

**INTERNATIONAL SOCIETY OF FOREST RESOURCE ECONOMICS (ISFRE)
2019 Annual Meeting**

Resources, Markets, Policies and People: The Broadening Scope of Forest Economics

**May 14-15, 2019
The Blackwell Inn
The Ohio State University
Columbus, OH**

Tuesday, May 14

BREAKFAST: 7:00 – 8:00 AM

Second Floor Foyer

OPENING SESSION: 8:00 – 10:15 AM

Room: PFAHL 140

8:00 AM: Welcome; Sayeed Mehmood, *The Ohio State University*

8:15 AM: ISFRE Business Matters, Marc Measells, *Mississippi State University*

8:30 AM: Keynote Speech—Rethinking the Principles of Economics: Lessons from Environmental and Resource Economics; *Dr. Tim Haab, Chair, Department of Agricultural, Environmental, and Development Economics, The Ohio State University*

9:15 AM: Panel Discussion—“From Where I Sit: Recent Trends and Future Directions of Forestry and Forest Economics”.

Panelists:

Jeffrey P Prestemon, *USDA Forest Service*

Daniel Balser, *Chief, Division of Forestry, Ohio Department of Natural Resources*

Fred Cabbage, *NC State University*

Mary Ellen Aronow, *Hancock Natural Resource Group* (Moderator)

BREAK: 10:15 – 10:30 AM

INVITED SESSION: 10:30 – Noon

Spatial, Temporal, and Market Approaches for Modelling Forest Sector Pathways—An Invited Special Session

Room: PFAHL 140

Moderator: Adam Daigneault, *University of Maine*

Global forest management, carbon sequestration and bioenergy supply under alternative shared socioeconomic and relative concentration pathways; *Alice Favero, Georgia Tech, Adam Daigneault, University of Maine*

The future of deforestation and forest sector emissions in the Shared Socioeconomic Pathways; *Craig M.T. Johnston, University of Wisconsin-Madison*

Downscaling global forestry projections to regional conditions; *Justin S. Baker and Jason Jones, RTI International, Gregory Latta, University of Idaho, Sara Ohrel and Shaun Ragnauth, US-EPA*

Global woody biomass harvest volumes under different SSP-RCP scenarios: does socioeconomic development outrun climate change mitigation; *Nicklas Forsell, Pekka Lauri, Mykola Gusti, Anu Korosuo, Petr Havlík, and Michael Obersteiner, International Institute of Applied Systems Analysis (IIASA)*

Discussant: Brent Sohngen, *The Ohio State University*

LUNCH: Noon - 1:30 PM Second Floor Foyer

CONCURRENT SESSIONS: 1:30 – 3:00 PM

SESSION 1A: Forest Management

Room: PFAHL 230

Moderator: Fred Cabbage, *NC State University*

Evaluating the Economic Benefits of Changing from Pure Forest to Mixed Forest Considering Carbon Payment and Harvesting Intensity; *Wan-Yu Liu and Yow-Ru Lin, National Chung Hsing University, Taiwan*

Abstract

Application of a clear-cutting system to an even-aged pure forest is a conventional forest operation model for wood production. However, this operation model does not align with multi-objective sustainable management. Additionally, mixed forests require forestation strategies that accommodate diversity. The purpose of this study was to assess an operation model for transforming an even-aged pure forest into a mixed forest. In this study, a simulation was conducted in which an even-aged pure forest of *Cryptomeria japonica* was cut under a fixed harvesting intensity and replanted with the native broad-leaved tree species, *Cinnamomum camphora*. In this model, the primary income for the forest owner was derived from wood sales and carbon payments. After deducting the costs of afforestation, management, tending, and cutting, the land expectation value was calculated, and the effects of critical variables, such as cutting time, harvesting intensity, and carbon price, were analyzed. Through analysis of the simulation results, this study explored strategies by which value could be increased in the transition from an even-aged pure forest to a mixed forest. Possible methods included reducing the costs of afforestation, management, tending, and cutting while increasing carbon prices to increase profits from wood and carbon income. Higher harvesting intensity could contribute to greater production of *Cryptomeria japonica* and increase the area available for planting *Cinnamomum camphora*, resulting in greater profits from wood and carbon income. However, this measure would also substantially affect forest ecology. A sole focus on increasing the production value of forestland will neglect the original goal of transforming an even-aged pure forest into a mixed forest.

Consequences of Evolving Forestry Practice Cost Trends on the Financial Feasibility of Timber Management Scenarios in the Southern U.S.; *Pushkar Khanal and Thomas Straka, Clemson University*

Abstract

Costs associated with timber production are crucial to analyzing the profitability of any given forest management regime. Changes in costs of forestry practices have the potential to alter timber management scenarios, including the number of thinning regimes, rotation length, or other stand establishment practices. The overall goal of this study was to evaluate financial performance of loblolly pine timber management scenarios due to recent changes in costs of southern pine plantation practices. Two specific goals were to: 1) estimate the real average annual rate of change for the cost of nine major forestry practices in the South, and 2) evaluate the financial performance of timber rotations due to the evolving forestry practices cost trends in the Southern United States. Cost data were compiled from all forestry practices cost studies published in *Forest Farmer* and *Forest Landowner* magazines between 1982 and 2016, while financial performance of the pine plantations was evaluated using standard discounted cash-flow analysis. Results indicated that management regimes incorporating chemical site preparation were subject to much more moderate reductions in net present value over time compared to regimes with other forms of site preparation. Our findings suggest that landowners and managers seeking to maximize return in the face of continued low stumpage prices should closely analyze their choice of management regime, the practices associated with that regime, and the trends in the cost of those practices.

Long-term timber cutting contracts in the southeastern U.S.: Updating the primer valuation framework; *Hector I. Restrepo, Richard B. Mei, and Bronson P. Bullock, University of Georgia*

Abstract

The U.S. timberland ownership has drastically changed in the last decades, mainly driven by vertically integrated forest product companies divestitures. However, by doing so, forest firms have exposed themselves to raw material risk. This risk is hedged by contractual options like long-term cutting contracts (LTTCs), which have been believed to represent a valuable asset for timber industry firms. Since the mid 80's, the methods, value, and implications of the LTTCs in the southeastern U.S. have not been updated. There is a new context for forest business compared to what it was in the mid 80's in terms of timber prices, risk-free interest rates, and corporate risk-adjusted discount rates. The overall objective of this research was to update the option pricing valuation framework for LTTCs proposed by Robert Shaffer Jr. in 1984. The estimation of the volatility and the use the information from the current financial/economic conditions was crucial to accomplishing the goal. In particular, the conditional volatility estimated from GARCH models was used into the Black-Scholes and binomial models (European and American) to value the call option of one LTTC. Contrary to Shaffer's result, our analysis suggests that LTTCs may not be profitable for timber firms, mainly because the volatility and the risk-free rate are relatively small. Thus, well-functioning wood markets not only preclude owning land by forest firms but also may make LTTCs worthless. Likewise, this result implies that forest companies will probably rely more on the open market and less on this type of legal agreements.

Financial performance of diverse levels of early competition suppression and pre-commercial thinning on loblolly pine stand development: Using Historical Data; *Shaun M. Tanger, Michael Blazier Louisiana State University; Gordon Holley, Eric McConnell and Curtis VanderSchaff, Louisiana Tech University*

Abstract

Competition suppression within loblolly pine plantations (*pinus taeda L.*) is typically carried out within the first two years of a plantation, but continuing competition control for longer durations could improve plantation productivity. As plantation growth improves with increasing vegetation suppression frequency, it may be necessary to pre-commercially thin stands to reduce intraspecific competition. The effect of these increased silvicultural activities for controlling inter- and intra-specific competition to optimize crop tree growth on plantation financial performance is relatively unexplored. This study was designed to test the financial performance of several operational mixtures of herbicides relative to sustained suppression of herbaceous, woody, and all non-crop vegetation; pre-commercial thinning was also tested to understand whether reducing stand density affected responses to vegetation control. Intensive vegetation control increased financial returns compared to sustained woody vegetation suppression, but it was similar to the control group and operational-analogue treatments. Introducing pre-commercial thinning undermined financial performance of the intensive treatments. While five years of total vegetation suppression increased loblolly pine yields, the improved yields did not overcome its high early-rotation costs. In other words, the rate of yield increase (plus any stumpage price increase) was less than the discount rate. Pre-commercial thinning increased the proportion of sawtimber produced, but it did not enhance financial performance of the vegetation suppression treatments due to its cost.

SESSION 1B: Climate Change

Room: PFAHL 140

Moderator: Don Grebner, *Mississippi State University*

Multi-criteria Management of Central Hardwood Forests under Climate and Fire Uncertainty with a Scenario Optimization Approach; *Wu Ma, Jingjing Liang, and Mo Zhou, Purdue University.*

Abstract

We developed multi-stage scenario-based optimization models for Central Hardwood Forests under climate and fire uncertainty. Based on climate-sensitive matrix models, mean fire interval models, future climate scenarios, and attendant fire intervals, tree-growth scenarios were built for different harvesting cycles. Three alternatives of optimization formulations were proposed: 1) optimize for the maximum objective value under each individual scenario independently; 2) based on results from 1), find the compromise harvesting plan that's feasible for all scenarios while minimizing the weighted sum of deviations between the realized and maximum objective values; and 3) derive the optimal harvesting plan over the entire scenario tree. Four management criteria were considered: net present value of harvested timber, total carbon stock, species diversity, and size diversity. Finally we determined the trade-off between economic and

ecological benefits by quantifying the opportunity cost of increasing ecological benefits in terms of NPV.

Multi-model assessment of long-term climate change impacts on forests; *Alice Favero, Georgia Institute of Technology; Robert Mendelsohn, Yale University; Brent Sohngen, The Ohio State University; and Benjamin Stocker, CREAM*

Abstract

In this study we develop a joint analysis of land use change that uses ecological predictions from the Dynamic Global Vegetation Model LPX-Bern and economic predictions from the Global Timber Model to explore the impacts of climate change on the forestry sector.

The study examines climate change patterns predicted by four CMIP5 climate models from 2010 to 2300 under RCP 8.5 and RCP 2.6 and the resulting impacts on vegetation. Climate scenarios are combined with the five Shared Socio-economic Pathways (SSPs) in order to provide a detailed range of possible outcomes for the future of the forestry sector.

Preliminary results show that the global net surplus of the sector is expected to increase in all socioeconomic scenarios under the RCP 8.5 relative to the RCP 2.6 scenario. Consumers receive the largest share of the benefits because of the lower prices and larger timber supply. Under the RCP 8.5, forestland is likely to decrease across all climate and socio-economic scenarios while forest carbon stock shows different patterns according to the climate model analysed. However, the global median of carbon biomass per hectare of forest and global forestland productivity is projected to increase as global average temperature increases under the all climate models tested. Under the same climate scenario, socio-economic factors (eg. high economic growth and high demand for woody biomass) will drive the conversion of natural forestland to managed forest. The inclusion of carbon sequestration policies will guarantee the preservation of high-value natural forests.

Land Use Sector GHG Mitigation Potential across Socio-Economic Future Scenarios; *Jason Jones, Yongxia Cai, Justin Baker, RTI Internal; Gregory Latta, University of Idaho; and Christopher Wade, RTI International*

Abstract

Reducing greenhouse gas emissions from U.S. Forest, Agriculture, and Land Use Sectors is an important component of a nations' GHG mitigation strategy (UNFCCC, 2016). A variety of mitigation possibilities exist within this space, including practices across land protection, production management, biofuels, and bioelectricity. These strategies are often compared on a cost effectiveness basis using symmetric price incentives, or carbon prices. Mathematical models have been employed to evaluate the potential implications of such price incentives, and increasingly these studies are explicitly capturing interlinkages both within and across land use sectors to project cost-effective mitigation portfolios by region and implementation time-line. However, projected portfolios of optimal mitigation practices over time will depend greatly on expected future market, policy, environmental, and socioeconomic conditions.

Recent literature has shown the importance of future socio-economic conditions on the land use sector using shared socio-economic pathways (SSPs) (Popp et al. 2017, Daigneault et al. 2018, Jones et al. 2019). This research extends a previous analysis of SSP scenarios using a U.S. land

sector model (Jones et al. 2019), and by analyzing GHG mitigation potential in the U.S. land use sectors relative to alternative SSP baselines. In a dynamic optimization framework where decisions are made based on expected returns well into the future, anticipated future economic conditions will be a large driver in determining net mitigation outcomes under various mitigation price scenarios. We compare marginal abatement costs and projected regional mitigation portfolios across SSPs, which assume variation in key model parameters including forest and agricultural product demand growth, productivity (yield) growth, urbanization, and public land management assumptions. This analysis provides a required robustness check on previous land use sector mitigation work to ensure policy makers now understand the potential sensitivity of projected mitigation outcomes to uncertain policy and socioeconomic futures.

Impact of Climate Change on wildfire across China, based on plot-level data from national forest inventory; *Shilei Liu, and Jintao Xu, Peking University, China*

Abstract

Forest fire is one of the primary threat to forest under climate change scenario. Evaluate reliable results of impact of climate change on forest fire is critical for the improvement of fire management system and meaningful for climate change adaption practice. In this paper, we use plot-level data from NFI matched with observed weather data and stimulated climate data from CGMs, employing SAC model to investigate the impact of climate change on forest fire intensity in China. The results show under climate change scenarios RCP 2.6 and RCP 8.5 by 2100, the forest fire intensity will decrease by 3.13% and 3.12% respectively in China due to increased precipitation in the future. Climate change may not threat Chinese forest by increasing forest fire in the future and the forest administration should by cautiously treat the decrease trend of fire activity.

SESSION 1C: Energy and Carbon

Room: PFAHL 240

Moderator: Marc Measells, *Mississippi State University*

Environmental and Health Benefits of Electricity Generation from Woody Biomass in the Southwestern United States; *Dr. Ching-Hsun Huang, Northern Arizona University; Dr. Benjamin A Bagdon, Colorado State University*

Abstract

The majority of National Forests in the southwestern United States need fuels-reduction treatments that have not kept pace with tree growth and fuels accumulation. The harvested small-sized trees are commonly disposed of through pile burning on the site due to their low market values. We assessed the environmental and health benefits of using small diameter wood from the fuels-reduction treatments as a renewable energy source for electricity production to increase forest health and environmental quality. Our study area was located in northern Arizona within the Four Forest Restoration Initiative project area. We investigated eight air pollutants, projected stand conditions, calculated pollutant emissions from power generators and assessed damage costs from power production. We further used life cycle assessments to investigate emissions from feedstock production, transportation and power generation. Our life cycle assessment results indicate that the annual total damage costs of three treatment-energy scenarios, 1) no thin-

coal, 2) thin & pile burning-coal, and 3) thin-bioenergy, are \$978,157, \$1,732,300 and \$43,216, respectively. We determined that in comparison with the no-action (no thin-coal) scenario, the total environmental and health damage cost avoided by utilizing removed woody biomass for the yearly output of a 1 MW (megawatt) power plant was \$934,941 annually.

Cost and Benefit Analysis for Converting Coal-heating to Electricity-heating in Rural Area: A Case Study in Beijing based on Choice Experiment Approach; *Hui Wang, Beijing Forestry University; Lei Jiang, Chongyang Li, Beijing Municipal Research Institute of Environmental Protection; Junke Zhang, Beijing Forestry University*

Abstract

To improve the air quality in Beijing, the government has supplied subsidies for residents in rural area around Beijing to convert coal-heating to electricity-heating during the winter. There are some costs and benefits for it. The costs include government invest in grid enhancement, government subsidies in heating devices purchase and electricity consumption, the energy cost increment of the rural residents. On the other hand, the benefits don't include the air pollutant emission decrement, but also include the living conditions improvement, such as higher temperature, less labor input, cleaner indoor environment and so on. Therefore, whether the conversion is economically efficient remains a problem to explore. Based on the rural residents' survey and the statistics from government, this paper carries out the cost and benefit analysis for the conversion. First, the non-market benefits of the residents, which include higher temperature, less labor input and cleaner indoor environment, are evaluated with the choice experiment approach. Second, the non-market benefit of air pollutant emission decrement was examined. Finally, the cost and benefit analyzes are carried out with government perspective, residents' perspective and the whole society respectively. The results show that, the conversion is economically efficient for the residents and for the whole society.

Potential Economic Impacts of Allocating More Land for Bioenergy Biomass Production in Virginia; *Thomas O. Ochuodho, University of Kentucky; Janaki Alavalapati, Auburn University; Pankaj Lal, Montclair State University; Domena A. Agyeman, University of Kentucky; Bernabas Wolde, and Pralhad Burli, Montclair State University*

Abstract

The growing attention for more renewable energy and rural development has created greater demand for production of biomass feedstock for bioenergy. But, forest growth rates and amount of land in most of the existing forests may not be sufficient to sustainably supply forest biomass demand required to support existing forest products industries and the expanding bioenergy industry. Concerns about agricultural land use competition has dampened expansion of biomass production on agricultural land base. Allocating currently marginal non-forested land for growing bioenergy feedstocks, may meet growing forest biomass feedstock demand for bioenergy production. In Virginia, about 80% of forestland are under nonindustrial private forest ownership. The land use allocation decisions of these private owners are critical for supply of forest biomass feedstock to support bioenergy production. We apply computable general equilibrium model to assess economy-wide impacts of forestland owners' willingness to plant pine on non-forested land for woody bioenergy in Virginia. We consider three counterfactual scenarios of biomass feedstock supply increase as intermediate demand for bioenergy production

based on forestland owners' willingness-to-accept biomass bid prices to set aside more non-forested land for biomass production in Virginia under general equilibrium condition. Overall, results show increase in social welfare and household utility but marginal decline in GDP. However, increased demand of biomass from logging sector depressed the manufacturing sector (wood manufacturing sub-sectors particularly), which also relies on logging sector for its intermediate inputs. Results from this study provide insights into the bioenergy land use competition debate, and pathways towards sustainable bioenergy feedstock supply.

Consistent carbon equivalents for pricing the warming power of surface albedo according to its social cost; *Jussi Lintunen, and Aapo Rautiainen, Natural Resources Institute Finland (Luke)*

Abstract

Optimizing forest management for timber and climate benefits means choosing a management schedule that jointly maximizes the net present value of both ecosystem services. Forests affect the climate through various mechanisms. Carbon storage and surface albedo are two mechanisms through which forests tend to force the climate in opposite directions. The accumulation of biomass in boreal coniferous forests increases carbon storage (cooling effect) but reduces Earth's surface albedo (warming effect). Taking carbon and albedo optimally into account in forest management requires pricing their warming impacts according to their social value. Management choices are affected by the assigned prices and the strength of the warming impacts. The socially optimal price for CO₂ is the Social Cost of Carbon (SCC). Albedo warming power can be priced in two ways: (1) directly, based on the transient warming power of a surface and the Social Cost of Forcing (SCF), or (2) indirectly, by converting the warming impact into carbon equivalents and then applying the carbon price. Potential inconsistencies between the methods lead to differences in the valuation of albedo warming and, thus, affect inferences made about optimal forest management. We present a consistent way to calculate carbon equivalents and compare it with a common but inconsistent method. We show that the latter method (coincidentally) produces roughly correct near-future albedo prices. However, the method is sensitive to arbitrary parameter choices and is unable to capture temporal changes in the albedo-to-carbon price ratio. Our findings enable the comparison of results obtained using different albedo-pricing methods.

BREAK: 3:00 – 3:15 PM

Second Floor Foyer

CONCURRENT SESSIONS: 3:15 – 4:45 PM

SESSION 2A: International Issues

Room: PFAHL 230

Moderator: Wan-Yu Liu, *National Chung Hsing University*

Forest Planning Authorization and Deforestation in the Amazon Forest; *Bruno Kanieski da Silva, Erin O. Sills, NC State University; Stella Schons, Virginia Tech*

Abstract

The high deforestation rate in the Amazon Forest has been a constant concern of Brazilian and international institutions. Over the past decades, there has been many policies and law

enforcement focused on eradicate illegal logging in the region. Among those, state agencies are responsible to authorize and inspect forest plans submitted by private landowners. This type of policy allows government to know exactly the quantity and type of wood being explored, and guarantee a certain technical accountability of logging decisions. On the other hand, the limit capacity of Brazilian government to inspect these areas might lead to over exploration. In this study, we use the Synthetic Control Method (SCM) to investigate whether the Forest Planning Units (FPU) have been effective in avoiding conversion of forestland to other land use. We analyzed 2,500 FPUs, including private and public areas, with Landsat images from 1985 to 2017 of three states in the Brazilian Amazon (Rondônia, Mato Grosso and Pará). Initial descriptive statistics show that there is a small but increasing expansion of pasture within FPU. We discuss in details the results of SCM and the key finding in concession and private areas.

Forest Reference Levels for the EU Member States: Uncertainties arising from the flexibilities in Regulation and respective modelling assumptions; *Nicklas Forsell, Anu Korosuo, Mykola Gusti, ILIASA, Austria; Sebastian Rüter, Thünen Institute of Wood Research, Germany; Petr Havlik, Michael Obersteiner, ILIASA, Austria*

Abstract

In 2018, the European Union (EU) adopted a Regulation 2018/841, which sets the accounting rules for the land use, land use change and forestry (LULUCF) sector for the period 2021-2030. This regulation is part of the EU's commitments to comply with the Paris Agreement, where the parties agreed to limit global temperature increase to well below 2 °C above pre-industrial levels, and to pursue efforts to limit this increase even further to 1.5 °C. For Managed Forest Land, the emissions and removals are to be accounted following a projected forest reference level (FRL) that is to be estimated by the EU Member States based on the continuation of forest management practices of the reference period 2000-2009. Applying the interlinked G4M and WoodCarbonMonitor modelling frameworks, we estimate the potential FRL for each individual EU Member State following a set of conceptual scenarios each reflecting different modelling assumptions that are consistent the regulation and the Technical Guidance document as published by the Commission.

The simulations of the conceptual scenarios show that changes in underlying modelling assumptions may have a large impact on the projected FRL. On an aggregated EU level, assumptions related to the description of the historical forest management practices have the largest impacts on the FRL. On the other hand, assumptions concerning starting year of the projection and the stratification of Managed Forest Land are seen to have relatively small impacts on the FRL.

How would the eucalyptus plantation possibly fill China's timber demand and supply gap?
Miaoying Shi and Jintao Xu, Peking University, China.

CANCELLED

CBFM (Community-Based Forest Management): Participation and Impacts: A case study in East Java, Indonesia; *Soraya Dayu, Hank Stelzer, Zhen Cai, Michael Gold, and Corinne Valdivia, University of Missouri*

Abstract

Community-Based Forest Management (CBFM) has been initiated since 2001 in Indonesia due to the forest resources depletion caused by massive illegal logging. By involving timber-state enterprise and local communities, the CBFM program attempts to achieve the sustainable use of forest resources while helping alleviate the poverty of forest communities. In practice, CBFM participants would obtain landholding in the state forest to be utilized sustainably for their own benefits. In attaining its success in the context of collective actions, participation has been believed as a key success in CBFM implementation. We conducted a survey interview with 105 CBFM participants and 105 non-CBFM participants in East Java, Indonesia to investigate the factors of participant attributes which lead to their decision whether to participate or not in CBFM. Further, we also examine the factors that affecting CBFM participants' perceptions in viewing the success of CBFM to maintain better forest management. Results show that education, biophysical factors, and economic benefit derived from the forest have a significant correlation with people's decision to participate or not participate in CBFM. The success of CBFM in the terms of environmental impacts was determined by frequent meetings among the CBFM members, the total area of state forest they obtained, and their willingness to comply with forest management practices. In addition, the income level of CBFM participants derived from forest activities including agroforestry, agro-silvopasture, non-timber forest products, and ecotourism are higher than those who are also practicing forest activities but not participating in CBFM.

SESSION 2B: Policy Analysis

Room: PFAHL 140

Moderator: Steve Grado, *Mississippi State University*

Potential Economic Impacts of Future Water Policy at Canton Lake, Oklahoma; *Adam Frakes, Omkar Joshi, Oklahoma State University; Neelam Poudyal, Zack Darby, University of Tennessee*

Abstract

Lake resources provide a wide variety of benefits ranging from economic goods (e.g., water supply and irrigation) to ecosystem services (e.g., recreation, wildlife habitat). Unfortunately, because of their non-market nature, benefits associated with ecosystem services are rarely incorporated in policy decisions regarding resource allocation and distribution. In Oklahoma, debates over water allocation for alternative uses followed water releases from Canton Lake during the 2010-2013 drought. While water rights at Canton Lake rest with Oklahoma City, the lake remains a popular recreation destination in the region suggesting significant social and economic value for its recreational use. By employing an input-output model for data collected from on-site surveys of lake visitors during 2018, this study aims to characterize economic impacts of recreational use of this lake on the local economy. In addition, potential impacts of recreational use under alternative water allocation scenarios (e.g. full drawdown, no drawdown) are explored with analysis of contingent behavior data provided by visitors. According to

preliminary analysis, the majority of lake users visit from outside the surrounding three-county region, stay overnight, and participate in four or more recreational activities. Nearly half of respondents would stop visiting the lake if water levels dropped to 2013 levels while 90% would at least reduce the amount of trips taken to the lake. Results will provide stakeholders, including the Oklahoma Department of Wildlife Conservation, valuable information for future policy and management decisions. In addition, the study will offer a methodology to evaluate economic impact of policy scenarios with contingent behavior data.

Accessing the Effectiveness of Forest Incentive Program on Watershed Conservation: An Ecological–Economic Modeling Approach; *Yangyang Wang and Mo Zhou, Purdue University*

Abstract

Forest Financial Incentive Programs (FFIPs) are policy instruments for encouraging forestland conservation and restoration, timber production, and watershed and wildlife habitat protection on the private forestland. GIS-based ecological–economic modeling for FFIPs is an innovative approach to promote watershed level Ecosystem Services (ES) more efficiently and sustainably, which includes spatially explicit conservation costs as a decision-making factor to modify conservation strategies. The overarching goal of this research is to assess the economic and ecological effectiveness of the Classified Forest and Wildlands (CFW) program in Indiana. To estimate timber production, we develop GIS routines that combine forest inventory data with ecological-economic Kriging analysis to conduct financial analysis under alternative management regimes. To map and value the nutrient retention service, we use InVEST Water Purification Model combining climate data, geomorphological information, with biophysical inputs to simulate the dynamics of Nitrogen and Phosphorus, and we explore Market-based methods to conduct conservation return of investment analysis at the watershed scale. Four land scenarios explored in this research include 1) the current CFW forests 2) CFW expansion with a random enrollment, 3) CFW expansion along the main forks of the WRB and 4) CFW expansion on high productivity forest patches. This integrated analysis can lead to substantial reductions in social costs and provide guidance on conservation policies.

Financial Effects of Alternative Federal Income Tax Treatment of Timber Casualty Loss on Private Family Forest Landowners in the US South; *Srijana Baral and Yanshu Li, University of Georgia*

Abstract

Timber damage inflicted by sudden and unexpected catastrophic events such as wildfire, hurricanes, and ice allow timber landowners to take casualty loss deduction on their federal income tax returns. However, due to the complicated restrictions on the casualty loss calculation, recovery of loss from this provision is considered too small by non-industrial private forest landowners. Therefore, this study analyzed the financial effects of alternative federal income tax treatment of timber casualty loss on private family forest landowners holding timber as material participants for federal income tax purposes. For this, tax-deductible loss situations were modeled in light of two tax scenarios: current casualty loss deduction law and relaxation of adjusted basis limitation under current law. In addition, fiscal impact on government from the alternative tax scenario was also estimated. Relaxing the casualty loss deduction rule improved the expected net return of owning timberland for landowners at all income levels ranging from

13.06% for median income to 40.24% for high income landowners. Annual average revenue loss to the federal government was estimated to be \$701,618. While reduction in fair market value under alternative loss deduction rule allows landowners to make tax savings on their tax return, the government would experience revenue loss at the same time. Findings from this study could improve our understanding of current timber casualty loss deduction law. It is also expected to be useful for policy makers to formulate laws that support sustainable forest management.

How State Laws Affect Illegal Cannabis Growing on National Forests; *Jeffrey P Prestemon, USDA Forest Service*

Abstract

Since 2012, ten US states and the District of Columbia have legalized recreational use of cannabis, and over half of states have legalized medical cannabis. The policy environment, from taxes to criminal sanctions to other forms of regulation, has changed substantially since the 2000s. Policy changes may have affected illegal growing on national forests, and future changes may further affect prevalence. With data on the number of cannabis grow sites reported on 111 national forests between 2004 and 2016, information about state cannabis laws and when they were implemented, and a set of cannabis market and production control variables, we quantify how recreational cannabis legalization is associated with decreased illegal growing operations on national forests. We also show how mandatory minimum sentencing laws, regulation of cannabinoid products, taxes on cannabis sales, and law enforcement presence also affect illegal growing and reveal how decisions at the state policy level can influence illegal production.

SESSION 2C: Wildfire and other issues

Room: PFAHL 240

Moderator: Craig Johnston, *University of Wisconsin-Madison*

Forecasting Wildfire Suppression Costs: Aggregate Climate Drivers; *Bruno Kanieski da Silva, NC State University; Karen Abt, Jeff Prestemon, Natasha James, USDA Forest Service*

Abstract

The US Forest Service and other land-management agencies work on developing better models to predict wildfire suppression costs. The land-management agencies must provide estimates of the funding allocated to suppress wildfires three years before the season begins. In this study, we present a new formulation of the wildfire suppression costs model for the Forest Service and the Department of Interior. Our analysis show that the best forecast models adopt the first difference and, among many climate variable investigated, the Palmer Drought Severity Index (PDSI) has proven to be the best predictor of wildfire suppression costs. Throughout simulations we generate the forecast distribution for the upcoming years. This model highlight the change in behavior of suppression cost as well as the climate variables and, their strong relationship.

Evaluating the wildfire risks and its impact on forest carbon in the United States; *Raju Pokharel, Gregory S Latta, University of Idaho; Sara Ohrel, US EPA*

Abstract

Wildfire performs an intrinsic function in forested ecosystems, but drought and fuel loading has contributed to an increase in its frequency and intensity across the United States. Despite the effect on ecosystem services such as water, habitat, and carbon sequestration, wildfire is often represented in a very simplistic manner in national forest projections. We utilize re-measured Forest Inventory and Analysis (FIA) inventory data as the basis for a two-tiered nationwide model of wildfire risk and intensity. First, we use the full set of over 150,000 forested FIA plots along with PRISM climatic parameters to determine the likelihood that a fire will occur. Next, we use only the re-measured plots on which fire was observed to relate biomass loss (intensity), calculated the proportion of biomass in trees that died, to PRISM climate and total pre-fire total stand biomass. When applied to estimate wildfire risk and intensity at the FIA plot-level we approximated an annual release of 40.39 million metric tons of CO₂. Maps of the spatial allocation of probabilities of fire occurrence and biomass loss are presented at the national level. To demonstrate the applicability of our models in forest projections we present mid and end of century maps of fire risk and CO₂ emissions for a range of Representative Concentration Pathways (RCP) characterizing potential future climatic conditions.

Representative Forest Market Pathways under Climate Change: Pine Forests in the US Southeast; *Jesse D. Henderson, Rajan Parajuli and Robert C. Abt, NC State University*

Abstract

We use the SRTS model to examine the consequences of carbon fertilization induced by climate change for pine forests in the US Southeast. Resulting changes in pine (loblolly) growth affect forest markets and regional carbon sequestration. We examine this impact in the context of baseline modeling scenarios of increasing sophistication to determine the comparative impact of growth and demand on forest inventory, removals and carbon sequestration. Carbon fertilization estimates come from above-ground biomass data generated by the 3-PG forest growth model based on 20 climate models and Representative Concentration Pathway (RCP) scenarios 4.5 and 8.5. We examine forest market and carbon sequestration impacts using SRTS, with and without climate change-related growth. Results suggest that forest inventory will increase under all climate change scenarios. Results show lower timber prices over the long run under carbon fertilization. Welfare analysis shows that modeling assumptions about demand and harvesting have a greater impact than carbon fertilization.

A Walk in the Woods: Leadership, Activism, and Professionalism in Natural Resources; *Fred Cabbage, NC State University*

Abstract

This speech and paper will cover somewhat novel subjects for ISFRE—leadership, activism, and professionalism in natural resources. In reality, we all have many opportunities engage in these activities, and must decide when to eschew them, when to pursue them, and how to become

involved when we choose to do so. I address these subjects based on four decades of experience with varying levels of leadership and activism as a professional. These insights are leavened with a moderate number of principles and literature, which came intermittently before, during, and after the fact. These reflections and synthesis can help inform others on how to be a more effective participant and leader in natural resource organizations and debates, or to provide shared solace for the failures we all feel occur when serving in such leadership roles.

With difficulty, leadership can help you get the right things done well; set the discussion and action agenda for right things and right approaches; and make your community, profession, and world better. For forestry and natural resources, leadership can improve land management and practices, as well as improve your life, esteem, impact, and self-actualization. One of my core principles in leading organizations has always been to teach what you believe; practice what you teach. At times this helped move organizations forward and resolved issues; at times it led to antipathy, expense, and career limits.

Good leaders do many things when successful. They identify, affirm, or implement an organizational vision, and develop strategy and tactics to achieve that vision. They listen and learn from staff and customers; discern changes that can improve the organization or community they work with; and lead new efforts to change the status quo and make improvements. Leaders try to work within existing policies, rules, and regulations to achieve success, and identify and make new rules and policies to help achieve their vision. Leaders try to build effective and enduring organizational and collegial teams, and reform rules to institutionalize improvements.

Leaders will take flak for upsetting status quo and causing trouble with current entrenched interests. Leaders must persevere with genuine, persistent politics to change and improve lives. They surely do more inglorious work than glorious stuff. Occasionally they are appreciated or recognized; occasionally they fail and give up. Activism and professionalism are tools of leadership that we often employ to manage and improve natural resources, and are ways we can practice what we preach. They help energize efforts to pursue worthwhile goals, using our technical skills and ethical precepts to balance sustainable forestry and economic development.

POSTER RECEPTION: 5:00 – 7:00 PM

Room: Second Floor Foyer

Sponsored by School of Environment and Natural Resources, The Ohio State University

North Carolina's Land Use; Transitions between Agricultural and Forest Land; *Chinazor S. Azubike, North Carolina A & T State University; Timothy Mulrooney, North Carolina Central University; Lyubov Kurkalova, North Carolina A & T State University*

Abstract

The United States has several programs that monitor and report land use or land cover, contributing to our understanding of land use and land cover change. The National Agricultural Statistics Service (NASS) collects and publishes several land use, land cover data. This study will focus on the National Land Cover Database (NLCD) and Crop Data Layer (CDL), both providing raster-formatted, land cover data. According to NASS, "the accuracy of the CDL non-agricultural land cover classes is entirely dependent upon the United States Geological Survey

(USGS), National Land Cover Database (NLCD)”, however the accuracy between these two datasets have not been studied. The purpose of this study is to analyze the consistency and compare forest land categories between CDL and NLCD, to understand transitions between agricultural, forest and other land uses in North Carolina. North Carolina was chosen for this study because of the complexity of the state’s land. Forest land data downloaded from CDL and NLCD are merged using the ArcGIS software. For each dataset, forest land is broken down into five main categories, deciduous forest, evergreen forest, mixed forest, shrub-land and woody wetlands. These categories are reclassified as forest and overlaid in ArcMap to show the spatial distribution of forest land. Maps are created to show the inconsistency between the datasets. This study answers an urgent need for comparison of the datasets and understanding the importance of predicting future land use conditions in order to better plan for sustainable future developments.

Forest Carbon Offsets: A Viable Opportunity for Small-Scale Forest Owners? Mark Megalos, Rajan Parajuli, Mansfield Fisher, Stephanie Chizmar, NC State University; Tatyana Ruseva, Appalachian State University

Abstract

While the payments for forest carbon offsets can be a worthwhile alternative income stream for forest landowners, high upfront costs for project development, carbon accounting and verification along with the long-term agreement of restrictions on harvesting are reportedly major hurdles for small-scale forest landowners. By developing an experimental design for baseline and inventory as well as utilizing spatial data and technology, a project funded by University of North Carolina Systems Inter-Institutional Planning Grant aims at exploring the viability of forest-based carbon markets for small forest landowners. This poster presents the preliminary results of the costs data collected from primary and secondary sources to ascertain key areas for possible cost reductions.

Effects of Tax Cuts and Jobs Act 2017 on Private Timber Income in the US South; Srijana Baral and Yanshu Li, University of Georgia

Abstract

The new tax bill ‘Tax Cuts and Jobs Act 2017’ is the most expansive federal tax legislation since 1986. Different federal tax codes in the bill can have crucial impacts on private forest ownerships in the country. In addition, proposals introduced prior to the passage of the bill, although not included in the final bill, could also have impacts on profitability of forest management. This study evaluates and compares the net financial benefit of owning and managing timberland under various tax scenarios to show the effects of current law and other proposals on timber income of private forest held as an investment and business in the Southern US. The economic analysis showed that the current law has minimal impacts on material participants and investors who elect to capitalize both annual management costs and property taxes. Alternatively, the current law decreased after-tax land expectation value by 8% over the previous law for those median income investors who capitalized annual management costs and itemized property taxes. While current deduction of reforestation expenses had least impact, 50% reduction in capital gain tax rate improved after-tax land expectation value by 11.4% over the current law and by 8.5% over the previous law. Therefore, owning timberland becomes less beneficial for median income investors and material participants under the current law. This study is expected to provide a

better understanding of financial impacts of current law and other proposals to private forest landowners, policy makers, and other associated authorities interested in sustainable management of the forest.

An Economic Valuation of Coastal Marshes and Wetlands in South Carolina; *Andrew Purcell, Puskar N. Khanal, and Thomas J. Strakal, Clemson University*

Abstract

South Carolina's coastal marshes and wetlands are increasingly recognized for the ecological and economic benefits they provide to the communities, businesses, and individuals in the state. However, these benefits are underappreciated by the public and continually under threat due to encroaching sea level rise and uncontrolled urban development along the coast. Although many researchers study and write about various biological and ecological benefits of coastal marshes, wetlands, and tidal creeks, attempts to quantify their social and economic contributions in monetary terms are few and far between. The main goal of this study is to address this gap in overall economic value information in an effort to help guide efforts related to coastal restoration and resilience in South Carolina. Making use of the recent advances in ecosystem services valuation techniques, our study uses the meta-analysis approach to derive an estimate of the economic value of the benefits provided by the South Carolina's highly productive coastal ecosystems. The findings of this study would increase the inclusion of the coastal wetlands and marshes in land-use decisions and add to the tools of policy advocacy.

Price Premiums Required for Growing Higher Quality Southern Pine on Longer Rotation Age; *Arun Regmi, Donald L. Grebner, Robert K. Grala, and John L. Willis, Mississippi State University*

Abstract

Pine plantations in the Southern United States are typically harvested in a shorter rotation to ensure a higher economic return which results in the production of more juvenile wood of inferior quality. Delaying the final harvest allows trees to produce higher quality solid wood. Forest landowners, however, might be interested in receiving a price premium to justify the final harvest delay. Thus, we modeled four different southern yellow pines to quantify a price premium necessary for growing higher quality sawtimber past a typical rotation age in Lower Coastal Plain and Coastal Flatwoods regions of Mississippi, USA. Different management regimes consisting of a range of site indices, planting densities and thinning frequencies were simulated in Forest Vegetation Simulator, a growth and yield model developed by USDA forest service. Each management scenarios were optimized for timber revenue using the Land Expectation Value method. Results suggest that growing higher quality pine sawtimber in a longer rotation is economically feasible if landowners are offered an appropriate price premium. On an average site at 5% discount rate, price premiums required for growing higher quality pine sawtimbers delaying the final harvest by 10 and 20 years past the optimal rotation age are \$5.06/ton and \$17.77/ton for loblolly pine, \$5.33/ton and \$16.71/ton for slash pine, \$2.44/ton and \$12.68/ton for shortleaf pine and, \$3.49/ton and \$14.32/ton for longleaf pine respectively. A price premium increases with an increase in discount rates and rotation ages. This finding will help forest landowners to make more informed management decisions pertaining whether to

extend the rotation age of their forest to produce large diameter trees and whether they might reasonably expect a price premium to justify the final harvest delay.

Small Versus Large Logging Businesses in the Lake States of Michigan, Minnesota and Wisconsin: Status and Future Outlook; *Shivan Ge, Karen Potter-Witter, Michigan State University; Charles R. Blinn, University of Minnesota; Mark Rickenbach, University of Wisconsin*

Abstract

A coordinated mail survey of logging businesses in the Lake States of Michigan, Minnesota, and Wisconsin was conducted in spring 2017 to assess the status and capacity of logging sector across the region. The response rate was 23% for Michigan, 39% for Minnesota and 63% for Wisconsin. The results indicate that despite the presence of many small logging businesses across the region, the market is dominated by a few large producers who harvest the majority of volume produced. Small logging businesses in general had older equipment, older owners and relied more heavily on nonindustrial private forests for their stumpage compared to larger-volume producers. Also, small logging businesses were less likely to operate at full operational capacity, were more likely to say that they will exit from market in the next five years and less likely to indicate that a family member would take over ownership of business at some point in the future. The findings raise concern about the future of small logging businesses across the region and potential implications that it might have on local rural economies as well as forest management, particularly in the nonindustrial private forestlands.

Impact of Geospatial Factors on Fuel Reduction Treatment Implementation by Nonindustrial Private Forest Landowners; *Anusha Shrestha and Robert K. Grala, Mississippi State University*

Abstract

Nonindustrial private forest (NIPF) landowners are major forestry stakeholder, owning most of the productive forestland in the southern U.S. Forest management activities implemented by NIPF landowners determine the wildfire risk associated with their forestlands and potential hazard to nearby communities. Wildfire occurrences are influenced by both social and geospatial factors. However, little is known about influence of geospatial factors on landowner decisions related to hazardous fuel reduction treatment. This study aimed to quantify the impacts of geospatial factors on fuel reduction treatment implementation by NIPF landowners at zip-code level. A mail survey of 2,000 randomly selected landowners was conducted to collect data on landowner's implementation of fuel reduction treatments. Geospatial data were collected from Mississippi Forestry Commission (MFC) and Mississippi Automated Resource Information System (MARIS). A t-test was used to compare differences in geospatial factors between the locations where landowners had implemented fuel reduction treatments and where they had not. Number of wildfires occurrences, wildfire hazard potential, and percentage of pine forest were significantly higher in the areas where landowners implemented fuel reduction treatments. Impact of geospatial factors indicated a higher fire risk was associated with the implementation of fuel reduction treatments and should be considered while developing wildfire mitigation activities and cost-share assistance programs.

Impact of European Union Demand for Bioenergy on US forests: plot-level analysis; *Houston Sudekum, University of Missouri; Francisco Aguilar, Swedish University of Agricultural Sciences; Ashkan Mirzaee, Ram Dahal, Ronald McGarvey, University of Missouri; Karen Abt, USDA Forest Service*

Abstract

Global wood pellet production grew from an estimated 1.7 million tons in 2000, to 29.7 million tons in 2015. U.S. mills established over this period account for a large share of new supply triggered by renewable energy targets set by the European Union (EU). There is concern over the potential effects of exponential growth in wood pellet supply on US forests. We offer a systematic quantitative analysis to assess the effects of wood pellet production on forest conditions within wood pellet mill procurement areas. We rely on plot-level information from the US Forest Inventory and Analysis (FIA) database to estimate changes in forest conditions (e.g. trees per hectare, carbon in trees, cubic-meter volume) between inventory years 2000, 2005, 2010, and 2015 across 31 States. Using spatial analysis and panel-regression for a sample of 7495 plots we attempt to discern EU renewable energy policy effects associated with pellet mill size and location. Propensity score matching was used as a re-sampling technique to select a subset of FIA plots to control for the non-random process of pellet mill siting. Panel regression models controlled for various anthropogenic and natural factors measure the net impact of wood pellet production on average plot-level forest conditions. Preliminary results suggest that forest conditions within wood pellet procurement areas saw decreases in standing dead trees per hectare, and increases in carbon, volume and removal trees per hectare. This research will contribute to a growing body of knowledge related to the sustainability and future prospects of wood energy and wood pellets.

Wednesday, May 15

BREAKFAST: 7:00 – 8:00 AM

Second Floor Foyer

CONCURRENT SESSIONS: 8:00 – 9:30 AM

SESSION 3A: Forest Products

Room: PFAHL 230 Moderator: Mary Ellen Aronow, *Hancock Natural Resource Group*

Estimation of the Effect of the Conservation Reserve Program (CRP) on the Price of Sawtimber in the US South; *Noel Perceval Assogbaa and Daowei Zhang, Auburn University*

Abstract

The Conservation Reserve Program (CRP) represents the largest environmental program in the US. In this paper, we estimate the effect of CRP on the price of sawtimber in the US south using a reduced form model. This reduced form model is derived from the market clearing condition between the demand and supply of sawtimber on the US south market. The results of the estimation based on time series data covering the period 1960-2017 suggest that the CRP had a negative effect on the price of sawtimber. This effect is estimated at 48%.

Cross-Laminated Timber (CLT) in the U.S. South: A sawmills' perspective; *Rajan Parajuli, NC State University; Richard Vlosky, Mason LeBlanc, Louisiana State University; and Charles Gale, Doug Fir Consulting*

Abstract

Mass timber products, led by cross-laminated timber (CLT), have gained momentum in the design and construction sector in the United States in recent years. While the Pacific Northwest has been leading efforts in both production and consumption of mass timber products for the past several years, these wood-based engineered construction materials are still relatively new to the Southern U.S. Using a mail-based survey of sawmills located throughout 10 southern states, this study assesses the perceptions of sawmills toward CLT as well as their willingness to sell lumber to CLT manufacturers in their region. Survey results suggest that more than 50% of respondents are somewhat familiar with CLT. Preliminary results from a logistic regression model suggest that sawmills are much more likely to sell lumber to the CLT manufacturing plants in their region if they are larger in size or produce hardwood lumber products. Similarly, sawmills which think a better future prospect of CLT in the U.S. are also highly likely to supply lumber to CLT industry. As the CLT sector heavily relies on sawmills for lumber as their primarily raw material, the findings of the study shed light on the market and investment potential of the rising CLT industry in the U.S. South.

Sawmills Willingness to Pay a Price Premium for Higher Quality Pine Sawtimber Grown to a Longer Rotation Age; *Arun Regmi, Donald L. Grebner, Robert K. Grala, and John L. Willis, Mississippi State University*

Abstract

The Southern United States comprised the greatest acreage of intensively managed pine forests which typically harvest in a shorter rotation to ensure a higher economic return. Shorter rotation harvest results in the production of more juvenile wood of lower quality. Delaying the final harvest allows trees to produce higher quality solid wood, however, incur additional costs to forest landowners which need to be compensated. Sawmills are a primary consumer of pine sawtimber. Therefore, a mail survey of southern softwood sawmills was conducted to evaluate their willingness to pay a price premium for higher quality pine sawtimber grown to a longer rotation age. A Tobit regression model was used to analyze data. Results suggest that sawmills are willing to pay a price premium for high-quality sawtimber and average price premiums they offered ranged from \$4.22/ton to \$12.98/ton. Various factors such as log size, procurement radius, sawlog grade, the capacity of sawmills, and the number of employees could affect the price premium. This finding will help forest landowners to make more informed management decisions pertaining to whether extend the rotation age of their forest to produce large diameter trees.

Forest Landowner Topologies: from Parcels to People; *Jesse D. Henderson, NC State University*

Abstract

We employ National Woodland Owner Survey (NWOS) data consisting of 170 variables and 10,109 observations to examine in detail the empirical relationships between parcel size and

landowner harvest behavior. The analysis follows three methodological pathways to understand how landowner characteristics relate to the future likelihood of timber harvests: (1) a production possibilities conceptual model with cluster analysis, (2) a probit analysis, and (3) a conditional probability analysis connecting forest landowner attributes to wooded acres (parcel size). Results show a strong empirical linkage between parcel size and a timber management objective, the future likelihood of timber harvests, consultation with experts, seeking costly information, and many additional factors. The results have applications in empirical agent-based models of forest landowners and in the development of similar bottom-up modeling approaches.

SESSION 3B: Input-output and other Forest Sector Models I

Room: PFAHL 240

Moderator: James Henderson, *Mississippi State University*

Contribution, Correlation, Causality? Matthew Pelkki, University of Arkansas at Monticello.

Abstract

In the United States, forestry's contribution to the US GPD is 2.35%. This contribution varies greatly among the 50 states, with Hawaii's forest industry contributing 0.24% and Maine's forest industry contributing 5.16% to the state's total value-added. What factors are correlated and might cause or predict a greater dependency on the forest industry in a state. Using IMPLAN data from 2016, each of the 50 state's contribution to value added was determined. Direct and total contribution data were tested against data from the US Census Bureau, the Department of Energy, and FIA data to see what attributes of a state's population, its energy cost structure, and its forest resources might be correlated or even predict economic contribution from forestry. State employment and value-added multipliers among states highlight important characteristics of interstate trade and leakage of economic contributions.

Economic Contribution of West Virginia's Forest Products Industry: A look at 2015 and 2017 Data; C. Clinton Gabbert, Kathryn Arano Gazal, and Joseph F. McNeel, West Virginia University

Abstract

As West Virginia's economy continue to adapt to shifting economic tides in many of its prominent industries, the state's forests and the products derived from them have become a source of economic stability in recent years. In the decade since the US housing market collapse and subsequent recession, the West Virginia forest products industry has steadily recouped many of the losses incurred in the major forest products sectors. In a continued effort to quantify the role the industry plays in the broader state economy, 2017 economic data was analyzed through the IMPLAN input-output economic modeling software. In 2017, the West Virginia forest products industry contributed \$3.36 billion in output and \$1.4 billion in total value added. The industry also contributed to the employment of nearly 18,000 workers in the state, a 10% increase from the 2015 level. Performance of specific sectors has been varied. Losses in the pulp and paper sector of 14% of total output since 2015 have been largely offset by gains made by the solid wood products and wood furniture sectors, in which total output increased by 4% and 17%, respectively since 2015. This updated data gives renewed insight into the role the West Virginia forest products industry and its major sectors play in the state economy.

Impact of European Union Demand for Bioenergy on US forests: plot-level analysis; *Houston Sudekum, University of Missouri; Francisco Aguilar, Swedish University of Agricultural Sciences; Ashkan Mirzaee, Ram Dahal, Ronald McGarvey, University of Missouri; Karen Abt, USDA Forest Service*

Abstract

Global wood pellet production grew from an estimated 1.7 million tons in 2000, to 29.7 million tons in 2015. U.S. mills established over this period account for a large share of new supply triggered by renewable energy targets set by the European Union (EU). There is concern over the potential effects of exponential growth in wood pellet supply on US forests. We offer a systematic quantitative analysis to assess the effects of wood pellet production on forest conditions within wood pellet mill procurement areas. We rely on plot-level information from the US Forest Inventory and Analysis (FIA) database to estimate changes in forest conditions (e.g. trees per hectare, carbon in trees, cubic-meter volume) between inventory years 2000, 2005, 2010, and 2015 across 31 States. Using spatial analysis and panel-regression for a sample of 7495 plots we attempt to discern EU renewable energy policy effects associated with pellet mill size and location. Propensity score matching was used as a re-sampling technique to select a subset of FIA plots to control for the non-random process of pellet mill siting. Panel regression models controlled for various anthropogenic and natural factors measure the net impact of wood pellet production on average plot-level forest conditions. Preliminary results suggest that forest conditions within wood pellet procurement areas saw decreases in standing dead trees per hectare, and increases in carbon, volume and removal trees per hectare. This research will contribute to a growing body of knowledge related to the sustainability and future prospects of wood energy and wood pellets.

Evaluating Potential Sources of Aggregation Bias with a Structural Model of the U.S. Forest Sector; *Justin Baker, Christopher Wade, RTI; Gregory Latta, Justin Baker, University of Idaho; and Sara Ohrel, US EPA*

Abstract

The global climate change and forestry communities can benefit from bioeconomic model projections integrating natural resource systems, markets and policy drivers in greenhouse gas (GHG) projections. Such tools can be used to develop future anticipated baselines, which can inform policy dialog or investment in activities that maintain or enhance forest carbon stocks. An important component of such analyses are the degree of spatial, temporal, and activity-level aggregation of the underlying forest resource or land cover and market data. This paper explores potential aggregation bias in the forest modeling literature by through a series of baseline forestry projections using the Land Use and Resource Allocation model (LURA), a detailed spatial allocation partial equilibrium model of the U.S. forest sector. In LURA, the forest sector spatial representation is defined by 150,350 forest plots with unique stocking levels and ages along with 3335 forest processing facilities. We generate a range of spatial aggregations by moving FIA plot and mill locations to the geographic centroid of 3109 counties, 48 states, and 11 regions. Our resource aggregations consist of averaging forest stocks across five or ten year age classes and again by either fourteen or two forest types. The results from this scenario-based approach allow us to isolate the effect of aggregation on key variables of interest (e.g., GHG

emissions and supply costs) while avoiding structural changes to the modeling framework itself. Maps of selected scenario differences are presented and regional detail is given highlighting changes in the US North, West and Southeast.

BREAK: 9:30 – 9:45 AM

CONCURRENT SESSIONS: 9:45 – 11:15 AM

SESSION 4A: Forest Products Trade

Room: PFAHL 230

Moderator: Changyou Sun, *Mississippi State University*

How long do U.S. forest products exports and imports persist? *Changyou Sun, Mississippi State University; and Xufang Zhang, Purdue University*

Abstract

The United States has been a leading participant in the global forest products market. Duration analysis is employed to measure the duration of U.S. exports and imports of forest products over 1996-2016 and to examine the underlying determinants. Outcomes from the descriptive statistical analysis reveal that the duration of U.S. forest products trade is remarkably short, with a median duration of one quarter based on the quarterly data, or one year for the annual data. The duration of trade spells also varies across different types of forest products. Based on the discrete-time duration model, several determinants of export and import duration are identified at the country and product level. Gravity-type variables (e.g., distance and income) are found to affect the likelihood of trade ceasing. Better endowments in forest resources can improve the survival rate of forest products trade. In designing policies to reduce the pressure of import growth, promote exports of forest products, or have a better trade balance, the differences in trade direction and product features should be considered.

Impacts of China's import tariffs on Indiana's hardwood industry: A Welfare Analysis; *Xufang Zhang, Mo Zhou, and Eva Haviarova, Purdue University*

Abstract

Since 2010, Indiana's hardwood industry has ranked the sixth in the state's manufacturing sector, with exports of log, lumber, and veneer playing a major role in its overall sales. Specifically, China has been Indiana's largest logs and lumber importer and the third importer of veneer in 2017. With the ongoing disputes between the U.S. and its trading partners, especially with China, it is of great interest to understand the potential impacts of different trade policies on Indiana's hardwood industry. In this study, we compared the impacts of China's import tariffs on Indiana's hardwoods industry by comparing four scenarios: tariffs imposed on log, lumber, veneer, respectively, and on all three combined. The two-stage partial equilibrium displacement model was adopted to measure the vertical linkage between the primary sector of log and the secondary sector of lumber and veneer. We then used Monte Carlo simulation to analyze parameters uncertainty. The results show that the profits for Indiana's hardwood producers would

dramatically decline in all scenarios. However, domestic customers would receive \$5 million increase in welfare on average. Besides, China could lose \$5.6 million in total apart from its tax revenue if there were tariffs on log only. When tariffs were imposed on joint production in the secondary sector of hardwood industry, lumber and veneer were shown to be substitutes. Additionally, we found the trade diversion effect due to positive welfare change for the rest of the world during this trade intervention.

Do Protectionist Trade Policies Integrate Domestic Markets? Evidence from the Canada-US Softwood Lumber Dispute; *Jinggang Guo and Craig M.T. Johnston, University of Wisconsin-Madison*

Abstract

We consider the effects of protectionist policies on international and domestic market integration using evidence from the long-standing softwood lumber trade war between Canada and the United States. The benefits of trade liberalization are widely acknowledged, among them include better home-to-foreign price transmission due to reduced tariffs and trade costs between countries. Yet, in recent years we see a revival of protectionist trade policies (such as taxes, quotas, and bans) that aim to promote the interests of specific groups including domestic producers. Such policies could improve the home-to-home price transmission across domestic markets as consumers may seek lower cost alternatives, domestically. We investigate these ideas using a bivariate 3-regime threshold vector error correction model, and examine the spatial price transmission between foreign Canada-U.S. markets, and within U.S. domestic markets by introducing a structural break at an effective free trade period within our sample. The results suggest that duty-free treatment for imported Canadian softwood lumber creates trade liberalization and substantially lowers the transaction costs between the two nations. Prices are more easily transmitted to the U.S. at a higher speed, but the reverse direction is not statistically significant. Contrary to the country level, the U.S. domestic market experienced a higher speed of price adjustment across domestic regions prior to the free trade period, providing evidence that protectionist policies lead to better domestic market integration. The 2006 U.S.-Canada Softwood Lumber Agreement aims to secure domestic lumber supply and stabilize the U.S. lumber market, and our results imply that the 2006 SLA brings its expected outcomes for markets from the domestic price transmission angle.

Market share and exchange rate pass-through in the international wood pellet trade; *Alexandra Siebel-McKenna, University of Wisconsin-Madison*

Abstract

Demand for solid biofuels in the form of wood pellets has grown exponentially in recent years due to international tightening of environmental policy coupled with a growing understanding of the potential of bioenergy in mitigating climate change. In particular, the European Union (EU) aims to meet its 2020 emissions reductions partly by incentivizing the use of solid biomass in both industrial and residential applications. Consequently, growing demand in the EU has necessitated increased international trade of wood pellets, primarily with the US, Russia, and Canada. However, such bilateral partnerships are vulnerable to exchange rate fluctuations, changing terms of trade, and market power. In this paper, I determine the degree of exchange rate pass-through (ERPT) to wood pellet import prices to seven destination markets in the EU,

and the relationship between pass-through and the exporter's relative market power. Using a panel data set for the period 2009-2018 on country-level wood pellet imports, I find that certain bilateral partnerships display the expected U-shaped relationship between market power and ERPT as predicted by economic theory, in that exporters with either very low or high market share will opt to pass close to 100 percent of exchange rate fluctuations, while exporters with intermediate levels of market share will engage in intermediate (i.e. incomplete) levels of pass-through. Understanding this relationship in more detail will prove invaluable to future trade negotiations, the efficacy of environmental policy, natural resource use and planning, and rural prosperity.

SESSION 4B: Input-output and other Forest Sector Models II

Room: PFAHL 240

Moderator: Matt Pelkki, *University of Arkansas at Monticello*

Sectoral Aggregation Bias in Economic Contribution Analysis: The Case of Kentucky Forest Sector; *Domena A. Agyeman, Thomas O. Ochuodho, University of Kentucky; and Omkar Joshi, Oklahoma State University*

Abstract

Input-output models are routinely used in regional economic contribution and impact analyses across states in United States as a basis of policy and management decision making in forest sector. In these analyses, data of closely related industries are usually purposefully aggregated into sectors for convenience. From multiplier economic theory, economic contribution and impact levels are driven by technical coefficients of intermediate demand of each related industries. Sectoral aggregation may therefore alter the technical coefficients through structural change. Such a change may subsequently result into biases in the resultant economic contribution and impact levels, following sectoral structural transformation. In this study, we investigate the extent of sectoral aggregation bias in Kentucky forest sector and how to minimize it. Sectoral aggregation bias is the difference between the vector of total output in the aggregated system and the vector obtained by aggregating the total outputs in the original un-aggregated system. Results indicate that the current aggregation scheme used to define Kentucky forest sector reduces the output contribution of the forest sector by \$24 million (-5.6%). The estimated bias ranges from 0.02 to -4.33%. At -4.33%, the highest aggregation bias was estimated in the logging sub-sector. A hierarchical clustering analysis yields a dendrogram that suggests a new aggregation scheme for Kentucky's forest sector which reduces the estimated bias to \$11 million (-1.28%), with a range of 0.01 to -1.09%. Results from this analysis provide insights and guidance to input-output analysts for more accurate and less biased economic contribution and impact analyses.

Forest Sector Dependence and Economic Well-Being of Kentucky Communities; *Kamana Poudel, and Thomas O. Ochuodho, University of Kentucky*

Abstract

Many rural communities depend on the forest sector to maintain their economic well-being. The forest sector plays a vital role in Kentucky's rural economic development through provision of market and non-market goods and services in addition to employment. However, the extent of

community dependence on forest sector and how this supports their well-being is not well-documented. An assessment of the level of communities' dependence on the forest sector and the impacts of dependency on their economic well-being is critical in economic development policy-making, particularly in structuring government forest incentive programs, among others. Further, it is important to understand regional and sub-sectoral aspects of forest sector dependence and its impact on community well-being over time. In this study, we analyze patterns of regional differences in the relationship between communities' forest sector dependence and their economic well-being, over time, in Kentucky. In addition, we estimate impact of forest sector dependence on economic well-being and evaluate reasons behind certain relationships. We use economic segmentation theory to aggregate Kentucky's forest sector into core and periphery industries and implement econometric analysis to achieve the objectives. Results from this study will guide policy decision makers in understanding extent of communities' dependence on forest sub-sectors by region and what factors drive this. This is vital strategic information for designing incentive programs to support sustainable and thriving forest sector. The expected results will also enable forest-dependent communities to examine their strategies for maintaining investments and coping with any negative externalities affecting the forest sector.

Status of eastern redcedar (*Juniperus virginiana*) encroachment and potential use in future bioproducts industry in Oklahoma; *Ravneet Kaur, Omkar Joshi, and Rodney E. Will, Oklahoma State University.*

Abstract

Fire exclusion has prompted the growth and encroachment of fire-intolerant woody tree species into the native grasslands and forests of the south-central United States. Eastern redcedar (ERC) is one such species that has altered the landscape through its encroachment in Oklahoma. Its encroachment into the state's Cross Timbers forests and prairies has been an ongoing management concern for decades. While active management activities may be effective for controlling ERC, the lack of markets to support harvesting and higher management costs have led to inaction. Therefore, our research utilized Geographic Information System and Impact Analysis for Planning platforms to perform spatial economic analysis for a new ERC-based bioproducts industry in Oklahoma. We used the Forest Inventory and Analysis (U.S. Forest Service) data to investigate the current merchantable bole volume (≥ 5.0 -inch d.b.h) of ERC trees that could be utilized for different bioproducts. Study results indicate that the existing merchantable biomass could potentially support a medium sized particleboard establishment with an annual industrial sale of \$58 million, and small-sized mulch and cedar oil establishments with annual industrial sales of \$1 and \$1.7 million respectively for approximately 25 years. The spatial analysis identifies 13 counties in northwest and southeast Oklahoma highly suitable for establishment of new facilities. Additionally, the introduction of these bioproducts facilities will generate over 300 employment opportunities in the state. The results suggest that the introduction of an ERC-based industry could benefit the state's economy by generating meaningful employment and could be an effective approach for managing the species in Oklahoma.

BOX LUNCH

Second Floor Foyer

OPTIONAL TOUR OF HOMESTEAD FURNITURE: Noon Departure from the Hotel

