is potential area for forest. The land covered area by forest is 39.6 percent out of total area 147,181 sq km where 10.6 is shrub land and 29 percent is the forest area. The forest product is one of the major sources of income for the livelihood of local community settled in the country side that consist 80.4 percent of total population. The forest sectors of Nepal have directly contributed 15 percent GDP of the country including 5 percent from NTFPs. Forest is the source of energy for the local people where 64 percent fuel wood has supplied from there. But one of the major problems of forest management is forest fire which has become as threats in community forest user group. There are 18,133 forest user groups and they have managed the one third of the total forest area of the country at local level under the approach of community forestry. As the literature shows that some 90 percent of regeneration process of Sorea Robusta is burnt by forest fire which is one of the major sources of income as forest products. Hence the paper tries to access the causes of forest fire, existing fire management practices and identify the future strategies' steps for the forest fire management. The data were collected using focus group discussion, key informant survey, fuel survey and SWOT analysis. The fieldwork for the study was carried out in the month of April & May 2015 with three community forest user groups. The number of respondents were 120 representing from three distinct stakeholders groups; 'executive committee members of three community forest user groups, 'representative of civil society local leaders' and the representatives of local government line agencies. The discussion mainly focused on the present status of forest fire, causes of forest fire and existing management practice and difficulties to control the forest fire. The deliberate forest fire practice is in existed for the collection of fire wood, to clear the cultivated land, to collect the timber and even to poaching wild animals. Mostly the fire begins from the national forest or leasehold forest area where local people do not participate and less sensitive to manage. Likewise the negligence of local people while passing through on the way to forest, domestic cattle's observer, fire from the picnic spots are also the causes of forest fire. However the community forest user groups have adapted some best practices like awareness program among the locals, paid observer to look after and communicate, construction of conservation pond and fire lines and the provision of incentive and fine to participate or not to control the forest fire.

March 16 (Wed), 2016
Session 2: Statistical Analysis

13:00～13:30
Growth analysis by using the idea for nuisance baseline

Ken-ichi Kamo (Sapporo Medical Univ., Japan), Tetsuji Tonda (Prefectural University of Hiroshima), Kenichi Satoh (Hiroshima University)

Regression models can handle multiple variables all at once. In the regression models, there may be two kind of explanatory variables, one is the variables in our interest, another is one that is necessary in regression modeling but not in our interest. In such situation, we try to construct the regression models including the nuisance parameters as a baseline. It can give the estimate for the coefficients which is in our interest without some setting for the part of nuisance. Such idea appears implicitly in other regression model setting. For example, in simple regression models the coefficient for slope can be estimated without using the information for the intercept, then the intercept can be regarded as baseline. For another example, in Cox proportional hazard model, the coefficients for explanatory variables can be estimated regardless of the setting for baseline survival curve. We apply such concept to varying coefficient models, and introduce the results for the forest growth analysis. Since the growth amount of forest is affected by several environmental factors, then we regard the geographical position and age dependent growth as nuisance baseline. We can estimate parameters without any assumption for the baseline, i.e., nonparametrically. Besides the simplicity of modeling baseline curves, we can also describe the baseline by using the residuals after the regression coefficients have been estimated. This work is the joint project with Tetsuji Tonda (Prefectural University of Hiroshima) and Kenichi Satoh (Hiroshima University).

13:30～14:00
Estimation of emission/removal factors using sample plots for development of Vietnam's forest reference level

Nguyen Dinh Hung (FIPI, Vietnam)

Development of forest reference level (FRL) is one of the key requirements for implementing REDD+ in developing countries. The FRL is calculated based on activity data and emission/removal factors. In this work, we estimated emission/removal factors and the associated errors related to forest using a system of 2,100 sample plots. These sample plots were inventoried during period 2006-2010 by Forest Inventory and Planning Institute of Viet Nam. The plot data were screened for potential errors of mistyping and corrected using the original field notes. A script written in R language was developed to facilitate the calculation process. The resulted emission/removal factors were used to develop the national forest reference level for Viet Nam.

March 16 (Wed), 2016
Session 3: Adaptive & Sensitivity Analysis

16:10～16:40

Adaptive management in Mediterranean forest systems: The challenges of managing anthropogenic forest systems in a climate change environment

Nuno de Almeida Ribeiro (Univ. of Évora, Portugal)

The cork oak woodland production systems are complex Mediterranean forest systems that dominate the landscape of the south-western Iberian Peninsula, occupying approximately 574000 hectares in Spain and 737000 hectares in Portugal, that represents approximately 61% of world area and 80% of world cork production. Cork oak woodlands result from the integration of agro-pasture activities in forest stands with the unique tree structure, density and dynamics design based on the site quality and production objectives. Under the environment of the current climate and socio-economic changes, adaptive management concepts are needed so as to maintain cork oak woodland systems sustainably. In the present context it is essential to implement adaptive management techniques associated with growth models and decision support systems, constructed in the knowledge based monitoring system to elaborate precise management plans focusing on the long term objectives. In the present work, we present the simulation framework composed of the tree spatial growth model called CORKFITS and the ecologic based decision support systems, ECCORK, and the 20-year high precision adaptive management plan for an 80000 ha cork oak woodland in Cabrela and Monfurado protected areas in Alentejo region. Our results show that the site variables related with the soil and topography characteristics are the main drivers in the decision process. It is also shown that within 20 years it is possible to improve the forest production system sustainably if the appropriate adaptive management plans are implemented by specifying the importance of forest engineering in the decision process.

16:40～17:10

Best mixture of woody biomass heating facilities with regard to fuel type, facility size, and availability of regional resource: An approach by sensitivity analysis and life cycle assessment

Yasushi Suzuki (Kochi Univ., Japan)

Among many methods of woody biomass utilization, direct combustion is more energy-effective than other methods, i.e. electric power generation or chemical processing. In a recent decade, regional usage of woody biomass in rural area has been increasing in number. This is because its cost balance, for example, woody biomass boilers, is often better than that of fossil fuel facilities, resulting in enhancement of local economy from socio-economic point of view. Heat generation by woody biomass boilers, for example, boilers for green-houses, community centers, and hot-spar facilities can be listed as some of such examples. Cost analysis of the practical applications on woody biomass heating facilities indicated that total operation cost of such facilities is sufficiently lower than that of fossil-fuel facilities (Suzuki et al. 2012 and 2014). However, cost balance is different by many factors, such as fuel type (wood chip, wood pellet, fire-wood), facility size, and availability of regional resource. In other words, there are many options concerning the above listed factors. This paper tries to propose best mixture of woody biomass heating facilities on regional use with an approach of sensitivity analysis concerning the factors. The result indicated that wood chip is suitable for larger facilities, wood pellet for smaller ones, while fire wood has intermediate characteristics between the former two fuel types. Cost balance of wood pellet is most sensitive with regard to availability of regional resource. Some implications from LCA (life cycle assessment) approach will follow in order to evaluate and compare environmental load of the facilities.

March 17 (Thu), 2016
Session 4: Renewal & Multiple Resources

9: 30～10:00
Land use change, food security and nutrition nexus: Case study from the Nam Ngum Watershed in Lao PDR

Yayoi Fujita Lagerqvist (Univ. of Sydney, Australia), Michael Dibley (Univ. of Sydney, Australia), Jessica Hall (Sydney School of Public Health, Australia), Sithong Thongmanivong* (National Univ. of Laos, Laos), Somphou Sayasone (National Institute of Public Health, Laos), Manithong Vonglokham (National Institute of Public Health, Laos), Silinthone Sacklokham (National Univ. of Laos, Laos), Lampheuy Kaensombath (National Univ. of Laos, Laos), Sayvisene Boulom (National Univ. of Laos, Laos), Lytoua Chialue (National Univ. of Laos, Laos), Phokham Lattachack (National Univ. of Laos, Laos)

This study explores the role and challenges of multi-disciplinary research in examining, and seeking to influence policy on, a key development dilemma for a resource-rich and income-poor country such as Lao PDR. Simply stated, the dilemma is that rapid economic growth based heavily on large scale natural resource development has had limited success in improving key health, nutrition and certain livelihood indicators of the country's rural poor. In many instances, the strategy has undermined access to the land and natural resource endowments on which the poor depend most. We employed multi-disciplinary perspectives to examine linkages between food security and the nutritional wellbeing of rural people faced with resource development and rural livelihood change. This study applied spatial analysis on land use and land cover change from 2005 to 2015 to classify five classes of land cover based on ground truth data in 2014. Household survey by cross-sectional using cluster sampling to interview 3,680 representatives of household entire the watershed area. The result of spatial analysis found that Forest has declined from 43 to 26% for the entire watershed area. While the food security based on World Food Program scoring shown the high level of sufficiency in food mainly poorer and ethnic minority households. Among children under the age of five, 29 % found to be stunted in highlands area.

* presenter

10:00～10:30
International trade and each management of shared renewable resources

Takeshi Ogawa (Senshu Univ., Japan)

Using differential games, this paper analyzes output controls of internationally shared renewable resources like transboundary natural forests with two-country, two-good (that is, shared-resource goods and non-resource based manufactures) general equilibrium trading model. Each country non-cooperatively decides each amount to use shared natural forests using welfare maximization of the country considering the other country's amount to use and shared stock of natural forests. If each country non-cooperatively manages amount to use resources with welfare maximization of each country, people think that both countries will choose incomplete specialization, that is, both countries not only use shared natural forests but also make non-resource based manufactures. However, even if the solution concept is chosen by not only open-loop type but also Feedback Nash solution which is economically suitable but difficult to derive some result, this paper shows that it cannot be appeared that both countries choose incomplete specialization along transition process. This means that if at least one country chooses complete specialization. If both countries' incomplete specialization equilibrium occurs, at least one country does NOT follow non-cooperative welfare maximization of the country. The key condition is that shared resource good's price and market is common, that each country focuses the price, and that each good cannot be kept. Therefore, the results can be kept with repeated game model, and another shared resource good, that is, shared fishery good, for instance, tuna or eel.

Session 5: Timber Production

10:55～11:25
Analysis on maize production in northern Laos: A case study Huaphanh, Xiengkhouang and Oudomxay

Daovorn Thongphanh, Boundeth Soutthavilay (National Univ. of Laos, Laos)

Over decades, the agricultural land in northern Laos has been dominated by mono cropping especially maize production. This study explored the productivity of maize production in the northern part of Laos to understand the natural structural of transformation and examining the situation of maize in relation to market especially neighboring countries demand, also the analyze the risk of potential factors effecting production of maize. This study interviewed 704 households from 3 provinces and applied the both desk study as well as using ground data for analyzing relevance factors that effects production and the risk factors, this applied multi linear regression forms with double-log through the Ordinary Least Squares (OLS). The result of the study indicated that some risky of producers appeared to be market uncertainty as well as input factors. Policy implication is one of the factors that slightly cause the potential risk to farmers, these due to the weak implementation or lack of support policies to facilitate agricultural productivity in adding value of the products. Some point of soil fertility is a big concern in Huaphanh and Xiengkhuang province but not mentioned in Oudomxay while market limitation is high risk for farmers in Huaphanh.

11:25～11:55
Assessing the impact of sustainable forest management (sfm) practices on plywood production in Peninsular Malaysia

Abdul Rahim Abdul Samad (Universiti Putra Malaysia, Malaysia)

The aim of this paper is to investigate the impact of SFM practices on production of plywood in Peninsular Malaysia. We adopted Autoregressive Distribution Lagged (ARDL) approach to estimate the determinants of production of plywood using annual time series data basis from 1970 to 2012. Then, we imposed four scenarios under SFM practices (i) reduced by 24-percent in harvested area (S1), (ii) increased by 25-percent of domestic price of plywood (S2), (iii) increased 47-percent in input cost (S3) and (iv) incorporated all the three scenarios (S4). The empirical result shows that, the domestic prices of plywood and wages represent input cost are statistically significant at 1% and 5% level respectively in determining the production of plywood. It is consistent with the theory where the production of plywood depends on the domestic price of plywood and input cost. When the domestic price increases, the producers are encouraged to produce more. The overall results show that the plywood production has negatively affected by 5% on average due to SFM practices. However, after a certain period of time, the results turn to be positively affecting the plywood production by 23% on average. It suggests that the producers will be benefiting from SFM practices as it could enhance the plywood production in Peninsular Malaysia. These results are important to the policy makers because of plywood industry have been expanding rapidly. Hence, SFM practices would be able to boost the plywood industry without compromising the effort to sustain and conserve forest resources.

March 17 (Thu), 2016
Session 6: Forest Management & Operations

13:00～13:30

Appling the optimal bucking method using terrestrial LiDAR to a clearcutting operation at the Funyu experimental forest, Utsunomiya University, Japan

Kazuhiro Aruga, Chunhui Liu, Ryo Uemura (Utsunomiya Univ., Japan)

In the previous study, the optimal bucking methods were applied to Nasu town and the factors of effects on profitability of commercial thinning operations and feasibility of the extraction of small sized logs were discussed. However, bucking operations should be conducted considering log quality although the previous study did not. Terrestrial LiDAR has been used to measure detailed description of stem shape. The present study applied terrestrial LiDAR with an optimal bucking algorithm to Japanese cypress and Japanese cedar at the Funyu experimental forest, Utsunomiya University. The root mean squared errors (RMSEs) between small end diameters of logs that were obtained below 10 m and measured using manual and terrestrial LiDAR were within 2 cm. Log diameters were normally rounded to 2 cm; therefore, the RMSEs were within allowable ranges. However, RMSEs were increased according to an increase in small end heights because of branches. Furthermore, the understory vegetation also disrupted laser scanning. The economic balance considering sweep from terrestrial LiDAR was estimated. As a result, the profit was estimated to be 177,511 yen, which was close to that estimated by manually measured data, at 195,500 yen. Without considering sweep, profit was overestimated as 214,175 yen. The use of an optimal bucking algorithm improved the profit to 233,576 yen (USD1 = 119 yen).

13:30～14:00

Optimal log production for maximized timber sale profitability using a network model with demand constraints

Yoonkoo Jung, Joosang Chun (Seoul National Univ., Korea)

As 67% of Korea's forest stand has become mature, the amount of timber harvested in Korea has increased dramatically during the last decade. Domestic timber market, on the other hand, has not been benefitted in accordance with the increase of merchantable timber volume. It is because logs produced on a forest stand are bucked without considerations of end-products resulting in value loss of an individual log. In fact, Pinus densiflora and Larix kaempferi logs which are considered as saw-logs are often bucked into pulp-stick size and transported to wood-chip or wood-pellet mills losing the premium as a raw material for lumber products. This state of forest products market will decrease the domestic timber value and disrupt the entire market network. This study was conducted to investigate the cause of the current situation and to maximize profitability of timber sale by optimally producing different log products using a network model. First, representatives of 9 forest products manufacturers that produce different forest products were interviewed in order to collect market data such as raw materials used to produce certain forest products, source of the raw materials, market price of different logs, etc. and figure out the contributors of the situation. Second, using a network model, the amount of different types of logs that should be produced on a forest stand located in the middle of southern inland of Korea was determined with considerations of different demands around the stand in order to maximize timber sale profitability.

March 17 (Thu), 2016
Session 7: Optimization Model

14:25～14:55
Stand-level forest management planning approaches

Patrick Asante (BC Ministry of FLNR Operations, Canada)

Seeking an optimal operational regime under different management environments has been one of the main concerns of forest managers. Traditionally the main operational regime includes planting density or regeneration scheme, thinning time/intensity, and optimal time to harvest over the given time horizon. Deterministic approaches to tackle this type of optimization problems with different controls have dominated the solution techniques in forestry literature. We present in this paper an overview the methodologies used in stand level optimization, in which we show the strengths and weaknesses of these methodologies as well as provide comments on the effectiveness of the methodology. We then propose a new dynamic programing approach for generalizing solution specification and techniques.

14:55～15:25
Effect of heterogeneous spread of disastrous events on an optimal landscape management

Atsushi Yoshimoto (ISM, Japan)

A new optimization model is proposed to capture the spatial dynamics of the spread of invasive species by a cellular automaton model and find the optimal solution to control its spread within a 0-1 integer programming framework. The model seeks a solution by minimizing the total costs to implement treatments for preventing the spread and damage of invasive colonization. By incorporating a cellular automaton model governed by state- and distance-dependent probability rule of colonization into a 0-1 integer programming model, we evaluate and compare an optimal allocation of treatments on colonized and uncolonized areas. With a hypothetical stylized map, our experiments show that treatments on colonized cells are effective when implemented at the front line of the invading species, while treatments on uncolonized areas are conducted with some distance or buffer zone away from the front line. These buffer zones are likely to be colonized regardless of treatment. When the annual budget limit exists, treatments on colonized cells are implemented first. With heterogeneity in the invasive species spread dynamics, the proposed optimization model provides an optimal allocation of treatments much different from the solution with homogeneous environment. However, treatments at the front line of the invading species are always recommended.

P01
39 years Growth of Picea Glehnii and Abies Sachalinensis low density stands

Masayoshi Takahashi (FFPRI, Japan)

Most of the artificial stand in Japan were planted 2,500 to 3000 stems per hectare and there ware managed with repeated thinning to produce timbers for housing especially wooden pillar. However, low density planting is about to spread, because of declined domestic timber price and demand for reducing planting and silviculture cost. Advantage of low density planting is related to expansion of stem spacing. It might be positive effect of the individual growth and the degree of the effect could be different among species. 39 years growth data of Picea Glehnii and Abies Sachalinensis stands with 1000 stems par ha that are two major panted species in Hokkaido were applied to determine low density growth trends. Generalized multivariate analysis of variance model are used to compare growth patterns of two species DBH and Height data. There are different growth trend among two species in DBH and there could illustrate various growth strategies.

P02
A preliminary analysis of available forest resources based on thinning records and forest register database: Case study in Komono Town, Mie Prefecture

Yuki Hirose (Mie Univ., Japan)

Komono Town in Mie Prefecture has a typical problem of inactive forest management like delay of thinning and final cutting as usual case in Japan nowadays. To change current situation and to build an energy circulation system for a sustainable society utilizing forest resources, Komono Town has been trying to estimate the available amount of the thinning practices. Using the forest register in 2014, our consulting paper has reported a roughly estimated amount. However, surveying the sample forest stands following typical forest types, some values of the forest register were deficit or non-updated. To improve estimating accuracy of the forest resources is a crucial issue at present. On the other hand, a public enterprise for promotion of thinning has been implemented since 2008 and has recorded thinning result data including logged timber volume and forest plot data in designated standard areas. The objective of this study is to improve the estimating accuracy of the forest resources for Komono's forest planning, using thinning records data, in addition, to consider estimation methods of the available forest resources by comparing these two data. The thinning data showed a wide difference from the forest register, that the thinning delay caused the forests become highly dense and increase in volume. This result shows a need for considering the estimation procedures for the available resources derived from initial conditions.

P03
Evaluating species characteristics of growth response to climatic conditions using the parameters of carbon balance model

Yasushi Mitsuda (Univ. of Miyazaki, Japan)

Carbon balance based stand growth model of sugi (Cryptomeria japonica) and hinoki (Chamaecyparis obtusa) were developed for evaluating species characteristics of growth response to climatic conditions. Carbon balance based stand growth model developed in this study consisted of following 6 processes: (1) photosynthetically active radiation absorption; (2) photosynthetic production; (3) photosynthesis rate control by temperature and vapor pressure deficit; (4) respiration; (5) litterfall and turnover; and (6) growth partitioning. We parameterized formulas describing each process using time series data of the permanent plots maintained by Forest and Forest Products Research Institute. Parameters of formulas represent species characteristics of growth response such as light use efficiency, tolerance to water deficit, and tolerance to low temperature. We interpreted parameters of growth model to identify species characteristics of sugi and hinoki.

P04

Sampling strategies for quantifying rainfall interception using a water balance method: case study from a bamboo stand

Miho Nagano, Akio Inoue, Hiroyuki Shima (Prefectural Univ. of Kumamoto, Japan)

The water balance method enables us to quantify rainfall interception loss (Ic), which is a critical factor affecting the water balance in a forested ecosystem, from the observation of rainfall (Rf), stem flow (Sf) and throughfall (Tf), i.e., Ic = Rf – Sf – Tf. In general, Sf varies among trees within a stand and Tf has a spatially intensive variation. Accurate and precise estimate of Ic requires the wide plot size and large sample sizes for Sf and Tf. Such sampling procedure is, however, time- and labor-intensive. In this study, we demonstrated the effects of plot size and sample sizes for Sf and Tf on Ic estimate in a stand of bamboo, Phyllostachys pubescens Mazel et Houz. A plot of 10 m × 10 m was established in a stand of P. pubescens, and Rf, Tf and Cf were monitored over a 10-month period. The effects of plot area and sample sizes were then simulated based on the measurement results. The simulation indicated that 1) the plot area was sufficient to 8 m × 8 m; 2) Sf should be measured for all culms; and 3) Tf should be measured by at least, but not more than, 15 storage-type rain gauges. Our results will be beneficial when evaluating the impact of range expansion of P. pubescens stands on water yield.

P05

An Application of Photogrammetry for Estimating Stem Volume in Subtropical Forest Tree species

Yuki Tamaki (Univ. of the Ryukyus, Japan), Peter Surový (Czeck Univ. of Life Sciences, Slovakia), Masashi Konoshima (Univ. of the Ryukyus, Japan), Atsushi Yoshimoto (ISM, Japan)

We estimated stem volumes for both coniferous and broadleaf species found in Okinawa using photogrammetric reconstruction. We took overlapping photos of individual stems and created 3D images using the processing software (Agisoft PhotoScan ©). We measured the total of 17 trees including both coniferous and broadleaf species in three different research areas in Okinawa. In order to collect the image data, we used we used the digital camera in a common smartphone, the iPhone 5STM and Nikon D7000 with a 18-105mm f/3.5-5.6 VR lens. For each tree, 90-100 photos were taken from a close range (approximately 1-2m from the tree). We recorded the time required for taking all overlapping photos necessary for constructing each tree stem. We computed stem volume using the processing software (Agisoft PhotoScan ©). We also created 3D images of multiple tree stems within a plot simultaneously. We established a 10 m x 10 m plot at University of Ryukyus Senbaru campus. Unlike the photogram metric measurement of an individual stem, we took a series of photos capturing the plot condition while walking through the plot. The walking route was designed to efficiently obtain overlapping photos of all trees within a plot. Using Agisoft PhotoScan © we successfully created 3D models of 11 trees within a plot and computed stem volume for each. For comparison, we also created 3D images of each stem within a plot by collecting image data of individual tree. Finally, we discuss the usefulness and limitations of these approaches for efficient and effective data acquisition of tree volumes in subtropical forest.

P06

Exploring the optimal aggregation patterns for thinning activities - A case study in Nasushiobara, Tochigi prefecture, Japan -

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We develop a spatially explicit 0-1-optimization model that searches for the optimal aggregation patterns considering the slope of management unit and its spatial location regarding nearby forest roads. We demonstrate our approach using the part of forest in Nasushiobara, Tochigi prefecture, Japan. Our study forest consists of 1,346 forest management units covering the area of 876.26 ha. We consider various management scenarios and search for the optimal solution to each scenario. Each management scenario has a different set of constraints (e.g. even flow constraint, the maximum allowable area for aggregation per period etc…) to be satisfied. In order to taking into account the distance between management units and nearby forest roads in the scheduling, we assume aggregated units located away from the nearby road must be treated only after the aggregated units that act as the pathway to the road are harvested. We solve 0-1 integer programming problem sequentially in each period of time. The solution space in each period is limited by the "connectivity" to nearby forest roads. For example, in the first period, the solution space is limited to the set of aggregated units, which are directly adjacent to forest roads. Then, in the later periods, the solution spaces consist of the remaining sets of aggregated units, which are directly adjacent to forest roads and the aggregated units, which are directly adjacent to the aggregated units selected in the previous periods. The objective function used in the model is to maximize total harvest volume over the planning horizon. The planning horizon is set to 25 years and divides into 5 periods of 5 years. We also compute and compare the net present value of the optimal management strategies for all management scenarios.