

2023 International Society of Forest Resource Economics Symposium

**Where is Timber Going? Trends and Predictions for Timber Supply
and Forest Markets During and After the COVID-19 Pandemic**

May 15-17, 2023
Texas A&M Forest Service
Houston, Texas

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Agenda			
Date	Time	Session	Room
Monday May 15	2:00-7:00 PM	Registration	
Day 1			
Tuesday May 16	6:30-8:00 AM	Breakfast and Poster Setup	Westheimer
	8:00-8:30 AM	Opening Remarks: Al Davis, <i>Interim Director, Texas A&M Forest Service</i> Rob Hughes, <i>Executive Director, Texas Forestry Association</i>	Regency CD
	8:30-9:00 AM	Keynote Presentation 1: Dr. Mo Zhou <i>Associate professor, Purdue University</i>	Regency CD
	9:00-9:30 AM	Keynote Presentation 2: Ryan Jones Partner, Lake Flato	
	9:30-10:00 AM	Break and Poster Presentations	Prefunction
	10:00-12:00 PM	Concurrent Sessions 1A: Forest Management	Regency CD
		Concurrent Sessions 1B: Forest Landowners	Rice
	12:00-1:00 PM	Lunch and Poster Presentations	Westheimer
	1:00-3:00 PM	Concurrent Sessions 2A: Policy Analysis and Trade	Regency CD
		Concurrent Sessions 2B: Bioenergy and Ecosystems	Rice
	3:00-3:30 PM	Break and Poster Presentations	Prefunction
	3:30-6:00 PM	Concurrent Sessions 3A: Economic Development	Regency CD
Concurrent Sessions 3B: Discussion-Wood Flow		Rice	
6:00 PM	Dinner on your own		
Day 2			
Wednesday May 17	6:30-8:00 AM	Breakfast and Business Meeting	Westheimer
	8:00-10:15 AM	Concurrent Sessions 4A: Carbon and Wildfire	Regency CD
		Concurrent Sessions 4B: Timber and Management	Rice
	10:15-10:30 AM	Break and Students Award	Prefunction
	10:30-12:30 AM	Concurrent Sessions 5A: Supply and Industry	Regency CD
		Concurrent Sessions 5B: Sustainable Investment	Rice
	12:30-5:00 PM	Tour with Light Lunchbox: Mass Timber Building Tour at Rice University Urban Forestry Tour at Houston Arboretum and Natural Center	
5:00 PM	Dinner on your own		
Thursday May 18		Departure	

Keynote**Are consumers “green” enthusiasts or skeptics? Evidence from nontimber forest products***Mo Zhou*

Associate Professor, Purdue University

Abstract: In recent years, to address consumers’ demand for “greener” products due to growing environmental awareness, eco-labels have been used by more and more businesses to claim the environmental benefits of their products or services. However, it is unclear how consumers’ willingness to pay (WTP) varies with different types of eco-labeling, particularly concerning forest products. Here, we apply discrete choice modeling to elicit consumers’ preferences for “green” maple syrup – syrup made with sap tapped from sustainably managed forests – under three eco-labels: self-claimed, verified by a voluntary conservation program, and certified by a third party. We find that the WTPs for “green” maple syrup are consistently higher than that for the organic label, but the amount is the lowest for the third-party certified label among all three. A plausible explanation is that some consumers may consider sustainability certification as greenwashing thus skeptical of the claimed benefits.

Keywords: Eco-label, sustainable forestry, forest management, green skepticism, choice experiment.

Mass Timber Market in U.S. South*Ryan Jones*

Partner, Lake Flato

The presentation will include mass timber basics, benefits, and potentials for Texas to be a market and producer, from the perspective of resource supply and manufacturing. In particular, the southern yellow pine mass timber, economics involving case studies that Lake|Flato has done will be covered. In addition, opportunities and obstacles to wider adoption specially related to economics and the south would be discussed.

Keynote

Subjectivity, Wellbeing, and Valuation of Ecosystem Services*Shashi Kant*

Professor, University of Toronto

Abstract: The positive economics has its foundations in objectivity and objective measures. However, every assumption of economic models and/or physical science models are subject to the perceptions of the modelers, and therefore subjective. The concept of rational economic agent, the soul of neoclassical economics, is a great example of subjectivity. Generally, economic preferences are identified by imposing arbitrary perception specifications so that estimated relationships follow mathematical equations which may serve positive but not normative purposes. For normative policy analysis, which is very common, an understanding of objective as well as subjective wellbeing is essential. The Life Satisfaction Approach (LSA) is based on subjective well-being in economics. The approach overcomes several of the problems associated with the application of objective measures, such as revealed- and stated-preference methods. For example, it: (i) avoids some of the problems of lack of consideration of budget constraints and trade-offs among several substitutes that are reported in contingent valuation research; (ii) captures individual welfare even in the absence of market equilibrium and in fact works best in the absence of market equilibrium; (iii) in the case of public goods, the contributions to life satisfaction are identified on the basis of materialized benefits, instead of expected benefits and as a result captures the full utility consequences independent of the degree of market capitalization; (iv) is less affected by distorted risk perceptions; and (v) can also capture effects of externalities to individual's life satisfaction even when these externalities are not noticed by the individuals themselves. In addition, the LSA does not require the strong assumptions of rationality and perfect information. Two applications of the LSA approach to the valuation of ecosystem services - Land Use Activities of Aboriginal peoples of Canada and Benefit/Cost Analysis of the Second Phase of the Grain for Green Program for Yi (Indigenous) Peoples of China – will be discussed.

Abstracts: Oral Presentations**Exploring the Impacts of the COVID-19 Pandemic on Forest Management and Markets in the Southern United States**

Sonia R. Bruck, Rajan Parajuli, Stephanie Chizmar, Erin Sills

US Forest Service Southern Research Station

NC State University Department of Forestry and Environmental Resources

US Forest Service Southern Research Station

NC State University Department of Forestry and Environmental Resources

Abstract: The COVID-19 pandemic spurred a positive shift in demand for wood products across the United States (U.S.). Yet, forest landowners and loggers may not have benefited from the high prices of dimensional lumber and finished goods. We used econometric and qualitative methods to explore the COVID-19 policy impacts on roundwood prices as well as the overall forest management and the timber industry in the U.S. South. We specifically evaluated the causal impacts of COVID-19 lockdowns and other policies on timber prices using Time Regression Discontinuity (T-RD) methods and Fixed Effects (FE) regressions. We found an overall significant decrease in prices across all timber product types during the COVID-19 lockdown period in 2020. Furthermore, we conducted four targeted focus groups with key informants to explore short, medium, and long-term effects of the pandemic on forest management and the overall forestry supply chain. Qualitative findings suggest that beneficial long-term impacts of the pandemic include continued use of online educational tools, and a renewed appreciation of forest landownership. We anticipate that findings from this study may help to set expectations for future market shocks if similar policy guidelines are implemented.

Abstracts: Oral Presentations

Assessing Income and Risk of Incorporating Pine Straw Production into Slash Pine Plantations*T. Eric McConnell*

Mississippi State University

Abstract: Slash pine plantation returns from both timber and pine strawing were compared. Bare land values (BLVs) were calculated for site index 65 (base age 25) across three discount rates (4%, 5%, and 6%) and three planting densities [545 (8' x 10'), 623 (7'x10'), and 726 (6' x 10') trees per acre]. The Cutover Slash Growth and Yield Simulator determined timber volumes. Straw yields were estimated stochastically using a Weibull distribution based on findings from Dickens et al. (2012). At the averages, straw production improved net returns across all discount rates and planting densities. Increasing discount rates expectedly lowered BLVs. The BLVs varied less across spacings; 7'x10' was the preferred option. Straw yields at the 95% confidence level did not cause BLV to significantly vary across strategies. The distance from the upper bound to the average was greater than the distance from the lower bound to the average across strategies. The lower bounds of the timber plus straw confidence intervals dipped below the timber only system averages across planting densities at each discount rate. While a greater potential existed to improve net income, risk associated with a strawing enterprise could reduce income levels below simply choosing to forgo this activity.

Abstracts: Oral Presentations

Improving Models of Wood Products Plant Locations with Restricted Access Data*Raju Pokharel, Anders Van Sandt, Craig Wesley Carpenter, Scott Loveridge*

Michigan State University

University of Wyoming

Michigan State University Extension

Michigan State University

Abstract: The United States is the largest producer and consumer of forest products, but due to industry aggregation and data suppression for privacy reasons the wood products manufacturing industries' locations determinants are not well understood. We use restricted-access microdata to explore the location determinants of several disaggregated employer wood products industries and compare results to the aggregated employer and non-employer wood products subsector. Results suggest important but differing relationships between restricted access variables and establishment counts at the local level. While trucking employment is consistently important, the significance and sign of clustering variables, electricity costs, and production wages vary depending on which wood products sector is the focus of the model. More specifically, Saw Mills and Other Wood Products both exhibit within- and across-industry externalities of agglomeration. However, not all wood product industries interact with one another in the same way. Veneer, Plywood, and Engineered Wood establishments show evidence of only benefiting from locating near downstream manufacturers while Other Mill Work establishments benefit from clustering near other similar establishments. The results should be useful to policy makers as they formulate ways to best position the natural resources sector to contribute sustainable jobs to the local region.

Abstracts: Oral Presentations

Residential fuelwood consumption estimates in County level*Rapeepan Kantavichai, Consuelo Brandeis, Marcus Taylor*

USDA FIA-Timber product Output

USDA FIA-Timber product Output

USDA Wood Innovations Program

Abstract: Wood is the largest source of renewable energy globally. In the United States, approximately 3.5 million homes use fuelwood as their main heating fuel and an additional 9.1 million homes use fuelwood for auxiliary heat. Annual US residential fuelwood consumption in 2015 was 25 million cords, equivalent to 90 million m³ of roundwood based on EIA Residential Energy Consumption Survey. However, these estimates are available in region level. The reliable estimates in small scales would bring valuable component to track wood usage and how it affects localities and ecosystems. The Timber Products Output (TPO) program of the Forest Service, U.S. Department of Agriculture is an example of a nationally coordinated effort to track roundwood production data across various product categories. The objective of this research was to develop a methodology to estimate residential fuelwood consumption on an annual basis at a sub-state spatial scale. Residential fuelwood consumption at county level was estimated by applying the relationships derived via the residential fuelwood survey to the high-resolution data from census and microclimate variable.

Abstracts: Oral Presentations

Economic analyses of growth & yield and thinning decisions on hardwood plantations*Sayon Ghosh, Mo Zhou*

Graduate Student, Purdue University

Associate Professor of Forest Economics and Management, Department of Forestry and Natural Resources, Purdue University

Abstract: Using life cycle economic analyzes we provide user-friendly tools to make better stand establishment and thinning decisions in black walnut plantations. A model of optimal stand establishment, as previously developed was dovetailed with a spatially explicit, early rotation thinning model and then projected to rotation length using the USFS Forest Vegetation Simulator (FVS). We investigated several different scenarios of planting densities, site productivities, thinning treatments, and expected yields (as a percentage of total volume) of veneer sawlogs, as integrated to quantify the growth and profitability from mid-rotation until final harvest. Additionally, we incorporated uncertainty and risk into these projections by assuming different timings and severity of windthrow. Our projections suggest that, without the threat of windthrow damage, the highest net present value (NPV) exceeded \$10,000 ac⁻¹ on the highest quality sites (SI =100) and high densities at planting (1210 tpa), assuming 20% or more of the final volume was veneer and using a 3% discount rate. In contrast, financial losses could exceed \$40,000 ac⁻¹ from windthrow at critical timespans in the rotation.

Abstracts: Oral Presentations

Effectiveness of landscape fuel treatments: Evidence from simulations for East Texas

Junyeong Choi¹, Tomás Lagos², Brittany Segundo³, Lina Zapata³, Katelyn Wilson³, Keily Pineda³, Oleg Prokopyev³, Lewis Ntaimo³, and Jianbang Gan¹

¹Department of Ecology and Conservation Biology, Texas A&M University

²Department of Industrial Engineering, University of Pittsburgh

³Department of Industrial & Systems Engineering, Texas A&M University

Abstract: The risk and associated damage of wildfires have become an increasing concern in many parts of the United States. Vegetation fuel treatments such as prescribed burning and thinning are considered as viable options along with fire suppression for mitigating wildfire risk and damage although treatment practices differ in cost and effectiveness. We simulated wildfire behavior and associated economic consequence in 10 adjacent units of a forested area under three fuel treatment practices including no treatment, prescribed burning, and thinning from below in East Texas. These units represent different vegetation types that widely exist in the region. Various weather scenarios and fuel dynamics after treatment were also incorporated. The economic consequence was measured using the sum of fuel treatment cost and expected damage to timber value by wildfire. The results indicate that while both prescribed burning and thinning can reduce fire spread, prescribed burning is more cost effective to mitigate wildfire damage. The most appropriate fuel treatment practice depends upon vegetation type, terrain and weather conditions, and economic consideration.

Abstracts: Oral Presentations

Tree planting decisions on agricultural lands in Andhra Pradesh, India: A multinomial probit analysis*Stella Schons, Gregory Amacher, Kelly Cobourn, Haripryia Gundimeda, Nilesch Shinde*

Virginia Polytechnic Institute and State University

Virginia Polytechnic Institute and State University

Virginia Polytechnic Institute and State University

Indian Institute of Technology Bombay

University of Massachusetts Amherst

Abstract: The literature shows that secondary forests can generate benefits at the local to global scale by increasing food and fiber production, reducing pressure on native forests, and supporting climate mitigation. Yet, the incentives to plant trees on private land in tropical developing countries is relatively understudied; the predominating discussion focuses on plantation establishment at a macroeconomic scale. Obstacles to tree planting on agricultural lands at the household level are usually related to the opportunity cost from reduced agricultural income or transaction costs given a lack of knowledge/experience with tree planting and management. The details behind these costs must be further investigated if as a society we aim at increasing forest cover as expressed in many national and international initiatives. Our objective is to understand farming households' incentives for tree planting in agricultural lands in India. Specifically, we seek to understand what determines planting of different types/purposes of trees. We develop and estimate a multinomial probit model that has as the dependent variable the type of tree planted: palm trees, fruit trees, fiber trees, mixed species, no trees. We estimated our model based on socioeconomic and decision data collected with over 2000 households around the Godavari River in Andhra Pradesh.

Abstracts: Oral Presentations

Understanding Non-industrial Private Forest Landowners' Characteristics and their Participation in Conservation Cost Sharing Programs*Bindu Paudel, Dr. Mo Zhou*

Department of Forestry and Natural Resources, Purdue University

Abstract: One of the top contemporary environmental concerns on forestlands is biological invasion. The introduction of invasive species can lead to the disruption of ecosystems, economic losses, and the decline of native species. As federal spending on invasive management increases, more and more nonindustrial private forest landowners turn to voluntary conservation programs for financial assistance to defray some of their control expenses. Alarming, to date, little information is available as to whether participations in conservation cost sharing have actually helped contain or reduce invasion on enrolled forestlands. This study collects data from non-industrial private forest landowners through survey in Indiana, regarding their expenditure on invasive plants control, participation in cost-share and other conservation programs, and characteristics of the landowners and their properties. The results from this study will guide future policy implementation, optimize the additional impact per dollar of public funds, and safeguard the sustainability of timber resources and ecosystem services.

Keywords: Invasive species, non-industrial private forest landowners, Conservation cost-sharing programs, Ecosystem sustainability

Abstracts: Oral Presentations

Heirs' Property Disputes in Forestlands, Partition Actions and the Determinants of Court Verdicts*Mahesh Tiwari; Changyou Sun; Donald L. Grebner; Ayoung Kim; Eric McConnell*

Mississippi State University

Abstract: In the United States, forests owned by families or individuals dominate private forestlands. When an owner dies intestate, family-owned forests are often held as heirs' property. That creates a tenancy in common ownership, where several co-owners own fractional undivided interests in forestland. Such ownership type can result in disputes among co-owners to effectively manage forestlands and cause forest fragmentation and loss. In this study, major legal disputes among heirs' property owners are examined through selected (244 of 823) published courthouse lawsuits. Three major conflicts are observed: ownership issues, partition, and forestland management. On most forestlands, all three disputes can occur simultaneously, and problems associated with heirs' property are complex. Logit and multinomial logit regressions are employed to study determinants of court verdicts concerning the partition of forestlands. Forestlands are sold at partition actions where courts apply economic tests relying on two statutory provisions: a) land can not be equitably divided among co-owners, and (b) land sale favors the interest of all co-owners. The findings from the study will help family landowners to resolve disputes and avoid partition sales or loss of forestlands, legal institutions to judge partition actions, and policymakers to improve laws relevant to heirs' property in forestland.

Abstracts: Oral Presentations

Assessing the Ecological Loss of Mining Areas in Taiwan*Wan-Yu Liu, Dai-Rong Lee*

National Chung Hsing University, Taiwan

Abstract: The development and use of mines have severely damaged the environment in Taiwan. Despite the long history of mining, the value of forest ecological services lost during mining operations have not yet been incorporated into the expenses borne by miners, and miners are not liable for compensation for ecological damage. This study evaluated the forest ecosystem service benefits lost since mining began, with the aim of providing future reference for calculating ecological damage related to mining. We investigated Mount Taibai mines in Yilan (northeast Taiwan) and Mount Yongshi mines in Hualian (east Taiwan), which are richly forested areas. By using four ecological services—forest production, carbon sequestration, water resource replenishment, and forest recreation—we estimated the loss of ecological values in both mining regions.

Abstracts: Oral Presentations

The Impact of Forest Policy Modernization in British Columbia: A Stock Market Perspective

Kurt Niquidet, Daowei Zhang

University of British Columbia

Auburn University

Abstract: This paper examines the impact of a modernized forest policy change in 2021 on the stock prices of forest products firms that operate and hold tenure in British Columbia. Our results suggest that the announcement of new forest policies led to substantial losses in the stock prices of five major publicly traded forest products firms that operate in the province. The impact on market capitalization is related to the harvesting rights held by these companies under various forest tenures. The results highlight that, for a variety of reasons, investors thought the proposed policy changes would adversely impact each firm's future financial performance.

Abstracts: Oral Presentations

Global Forest Product Markets Implications of Increasing Protected Forest Area Worldwide Under the 30x30 Initiative

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Abstract: This study evaluated impacts on production, consumption, trade, prices, and net value of roundwood production in individual countries of simulated increased protected forest area worldwide under the 30x30 Initiative. Global forest sector implications were evaluated by comparing the market equilibrium outcomes for a reference scenario with three alternate scenarios of forest area protection focusing on maximizing biodiversity conservation and varying levels of comprise between conservation and production. Results indicate that the global forestry sector would respond to supply shocks resulting from alternate forest protection scenarios by shrinking its global roundwood production (by 1.1 to 3.7 billion m³, or 0.6% to 2.1%), leading to higher prices (by 4% to 9%) and increased dollar value of roundwood production (by 2% to 7%, or \$253 to \$871 billion in constant 2017 U.S. dollars), relative to a no-30x30 reference scenario, 2020-2060. Net roundwood production value increases varied by individual scenarios, most of which were projected to be shared by North America (39% to 52%) and Europe (30% to 46%), followed by Africa (9% to 15%), South America (6% to 14%), Asia (-29% to 10%) and Oceania (-3% to 5%). Contrary to general perceptions, these results show that carefully crafted strategies to achieve the conservation goals envisioned in the 30x30 Initiative would not necessarily reduce the economic output of the global forest sector.

Abstracts: Oral Presentations

US imports of soft lumber: Assessing the significance of spillover effects*Inoussa Boubacar, Malick Diarrassouba, Gibson Nene*

US Forest Service

Nebraska State Legislature

University of Minnesota-Duluth

Abstract: The trade flows of forest products can be influenced by traditional factors associated with general international trade as well as those specific to forest product markets and trade. A slew of existing studies has documented the existence of spatial spillover effects in deforestation, which we posit to extend to forest products trade. Thus, we employ a spatial autoregressive (SAR) model to analyze spatial spillover effects across origin countries of US soft lumber import from 1997 to 2017 after controlling for other relevant determinants as per the literature. Our preliminary results indicate that spatial spillover plays a significant role in the trade network. Therefore, ignoring the spatial interconnectivity would lead to inconsistent and biased parameter estimates. Our study has policy implications to forest products trade and forest conservation. In effect when designing forest conservation policy, a country should consider the possible indirect impact of the policy on other countries and their reactions throughout the trade network.

Abstracts: Oral Presentations

**Forest-based Employment in the Southern United States amidst the COVID-19 Pandemic:
A Causal Inference Analysis**

Stephanie Chizmar, Rajan Parajuli, Sonia Bruck, Gregory Frey, Erin Sills

US Forest Service Southern Research Station

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Abstract: This study examines the impact of mandatory stay-at-home orders for all individuals instituted by state governments in response to COVID-19 on employment in the forest sector at the county level in forest dependent counties. These policies made exceptions for individuals to seek food or health care and for workers in essential industries such as the forest and forest products sectors. Thus, it is not clear a priori whether and how these policies would affect forest-based employment. Results from various causal inference techniques suggest that while employment in the aggregate forest sector and wood product manufacturing was lower in counties that experienced a mandatory stay-at-home order, employment in the forestry and logging, pulp and paper manufacturing, and furniture manufacturing industries was not significantly affected by the pandemic policies. Further, findings from the panel event study imply that employment in counties that experienced the policy was significantly different than employment in counties without the policy two to eight months following initial enactments. Our results provide insights to inform policy decision-making and research on the impacts of economic shocks on employment.

Abstracts: Oral Presentations

Economic impact of the Trade War and Covid-19 on Tennessee Export of Forest Products

Noel Perceval Assogba, Andrew Muhammad, and Chad M. Hellwinckel

Assistant Professor of Forest Economics and Management, University of Tennessee

Professor and Blasingame Chair of Excellence in Agricultural Policy, University of Tennessee

Research Associate Professor, University of Tennessee

Abstract: This study investigates the impact of the US-China trade war and COVID-19 on Tennessee export of forest products. Time series econometrics is used to analyze the data covering the period 2010-2021. The results suggest that the trade war and COVID-19 had a negative impact on Tennessee exports of logs and lumber. The losses in logs and lumber exports are estimated at USD 48.5 million and USD 255.70 million, respectively.

Abstracts: Oral Presentations

Optimal contract arrangements for conservation on working forests*Changyou Sun, Bin Mei, Yanshu Li*

Mississippi State University, University of Georgia

Abstract: Forestland can be managed for timber and environmental goods simultaneously. A conservation contract allows a government agency to pay a landowner for the portion of property rights encumbered in the production of environmental goods. In this study, a theoretical model is developed to examine optimal contract provisions for carbon sequestration on working forests under a budget constraint for the agency. The analyses reveal that a landowner requires a higher payment if more property rights are encumbered in a conservation contract. A landowner whose land can sequester more carbon also requires a more favorable contract arrangement. Assuming a logistic growth path for carbon sequestration, the agency under a budget constraint tends to have a shallower relationship with more landowners, i.e., encumbering a smaller portion of property rights from more landowners. This tendency supports the use of conservation contracts with a shorter term and a higher enrollment share in a forest community.

Abstracts: Oral Presentations

What factors drive the presence of invasive plants in coastal Mississippi?*Robert K. Grala, Kate Grala, John Cartwright*

Mississippi State University

Abstract: Coastal Mississippi's forests are frequently exposed to extreme weather events that contribute to the spread of invasive plants. These plants outcompete native vegetation, result in the loss of ecosystem services, diminish timber production, and require sizeable expenditures to mitigate their spread. Although the economic impacts of invasive plants are significant, it is not clear how they spread in coastal areas and what factors contribute to their presence. Thus, it is challenging to implement effective mitigation strategies that would limit their spread. Geospatial and regression models were constructed to determine the association of four invasive plant species present in coastal Mississippi with the occurrence of wildfires, prescribed fires, and ecological, socioeconomic, urbanization, and extreme weather factors. In general, invasive plants were less likely to occur in areas with a greater percentage of forest cover, older-age forests, in proximity to a wildfire, and further away from a city. However, areas in proximity to a railway, highway, county road, and coastline were likely to have a greater presence of invasive plants. Results will help develop and prioritize mitigation measures to limit the spread of invasive plants and achieve other benefits such as increasing timber production and improving the provision of ecosystem services.

Abstracts: Oral Presentations

Assessing the environmental impacts of proposed biochar production facilities using forest biomass in Michigan

Nafisa Nowshin Ahmed, Raju Pokharel, Christopher Saffron, Jessica Miesel

Graduate student, Department of Forestry, Michigan State University

Assistant Professor, Department of Forestry, Michigan State University

Associate Professor, Department of Biosystems & Agricultural Engineering, Michigan State University

Associate Professor, Department of Plant Soil & Microbial Sciences, Michigan State University

Abstract: Biochar is a carbon-rich product produced through pyrolysis which has great carbon sequestration abilities and is known for amending soils in agriculture. We investigated if biochar production and utilization can be a viable climate solution when forest biomass is procured through stationary and rotating mobile pyrolytic units. A cradle-to-grave life cycle assessment methodology has been adopted to quantify the environmental impacts of biochar production based on different biomass production technologies. The LCA encompassed cultivation; biomass procurement; transportation; drying; biochar production; grinding; packaging; and biochar application to agricultural land. Global warming potential and energy return on investment were used as quantitative parameters to assess the sustainability of such systems in Michigan. The preliminary results of the study demonstrated that mobile pyrolytic units using air curtain technology are more economically sustainable despite having lower conversion yields while the opposite was true for mobile downdraft gasifiers. However, stationary facilities using rotary kilns had the highest conversion yield and the lowest negative environmental impact comparatively. The study outcomes will encourage stakeholders in agriculture and forestry to consider biochar in building a circular bioeconomy in Michigan. It will also initiate dialogue on developing energy and carbon policies around biochar commercialization across the Great Lakes Region.

Keywords: lifecycle assessment, stationary facilities, mobile pyrolytic units, global warming potential, soil amendment

Abstracts: Oral Presentations

Identifying optimal locations for biochar production facilities to reduce wildfire risk and bolster rural economies: A New Mexico case study*Ram Adhikari, Tomasz Falkowski, Joshua Sloan*

New Mexico Highlands University

Abstract: Most land managers throughout the Intermountain West are practicing periodic thinning of woody biomass to prevent overcrowded forests posing a risk of catastrophic wildfire. Biochar has received considerable attention in recent years due to its potentiality to deal with biomass wastes such as slash from thinning, and improve soil health. However, there are few biochar facilities located in the region that can consume the available woody biomass. By presenting a case of New Mexico, this study provides a spatially-explicit framework to utilize a variety of spatial (road networks, and markets) and aspatial data (biomass availability, wildfire risks, soil conditions) to identify optimal location for biochar facilities. Several locations suitable for biochar facilities have been identified but their numbers depend on facility capacity, and thinning intensity in adjoining forests. Findings from this study will help establish several centralized biomass facilities in the region. In addition, identification of new locations for biochar production can incentivize forestry contractors and landowners to expediate thinning operations in the dense forests.

Abstracts: Oral Presentations

A proposed carbon dioxide sequestration methodology for planted forests that increase additionality and permanence*Pedro Junqueira Sartori, Stella Z. Schons, Gregory S. Amacher, Harold Burkhart*

Virginia Polytechnic Institute and State University

Abstract: Temporary planted forests have a potential to help in climate change through carbon dioxide sequestration. We propose an incentive-based methodology that pays landowners to extend their forest rotation from the private to the socially optimum time. We analytically derive the landowner's optimal decision and then simulate how the harvesting optimal time changes for three different site indices and methodology assumptions. Benefits of extending the forest rotation come through the increase in the sawtimber production, which store carbon dioxide away from the atmosphere for a longer time, therefore, reducing the forest harvesting Social Cost of Carbon. We show the importance of the assumptions in determining the socially optimum rotation time. Higher Social Discount Rates increase the marginal benefits and push the socially optimum rotation age further in time, while decreasing the sawtimber lifespan time assumption reduces the marginal benefits, and therefore, the socially optimum rotation time. The higher the site index, the smaller the extension time due to a higher land and capital opportunity costs, and the smaller the total benefits to society. All our examples suggest extensions greater than one year, which reduces the probability of having non-additional projects.

Abstracts: Oral Presentations

Decomposing the Economic Contributions of Natural Resource based Industries to Illustrate Economic Effects Along the Value Chain

*Raju Pokharel, Shivan Gc and Ichchha Thapa, Michigan State University, Greg Alward
University of Idaho*

Abstract: Timely and up to date information about economic measures resulting from natural resource-based industries is crucial for emphasizing the importance of such industries in regional economies. Irrespective of the I-O modeling software used, past economic contribution and impact analyses studies of natural resource-based industries primarily report economic measures of an industry at the final industry level and make little effort to tease out the economic contributions along the value chain. This approach deprives value chain sectors of receiving appropriate attention in terms of favorable policies or supportive measures. Our study attempts to address this gap by establishing a value chain for natural resource-based industries and measuring the economic effects of such industries not just at the final industry level but also along the value chain. To illustrate this, we present the case studies of selected natural resource-based industries utilizing wood as their inputs for production in the Lake States region of Michigan, Minnesota, and Wisconsin. Input-output model for the study region is built using 2017 IMPLAN data and accompanying SAM multipliers and output multipliers are then exported from IMPLAN into Microsoft Excel to conduct matrix decomposition to illustrate the economic contributions along the value chain.

Abstracts: Oral Presentations

Analysis of location, feedstock availability, and economic contributions of a mass timber manufacturing plant in Michigan*Naresh Khanal, Raju Pokharel, Andrew Finley, Emily Huff, Jagdish Poudel*

Graduate Student, Michigan State University

Assistant Professor, Michigan State University

Professor, Michigan State University

Associate Professor, Michigan State University

Adjunct Faculty, Michigan State University

Abstract: Mass timber has been proposed as a viable alternative for steel and concrete for multifamily and commercial buildings due to its environmental and engineering benefits over concrete and steel. The objective of this study is to evaluate the feasibility of mass timber production and it's the economic impact assessment in Michigan. Network Analysis in ArcGIS was used to create hotspots around softwood lumber producers. IMPLAN was used to assess the economic impact associated with a mass timber facility. Based on competition hotspot and stockholder consultation, Marquette County in Upper Peninsula and Clare County in Lower Peninsula were identified as optimal locations for mass timber manufacturing in Michigan. There is sustainable availability of softwood in proposed areas after accounting for current removals and mortality (169,913 cubic meter in LP and 84,597 cubic meter in UP). Our analysis shows that, there are 90 additional jobs creation if current mass timber demand in Michigan is produced within the state. The IMPLAN analysis shows that mass timber processing facility will generate the total impact of \$12,806,418 in the state. The state can earn \$280,587 from production and import taxes. The federal government can earn an additional tax of \$350,237 from employee compensation.

Abstracts: Oral Presentations

Economic Impacts of Maple Syrup Production in Kentucky: Input-output Analysis*Bobby Thapa, Thomas O. Ochuodho*

Graduate Student, Department of Forestry and Natural Resources, University of Kentucky

Assistant Professor Forest Economics and Policy, Department of Forestry and Natural Resources, University of Kentucky

Abstract: Historically, extraction and conversion of maple sap into syrup was part of American rural tradition that contributed to economy. While Kentucky is not known for maple syrup production, a biophysical study has demonstrated reasonable production potential in the state as a viable land use for many rural forestland owners. In this study, we conduct potential economic impact analysis of maple syrup production in Kentucky. Using Impact Analysis for Planning (IMPLAN) database and software, we conduct the analysis considering two scenarios based on two price levels of maple syrup - at \$160 per gallon and \$35.90 per gallon. The higher price of \$160 per gallon results into 6043 jobs, \$39.6 million in labor income, \$51.3 million in value-added, and \$111.6 million in output. Similarly, at the lower price level of \$35.90 per gallon, the potential total impacts are 1356 jobs, \$8.9 million in labor income, \$11.5 million in value-added, and \$25.05 million in output. The potential tax income of the maple syrup industry are \$7.1 million and \$1.6 million for high and low price scenarios respectively. These results demonstrate the potential of the Kentucky maple syrup industry to provide economic benefits to the state through job creation and revenue generation.

Abstracts: Oral Presentations

Economic Contribution Analysis of the Logging Sector in East Texas*Pooja Chhetri, Anusha Shrestha, Matthew W. McBroom*

Graduate Student, Arthur Temple College of Forestry and Agriculture, Stephen F. Austin State University

Assistant Professor, Stephen F. Austin State University

TLL Temple Distinguished Professor Stephen F. Austin State University

Abstracts: The logging sector is vital to the Texas economy, particularly in East Texas as the majority of Texas timberlands are situated there. However, there exist few economic contribution studies at regional levels and how these regional economic effects generated by logging activity circulate throughout the state. A robust logging sector is key to sustaining an active forest-based economy and preserving healthy forest structure. Therefore, this study estimated the economic contribution made by this sector using Impact Analysis for Planning (IMPLAN) and regional datasets. Results showed that the logging sector contributed 3,480 total jobs, \$148 million in total labor income, \$176 million in total value added, \$302 million in total output, and \$37 million in total taxes in 2021. The total economic contribution from 2012 to 2021 was also determined which provided insights that, on average, the logging sector contribution increased over the past 10 years with an additional 985 jobs, \$53 million in labor income, \$85 million in value added, \$139 million in output, and \$13 million in taxes. These findings offer policymakers an update to the sector's baseline economic data, which is useful for addressing critical economic issues and strengthening the sector's economy.

Keywords: IMPLAN, economic contribution, logging sector

Abstracts: Oral Presentations

Chronic Wasting Disease: Economic impacts and management*Sushma Bhattarai, Robert K. Grala*

College of Forest Resources, Mississippi State University

Abstract: Chronic wasting disease (CWD) is a fatal disease that affects cervids and has significant impacts on their ecology, environment, society, economy, and affected stakeholders. Despite an increase in the CWD literature, the complete extent of its ecological, social, and economic impacts has not been determined. This study synthesized the economic impacts of CWD and management strategies to mitigate it through a systematic review of 134 published peer-reviewed papers. While the number of publications on CWD has increased steadily since 2000, only 5% of them investigated the disease's economic impacts. CWD has negatively impacted local economies by reducing deer hunting, recreational activities, and venison consumption. Decreased hunting translated to lower economic activities such as travel, accommodation, food, equipment purchases, and lease purchases. While culling has been found to be an effective management strategy, it was often met with public resistance. Despite the potential for significant negative economic impacts due to CWD, studies on them have been limited. Future disease control and management efforts will require sustained surveillance, further research on the economic aspects of CWD, and engagement with all affected stakeholders.

Abstracts: Oral Presentations

Feedstock availability and economic contribution of increased bioenergy production in a Michigan facility for the next 15 years*Tara Allohverdi, Raju Pokharel, Jagdish Poudel, Greg Latta*

Michigan State University, University of Idaho

Abstract: Investing in a facility using biomass for bioenergy production requires detailed research and estimation of feedstocks for bioenergy power plants, understanding current and future biomass availability and demand for forest products. This study estimated the current and future feedstock availability to upgrade a power plant production capacity in Michigan. Supplying 500,000 green tons per year of biomass to meet the new demand for this bioenergy plant means that biomass procurement may be a concern. To determine the supply and demand of biomass feedstock, scenarios were first identified with direct procurement of feedstock into the filer city and using ports in Upper Peninsula that deliver wood products using barges. We created ten different scenarios to estimate the biomass feedstocks using FIA (Forest Inventory Analysis), network analysis in ArcGIS, and the LURA model (Land Use and Resource Allocation). Results indicated enough biomass to run this facility in Michigan at a feasible cost. LURA is a partial equilibrium model that accounts for supply and demand for all forest products to estimate future biomass availability. Lastly, the IMPLAN analysis was done to determine the economic contributions of this bioenergy facility. This study provides an estimate of feedstock availability and the economic contribution of a facility to support decision-making for investors, agencies, and stakeholders, leading to improved forest management and reduced carbon emissions.

Abstracts: Oral Presentations

Power to the Pollinators: A Stated Preference Study of Florida Residents to Protect Pollinators

Tyler Carney, Melissa Kreye, Damian Adams, Rachel Mallinger, Lillian Hendrick, Andres Susaeta

University of Florida

Penn State University

University of Florida

University of Florida

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Oregon State University

Abstract: Both managed and wild pollinator species face well-documented declines due to climate change, over exposure to pesticides, loss of forage and habitat, and pests and pathogens. Pollinators contribute to numerous ecosystem services beyond crop pollination and are important for maintaining forest health and biodiversity. Research into the economic contributions of pollinators and pollination services has primarily focused on market values, specifically contributions to crop pollination. Non-market valuation of pollination services, however, is not yet common. Using contingent valuation method, we surveyed Florida residents (n=1618) regarding their preferences for ten different pollinator species, the services they provide, and their willingness to pay to protect their top two ranked species using a surcharge on their utility bill. Charismatic species such as the ruby-throated hummingbird, monarch butterfly, and honey bee were the highest ranked among respondents. Using a double-bound dichotomous choice model, we found that willingness to pay estimates ranged from \$13.38 to \$4.26 per month per household to protect certain species. Our findings suggest that pollinator conservation is an important issue for Florida residents and helps fill a prominent gap in our understanding of the economic value of pollinators.

Abstracts: Oral Presentations

Developing and harnessing climate-smart commodities from hardwood restoration for small and underserved landowners in the Southern Bottomland Region*Nana Tian, Jianbang Gan*

Assistant Professor, University of Arkansas at Monticello

Professor, Texas A&M University

Abstract: Bottomland hardwood (BLH) forests have shown high potential for producing climate smart commodities including C sequestration and storage, wood products, wildlife, and other ecosystem services. Yet, 70% of BLH area have been lost in the past 100 years. There is a compelling need for restoring BLH forests, a viable climate-smart agricultural/forestry (CSAF) practice. Small and underserved family landowners play a critical role in implementing this CSAF practice while they face more adopting barriers than other landowners. This project aims to: 1) plant 500-600 acres of BLH oak forests in the agricultural dominant floodplain of the Red River Valley of southwestern Arkansas, the Ouachita River Valley of southcentral Arkansas, and the Bayou Meto Watershed in eastern Arkansas by recruiting 10 or more small and underserved landowners with a minimum of 5 underserved landowners; 2) quantify and demonstrate the ecological and economic benefits of BLH restoration on working lands; and 3) help these landowners manage the plantations and market climate-smart commodities.

Abstracts: Oral Presentations

Creating New Markets is a Team Effort: Knowledge-Sharing & Connections Amongst Diverse Stakeholders*Leslie Boby*

Southern Regional Extension Forestry

Abstract: stakeholders as well as economic developers and more. Each have their own knowledge that contributes to the process, but there is often a gap between the two. In addition, ongoing retirements and employee turnover across multiple agencies threaten existing connections amongst these stakeholders. Learn about efforts to bridge these knowledge gaps and create new connections through a series of interventions from cross-sector meetings, to a community of practice and ongoing development of helpful tools. While demand for new forest products is one part of the process of increasing or creating new forestry markets, there are extensive logistics and data that are needed in order to select sites for new mills or expand existing mills. Forestry stakeholders including state and federal agencies, and others have access to data that can help in this process, but economic developers or other consultants may not be aware that this information exists and that it is easily accessed. In addition, economic developers from state agencies have information that can assist in development of these sites that forestry stakeholders may not be aware of. Creating multiple connections amongst these stakeholder groups through meetings, working groups and tools can help bridge these knowledge gaps and facilitate development. Lastly, creating multiple points of connections across these stakeholder groups is important for ensuring that institutional knowledge is retained and relationships are maintained, even when individuals retire or move on to new positions.

Abstracts: Oral Presentations

Where is all the timber going? Analysis of the timber supply chain in the U.S. South*Xufang Zhang, Tim Adams, Jingtang Guo, Eric McConnell, Andres Susaeta*

Forest Resource Analyst, Texas A&M Forest Service

South Carolina Forestry Commission

Assistant Professor, Louisiana State University

Assistant Professor, Mississippi State University

Assistant Professor, Oregon State University

Abstract: Continuous pressures from imports and protectionist trade policies have caused unknown impacts on forest stakeholders. Moreover, the COVID-19 pandemic has created great uncertainty across global supply chains. The US Gulf South possesses both abundant forest resources and robust forest industries. The region's vital roles in interstate and international markets necessitate tracking trade flows here from timber to final products. Within this region, we propose a web-based platform that spatially represents timber's supply chain from forest to final products. The platform will show the "what, where, and when" of regional timber imports and exports. Studying trade policies' impacts on forest products will include the welfare analysis of forest stakeholder groups. Two Quantitative Accomplishments will be achieved: economic benefit and landowner assistance. Implications of trade policies regarding stakeholders' forest management planning and sustainable investment will be provided.

Keywords: wood flow, trade, timber supply, economic benefit

Abstracts: Oral Presentations

Beyond the Peer-reviewed Article: Sharing Your Findings in a Catchy Way with Diverse Audiences

Leslie Boby

Southern Regional Extension Forestry

Abstracts: Once the data have been analyzed and the paper has been written, you may be ready to be done with your project. However, your work is important to your state, its industry and more, but these stakeholders may not read your article. In this mini-workshop, identify your other audiences and learn how to communicate your findings in a way that makes sense to them. Whether it is sharing information with your department's communications person or tweeting, posting on LinkedIn, talking to your aunt at a family party, learn a few tricks to improve your messages.

Abstracts: Oral Presentations

Economic Tradeoffs in Timber Products Under Various Carbon Management Strategies for Maryland and Pennsylvania*Shivan Gc, Raju Pokharel, Kylie Clay, Chad Papa,*

Michigan State University

Abstract: Increasing recognition of forests role as a nature-based solution to climate change has spurred interest among policy makers, federal and state government agencies, and academia alike in understanding how carbon benefits from forests can be increased in the future. Though carbon capture in forests is a natural phenomenon, forest management practices can alter the ways that forests sequester carbon. Management interventions focused on promoting carbon benefits from the forests can however have varying effects on other ecosystem services that forests generate including timber products harvested. This study aims to quantify the monetary tradeoff between forest management for carbon and harvested wood products. For this, we convert the carbon outputs resulting from the Carbon Budget Model of Canadian Forest Sector (CBM-CFS) under various forest management scenarios in Pennsylvania and Maryland into timber product outputs to estimate and quantify the tradeoffs of carbon and timber products. Our results indicate that for carbon management scenarios like extended rotation or no harvest to yield higher net present value (NPV) compared to business-as-usual scenario, market price of carbon needs to be higher than what it is at present (at least \$15 per ton of CO₂ equivalent assuming all unharvested timber volume is enrolled in carbon program).

Abstracts: Oral Presentations

Economics of forestland carbon credit: Does income matter?*Sofwaan Ademonla Bakary, Noel Perceval Assogba*

Graduate Research Assistant, School of Natural Resources, University of Tennessee

Assistant Professor of Forest Economics and Management, University of Tennessee

Abstract: Forests play a vital role in global warming mitigation. This study investigates the trend of forest carbon sequestration studies from the perspective of landowners' willingness to accept payments. A systematic review of scientific papers published between 2007 and 2022 was carried out. The results showed about 85% of the studies were conducted in North America while Europe and Asia accounted for the remaining 15% of studies. Forest land area, the carbon price per acre unit, and the number of years for enrolling are the most used attributes to characterize the Forest Carbon credit program. The socioeconomic characteristics of landowners such as gender, age, and education level are also relevant factors. Overall, the findings suggest a growing research interest in forest carbon credit programs and a near consensus on the attributes to be considered in their implementations.

Abstracts: Oral Presentations

Does supply competition affect forest carbon outcomes? Some initial results from a harvest scheduling simulation

Shaun M. Tanger, Bruno Kanieski da Silva, Jesse Henderson, Andrew Tilman

Associate Professor, University of Arkansas at Monticello

Assistant Professor, Mississippi State University

Research Economists, USDA Forest Service, Northern Research Station

Research Economists, USDA Forest Service, Northern Research Station

Abstract: Scant literature exists in the forestry literature on the impact of market structure on timber supply despite agreement that wood stumpage markets often do not approximate perfectly competitive outcomes. Concentrated market structures, market strategies, and profit outcomes can alter the provision of social benefits provided by forests, such as a stable and sustainable supply of timber and related carbon benefits. Utilizing simulated data, we investigated the impact of non-competitive market conditions in forest management and planning over a 50-year planning horizon to determine the impacts on carbon supply outcomes. Initial findings suggest that market structures do influence carbon outcomes through the ability of suppliers, with market power, to restrict timber supply within their market. As well there are consequences for age-class structure outcomes and replanting decisions. These initial results suggest that policies promoting greater competition, *ceteris paribus*, should increase the levels of carbon stocks in wood basins.

Keywords: Forest Management, Market Competition, Oligopolies, Carbon Stocks

Abstracts: Oral Presentations

Incorporating Spectral Unmixing to Determine the Carbon Sequestration Potential of an Urban Forest Canopy*Michael K. Crosby, T. Eric McConnell, Jason J. Holderieath, Shaun M. Tanger*

Louisiana Tech University

Mississippi State University

Louisiana Tech University

University of Arkansas at Monticello

Abstract: The urban forest canopy can provide many important services, among them the storage and sequestration of atmospheric carbon dioxide. Healthy trees that are well managed in an urban setting can provide these services comparable to forests managed for production or as nature preserves. If the urban trees are damaged or mortality occurs, their ability to sequester carbon is either diminished or erased (i.e., if mortality occurs). A tornado tore through portions of Ruston, Louisiana, on 25 April 2019. We used iTree Canopy to obtain estimates of ecosystem services (carbon sequestration, etc.) and converted this to a per-pixel value before interpolating for the study area. Utilizing Sentinel-2 data, spectral unmixing is utilized to determine the fractional composition of tree cover in each pixel and whether there was a partial or total compositional change following the passage of the tornado. Using the spectral endmember for tree as a weight, we found a reduction in carbon sequestration of 15% and a reduction in the proportion of tree canopy cover between no change to total loss of tree canopy. This is a useful methodology for assessing the impacts of disturbance events in urban environments and calculating the fractional portion of losses using spectral reflectance.

Abstracts: Oral Presentations

Wildfire Suppression Expenditures Drivers and long-term behavior*Bruno Kanieski da Silva, Jeffrey P. Prestemon*

Assistant Professor, Mississippi State University

Senior Research Foresters, USDA Forest Service

Abstract: The occurrence and magnitude of wildfires have increased substantially over the past decades, elevating suppression expenditures in forestland management agencies such as the Forest Service (FS) and the Department of the Interior (DOI). Modeling that can improve predictions of agency financial outlays for wildfire suppression could help advance efforts to manage their landscapes more effectively in the presence of fire. Previous studies have examined the relationship between climate variables and suppression expenditures at annual frequencies, missing possible seasonal effects observed in summer months and lowering prediction accuracy. In this study, we use advanced time series techniques to investigate: (1) the seasonality present in suppression expenditures and related climate variables, and (2) how seasonal effects impact the relationship between expenditures and climate. Our results indicate that two climate measures, Niño 3.4 and NAO, and suppression expenditures of both the Forest Service and DOI have statistically significant seasonal time series components. The seasonality analysis for other climate variables such as PDSI, SOI, PDO, and AO did not reveal any significant variation in their values across different months. The relationship between suppression expenditures and climate variables showed mixed results. After controlling the autocorrelation with suppression expenditure lags, contemporaneous NAO and its sixth lag did show a significant correlation with on FS suppression expenditures, while PDSI was significantly associated with DOI suppression expenditures. Our study highlights the importance of seasonality in monthly expenditures and the need for different modeling approaches. While climate variables are likely to be closely correlated with wildfires and suppression expenditures, using them for forecasting remains challenging.

Quantifying additionality of forest carbon*Richard Mei*

University of Georgia

Abstract: This study applies the discounted cash flow approach to price forest carbon additionality. A carbon credit is derived from the annual marginal forest growth, while a carbon release penalty is triggered by a harvest based on biomass removal. The business-as-usual is defined by the Faustmann rotation, in which the profit from timber production from perpetual rotations is maximized. Accordingly, additionality is defined by the net present value of the extra carbon sequestration beyond the baseline on a perpetual basis. It is discovered that a higher planting density on a better-quality site combined with no thinning provides a more cost-effective means for a southern pine plantation to sequester additional carbon. It is also found that a shorter carbon contract is more cost-effective in achieving additionality despite a lower total carbon benefit.

Abstracts: Oral Presentations

Economics of forestland carbon credit: Does income matter?*Sofwaan Ademonla Bakary, Noel Perceval Assogba*

Graduate Research Assistant, School of Natural Resources, University of Tennessee

Assistant Professor of Forest Economics and Management, University of Tennessee

Abstract: Forests play a vital role in global warming mitigation. This study investigates the trend of forest carbon sequestration studies from the perspective of landowners' willingness to accept payments. A systematic review of scientific papers published between 2007 and 2022 was carried out. The results showed about 85% of the studies were conducted in North America while Europe and Asia accounted for the remaining 15% of studies. Forest land area, the carbon price per acre unit, and the number of years for enrolling are the most used attributes to characterize the Forest Carbon credit program. The socioeconomic characteristics of landowners such as gender, age, and education level are also relevant factors. Overall, the findings suggest a growing research interest in forest carbon credit programs and a near consensus on the attributes to be considered in their implementations.

Abstracts: Oral Presentations

Understanding Causes and Solutions of No-Bid Timber Sales: Insights from open-ended responses from a National Forest System Personnel Survey*Jaana Korhonen, Sonia Bruck, Greg Frey*

Oak Ridge Institute for Science and Education

USDA Forest Service, Southern Research Station

USDA Forest Service, Southern Research Station

Abstract: “No-bids” is a colloquial term for a timber sale that is offered but does not receive a bid. No-bid timber sales can result in lost revenue for the United States (U.S.) National Forest System (NFS). Past research has identified many direct and proximate causes behind no-bids. Using a recent survey of 784 NFS personnel past analyses revealed that planning timelines and timber target pressures, insufficient coordination and communication, lack of ability to respond to market factors, low staffing levels, and lack of training and institutional support were perceived as the main causes of no-bid sales. This research complemented existing findings through use of qualitative analysis techniques to examine open-ended responses from the NFS personnel survey. We found that additional interrelated institutional, operational, market, and policy factors impact no-bids. For example, it is likely that barriers, such as lack of efficient workforce recruitment, training, and retention, as well as environmental and market constraints may prevent potential buyers from participating in the bidding process. This work further identified needs of NFS personnel who work with timber sale processes and contracts not discovered in previous research efforts.

Abstracts: Oral Presentations

Analyzing the Game of Bidding on Timber Sales in Michigan*Jagdish Poudel*

Michigan Department of Natural Resources

Abstract: The forestry industry is a significant contributor to Michigan's economy, generating over \$22 billion annually. As such, it is essential to track stumpage prices, which reflect the value of standing timber. This practice is crucial in ensuring the industry's sustainability and profitability. Accurate price trend monitoring assists forest product industries and landowners in making informed decisions and maximizing profits. This paper reviews the game of bidding on Michigan DNR timber sales, which affects the estimation of average stumpage prices and future timber sale appraisals. By analyzing this game, the paper aims to improve the optimal reserve price estimation process.

Abstracts: Oral Presentations

Forest succession, management and the economy under a changing climate: Coupling economic and forest management models to assess impacts and adaptation options

Van Lantz, Galen McMonagle, Chris Hennigar, Chinmay Sharma, Patrick Withey, Thomas Ochuodho

Abstract: Wood is the largest source of renewable energy globally. In the United States, approximately 3.5 million homes use fuelwood as their main heating fuel and an additional 9.1 million homes use fuelwood for auxiliary heat. Annual US residential fuelwood consumption in 2015 was 25 million cords, equivalent to 90 million m³ of roundwood based on EIA Residential Energy Consumption Survey. However, these estimates are available in region level. The reliable estimates in small scales would bring valuable component to track wood usage and how it affects localities and ecosystems. The Timber Products Output (TPO) program of the Forest Service, U.S. Department of Agriculture is an example of a nationally coordinated effort to track roundwood production data across various product categories. The objective of this research was to develop a methodology to estimate residential fuelwood consumption on an annual basis at a sub-state spatial scale. Residential fuelwood consumption at county level was estimated by applying the relationships derived via the residential fuelwood survey to the high-resolution data from census and microclimate variable

Abstracts: Oral Presentations

Market-based feedstock supply analysis for mass timber manufacturing in Michigan*Ichchha Thapa, Raju Pokharel, Emily Huff, Greg Latta, George Berghorn, Jagdish Poudel*

PhD Student, Department of Forestry, Michigan State University

Assistant Professor, Department of Forestry, Michigan State University

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Associate Research Professor, Department of Natural Resources and Society, University of Idaho

Assistant Professor, School of Planning, Design, and Construction, Michigan State University

Adjunct Assistant Professor, Department of Forestry, Michigan State University

Abstract: With the rising demands of low carbon and sustainable building material, mass timber has gained attention in recent years in the United States. Timber-rich areas like Michigan offer sustainable utilization of untapped timber potential—this study models supply and demand scenarios for mass timber manufacturing in Michigan. Various supply chain factors such as demand, resource availability, production capacities, infrastructures, and policy incentives were identified. Based on these factors, feedstock supply scenarios were formulated. Some of the supply scenarios are current regional demand and increased demand met by wood from Michigan only and Michigan wood supplemented by wood from other US regions, policies providing subsidies to landowners, sawmills, and mass timber manufacturers in Michigan only, increased production of wood in Michigan and supplemented by wood from other regions, and use of softwood species only and a mix of softwood and hardwood species from Michigan only and supplemental mixed species from other regions. Demand and supply scenarios will be modeled using Land Use and Resource Allocation model by linking locations of raw materials supply locations (Forest Inventory and Analysis plots and sawmills) and potential locations as demand through cost-optimized feedstock supply logistics. Examining different market-based supply and demand scenarios will help prospective manufacturers, and decision-makers provide information on the market direction of mass timber in Michigan.

Abstracts: Oral Presentations

Optimal Routing for Softwood Sawmill Supply Chain: Strategic Repair of Roads and Bridges

Swagat Attreya, Dr. Michael Crosby, Dr. Shaun M. Tanger, Dr. Eric McConnell

Graduate Student, Mississippi State University

Louisiana Tech University

University of Arkansas at Monticello

Mississippi State University

Abstract: Truck transportation in Mississippi accounts for the greatest percentage of logging operation costs. This study aimed to identify optimal routes between 46 harvest sites and 32 active sawmills that minimized transportation costs. The required datasets were collected from the U.S. Census Bureau, Mississippi Department of Transportation, Mississippi Office of State Aid Road Construction, U.S. Department of Transportation Federal Highway Administration, Mississippi Forest Commission, RISI mill asset database, and USDA Forest Service's Forest Inventory and Analysis National Program websites. The "Closest Facility" tool under the "Network Analysis Extension" of ArcGIS was employed for computing shortest optimal trucking routes between the sawmills and harvested areas, disregarding closed bridges and those posted to lower weight limits than maximum gross vehicular weight for hauling timber products. Additionally, solutions were derived for alternative routes that encountered these impediments. The analysis was restricted to routes with a distance of up to 50 miles due to the added cost constraints of long-haul premiums. Ninety-six routes were identified out of which 18 routes were affected by impediments. The Mixed Integer Linear Programming method will be employed for the shortest optimal and alternative routes in a subsequent study to calculate the minimum cost in both scenarios and compare them.

Abstracts: Oral Presentations

Climate Change or COVID-19? Uncovering the Main Catalyst of Lumber Price Surge*Jameson Augustin, Berna Karali*

PhD Student, University of Georgia

Professor, University of Georgia

Abstract: The U.S. lumber industry relies heavily on softwood lumber imports from Canada, which supplies about 30% of its lumber needs (Fowke, 2022). Lumber is a critical input for U.S. construction, with 92% of new homes built in the country being wood-framed (U.S. Census Bureau survey of construction, 2021). Any disruption in timber supply or demand will ultimately impact every relevant party in the value chain, from processors to homebuyers. This has been the case during the peak of the COVID-19 pandemic when lumber futures prices surged over 400% between May 2020 and May 2021 as processing facilities shut down and labor shortages spiked (Trading Economics, 2021; Stanturf et al., 2021). Apart from global pandemics, hurricanes also severely impact lumber prices and have been more frequent and intense due to climate change. The occurrence of category 4 and 5 hurricanes at the global level is expected to grow by a median change of 13% along with an estimated 5% increase in intensity (Knutson et al., 2020). We use an event study to uncover price and volatility patterns in the U.S. lumber market following disaster events of interest. Our event study framework utilizes daily prices of lumber futures contracts traded at the Chicago Mercantile Exchange (CME) group from 1986 to 2022.

Abstracts: Oral Presentations

Examining Variance in U.S. Silvicultural Costs*Shawn Baker, Amanda Lang, Brooks Mendell*

Forisk Consulting

Abstract: Forest management practices vary geographically and temporally. As part of an ongoing research program, Forisk's silviculture survey tracks forest management practices and costs on over 30 million privately-owned acres in the U.S. South and Northwest. To compare management intensity across geographies and time, we developed a weighted-average management cost per acre. We introduce the Forisk Average Silviculture Expenditure (FASE) and examine sources of variance across regions and years to provide context to shifting silvicultural practices. The FASE offers a comparison of silviculture expenditure per acre owned. Rotation lengths and silvicultural intensity drive regional variance. We compare the FASE among management organizations (TIMOs, forest industry, consultants) and by ownership size. Site preparation practices and fertilization intensity differ substantially among respondents. While not intended as a tool for site specific cost analysis, the FASE compares the economic burden of silviculture across larger areas.

Indicators of North American Forest Products Mill Capacity*Jesse D. Henderson*

USDA Forest Service, Southern Research Station

Abstract: We develop metrics to quantify spatial and temporal properties of forest product mill capacities in North America and the distribution of capacity among firms over the decade 2009 to 2019. Results show that the distribution of capacity ownership among firms is best described by a lognormal distribution. Aggregate forest product capacity became more concentrated in larger companies during this decade. The most volatile changes to capacity occurred due to mill closure (10 million green tons per year on average), while aggregate North American capacity increased by an amount equivalent to 20 million green tons of stumpage input between 2009 and 2019. The analysis shows that annual greenfield capacity increases and capacity expansion at existing mills were both on the order of 7 million green tons per year, whereas on site capacity reductions averaged 2.5 million green tons per year.

Abstracts: Oral Presentations

Current Timber Supply Condition to Forest Industries in Arkansas*Sagar Godar Chhetri, Pradip Saud, Matthew Pelkki*

Arkansas Center for Forest Business, University of Arkansas at Monticello

Abstract: Forest growth and removal rate are crucial to understanding the current forest management practices and providing recommendations for the timber industry establishment. In Arkansas, private landowners supply harvested wood to the forest-based industry. However, the forest growth and removal rate information are less understood to quantify the forest growth-to-drain ratio (GDR) and explore its association with socio-economic factors. Data obtained from the FIA program and IMPLAN suggested that over the decade, the overall GDR significantly differs among the ecoregions ($p < 0.003$). GDR differed by hardwood species (p -value = 0.007) but did not vary by softwood species among the ecoregions. The average GDR was 3.6, while ecoregions, Mississippi Alluvial plain, has the highest (3.8) GDR, followed by Ozark Highlands (3.7), Ouachita Mountains (3.1), and South-Central Plains (1.7). The overall GDR had a moderate negative correlation with the average private land holding and a positive correlation with sawmill capacity. The logarithmic regression model suggested an average number of forest employees, household income, population over the decade, and sawmill presence could explain 26% variability in the GDR. The findings suggest that Arkansas forestland has a surplus of timber production to sustain more timber industries and support upgrading the existing sawmill production capacity.

Abstracts: Oral Presentations

Available Work Days for Forest Operations in Northeast Mississippi*T. Eric McConnell, Michael K. Crosby*

Mississippi State University

Louisiana Tech University

Abstract: Forest operations are impacted daily by the interactions between weather (temperature x precipitation) and soil structure (sand x silt x clay). Monthly average available soil capacity figures for 1991 to 2020 were obtained from the US Geological Survey's National Climate Change Viewer for Mississippi State University's (MSU) weather station. Daily temperature and precipitation data were sourced from the Applied Climate Information Systems NOAA Regional Climate Centers and standardized. A daily weather index was calculated and applied to the monthly soil data to estimate daily workability. There were 220 median minimum working days available on sandy soils (range: 175 to 271 days), 180 days on loams (range: 141 to 240 days), and 147 days on clays (range: 98 to 209 days). Excluding Sundays reduced median minimums to 183, 157, and 131 for sand, loam, and clay. When compared to 1961 to 1990, there were an estimated 13 fewer available work days on sands, three less days on loams, and seven more days on clays. Monthly distributions moderately differed between the two climate cycles for clay soils ($p = 0.0933$). The implications are pertinent to timber procurement, harvest planning, and roundwood inventory management, but also business administration and credit financing more broadly.

Abstracts: Oral Presentations

Inflation Hedging Effectiveness of Farmland and Timberland Assets in the United States*Srijana Baral, Bin Mei*

Colorado State University

Warnell School of Forestry and Natural Resources, University of Georgia

Abstract: We examine the effectiveness of private- and public-equity farmland and timberland assets in hedging actual, expected, and unexpected inflation by using the capital asset pricing model under inflation. Rolling regression is used to assess the time-varying ability of hedging inflation. Results show that private-equity farmland can hedge all inflation types with a 15-year investment horizon, whereas private- and public-equity timberland can hedge expected and unexpected inflation with 15- and 30-year investment horizons. Public-equity farmland is found to be an ineffective inflation hedge in the whole sample period (2013Q1-2021Q4). Rolling regression reveals that the financial crisis of 2008 is the cutoff period after which public-equity farmland and timberland assets become more effective inflation hedges and the ability gets stronger as the investment horizon goes beyond 10 years. Overall, results suggest that the inflation hedging effectiveness depends on the investment horizon and the state of the economy, and differs across farmland and timberland assets. Keywords: alternative investment, asset pricing, NCREIF index, risk factor, time-varying coefficient.

Abstracts: Oral Presentations

Fanning the Flames of Cooperation: A Collective Action Approach to Prescribed Fire Agreements

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Abstract: Fire-dependent ecosystems in the southeastern U.S. such as Longleaf pine (*Pinus palustris*) ecosystems have lost a significant portion of their historic range due to numerous factors including fire suppression and land conversion. These ecosystems require frequent prescribed fires to maintain ecosystem health, function, and the provisioning of ecosystem services. Prescribed fires are also used to mitigate wildfire risks by reducing fuel loads. Despite these benefits, there are numerous barriers to implementing prescribed fires that might be social, political, ecological, and economic in nature. Memorandums of Understanding (MOUs) and other collaborative agreements are written tools that public agencies, nongovernmental organizations, and private entities use to formally resolve challenges and establish standards and protocols that reduce barriers to prescribed fire use. This qualitative study uses thematic analysis to investigate MOUs as a mechanism of collective action for fire management. We analyzed $n = 21$ agreements and identified six emergent themes. These findings demonstrate how formalized agreements might increase the implementation of prescribed fire and how they are used. In doing so, our findings will help land managers and other entities prioritize components of an agreement based in collective action.

Abstracts: Oral Presentations

A Multi-Criteria, Multi-Stakeholder Approach to Conservation Conflict Resolution in Public Forest Management: The Case of Yellowwood State Forest*Katelyn Jeffries, Mo Zhou*

Forestry and Natural Resources, Purdue University

Abstract: Conservation conflicts, commonly defined as “situations that occur when two or more parties with strongly held opinions clash over conservation objectives, and when one party is perceived to assert its interests at the expense of another,” are common within the realm of public land management. Conservation conflicts have been an increasing issue worldwide as the consumption of natural resources can be in direct opposition to conservation efforts. Both quantitative and qualitative approaches have been adopted to mitigate or resolve conservation conflicts. Here we focus on a conflict occurring over logging in Yellowwood State Forest in Indiana in 2018. A Social Multi-Criteria Evaluation (SMCE) framework is used to examine economic, ecological, and recreational criteria from the perspectives of multi-stakeholders and understand how a retrospective assessment can contribute to improved conflict resolution. To engage stakeholders and ensure transparency, the study is carried out in four steps: institutional analysis, defining criteria and potential scenarios, generation of an impact matrix through surveys and interviews, and aggregation of results for cross-scenario comparison.

Abstracts: Oral Presentations

**Stand-Level Variable-Density Yield Equations for Oak-Gum-Cypress Bottomland
Hardwood Forests***Suchana Aryal, Eric McConnell*

Graduate Research Assistant, Mississippi State University

Assistant Professor, Mississippi State University

Abstract: Variable density yield equations were constructed using fuzzy linear regression techniques for bottomland hardwood oak-gum-cypress forests along the US Gulf Coast and lower Mississippi River delta region. Data were from the USDA Forest Service's Forest Inventory and Analysis (FIA) program. Independent variables included stand age, growing stock basal area per acre, site index, and ecoregion dummy variables located in Alabama, Arkansas, Louisiana, Mississippi, Tennessee, and Texas. Dependent variables were growing stock cubic foot yield (GSV) and the Doyle board foot sawlog yield (SLV) per acre. Plots ($n = 526$) averaged 58 years, 90 ft²/acre basal area, 79 feet for sweetgum at 50 years base age, 2,556 ft³/acre GSV, and 11,183 bf/acre SLV. Adjusted R² was 98% for GSV and 77% for SLV. The basal area possessed fuzzy characteristics in the GSV model, while the SLV model's intercept was fuzzy. Six ecoregions possessed fuzziness in each model, but these were not identical across models. The models were validated and are expected to be helpful as a decision-making tool for any individual/group who is willing to manage their land for an oak-gum-cypress forest mix.

Abstracts: Oral Presentations

Developing a Forest Management Activity Cost Guide and Dashboard for Small-Scale Family Forest Owners in the Lake States*Jeremy K. Natzke, Paul Doruska, Melinda Vokoun*

Master of Science in Natural Resources Management, University of Wisconsin-Stevens Point

Professor of Forest Measurements, University of Wisconsin-Stevens Point

Associate Professor of Natural Resources Economics and Finance, University of Wisconsin-Stevens Point

Abstract: Investing in the forest as a resource today provides long-term ecological, social, and economic benefits to the working mosaic of forestland owners, forests themselves, and society. However, small-scale (10 to 49 acres) family forest owners in the Lake States (Mich., Minn., and Wis.) lack readily available passive resources to approximate the cost of managing their forestland; such information is accessible in other regions of the United States. Therefore, to close the knowledge gap, an online survey was developed and distributed to forest practitioners in 2022 to capture the cost of 21 forest management practices following an accounting approach. The survey results were analyzed through a break-even analysis and used to develop the Lake States Forest Management Activity Cost Guide. The publicly available online dashboard described herein is available at the Wisconsin Forestry Center's Research and Development webpage and serves to provide landowners with information to encourage transparent dialog between forest practitioners and small-scale family forest owners.

Abstracts: Oral Presentations

Implication of Mississippi's Forest Resource Development Program in forest investment*Sakar Nepal, Eric McConnell*

Graduate Research Assistant, Mississippi State University

Assistant Professor, Mississippi State University

Abstract: Mississippi's timber severance tax supports the Forest Resource Development Program (FRDP), a cost-sharing initiative that provides partial reimbursement for forest management expenses to landowners. This study investigates the impact of the FRDP on the viability of forest investment. Using the Multivariate Adaptive Regression Splines (MARS) algorithm and its variable importance feature, the study examines changes in Land Expectation Value (LEV) resulting from different levels of FRDP incentives, while considering diverse forest management practices, site conditions, discount rates, and stumpage prices. Results indicate that a landowner's decision to participate in the FRDP is the most significant factor influencing LEV. Moreover, landowners with higher discount rates, lower-quality land, and who receive lower stumpage values benefit most from FRDP incentives. The study also conducts portfolio analysis to determine the optimal combination of timber and financial assets for different risk tolerances, with and without FRDP incentives. The analysis reveals that timber investment is only included in the optimum portfolio when landowners use FRDP incentives. These findings have important implications for policymakers and landowners seeking to maximize the economic value of forest investments in Mississippi.

Abstracts: Oral Presentations

Exploring a new macro-economic paradigm for the forest products industry in the US South*Matthew Pelkki, Shaun Tanger, and Nana Tian*Arkansas Center for Forest Business College of Forestry, Agriculture, and Natural Resources
University of Arkansas at Monticello

Abstract: Numerous events over the first 20 years of the 21st Century have had considerable impacts on the structure and economic contributions of the forest industry in the US South. The acceleration of timberland divestment, the great recession, the acquisition of foreign investment, and the COVID-19 pandemic have generated economic upheavals in the forest economies of the US South. This requires a shift in how we understand the macro economy that accounts for major economic shocks. As a preliminary effort in this research, we will present economic data from IMPLAN for the US South as a whole and individual southern states in 2001, 2006, 2011, 2016, and 2021 and relate the observed changes to the economic shocks of those periods. We will present shifts in structure by forest industry segments, direct and contribution analyses by state and region for the time periods. This work will help lead us to develop a paradigm that will better cope with economic upheavals, climate change, and even global conflicts.

Abstracts: Oral Presentations

Estimation of carbon stock dynamics in a disturbed tropical forest ecosystem of central India: ways towards carbon neutrality*Tarun Kumar Thakur*

Department of Environmental Science, Indira Gandhi National Tribal University

Abstract: Anthropogenic land use changes in the vicinity of forest catchments are explicitly responsible for the deforestation and degradation of tropical forest thereby altering the carbon (C) balance under rising atmospheric carbon dioxide (CO₂). Thus, strategic mitigation measures are required to achieve climate neutrality by 2030. It becomes imperative to understand the impact of land cover conversion on functioning of tropical forests and to determine the carbon dynamics. The present study examined the land cover changes (LUC) in dry tropical ecosystem of Central India during the last two decades and assessed its influence on the forest biomass, litter crop, and C stocks. Geospatial techniques coupled with ground measurements were employed in the study. The total biomass, vegetative C stocks and soil C were estimated as 64 to 338.3 Mg ha⁻¹, 26.4 to 131.1 Mg C ha⁻¹ and 24.6 to 50.2 Mg C ha⁻¹ respectively. In the past decades (2000-2020), about 1851.8 ha of forest constituting 15.1% of the total area under study was lost (mainly to Agriculture) under open mixed forest, moderately mixed forest and mixed teak forest. The study demonstrated that forests of the studied region behave as a potential C source, which accounted for a net loss of 59 gigagram carbon (Gg C) equivalent to 216 Gg CO₂eq. Besides, discussed three viable scenarios of restoration to offset C emissions and to achieve C neutral landscape by 2030. Finding of this study helps to understand the climatic extremes as per the commitments of Paris Agreement, 2015 and Glasgow Pact, 2021.

Abstracts: Oral Presentations

Is afforestation for carbon sinks an effective way to achieve carbon neutrality-The Case of Northwest China*Wang Zongshun, Zhnag Ha*

School of Economics and Management, Northwest A&F University

Abstract: Afforestation is an important way to mitigate climate change, but its cost effectiveness cannot be ignored, which is especially important for the arid and semi-arid regions in Northwest China. To evaluate the cost effectiveness of afforestation for carbon sinks in Northwest China, this paper constructed a three-dimensional integrated geography-economy-ecology analysis framework. The marginal afforestation areas in Northwest China was identified based on the superposition model of environmental factors and the dynamic optimization model of land use. The carbon sinks potential by afforestation was predicted using the Richards growth equation, based on which the carbon sink supply curve was fitted. The cost effectiveness of afforestation for carbon sinks in Northwest China was also analyzed. The results showed that : ①The afforestation area that meet the natural suitability in Northwest China is 5,118,500 hectares, of which only 872,600 hectares meet the economic feasibility, accounting for about 17.05%. Among them, grassland and unused land were dominant, and suitable afforestation areas were mainly distributed in Qinghai and Gansu provinces. ②The carbon sequestration potential of afforestation in Northwest China is 0.08 billion ton CO₂ per year, and by 2060, afforestation in Northwest China will absorb 319 million ton CO₂, which can provide about 8.25%~12.90% contribution to the carbon neutrality target of the region. ③The marginal cost range of afforestation for carbon sinks in Northwest China was 160.18~1331.04 RMB/tCO₂, with an average cost of 876.82 RMB/tCO₂, which was not cost effective compared to the marginal CO₂ reduction cost of 680 RMB/tCO₂. And when the carbon physical discount rate was 5%, the afforestation for carbon sinks in Northwest China will become even less cost effective. Accordingly, policy recommendations were proposed to improve the contribution of afforestation for achieving carbon neutrality.

Abstracts: Oral Presentations

Forecasting pine sawtimber stumpage prices: A comparison between time series hybrid model and artificial neural networks*Sabhyata Lamichhane, Bin Mei, Jacek Siry*

Warnell School of Forestry and Natural Resources, University of Georgia

Abstract: We conducted a comparative analysis of the predictive ability of classical econometric models and artificial neural networks for pine sawtimber stumpage prices across 22 southern timber regions in the United States, using quarterly prices from 1976 to 2022. Model accuracy was assessed via Root Mean Square Error and Mean Absolute Percentage Error metrics, and the modified Diebold-Mariano test was employed to determine if there existed a significant difference in forecast accuracy between the two models. Our findings demonstrated that artificial neural networks outperform classical models in predicting turning points, while the classical models tended to smooth price trends and produce forecasts that were biased towards the average value. This study serves as additional evidence in the ongoing discourse regarding the application of machine learning algorithms to generate more precise forecasts, and provide timberland investors with the information necessary to make informed decisions within the timber market.

Abstracts: Oral Presentations

Exploring the role of values, attitudes, and norms on the behavioral intention of landowners to conduct best management practices in rangelands: A case study from southern Great Plains

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Abstract: The traditional range management focused on stocking rate maximization has resulted in woody plant encroachment, land use change, and species diversity loss in rangelands. In recent decades, there is a growing realization for alternative range management that simultaneously promotes biodiversity and agricultural productivity. Our study was focused on exploring the role of landowner values, attitudes, and norms on their behavior to adopt best management practices (BMPs) that promote wildlife abundance in the southern Great Plains. Based on cognitive hierarchy theory, our study utilized the structural equation model to estimate the influence of values orientations on social norms and attitudes, and finally estimated the influence of social norms and attitudes on behavioral intentions concerning best management practices in the rangelands. The requisite data was collected through a mail survey following the Tailored Design method. The study results indicated that the value orientations were significantly related to the attitudes. However, the relationship of value orientation was statistically insignificant to social norms. Further, the results indicated that both social norms and attitudes had a positive and statistically significant relation with ranchers' intentions to conduct the BMPs. Study results underline the need for innovative communication and non-traditional outreach methods to educate rangeland owners on the importance of patch-burn grazing and other best practices.

Abstracts: Oral Presentations

Public preference program to protect the Upper Floridan Aquifer: A willingness to pay approach

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Abstract: The Upper Floridan Aquifer (UFA) is a shared resource between Florida and Georgia and provides a variety of ecosystem services. The water quality and quantity of the UFA have declined from nitrogen pollution and overuse of water. One way to mitigate these impacts is to limit nitrates and water use by producers within the UFA through voluntary Best Management Practices (BMPs). We estimate the public's preferences for a hypothetical program to incentivize producers around the UFA to use water and nutrient-conservative BMPs through a discrete choice experiment, followed by a latent class analysis to categorize respondents on the basis of support. The results indicate the public is not willing to participate in the incentive program. However, two groups, one consisting of respondents with conservative political identities and the other with democratic identities, support the program and represent 55% of class shares. The results can be used to redirect policy efforts to those that support the program, specifically highlighting the highly durable program attributes, such as positive impacts to producers and opportunities to recreate within the UFA.

Abstracts: Oral Presentations

An editor's perspective on Contingent valuations*Sun Joseph Chang*

School of Renewable Natural Resources, Louisiana State University

Abstract: In this presentation, I will highlight the from a former editor's point of view concerns regarding the stated preference studies, especially those of the willingness to pay types. First, there are the general question about the relevance of the study. Why this study, why this location, why this method. What innovations are there? Second, there are the technical questions. Is the author aware of the three problems raised by Haustman (2012) about WTP - the hypothetical biases and upward biased results; difference between willingness to pay and willingness to accept; and scope and embeddedness or are attempts being made to address these problems. Examples will be presented to highlight these concerns.

Abstracts: Oral Presentations

Perception of tree planting in urban public rights-of-way: a pilot framed field experiment*Stella Schons, Eric Wiseman, Jason Sprouls*

Virginia Tech

Virginia Tech

Neighborhood Design Center

Abstract: The benefits that tree canopy cover provides society in urban spaces in the form of ecosystem services cannot be overestimated. Yet, the literature has shown that tree canopy cover is not necessary welcome in every urban community, especially when trees are planted in public rights-of-way and in low-income communities. With the COVID-19 pandemic, however, there has been a great discussion about equity in access to urban natural resources, with low income and minority communities having the least access to these resources. Our objective is to better understand the reasons why some urban households would rather not have trees planted in public rights-of-way in front of their houses (leading to no planting requests) and to explore potential incentives-based policies that may be used to overcome the challenges or costs that the planting of these trees may pose. Our analysis is based on a series of surveys and a pilot framed field experiment carried out in Prince George's County, MD, in which participants state their willingness to pay not to have a tree planted in front of their house that we, in turn, use as a proxy value to be used in a potential payment for ecosystem services policy.

Abstracts: Poster Presentations

Economics of forestland carbon credit: Does income matter?

Sofwaan Ademonla Bakary, Noel Perceval Assogba

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Abstract: Forests play a vital role in global warming mitigation. This study investigates the trend of forest carbon sequestration studies from the perspective of landowners' willingness to accept payments. A systematic review of scientific papers published between 2007 and 2022 was carried out. The results showed about 85% of the studies were conducted in North America while Europe and Asia accounted for the remaining 15% of studies. Forest land area, the carbon price per acre unit, and the number of years for enrolling are the most used attributes to characterize the Forest Carbon credit program. The socioeconomic characteristics of landowners such as gender, age, and education level are also relevant factors. Overall, the findings suggest a growing research interest in forest carbon credit programs and a near consensus on the attributes to be considered in their implementations.

Abstracts: Poster Presentations

Assessing the environmental impacts of proposed biochar production facilities using forest biomass in Michigan

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Abstract: Biochar is a carbon-rich product produced through pyrolysis which has great carbon sequestration abilities and is known for amending soils in agriculture. We investigated if biochar production and utilization can be a viable climate solution when forest biomass is procured through stationary and rotating mobile pyrolytic units. A cradle-to-grave life cycle assessment methodology has been adopted to quantify the environmental impacts of biochar production based on different biomass production technologies. The LCA encompassed cultivation; biomass procurement; transportation; drying; biochar production; grinding; packaging; and biochar application to agricultural land. Global warming potential and energy return on investment were used as quantitative parameters to assess the sustainability of such systems in Michigan. The preliminary results of the study demonstrated that mobile pyrolytic units using air curtain technology are more economically sustainable despite having lower conversion yields while the opposite was true for mobile downdraft gasifiers. However, stationary facilities using rotary kilns had the highest conversion yield and the lowest negative environmental impact comparatively. The study outcomes will encourage stakeholders in agriculture and forestry to consider biochar in building a circular bioeconomy in Michigan. It will also initiate dialogue on developing energy and carbon policies around biochar commercialization across the Great Lakes Region.

Keywords: lifecycle assessment, stationary facilities, mobile pyrolytic units, global warming potential, soil amendment

Abstracts: Poster Presentations

Estimating Aboveground Carbon Stock and Sequestration Potential of Oak-Gum-Cypress Forests in Bottomland Hardwood Sites*Suchana Aryal, Eric McConnell*

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Abstract: Bottomland hardwood (BLH) forests are an essential ecosystem for carbon storage, but their carbon sequestration potential has yet to be fully understood. This study developed an aboveground live tree carbon stock model and explored the sequestration potential of the BLH oak-gum-cypress forest type using USDA Forest Service Forest Inventory and Analysis (FIA) data for BLH sites in six states: Mississippi, Alabama, Arkansas, Louisiana, western Tennessee, and eastern Texas. The predictions were based on site index, basal area, and stand age. The carbon stock model was developed using multiple linear regression, and growth was based on basal area increment. Adjusted R² for the carbon stock model was 94.4%. The model's accuracy was evaluated using Mean Absolute Deviation (MAD: 3.53 tons/acre) and Mean Absolute Percent Error (MAPE: 14.22%). Findings indicate that one acre of naturally regenerating oak-gum-cypress forests in BLH sites stored an average of 30.56 tons of carbon stock at an average stand age of 57 years, supporting the idea that BLH forests are an essential carbon sink. Additionally, with a maximum average discounted present value of carbon accumulation of \$15.94/ton/acre/year, findings suggest an additional revenue stream from carbon sequestration on BLH sites.

Abstracts: Poster Presentations

Assessing the Impacts of Climate Change on Forest Based Employment in the US South*Austin Lamica, Rajan Parajuli, Christopher Mihiar*

Abstract: The US South is projected to be one of the most vulnerable regions in the US to climate change with rising extreme weather events. Since the US South is the world's largest wood basket, climate change and its ecological and economic alterations in this region could shape the forest products industry. This article estimates the quantitative impacts of precipitation and temperature on forest based employment in the US South using county level climate panel data from 2001 to 2021, and projects the future forest based employment in the region under various future climate scenarios. Preliminary results suggest that historical precipitation influences the employment in the forest-based employment including forestry and logging, and wood based manufacturing sectors. The empirical model results also indicate that temperature negatively influences furniture and related products, paper, and wood products manufacturing and aggregate sectors employments. These results may have implications for forest managers, policy makers, and employees in forest based industries, as they plan for future management decisions and employment opportunities.

Keywords: Climate Change, Forest Based Employment, RCP

Abstracts: Poster Presentations

A Multi-Criteria, Multi-Stakeholder Approach to Conservation Conflict Resolution in Public Forest Management: The Case of Yellowwood State Forest*Katelyn Jeffries, Mo Zhou*

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Abstract: Conservation conflicts, commonly defined as “situations that occur when two or more parties with strongly held opinions clash over conservation objectives, and when one party is perceived to assert its interests at the expense of another,” are common within the realm of public land management. Conservation conflicts have been an increasing issue worldwide as the consumption of natural resources can be in direct opposition to conservation efforts. Both quantitative and qualitative approaches have been adopted to mitigate or resolve conservation conflicts. Here we focus on a conflict occurring over logging in Yellowwood State Forest in Indiana in 2018. A Social Multi-Criteria Evaluation (SMCE) framework is used to examine economic, ecological, and recreational criteria from the perspectives of multi-stakeholders and understand how a retrospective assessment can contribute to improved conflict resolution. To engage stakeholders and ensure transparency, the study is carried out in four steps: institutional analysis, defining criteria and potential scenarios, generation of an impact matrix through surveys and interviews, and aggregation of results for cross-scenario comparison.

Abstracts: Poster Presentations

Chronic Wasting Disease: Economic impacts and management*Sushma Bhattarai, Robert K. Grala*

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Abstract: Chronic wasting disease (CWD) is a fatal disease that affects cervids and has significant impacts on their ecology, environment, society, economy, and affected stakeholders. Despite an increase in the CWD literature, the complete extent of its ecological, social, and economic impacts has not been determined. This study synthesized the economic impacts of CWD and management strategies to mitigate it through a systematic review of 134 published peer-reviewed papers. While the number of publications on CWD has increased steadily since 2000, only 5% of them investigated the disease's economic impacts. CWD has negatively impacted local economies by reducing deer hunting, recreational activities, and venison consumption. Decreased hunting translated to lower economic activities such as travel, accommodation, food, equipment purchases, and lease purchases. While culling has been found to be an effective management strategy, it was often met with public resistance. Despite the potential for significant negative economic impacts due to CWD, studies on them have been limited. Future disease control and management efforts will require sustained surveillance, further research on the economic aspects of CWD, and engagement with all affected stakeholders.

Abstracts: Poster Presentations

Factors affecting prescribed burn costs in the southern Great Plains*Maddie Watts, Aaron Russell, Omkar Joshi*

Abstract: Fire is both a natural process and an important land management tool in the Great Plains. Maintenance of regular fire return intervals helps to preserve important ecosystems and can enhance rangeland, forestland, and agriculture. Prescribed fire is an important option, especially for private landholders, who manage the majority of lands in the region. To increase its usage, economic factors to adopting and implementing prescribed fire should be considered and obstacles reduced. The costs associated with prescribed burn practices have significant influence on the decisions of landowners to adopt and continue the practice. In this project, we use data from a survey of prescribed burn professionals in the Great Plains to perform a multivariate regression analysis of cost factors. Seven significant associated variables emerged including number of burns and acreage, firebreak type, and fuel characteristics. The results also suggest that economies of scale play a role in the cost of prescribed burning. Through the identification of the cost of prescribed burning and the factors that influence it, landowners, prescribed burn professionals, and government agencies in the Great Plains will be able to better understand and implement prescribed burns as part of their land management plans.

Abstracts: Poster Presentations

Lumber futures and its development: A review and some prospects*Nan Zhang, Bin Mei*

University of Georgia

Abstract: This review aims to examine the significance of lumber futures in the context of timberland investment, by reviewing past studies in the field. The paper begins by providing a historical overview of the development of lumber futures in the United States. It is then divided into four sections: (i) the information transmission process between futures and spot prices in lumber futures; (ii) the price volatility in lumber futures markets (iii) the long-run equilibrium relationship between timberland market values and lumber futures; and (iv) the information process of lumber futures market and its efficiency. By examining these different elements, this review seeks to shed light on the role of lumber futures in timberland investment and provide insights for future research in the field.

Abstracts: Poster Presentations

The impact of rapid fuel costs inflation on Arkansas' logging sector*Ana Gutierrez-Castillo, Nana Tian, Matthew Pelkki*

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Abstract: The logging sector is vital to the wood supply chain supporting both the sustainable management of forest resources and the prosperity of the forestry industry. This study analyzed the immediate impact of rapid fuel cost inflation from February to May of 2022 on the logging sector based on a survey sent to 430 logging and/or hauling firms in Arkansas. We made a direct comparison between the January and May operating costs and production quantities. Results showed that on average logging and/or hauling firms paid about 50% more per liter of diesel fuel in May as compared to January; however, their purchasing frequency remained unchanged, and purchasing quantity for off-road and on-road diesel increased slightly. More than half of the firms received additional compensation from sawmills, averaging \$1.4 per metric ton. The overall timber production declined in May with respect to January, but the firms displayed different reactions. Whereas 31.6% of the firms harvested more and 18.4% kept their production constant, 50.0% of the firms significantly lowered their production by 16.1%. There are several potentially confounding factors explaining the loggers' different responses during the high fuel price context.

Abstracts: Poster Presentations

The logging Sector in East Texas: Current Status, Issues, and the Future Outlook

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Abstract: The logging sector plays a critical role in the wood supply chain and in forest management. It connects forest resources with mills, who consequently use that wood to manufacture a multitude of products. A better understanding of the logging business status among policymakers is crucial in sustaining this industry. Therefore, this study's objective is to determine the status and capacity of the logging sector in East Texas. Furthermore, this study determined the impacts of COVID-19 and also identified concerns of logging businesses regarding the future of this sector. Both online (using Qualtrics) and mail surveys were used to collect the data from loggers and logging companies. According to the data collected from the online survey, average business owners age was 53 years, the majority were white, male, had only one crew, and were not able to operate at their full capacity. The majority of businesses were negatively impacted by COVID-19 due to difficulty in getting parts/equipment, lack of labor, and mills went on quotas while fewer were positively impacted due to less traffic and fewer interruptions. The results will be useful to enhance the logging sector and ensure the continued supply of wood products to the mills and better forest management.

Keywords: Logging sector, mail survey, Qualtrics, COVID-19.

Abstracts: Poster Presentations

Wood Products Market and Competition in the Lakes States*Tara Allohverdi, Raju Pokharel, Emily Huff*

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Abstract: Managers and decision-makers are often tasked with accomplishing large landscape-scale goals with limited resources. This is especially true when conceptualizing forest product harvesting as a management strategy. We use economic modeling and GIS to create woodshed or procurement area maps of the Lake States forested region using delivered wood prices for major wood products for three broad end-user groups: forest landowners, industry, and forestry and Extension professionals. The project's goal is to develop a web tool or application to map wood procurement zones and a spatial competitiveness index to allow end-users to determine if their forested region is suitable for different types of forest product markets. We conduct network analysis in GIS utilizing the current transportation network, primarily roads and processing facilities (e.g., primary wood processing mills, pulp producers, plywood, OSB), in identifying cost-based wood products market and competition hotspots. To show the market extent and competition, we will utilize existing and potential mill locations coupled with a road network database to determine the geographical extent of each facility's potential procurement zone or woodshed. The output of this project is then used to develop an interactive web-based geospatial tool to map market coverage and competition hotspots and identify high-priority areas to direct funding.

Abstracts: Poster Presentations

Prospects of Mass Timber Manufacturing: Feedstock Supply Analysis in Michigan and the Great Lakes Demand Survey

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Abstract: Increased housing demand with the growing urban population and the reduction in the emissions in the construction sector has urged the use of bio-based materials such as mass timber as an alternative construction material. Despite proven benefits and growing interests, mass timber has yet to gain momentum in the United States. The lack of information on the demand and supply chain of the mass timber industry stands as the bottleneck for its wide adoption. The state of Michigan, rich in forests, is seeking to attract mass timber manufacturers to sustain the net growth of timber resources. For this, information on existing and future market demand, an estimate of the availability of raw materials, and supply pathways stand vital. This study assesses the awareness and demand-related factors using various qualitative methods. Surveys with key influencers such as construction and real estate industries, government officials, forest products industries, non-governmental organizations, and multi-family residents in the Great Lakes Region and the public in Michigan are being conducted. Feedstock supply analysis examines the feedstock availability, procurement areas, competition hotspots, and potential locations across different market and policy scenarios in Michigan. Preliminary results showed about 231 MMBF and 104 MMBF of softwood sawlogs are available for a potential mass timber facility in Clare County of Lower Peninsula and Marquette County of Upper Peninsula in Michigan at a delivered log price of \$295/MBF. Understanding the regional mass timber demand and supply analysis will help prospective manufacturers and decision makers identify how many facilities, at what capacities, and their potential location/s for mass timber manufacturing in Michigan.

Abstracts: Poster Presentations

Historical trend of market coverage and competition of various wood products in Michigan

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Abstract: Forests in Michigan are valuable to the state because of their contribution in creating jobs, providing raw materials to industries, and environmental benefits. The forestry sector in Michigan has been affected by two major events in last four decades: Northwest Forest Plan 1994 that prevented harvesting of wood materials from federal lands and the Great Economic Recessions of 2007/08. The objective of this study is to generate the market coverage and competition of wood products in Michigan and assess changes for last four decades. Milling facilities from four different years (1985, 1994, 2002, 2018) were categorized into four types based on the forest product they use: softwood sawtimber, hardwood sawtimber, pulpwood, and biomass. Using “Network Analysis” in ArcGIS, we created competition hotspots of these categories for all four years. We then compared how the coverage and competition of milling facilities have changed in last four decades along with change in forest cover. This helped in inferring the impacts of Northwest Forest Plan 1994 and the Great Economic Recessions of 2007/08. The findings help to present the impact on forest market coverage due to the economic recessions and restricted harvesting on the national forests.

Abstracts: Poster Presentations

Socio-economic Analysis of Wood Charcoal Production as a Significant Output of Forest Bioeconomy in Africa

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Abstract: Wood charcoal (WCH) is a sustainable biofuel for rural and urban users because of its higher energy density and emission of marginal smoke when compared with firewood. Besides helping the poor majority who cannot afford kerosene, electricity, or liquid petroleum gas (LPG), WCH is a key source of income and livelihood. This work was aimed at quantifying the volume of WCH production as well as appraising its socioeconomics, including environmental impacts, especially the impact of long-term deforestation and forest degradation in Africa. Historically robust data from the databases of UN-FAO, FAOSTAT, International Energy Agency (IEA), United Nations Statistics Division, UN-DESA energy statistics yearbook, and the Forest Resources Assessment (FRA) were used. The data analysis involved descriptive statistics, multivariate analysis, and geospatial techniques. The result revealed that East Africa had the highest average wood charcoal production which was 32,058,244 tonnes representing 43.2% of the production whereas West Africa had 23,831,683 tonnes denoting 32.1%. Others were North Africa (8,650,207 tonnes), Middle Africa (8,520,329 tonnes), and South Africa (1,225,062 tonnes) representing 11.6%, 11.5%, and 1.6% respectively. The correlation matrix showed that WCH production for the three decades had a significant positive correlation with all the measured parameters (such as areas of forest cover, export quantity, export value, GDP, human population, climate season, average income per citizen, and literacy rate). Wood charcoal is an essential livelihood support system. New policies including commercial wood charcoal production and licensing for revenue and ecological sustainability are required. Enterprise-based approaches for poverty reduction, smallholders' tree-growing, wood charcoal-energy conserving technologies, improved electricity supply, and agricultural productivity are encouraged. The novelty of this study can also be explained by the diverse parameters examined in relation to WCH production which no other studies in the region have done.

Keywords: biofuel, socioeconomics, bioeconomy, forest resources, sustainable development, Africa

Abstracts: Poster Presentations

Legal Environment of Prescribed Fire on Forestland: An Analysis of the Evolving Legislative Trends

Kalani G. Perera, C. Sun, Gregory E. Frey, Bruno K. da Silva, Xiaofei Li

Abstract: Forestry prescribed fires have been an essential tool for managing forestland and reducing the risk of catastrophic wildfires. However, the use of prescribed fires has also raised concerns about their potential environmental and social impacts, leading to the development of legislative frameworks that govern their implementation. This study will explore the dynamic nature of these legislative efforts and how they have evolved to meet the challenges of managing forests and reducing the risk of wildfires. Moreover, it will examine the determinants driving these patterns. Computational content analysis will be used to detect the evolution patterns in legislative bills, and a spatial panel data model will be employed to examine their determinants. Given the significance of forests in the rural economy and the prevalent use of forestry prescribed fire, this study will generate new insights that help improve our understanding of the legal environment, demand and supply in the legislative market, and future direction of legal reforms.

Abstracts: Poster Presentations

Stepping into the shoes of landowners: insights from the Cross-Timbers forested region*Chamali Rodrigo, Aaron Russell, Maddie Watts, Omkar Joshi*

Department of Natural Resources Ecology and Management, Oklahoma State University

Abstract: The Cross-Timbers region, spanning from southern Kansas through central Oklahoma into Texas, is an ecologically and socially important ecoregion in the Southern Great Plains of the United States. Although cross-timbers forests provide several ecosystem services, active forest management comes at a cost to the landowners due to the lack of direct timber market opportunities. Therefore, the broader goal of our research is to identify sustainable forest management prescriptions that are socially acceptable, economically feasible, and have the potential to enhance ecosystem services in the Cross-Timbers Region. We administered a survey instrument among forest landowners in Kansas, Oklahoma, and Texas and solicited information concerning their interest in adopting prescribed fire, herbicide applications, and thinning. Our preliminary results suggest that thinning was the most preferred active management tool in the Cross-Timbers region, followed by prescribed burning and herbicides application. However, nearly two-thirds of landowners did not have any timber management objectives and a written forest management plan. About 75% of landowners experienced encroachment by woody plants such as eastern redcedar. The results provide practical implications for policies to reduce the management costs. They also show where policy measures might increase landowner participation through socially-influenced motivations related to broader ecosystem services.

Abstracts: Poster Presentations

Assessment of Factors Driving Spatiotemporal Variation in Timber Products Output (TPO) Trends*Olakunle E. Sodiya, Justin S. Baker*

Abstract: Starting in 2018, the Timber Products Output (TPO) monitoring program shifted from a complete periodic census to an annual sampling methodology. Estimates from the TPO program have provided the essential foundation for US timber market analyses and projections, sustainability analysis, policy analysis, bioenergy modeling applications, and local wood basket analysis of potential market expansion. The usefulness of any of these analyses is constrained by the quality and precision of the essential data. Therefore, there is a need to appropriately adjust for non-response and quantify precision, observe production and consumption trends at a fine spatiotemporal scale, and integrate TPO estimates with national FIA inventory. However, a critical question remains as to whether the pre-2017 measurements of roundwood volumes are comparable to current annual estimates at a spatiotemporal scale? Using a simultaneous equation estimation approach, we estimate the supply and demand of total softwood and large roundwood production in the southern US to determine whether the changes in production trends after 2017 are attributable to actual market-driven events, changes in mill capacity, or to changes in the TPO survey methodology. Our results help provide insight into potential inference from TPO statistics and use in supply and demand estimation post-2017 survey methodology change.