SOFEW 2013

March 11-12, School of Forestry and Wildlife Science, Auburn University, Auburn

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Session A0-1

Twelve Unresolved Questions for Forest Economics

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Abstract
Faustmann showed us the basic economic formulation of the forestry problem 163 years ago. However, since then foresters and economists have learned of a number of situations in which Faustmann's marvelous contribution is incomplete, inaccurate, or inappropriate. Our more recent experience addresses some of those situations—but we do not have fully accepted answers for all of them. This paper identifies issues that still remain unresolved within the discipline of economics as applied to forestry at the beginning of the 21st century, and then adds two more crucial concerns for policy applications.

Session A0-2

Carbon Offset Payments and International Forest Products Markets

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Abstract

According to projections with the Global Forest Products Model (GFPM), offset payments applied in all countries could increase sequestration in world forests by 5 to 14 billion tonnes of CO2e from 2009 to 2030. Concentrating payments in developed countries led to leakage and environmental damage as developing countries harvested more. Offset payments increased wood prices relatively more than they decreased production, thus increasing the revenue of timber producers.

Acknowledgments

The work leading to this paper was supported in parts by the USFS Southern Research Station through a research agreement directed by Jeff Prestemon.

Introduction

There is increasing evidence of global climate change, caused in part by carbon dioxide in the atmosphere (IPCC 2012). Consequently, several initiatives attempt to lessen CO_2 emissions and raise carbon sequestration. The REDD programs intend in part to reduce emissions by increasing global forest carbon stocks (World Bank 2011). But, more unilateral policies especially within developed countries, also hope to get significant results quicker. This raises the possibility of “leakage” according to which environmental improvements in regions reducing emissions would be offset by more economic activity and attendant pollution in regions maintaining the status quo. Indeed, the results of Murray et al. (2003) for regions in the United States suggest that leakage cannot be ignored in accounting for the effects of CO_2 mitigation activities in forestry.

The objective of this study was to project some international effects of policies to increase carbon storage in forests for different levels of offset payments, and for policies with offset payments in all countries or in developed countries only, to determine the attendant leakages and inefficiencies.

Methods

Offset payments increase the marginal cost of harvesting wood by an amount equal to the payment per unit of volume, c, that could be earned by leaving the wood in the forest. This payment can be envisioned as an annual rent per unit of increase in permanently stored wood, equal to cr, where r is the interest rate.

Consequently, in a region with offset payments for stored carbon, the wood supply curve shifts upwards. This changes the market equilibrium. The world price increases but by an amount less than the offset payment, as the system reacts to restore the pre-offset payment equilibrium. In the region with offset payments, production decreases due to the supply shift compensated in part by the price increase, while the quantity demanded decreases along the unchanged demand curve, and net exports decrease. In the rest of the world, where there are no offset payments, consumption decreases and production increases due to higher world price, by movements along the unchanged demand and supply curves, leading to lower net imports equal to the net exports of the region with offset payments.

This general principle was simulated in detail with the Global Forest Products Model (GFPM), a dynamic spatial equilibrium model of the forest sector. The original model is described in Buongiorno et al. (2003, updated in Buongiorno and Zhu (2012 a, b). The essential part of the static phase, which computes the global equilibrium in a given year, consists of two equations. The objective function maximize producers and consumers surplus (Samuelson 1952). The second equation expresses the equilibrium between demand and supply for each product and country. The left hand side is the sum of imports and of domestic production. The right hand side is the end demand, plus demand in the production of other products, plus exports. The dual solution gives the equilibrium price by product and country. The dynamic phase of the GFPM represents the changes in the demand and supply conditions over time. For this application the upward shift of the inverse wood supply of a particular country due to a change of offset payments for CO_2e from C_{-1} to C shifted the inverse supply curve to:

$$P = \alpha + \beta Y + \omega(C - C_{-1})$$

where ω was the CO_2e content of the living biomass per unit of growing stock.

The GFPM for this study was calibrated with base year 2009 data from FAO (2010, 2012). The assumptions on the rate of growth of total and per capita gross domestic product up to 2030 were taken from USDA-ERS(2012). The parameters of the equations of forest area change and growth of forest stock were as in Buongiorno et al. (2012), as were the rates of technical change. The assumptions regarding the offset payments were based on projections of carbon market prices (IEA 2009, Synapse 2011, CEC 2011). The adopted three scenarios for offset payments started at 0 \$/t in 2009, increased to \$15/t, \$30/t, or \$50/t by 2015 and then stayed at those levels until 2030. The ratio of forest growing stock to carbon sequestered was set at 2 m^3/t based on 0.55 t of carbon per m^3 of living forest biomass derived from FAO (2010).

Results

Without carbon offset payment the amount of CO_2e stored in world forests from 2009 to 2030 increased by approximately 159 billion tonnes. This implies an average yearly accumulation of 2.1 billion tonnes of carbon in world forests. The largest projected increase of stored CO_2e was in North/Central America, 45 billion t, then Europe, 37 billion t, Africa, 35 billion t, and South America, 22 billion t. Asia and Oceania together 21 billion t. Still, according to this base scenario, the total amount of CO_2e added in all the forests of the world in 21 years was only five years of the annual global CO_2 emissions (32 billion tonnes in 2008 , see Boden et al. 2011).

With offset payments of \$30/t in all countries, the amount of CO_2e stored globally in forests increased by 9 billion tonnes by 2030, 5 billion tonnes in developed countries, and 4 billion tonnes in developing countries (Table 1). The same offset payments applied in developed countries only led to 5 billion t more stored CO_2e by 2030. Although the developed countries stored more, leakage occurred as developing countries stored less. Thus, the effect of a policy concentrating on developed countries was to export an environmental problem from north to south.

Table 1 Change, relative to base scenario, of CO_2e stored in living forest biomass from 2015 to 2030 due to offset payments of \$30/t CO_2e applied in all countries (Global policy) or in developed countries only (partial policy).

	Offset payment policy	
	Global	Partial
	---------------Million t-----	
AFRICA	1159	71
N/C AMERICA	1642	2649
United States	928	1563
SOUTH AMERICA	1132	-1114
ASIA	1680	-1914
OCEANIA	260	344
EUROPE	3243	4984
DEVELOPED	5095	8455
DEVELOPING	4021	-3433
WORLD	9116	5022

Figure 1 illustrates the effects of the level of carbon offset payments on the amount of CO_2e stored in forests from 2009 to 2030 with the policy applied everywhere or in developed countries only, other things being equal, and taking into account the opportunity cost of not using the wood sequestered to produce other commodities. With offset payments in all countries, the increment of carbon storage increased with the price paid per unit of CO_2e. However, with offset payments in developed countries only an increase of the price of CO_2e decreased the amount stored in the forests of Asia and of South America. Thus, the world supply curve was much steeper with offset payments in developed countries only than with offset payments in all countries. Consequently, a policy concentrating on developed countries was inefficient, as a global budget for offset payments spread over all countries increased the amount of CO_2e stored in forests by much more than the same budget limited to developed countries.

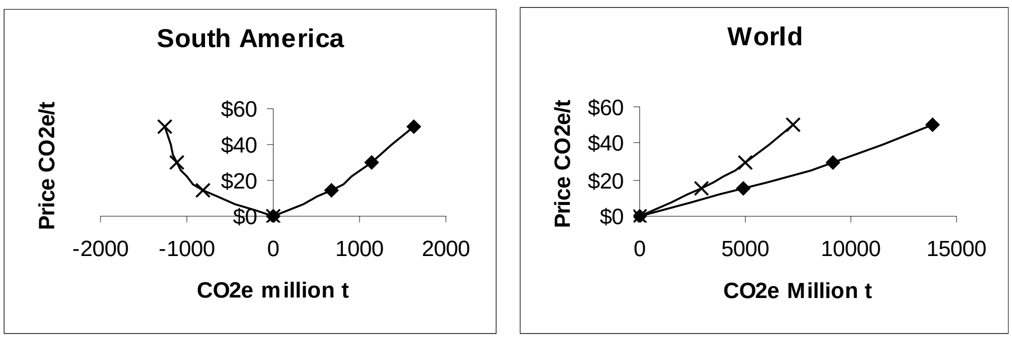

Figure 1. Additional CO2e stored in forests from 2009 to 2030 at varying prices of CO2e paid in all countries (—♦—) or in developed countries only (—×—). ——.

Offset payments for CO_2e decreased wood production and raised the price of roundwood and products. $30/t of CO_2e increased the real price of industrial roundwood by 52% relative to the base scenario. Meanwhile, the real price of sawnwood increased by 31% while the price of paper and of paperboard increased by 5%.With the same payment in developed countries only, the price increases relative to the base scenario were more moderate.

With offset payments of $30/t of CO_2e in all countries, the world production of total roundwood in 2030 was 308 million tonne lower than without offset payments (Table 2). Production was lower in almost all developed and developing countries. With the same payments confined to developed countries production in 2030 decreased further in all developed countries, but this was compensated in part by higher production in developing countries, leading to a net world decrease of production of 138 million tonnes. When offset payments were applied in all countries world timber revenues increased by 54% relative to the base scenario because the increases in prices of wood largely exceeded decreases in production. With offset payments in developed countries only, the world timber revenues still increased by 51%. In addition to increased timber revenues, producers also benefited directly from the offset payments for carbon stored in forests. The global offset payments were nearly the same when applied to all countries or to developed countries only, 17% to 18% of the change in global timber revenue. However, with payments to all countries, nearly 700 million tonnes per year of CO_2e were stored globally in 2030. With payments limited to developed countries, only 400 million tonnes per year of CO_2e were stored.

Table 2. Change, relative to base scenario, of annual total roundwood (fuelwood and industrial roundwood) production in 2030 due to offset payments of \$30/t CO_2e applied in all countries (Global) or in developed countries only (Partial).

	Offset payment policy	
	Global	Partial
	----------million m^3----	
AFRICA	-40	-1
NORTH/CENTRAL AMERICA	-48	-77
United States of America	-24	-44
SOUTH AMERICA	-46	44
ASIA	-75	55
OCEANIA	-8	-11
EUROPE	-91	-148
DEVELOPED	-139	-248
DEVELOPING	-169	110
WORLD	-308	-138

The consequences of carbon offset payments for the consumption, production, and trade of forest products varied according to the share of wood cost in the cost of the manufactured product. For example, with offset payments in all countries sawnwood consumption decreased everywhere due to the higher sawnwood prices, and total world consumption was about 3% lower in 2030 (Table 3). Production decreased by 5% in developed countries but increased by 2% in developing countries.

With offset payments in developed countries only the world sawnwood consumption decreased less, due to the lower price increase, by about 2% both in developed and developing countries. But while production was 9% lower in developed countries than without offset payments, it was 13% higher in developing countries.

Table 3. Change in sawnwood consumption and production in 2030 with offset payments of \$30/t CO2e applied in all countries (Global) or in developed countries only (Partial).

	Offset payments policy			
	Global		Partial	
	Consumptio n	Production	Consumptio n	Productio n
	------------------------------------1000 m^3----------------------------			
AFRICA	-564	-1932	-307	400
N/C AMERICA	-3068	-4253	-2279	-4
United States	-2227	-10737	-1688	-10214
S AMERICA	-1633	-10921	-652	-3490
ASIA	-3020	23206	-1897	26301
OCEANIA	-261	902	-194	640
EUROPE	-3069	-18617	-2316	-31492
DEVELOPED	-6708	-13841	-5069	-25206
DEVELOPING	-4907	2227	-2575	17561
WORLD	-11615	-11615	-7644	-7645

These effects of offset payments on consumption and production led to large variations on international trade. For sawnwood for example, the base scenario with no offset payments, led to increasing net exports from Europe, matched by increasing net imports in Asia. With the scenario of offset payments in all countries, net exports from Europe were 26% lower in 2030 than without offset payments, and net imports of Asia were 50% lower. A policy of offset payments restricted to developed countries further reduced the trade imbalance between Europe and Asia.

Summary and conclusion

The highest sequestration level, with offset payments of $50/t in all countries, increased the CO2e sequestered in world forests 14 billion tonnes from 2009 to 2030. This was a modest amount compared to the current world CO_2 emissions of approximately 32 billion tonnes per year (Boden 2011).

Unilateral policies, concentrated in rich countries, led to leakage and exportation of environmental damage. Policies concentrating in developed countries were also economically inefficient. This underlines the importance of global agreements involving both developing and developed countries. Although international programs such as REDD and bilateral agreements are funding projects in developing countries they are still modest in scope and face many implementation difficulties (Creed and Nakhooda 2011).

Few countries lost timber production revenues due to offset payments for CO_2 sequestration, with either a global or a partial policy, because the relative change in production was less than the relative change in price. Where losses did occur they were more than compensated by the receipts for sequestered CO_2e. The reduction of wood supply due to offset payments led to higher product prices and diminished consumption, implying lower consumer welfare.

One should not underestimate the difficulty of implementing the policies. Implementing programs like REDD requires credible commitments of long-term finance from both developed and developing countries (Creed and Nakhooda 2011). It also requires the implementation of monitoring systems to estimate carbon stock changes with sufficient accuracy.

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Session A0-3

Fuel of Land Use Change

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Abstract

There are three major forces causing land use changes: exurban housing, rising developing country income, and biofuels. All three of these causes can trace their roots to increased income. Exurban housing uses upwards of 2 hectares of land per family and becomes feasible with a very modest taste for rural life and increased income. Developing countries demand for food and for protein drove a boom in commodity prices and threatens to do so again as the recovery takes hold. Biofuels themselves are partially a reaction to record petroleum prices driven by increased demand. All of these factors increase the demand for land for productive uses and threaten to replace natural uses both in developed and developing countries.

Session A1-1

Non-industrial private forestland owner's willingness-to-harvest and how higher timber prices can drive greater commercial harvesting of woody biomass

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Abstract

Active management of woodlands includes the harvesting of commercial products such as timber and pulpwood. Emerging public interest in renewable energy feedstock has the potential to create new markets for material (woody biomass) with current little to non-commercial value. New woody biomass for energy markets will unquestionably rely heavily on supply from non-industrial private forest landowners. Using a multinomial framework we analyzed non-industrial private forest landowners' willingness-to-harvest (WTH) forestlands in three U.S. States for (1) commercial and woody biomass products, (2) commercial products only, (3) woody biomass only, and (4) none. Factors other than price showed a large effect on WTH reflecting on how recreational objectives dominate non-industrial private forest ownership. We conclude that the marginal effect of timber prices had a greater effect on WTH both timber and woody biomass compared with harvesting timber only. We argue that public policies aimed at increasing the supply of woody biomass from NIPFs might be most effective by targeting timber prices, not woody biomass.

Session A1-2

Assessment of Woody Biomass Supply from Natural Forests: Biophysical, Social and Economic Availability

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Abstract

Woody biomass from natural forests has substantial potential to be used as a feedstock for renewable energy production in the United States. However, the potential availability of woody biomass for energy production is limited by a suite of biophysical, social, and, economic factors that constrain availability. Because of these constrains, business developers and wood procurement managers often struggle with quantifying whether adequate woody biomass supplies will be available at competitive prices in a particular location. This study developed a procedure to estimate potential supply of woody biomass for a specific energy facility location that considers multiple biophysical, social, and economic factors using publicly available data and published literature. The procedure was applied to a case study of siting a woody biomass energy facility in Williamsport, Pennsylvania. Cost curves were developed to illustrate the available quantity for a range of delivered cost. The resulting procedure can be utilized by organizations interested in evaluating initial feasibility and subsequent operation of woody biomass-based energy facilities that require accurate and dependable information on supply within their expected wood procurement area.
Keywords: Biomass procurement; Supply cost; Facility siting

Session A1-3

Economic Viability of Woody Bioenergy as a Mine Reclamation Procedure

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Abstract

Planting woody biomass for energy production can be used as a mine reclamation procedure to satisfy the Surface Mine Control and Reclamation Act (SMCRA) and provide renewable energy for the United States. This study examines the economic viability of bioenergy production on previously mined lands using different species and treatments. Three species were planted at two densities; one-half of the trees were fertilized in year two. Height and diameter of the trees were measured annually for five years. This presentation summarizes current and predicted volume of these species, the effect of planting density and fertilizer application, and the net present value of each treatment. A sensitivity analysis was conducted to determine how changes in production costs, stumpage price, rotation length, and interest rate affect the economic feasibility of bioenergy production. Production cost appears to have the largest impact on net present value and is often the difference between positive and negative returns. The extra costs of fertilization and high density planting do not appear to be economical; the unfertilized, low density treatments have the best NPV in all examined scenarios. In general, bioenergy was found to be economically viable as a mine reclamation procedure only in limited circumstances. In these scenarios, bioenergy crops could have the potential to reforest both active and abandoned mine lands in southern Appalachia.

Session A1-4

Outlook of Woody Biomass Energy Market

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Abstract

This study reviews the historical trends of woody biomass energy consumption by U.S. energy consumption sectors and predicts woody biomass energy future market in the U.S. and the Northern region for the next 30 years under high, baseline, and lower scenarios. Multiple time series models are used in predicting wood energy consumption in industrial and residential sectors. Analytical method is used to predict the commercial and electricity woody energy consumption based on historical trends and policy supports. The predictions suggest that the future path of wood energy consumption in the industrial sector depends on future paper production which is not expected to grow. The residential wood energy consumption is determined by the average wage rate of production workers, and price of composite non-wood energy prices. The wood energy consumption by electricity and commercial sectors is policy driven and likely to continue to grow, but it will remain to be a small fraction of total wood energy used in the next several decades. Although we have heard loud voice in biomass energy, the wood biomass energy in this country will still grow very slowly in the next 30 years if cellulosic biofuel cannot compete with fossil fuel in the market.

Session B1-1

Economic Analysis of Chinese fir Forest Carbon Sequestration Supply in South China

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Abstract

Increasing the forest carbon sequestration has become the important measure to meet climate change. To the typical forest of Chinese fir advocate produce in South China as a case, On the basis of assumption about afforestation on bare land at land types with three kinds' site conditions and management strength, this paper uses the Chinese fir growth model and the modified Faustman-Hartman model to analyze the impact of increasing carbon sequestration incomes on forest management. The results indicate that the increase of carbon sequestration incomes will obviously increase the value of forest land; the increase of forest land's value may make the lands for other uses transfer to the forest lands, the optimal rotation will show the extension trend with the increase of carbon sequestration's price. However, it has different influences for different kinds of forest lands. Carbon supply of middle and inferior forest land will be more sensitive to carbon sequestration's price, which also provides the possibility to change the forest land management ways and further increase the forest land's forest carbon sequestration supply by the means of market and price. Chinese fir forest carbon sequestration supply were negatively correlated to interest rate and the price of timber, but the interest rate and the timber price changes on different types of woodland are various. Interest rate and timber price change to top forest land's forest carbon sequestration supply affect overall is not significant, but at a lower interest rate level or timber price reduce situation, carbon supply of middle and inferior forest land increase. The relation of Carbon supply and interest rate change makes using monetary means to stimulate increase forest carbon sequestration as possible.
Keywords: Chinese fir; optimal rotation; land expected value; carbon sequestration; carbon supply

Session B1-2

Carbon Life-Cycle and Economic Analysis of Forests Carbon Sequestration and Woody Bioenergy Production from Loblolly Pine Forests in Southern U.S.

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Abstract

Forests play an important role in reducing greenhouse gases (GHG) in the atmosphere through storing the atmospheric carbon in their woody biomass. Also, woody biomass is considered a potential source of energy. This study assesses the impact of carbon offset payments and woody energy production on LEV and rotation age under four different management scenarios in the loblolly pine forests – 1) No management, 2) Thin only, 3) Fertilization only, and 4) Thin and fertilization. A modified Hartman model is used to estimate the benefits from carbon sequestration and bioenergy production along with traditional timber benefits. Life-cycle analysis is used to estimate total CO2 production during management and harvest. The results showed that in all four scenarios, LEV is increased and rotation age is decreased with carbon payments and bioenergy production. There is more impact of carbon payments on LEV than bioenergy production. At low carbon prices, the thin only scenario has the highest LEV. But with subsequent increases in the carbon price, the thin and fertilization scenario has the highest LEV. The fertilization only scenario has the lowest LEV even under high carbon prices.

Session B1-3

The Treatment of Soil Erosion (TSE) from the perspective of stakeholders: evidence from China and policy implications

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Abstract

The treatment of soil erosion (TSE) is one of the most important means of ecological restoration in China. However, the success of this kind of ecological restoration was elusive and sometimes even compromised the impoverished people who need to be protected most. Taking Changting County in southeast China as an empirical case, and within the analytical framework of stakeholders, i.e. the government, the farmer, the enterprise, and the non-government organizations (NGOs), this article aims to explore the benefit evolution of varied stakeholders in the progress of TSE. The results show that all stakeholders played varied but important roles during different periods of TSE. The evolution of their benefit pursuit and concerns largely determined the characteristics and consequence of TSE and poverty alleviation. It is unsustainable to focus purely on ecological benefit and ignore economic benefit in TSE and vice versa. At the same time, it is important to improve the livelihoods of the farmer, in particular the impoverished farmer who are heavily dependent on the environment and most affected by TSE. This study demonstrates a new perspective for exploring the relationship between ecological restoration and poverty alleviation, and is conducive to understand the internal mechanisms of it, as well as provides a reference for similar areas in developing countries to devise ecological restoration policies and poverty-alleviation strategies.
Keywords: treatment of soil erosion (TSE); stakeholders; ecological restoration; poverty alleviation; China

Session B1-4

Willingness to Mississippi's forest landowners to manage their forests for ecosystem services.

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Abstract

An active management of private forests for ecosystem services will be needed to satisfy a growing demand for these services. By including ecosystem services in their management portfolio, non-industrial private forest (NIPF) landowners can diversify their income and help decrease negative impact of fluctuating timber prices. In addition to monetary returns, this approach would help achieve important conservation benefits. While many landowners are familiar with and value ecosystem services, they have not actively managed their forests for ecosystem services due to lack of monetary incentives. A mail survey of Mississippi's NIPF landowners was conducted to examine their attitudes toward ecosystem services. The survey collected information on landowner objectives, familiarity with ecosystem services, familiarity and participation in ecosystem services programs, forest land acreage available for provision of ecosystem services, landowner's willingness to manage their forests for ecosystem services in exchange for an annual fee, and sociodemographic information. The study results will be helpful in understanding motivation of NIPF landowners and designing policies and programs related to ecosystem services.

Session A2-1

Economic Development and Farmland Protection: An Assessment of Rewarded Land Conversion Quotas Trading in Zhejiang, China

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Abstract

Facing a substantial loss of farmland in the reform era, the Chinese central government established a highly centralized land management system in 1998 to guarantee its capacity to meet the domestic food needs. In order to maintain high-speed economic growth, local governments in China made great efforts to circumvent the stringent constraint on land use by launching various innovative land management schemes, among which Zhejiang's rewarded land conversion quotas (RLCQ) trading scheme, a program similar to the transfer of development rights (TDR) in Western countries, has attracted a lot of policy and scholarly attention. In this research, we first provide an overview of China's farmland protection policy and the RLCQ trading scheme in Zhejiang. Then, using the system GMM estimator for economic growth models and a panel dataset of 69 local jurisdictions in Zhejiang Province covering the period of 1989-2008, we assess the impacts of RLCQ trading on local economic growth. The empirical results corroborate our hypotheses that participation in land quota trading in general led to faster local economic growth, and that the trading had a stronger and more lasting impact on the economic growth of the quota buyers than on that of the sellers. The analysis suggests that in order to balance the competing goals of economic development and farmland protection, market-based land management tools have a good potential for further development in China and other countries confronting similar challenges.
Key Words: transfer of development rights (TDR), rewarded land conversion quotas (RLCQ), economic development, farmland protection

Session A2-2

Ukrainian Forest Policy and Forestry: What are the drivers of change?

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Abstract

Ukraine's forest policy is influenced by reforms in the national economy and by international forest policy developments. The country's forest sector is still in a transitional stage and has a huge potential for improvement in economic efficiency. Forest policy is strongly state-oriented and follows a top-down approach. Still, there is a lack of forest policy coordination, management control, forest planning, data collection and analysis. Previous administrative reforms in Ukraine have only partially settled the problems in the forest sector. Although market instruments have been increasingly applied and certification efforts have been intensified (under the pressure of the new EU Timber Regulation), there is still room for deliberately involving governmental, social and private sector stakeholders. The European Neighborhood Policy Initiative – Forest Law Enforcement and Governance Program has improved the forest governance system, the legal basis for policies, and strengthened regional collaboration. The major international forest policy event in Ukraine - UNECE-FAO Lviv Forum on Forests in a Green Economy (Sept 2012) -stressed that the forest sector can play a leading and exemplary role in the emerging green economy of the region.

Introduction.

Ukraine is the largest European country, covering 233,090 sq. mi. with GDP per capita $7,208. The population of Ukraine is continuously degreasing from 51.8 million people in 1990 to 45.6 million in 2012.

The area of Ukrainian forest found is 10.87 million ha, the forest coverage is 15.7%. Growing stock of wood is 1.8 billion m^3 and the annual wood increment – 4 m^3/ha.

Ukraine has five natural zones: Polissya, Forest Steppe, Steppe, Crimean Mountains and Carpathian Mountains. The role of Ukrainian forests is very important for ecosystem services delivering, in particular soil protection, water regimes regulation, creating more favorable microclimate conditions for agriculture (especially in the south region), recreation, and cultural heritage conservation.

Forest ownership.

Most of forests are State-owned and used by enterprises specializing on forest management. Small parts of forest (up to 5ha) may be permanently used by private owners (also long term lease possible – up to 49 years). The historical experience of private forest management is practically lost. Among permanent forest users, there are oblast (district) level councils, communities, agricultural enterprises. These forests mostly are small areas surrounded by agricultural land and forest belts. Economic activity in these forests is not enough efficient. Most wood-processing is privatized. Sawmills are distributed between State and private enterprises.

Ukrainian forests are managed by state enterprises mainly which belong to different ministries and agencies (Figure 1.)

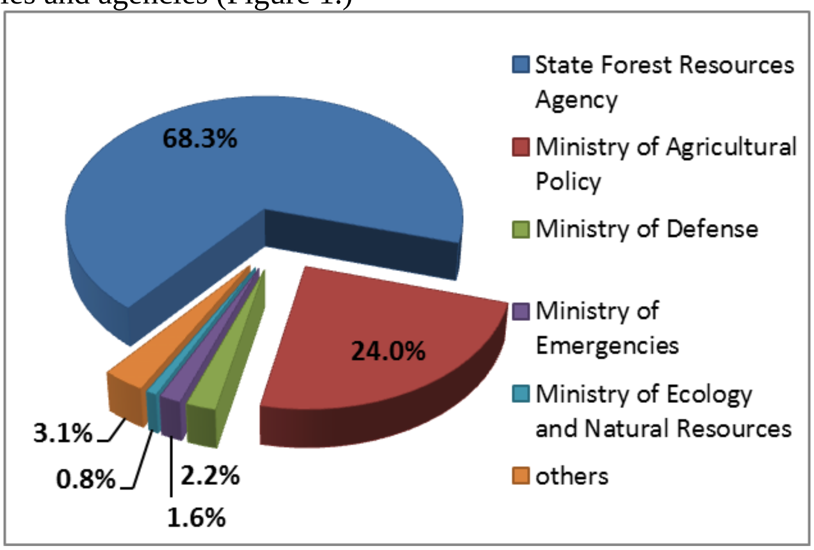

Figure 1. Ministries and agencies involved in forest management structure in Ukraine

The main objectives of the State Forest Resources Agency are:

- to implement the state policy in forest and hunting management, protection and conservation, sustainable forest management, regeneration of forest resources and game animals, to improve the efficiency of forest and game management;

- to administer, regulate and control forest and hunting management;
- to develop and implement the national, international and regional programs in order to protect forests, improve their productivity, sustainable forest management and reforestation, management and regeneration of game animals, development of hunting and forest management planning.

In Ukraine, while legislation defines state, municipal, and private forest ownership, in practice the state ownership predominates, with 66% of the country's forests managed by the departments of the State Forest Resource Agency. Forests land in Ukraine also can be in long term (up to 49 years) lease main purpose of which is use of forest land for recreation, tourism, sport, education, research or hunting with a term up to 49 years. The main problems of forest land lease in Ukraine are: social conflicts with local communities because of limited access to forests (fencing, bulging resorts, summer houses etc), investments aimed towards shadow privatization.

Although municipal ownership could be a basis for 'communityforestry,' and restoration of traditional uses of forest-related resources, the public has little role in forest-related decision-making. (Soloviy and Cubbage 2007) . Unlike countries in Central Europe, property restitution was not considered in Ukraine (or in other countries of the former Soviet Union) during the process of reforming forestry in the years following the breakup of the USSR. This was due to various historical circumstances in the different regions of Ukraine and the public's fear that forest management would not be sustainable in privatized forests. This, combined with a lack of private forestry skills in the private sector, has limited private forest ownership and management to very limited areas in the country. There is a need in Ukraine to conduct forest research, train foresters, and raise public awareness about the values of traditional nature uses and forest protection (Bocharnikov et al. 2012).

Forest management.

The annual harvest of Ukrainian forests is about 15 million m^3 (12 million m^3 by the State Forest Resources Agency). The technological process combines ground hauling and cable yarding by modern machinery: Ukrainian tractors LT-157, MTZ-82L, TTR-401, "Tayfun" equipped with Slovenian winch, MTZ-82.2 made in Belarus, LKT-81, LKT-120 made in Slovakia and TAF made in Romania. Among cable yarding systems the most popular are TL-4 and „Larix" made in Czech Republic. Forestry enterprises situated in plain territories use straddle trailers equipped with hydraulic manipulators "Veimer". The most popular chainsaws are those made by "Stihl", "Husqvarna" and "Motor-Sych".

Alongside with wood production forestry enterprises provide non-timber forest products and services -harvest of wild fruit, nuts, mushrooms, medicinal plants, tree sap removal, apiary management etc. The NTFPs are not used to the full extent, thus its management needs further development.

Low density of forest road network and its mostly poor technical condition causes low level of access to forest resources, poor conditions for forest workers.

In 2007 it was decided to expand the network of forest roads on a fundamentally new basis of European experiences with the roads design and construction (inventory of existing road network with GPS and GIS-technologies, development of a terrain model).

The main sources of damage for forests in Ukraine are shown on Figure 2.

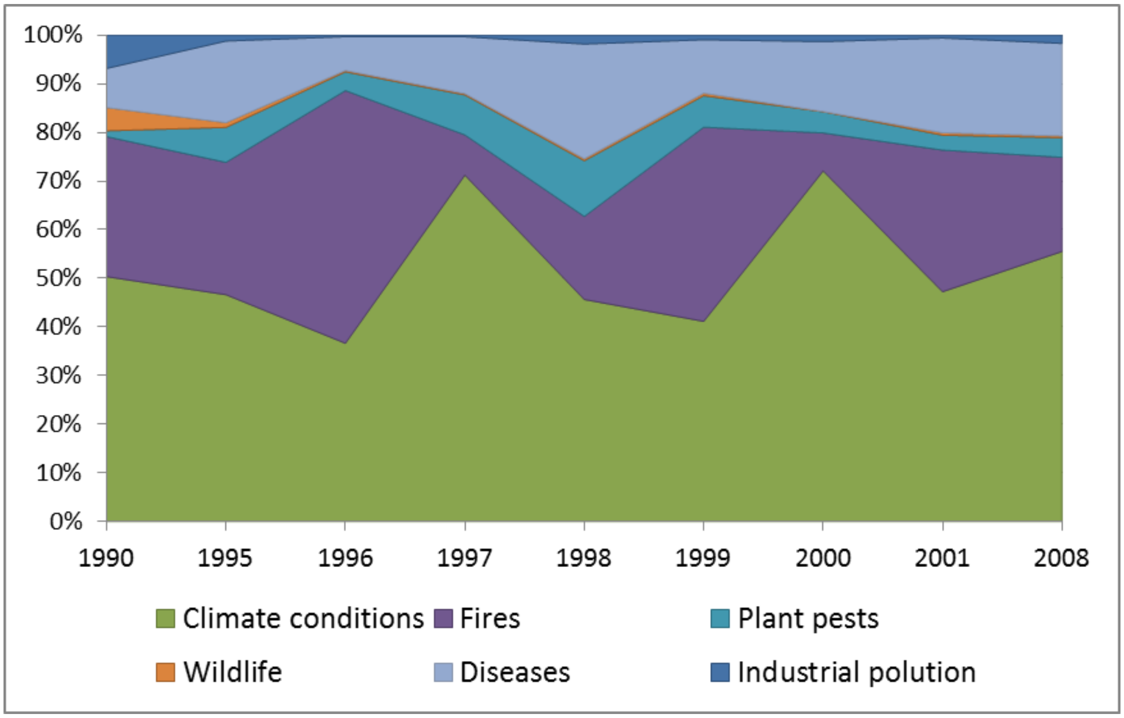

Figure 2. Main sources of damage for forests

The main afforestation difficulties in Ukraine are:

- Lack of long term financing. There are growing difficulties in long-term state financing of afforestation programs.
- Institutional weakness. Forest melioration operational units reduce its activity.
- Lack of incentives and land assess issues. Because of the privatization process in agriculture new forms of agricultural enterprises were created. New mechanisms for afforestation promotion (subsidies, grants were not introduced).

In order to accelerate and improve the process of local renewable types of fuel use Main Forestry office of Ukraine initiated the State program of using wood as hard biofuel. The forest industry level of consumption allow to use approximately 4 million m3 of wood suitable to be used for the production of biofuel. It can replace 1 trillion m^3 of gas by its energy value.

Forest law and policy trends.

According to Forest Code, 2006 forests of Ukraine primarily perform: watershed protection; protective function; sanitary and hygienic, health, recreational, aesthetic, educational, and other functions. Also forests are a source for satisfaction of society's needs in forest resources.

In Ukraine, a separate Forest Policy has not been formulated. Instead, the Forest Code of Ukraine, which is the main legislative document in Ukrainian forest management, defines the role of Ukrainian forests (Nordberg 2007, Global Forest... 2010): Ukrainian forests are national assets whose designated functions, depending on their locations, have predominantly ecological (water protection, conservation, sanitation, recreation), aesthetic, educational and other uses, the use and exploitation of which are restricted and subject to State monitoring and protection.

Forest policy in Ukraine is influenced by reforms in the national economy and by international forest policy developments. The country's forest sector is still in a transitional stage and has a huge potential for improvement in economic efficiency. Forest policy is strongly state-oriented and follows a top-down approach. Still, there is a lack of forest policy coordination, management control, forest planning, data collection and analysis.

Forestry in Ukraine has following financing sources - state and local budgets and means received from sale of wood, not wood forest products and services. Means from sales are directed to financing forestry production, development of resource base, implementation of social programs. Increased price for cubic meter of timber sold allowed to forest enterprises under responsibility of State Forest Resources Agency increase sales volumes in 2011 on 36% compared to 2010. Level of state financial support for forestry in Ukraine is around 15-30% in total forestry expenses (Ukraine Perspective 2012).

Previous administrative reforms in Ukraine have only partially settled the problems in the forest sector. Although market instruments have been increasingly applied and certification efforts have been intensified (under the pressure of the new EU Timber Regulation), there is still room for deliberately involving governmental, social and private sector stakeholders.

Among the problem areas of national forest policy are:

- Challenges of transition from command to market economy of the whole economy for forest enterprises and simultaneous decreasing of state budget financing for these enterprises (Synaykevych et al 2009).
- Nonconformity of national forest legislation to socio-economics and market transformations,
- The slower rate of economic and institutional reforms has held back the restructuring of forest management systems, in particular separation between forest management and commercial use of forests has not been achieved (Pachova et al. 2004).
- Governance relies on state authority, without properly functioning market incentives (Nijnik 2002).
- Reduced state wood-processing sector as consequence of disintegration of forest sector as a complex unit and grooving number of uncontrolled small sawmills,
- Sharp reduction of consumer demand on internal market of wood and large increase of volume of wood exported, especially of more valuable tree species,
- Discrepancy of forest management information systems to the modern requirements (Buksha 2004).

FSC certified forest area in Ukraine is 1.45 mln ha (13% of forests) and it's constantly increasing (specifically under the influence of the new EU Tiber Regulation which require to confirm legal origin of timber) but there are a lot of challenges of forest certification such us:

- low public level of awareness about what it really means that forests are certified;
- forest certification process is expensive and it didn't bring real financial benefits to the state forest enterprises as it was expected;
- marketing strategies should be introduced to get "green premium" from forest certification.

International Forest Policy Influences.

Ukraine is involved in international forest policy dialogue, particularly Intergovernmental and Pan-European processes of the forest sector development on the principles of sustainability, but implementation of international agreements needs to be sounder in practice. Also Ukraine ratified a number of selected treaties in the field of biodiversity conservation (European Landscape Convention (2005), African-Eurasian Waterbird Agreement (2002), Framework Convention on the Protection and Sustainable Development of the Carpathians (2004), Cartagena Protocol to CBD (2002), UN Convention on Combating Desertification (2002), The Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and Contiguous Atlantic Areas (Lopatin et al 2011).

The European Neighborhood Policy Initiative – Forest Law Enforcement and Governance Program has studied challenges of illegal logging, corruption risks in a forest sector and developed practical proposals towards improvement of the forest governance system, the legal basis for policies, and strengthened regional collaboration.

The major international forest policy event in Ukraine - UNECE-FAO Lviv Forum on Forests in a Green Economy (Sept 2012) - stressed that the forest sector can play a leading and exemplary role in the emerging green economy of the region.

The Lviv Forum on Forests in a Green Economy approved 10 key messages:

1. Capture the true values of forests.
2. Use all resources efficiently.
3. Be energy-wise.
4. Make jobs decent and green.
5. Address threats to forests.
6. Define governance principles and stick to them.
7. Update skills.
8. Innovate and build partnerships.
9. Cooperate across boundaries.
10. Make the case for the forest sector’s role in the green economy.

Recent Changes and Prospects.

The challenges to the sustainable development of forest and forestry include inadequate funds to support the SFM and combat illegal logging, as well as low incomes, unemployment and job loss, limited educational possibilities and depopulation in rural areas. Some of these factors decrease forest productivity, which in turn, compromises watershed functions and the stability of fragile mountain ecosystems. Other important problems include pollution, unsanctioned land acquisition and unregulated development of recreational areas by outside business concerns which ignore local cultural traditions, including traditional landscape planning and land use systems. The new forest sector policies should be consistent with the dynamics of a market economy, the values of democratic governance, and the principles of biodiversity conservation and sustainable use of natural resources. The number of activities should be focused on the conservation of the globally significant biodiversity, reach cultural traditions and improving socio-economic situation by transforming forestry and land management practices more flexible and adaptable level of a market economy (Nijnik et al 2007).

The main institutional changes in Ukraine for last few years are:

- decreasing the status of the forest sector – from Committee to Agency;
- changing the priorities – from “State Forestry Committee” to “State Agency for Forest Resources”;

- changing subordination – from Ministry for Environment and Natural Resources to Ministry of Agriculture and Food;
- changing the top management (political appointments).

In close future Ukrainian forest policy needs first of all decentralization of the sector's administrative and financial system of management by transmission of the decision making rights from central level of authorities to the regional level and local level. Also such policy needs more rights to select the effective forms of forest land tenure, harvesting and silvicultural technologies, forest management organization to the State forestry enterprises (Table 1).

Table 1. Policy measures towards forest sector institutional transformation

Aspects	Blocks	Policy measures
Economic	*Market oriented reforms*	Economic liberalization Ownership diversification (incl. privatization) Property rights legislative guarantees De-monopolization Investment climate improvement
	Decentralization	Financial decentralization
Environmental	*Greening of the sector image*	Eco-certification Commercial markets for environmental services (carbon dioxide, biodiversity etc.) Environmental management system Eco-marketing for forest products
Social	*Democratization*	Access to information Policy openness and transparency Public involvement
	Decentralization	Administrative decentralization Respect for local communities

The future Ukrainian forest policy must be more comprehensive and foresee the integration of biodiversity conservation policy, climate changes policy, energy policy, land use planning policy, international trade policy, and participatory and community building policy.

One of the main challenges is to create effective institutional mechanisms for the involvement of all stakeholders in the planning and decision-making process. Implementation of forest policy should use the advantages of green economy new course initiative. Good governance, participatory policy, transparency, rent distribution that support local socioeconomic development, and SFM are core tools for forest resource conflicts prevention. Participatory forest policy can serve for conflict resolution and for transformative purposes as tool for improving the lives of people, fairness and balance.

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Session A2-3

Money for Signatures or Signatures for Money: An Empirical Analysis of the 2007 Tree Act

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Abstract

Political scientists and economists have long been interested in whether interest groups use money to influence election outcomes and/or legislative voting behavior on congressional floor votes. This study extends these two threads and attempts to uncover whether forestry interest groups intend to use campaign contributions to influence another important legislative process—the sponsorship and co-sponsorship of congressional bills. The purpose of this study is twofold. First, I relate the co-sponsorship to a bill important to the contributing interest groups to campaign contributions received by legislators from the interest groups in the immediately past and current election cycles. Second, I analyze the timing of campaign contributions and correlate them with co-sponsorship of the bill. Third, I identify when and how much the payment for co-sponsorship is delivered. I use the Tree Act of 2007, a tax relief bill that only benefits the forestry sector and that is the only bill significant to the forestry interest groups in the 110th Congress, as a test case. My cursory findings suggest that legislative interest groups do behave strategically with respect to specific legislation and reward congressmen for behavior other than floor votes.

Session A2-4

Defining Forest Sustainability within Regional Wood Basin Analysis

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Abstract

The definition of forest sustainability concerning regional wood basin utilization/feasibility studies is often limited to discussions of current growth/removal (GR) ratios. There is little research, however, in the dynamics of such ratios and their appropriate use as sustainability metrics. In addition, the definition of sustainability in regard to regional wood basin analysis is currently being interchanged with the definition of sustainability found within forest certification schemes which may not be appropriate.

Recent findings indicate that over time, periods of low G/R ratios are followed by periods of high G/R ratio (Sheffield, 2012 SOFAC). This suggests that the use of a static, one point in time G/R ratio may be inappropriate for determining future sustainability. More specifically, over time, the G/R ratio appears to have a negative, cyclical relationship suggesting other forest inventory variables such as forest type, age class distribution, and timberland ownership appropriate for inclusion in analysis of sustainability of regional wood basins.

Additional research investigating the relationship between the G/R ratio and its components over time and space suggest the G/R ratio is mixed, depending on the time scale involved. Also, variations in space explain more of the overall G/R ratio than variations in time (James 2013). Their research, which examined the relationship between the G/R ratio and its individual components over time, found neither growth nor drain to dominate the dynamics of the G/R ratio. This suggests other variables significant for consideration and analysis of sustainability.

These current studies suggest that the use of current negative G/R ratio as a negative indicator of regional forest sustainability is inappropriate if used to assess long-term sustainability. Likewise, the lack of dominance of either growth or drain in the dynamics of the G/R ratio would suggest the inclusion of other forest inventory metrics in the measure of sustainability. The objective of this paper is to examine possible methods to do so, as well as the appropriateness of using a forest certification definition of sustainability in forecasting regional timber supply.

Session B2-1

Projecting county harvests using historical county production and macro-economic variables

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Abstract

The question of expected volumes of timber supply and demand has received significant attention in the literature. However, most research in this area focuses on long-term equilibrium analysis applied over large geographic areas. The question of expected timber production for smaller areas, such as a county, remains less documented. Yet, forecasts of county timber production can provide planning information useful to forestland owners, managers, and mill procurement agents. The following research explores forecasting of county roundwood pulpwood production with panel vector autoregressive and spatial dynamic panel regressions. The analysis used timber products output data collected by the USDA Forest Service Forest Inventory and Analysis for the state of Florida, together with a set of macro-economic variables. Overall, the panel specifications significantly reduced the forecast error, with some counties exhibiting over 50 percent reduction in forecast error. Results reveal the high degree of uncertainty associated with projected volumes of county production and support the need for analysis with disaggregated data to better capture the dynamics across counties.

Session B2-2

Rail Connection Viability for the Forest Product Industry in Southeast Mississippi

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Abstract

Mississippi State University and the University of Southern Mississippi evaluated the potential benefits and constraints related to establishing a rail line connecting Waynesboro and Lucedale in southeast Mississippi as it related to the forest products industry. The Mississippi Institute for Forest Inventory (MIFI) has documented a substantial forest resource to support current and new wood material-based industries in the region. Researchers conducted surveys and interviews of companies and regional experts to develop data used for economic impact modeling. The economic impact analysis was completed using both Regional Economic Models, Inc. (REMI) and Economic Modeling Specialists, Inc. (EMSI) models. Results indicated the new rail line will help the region be more competitive in attracting wood pellet and chip mill facilities, particularly if the Port of Pascagoula develops a new wood pellet handling facility. Improved freight connections would also help existing forest products industry, but these facilities would likely remain dependent on trucking for most shipments. Projected economic impacts were driven by three new potential industries with estimated investments of $165 million or more, creating over 1,000 construction-related jobs and providing over a $90 million stimulus to personal income in the region. These new investments, and lowered transportation costs of $10-12 per ton, will lead to the creation of an additional 218 permanent direct jobs and 123 secondary jobs resulting in over $1 million of additional annual state tax revenues by 2025. If successful, the rail connection has the potential to foster the competitiveness of the forest products industry in southeast Mississippi by providing efficient connections to the Port of Pascagoula and other destinations.

Background:

The Rail Association of East Mississippi (RAEM) proposed establishing the East Mississippi Intermodal Rail Corridor, a 56 mile rail line connecting Waynesboro and Lucedale, Mississippi. An earlier study by the Tioga Group (2010) proposed that the forest products industry would be the driving force for this rail line. To apply for additional public funding to establish the rail line, RAEM needed information in regards to southeast Mississippi as it related to the industry outlook for forest products generated, particularly as related to the bioenergy industry; an industry outlook for traditional wood products, wood processors, and wood producers; the major markets for wood products generated and modes used for shipping those goods; the economic benefits which could be bestowed on the forest products industry with access to short-line rail service, giving them more direct access to ports along the Gulf of Mexico and to Class I rail carriers; and rail access potential that could lead to an expansion of existing wood products-related industries and how rail access might encourage new forest industries. The Forest and Wildlife Center (FWRC) at Mississippi State University (MSU) and the University of Southern Mississippi's (USM) Department of Economic and Workforce Development and Center for Logistics, Trade, and Transportation developed a forecast analysis of potential usage and resultant economic impacts from this proposed rail line to answer these questions.

Methods:

To develop the necessary data and assumptions concerning how a railroad operation would benefit the region, the study team relied on interviews with key stakeholders to develop the required data necessary to adjust input-output models to estimate local economic benefits. The study area included Clarke, George, Greene, Jackson, Jones, Lauderdale, Perry, and Wayne Counties in Mississippi along with Choctaw and Washington Counties in Alabama (Figure 1). Forest industry representatives from the study area were surveyed in person for approximately 30 minutes each. In some cases, surveys were left with representatives to complete and send back to the FWRC. In addition to forest industry representatives, a number of other stakeholders (i.e., government officials, economic developers) were interviewed in person by USM. The economic impact analysis was completed using the Regional Economic Models, Inc. (REMI) and Economic Modeling Specialists, Inc. (EMSI) models. These models develop economic forecasts for job creation, wealth creation, and other related metrics based on assumptions. REMI uses a dynamic model of the entire regional economy. It includes hundreds of equations that describe cause-and-effect relationships in the economy. Whereas EMSI uses an input/output model which involves the flow of products from each industrial sector (i.e., the producer) to each of the industrial sectors considered as consumers.

Interviews and surveys, supplemented with secondary research, were used to gather data on direct projections and the models were then utilized to determine indirect projections. Direct projections included volume of wood product movement via rail along the proposed corridor; emerging markets and projected volumes for wood products from the region; operational and logistical requirements for the industry; potential impact on production costs (i.e., lower transportation costs for inputs, lower transportation costs for finished goods) for the forest product companies in the region; potential number of wood hauling trucks and road distance displaced if the new rail line was established; potential number and sizes of projected company expansions; and potential number and sizes of new wood products companies attracted to the

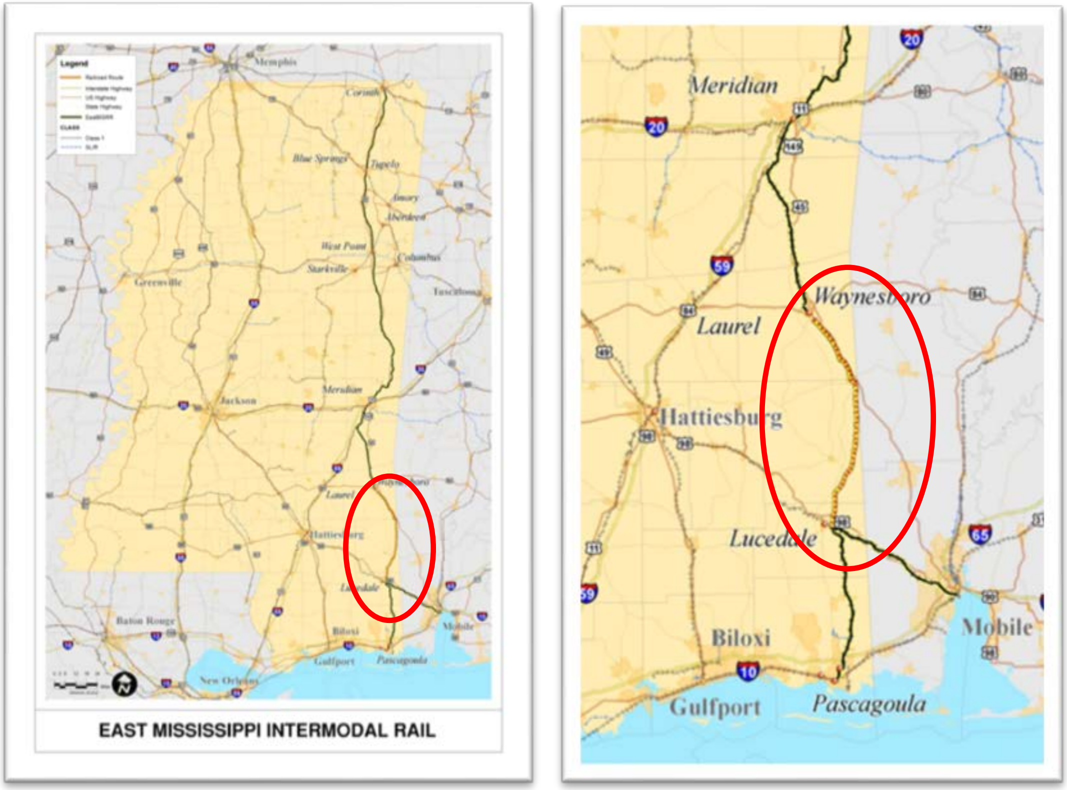

Figure 1: The proposed East Mississippi Intermodal Rail line linking Waynesboro and Lucedale, Mississippi.

area. Indirect projections included total economic impacts in terms of output, jobs, and wages; and state government fiscal impacts.

Results and Discussion:

Numerous forest industry facilities in the region closed in the recent past due to tough economic conditions. Of the 25 facilities in operation, seven completed a survey for a response rate of 28.0%. However, a number of forest industry representatives were unable, unwilling, or forbidden to provide detailed answers to the survey because of company policies and procedures. As expected, all seven mills receive 100% of their raw materials via truck shipments. Of the 25 mills in operation, only 10 have a rail spur directly into their facility. Only two forest industries indicated they currently use rail to deliver their final products to customers. One industry indicated that only 10% of their domestic shipments were via rail while the second indicated that approximately 65% of shipments were via rail.

Primary reasons given for not using rail were lack of availability, timing issues, and that market conditions and shipping rates dictated use of trucks. One representative indicated he checks shipping rates for truck and rail transportation on a daily basis and that the majority of times trucking was the least expensive alternative. However, when shipping distances exceed 500 miles, he indicated that rail was the preferred method. Three of the seven firms indicated they exported finished products (only two use rail for shipping) while the majority deliver finished products within the eastern and central portions of the U.S.

Rail transportation had limited use by forest industry within this region primarily because there was poor access to a rail line. The two firms that use rail have direct access and indicated they used rail because rates for longer distances eliminated the use of truck transportation. One firm indicated that the ramp or spur they use was very busy and affects the time it takes to process their shipments. One firm indicated they would be willing to ship via rail if it connected with Norfolk Southern's Crescent Corridor line. Four others indicated that a local access, or intermodal facility, within 20 miles would increase the odds their company would use rail. However, they also stated it would depend on costs to ship via rail. In general, existing and new industries would need access to the rail link via an intermodal facility or direct rail access from their facilities.

All firms indicated that transportation costs were a major competitive issue for forest industry. A major concern for company representatives was costs associated with having rail access and how much it would cost to ship via rail. It was evident that firms not in close proximity to a rail line were not as willing to consider using rail for shipments, stating they would still have to use truck transportation to access the rail line. Another concern of forest industry was the timely delivery of materials to their customers. Several indicated they were not certain rail shipments would be timely enough to meet their customer demands.

The majority of forest industry representatives indicated there was potential to attract new forest industries to the region if the rail line was established. However, only four thought it would lead to current forest industry expansions. Of note, the potential advent of biomass for energy was not paramount in their thought processes.

South Mississippi's non-forestry stakeholders are collectively supportive of the proposed short-line rail project. There were several themes throughout the interviews that led to the inference that stakeholders believe in the positive impacts the rail extension would provide to their respective region. Some individuals and groups believe specific transportation savings would occur, while others were unable to accurately calculate savings. In addition, most stakeholders could foresee that various industries both inside and outside forest industry sectors could and would be recruited to their areas if this railroad link was established. Many key stakeholders stressed the importance of the forest industry to this region. Several key stakeholders also indicated that the rail line would help their area in current efforts to recruit wood pellet plants as well as chip mills. The growth of interest in the region for wood pellet plants was being driven by demand from Europe so efficient access to seaports was a major site location factor.

A common theme or issue brought up in many stakeholder interviews was poor access to the Port of Mobile's Theodore Terminal and the Port of Pascagoula. Alabama has not improved its section of Highway 45 that connects the region to the Port of Mobile and railroad connections are not efficient. Current rail access does not allow trains to have direct access to the Port of Pascagoula from the RAEM region due to the lack of a rail link. Today, these shippers are forced to take alternate routes to go around and down to the Ports for shipping. With the proposed rail line, these counties would avoid the detouring that ultimately raises their transportation costs. In addition, the Port of Pascagoula was cited for its potential opportunities for wood product exporting because the Port can accept non-containerized products whereas the Port of Gulfport is focusing on containerized traffic. The Port of Pascagoula is planning to add facilities to handle 500,000 to 1,000,000 tons of wood pellets per year. Ten million dollars of the $30 million project cost will be funded by a state bond issue. The port and primary user will provide the remainder. This new facility would make the Port of Pascagoula more attractive to wood pellet manufacturers shipping overseas. This makes the proposed rail line even more desirable to these stakeholders.

Holistically, the project is viewed as positive and productive as stakeholders see it as a utility that could create economic development. Stakeholders have particular interest in biomass industries and have continued to recruit such industries to their respective regions. It is believed that the short-line railroad would help recruitment efforts of biomass industries and other related industries due to transportation cost savings and access to other major rail lines. A consensus 7 to 10% cost savings in general is expected for most counties and industries if a majority of products currently shipped by truck were transferred to rail. There is great potential for other industries to be recruited that are related to the wood products sectors, as cited by a number of stakeholders.

Based on interviews, there is not expected to be any net reduction in truck usage that would result in lower carbon emissions, energy efficiency, lower road maintenance, and highway safety. Any displacement in trucks hauling wood products from the region would be made up for by trucks serving new facilities that are projected to be attracted to the region. A major issue that was uncovered concerned the interconnections between the short-line railroad with the port rail as well as with major Class 1 railroads. Because of numerous connections, it may become too costly for most industries to ship products via railroad.

The supporters of the rail line envisioned that the new rail line would rely heavily on woody materials, primarily targeted at the emerging bioenergy industry. According to the April 2012 Forisk Consulting Wood Bioenergy Report, the projected annual wood demand in 2022 for the South would be 61.2 million green tons of woody materials. They also projected a total of 143 bioenergy facilities located in the southern U.S. More specifically, there is potential for 42 electric, 22 combined heat and power (cogeneration), 10 thermal, 21 liquid fuel, and 48 pellet plant facilities to be in operation by 2022. Timber Mart-South (2012) suggested that U.S. biomass cogeneration projects compete with other fuel alternatives which have seen their costs decrease the first quarter in 2012. This makes biomass cogeneration projects economically less appealing compared to other fuel sources. In addition, biomass transportation fuel projects must successfully switch from the success of laboratory tests to large-scale commercial production before it will be an economically viable alternative (Timber Mart-South 2012). Biomass still remains uncompetitive with other fuel options at this time.

The major demand for wood pellets originate from foreign countries, primarily Europe and the Far East. European demand is estimated to be 25 million tons through 2020 with projections of it reaching 100 million afterward. This demand is there because European utilities are required to meet government carbon emissions standards for their coal-burning plants that U.S. utilities are not currently required to meet. The Far East market is developing and projected to demand up to 15 million tons by the mid-2020s. Timber Mart-South (2012) indicated that U.S. pellet production is still dependent on European markets. This demand could slacken in three to five years if, as some industry analyst claim, European pellet imports from Africa, South America, Russia, and Asia become cheaper than those from the U.S. or Canada (Dorminey 2012). In addition to the foreign markets, the U.S. market will continue to grow as more companies and homeowners switch technology for heating their businesses and homes. Additionally, if an updated U.S. Federal Renewable Energy Standard is approved, the domestic demand for pellets will substantially increase. This is expected to also increase the demand for U.S. bioenergy producing facilities. Thus, wood pellet markets from Mississippi have been growing, but numerous factors could significantly impact where wood pellets would be shipped.

Based on the production of existing and projected wood pellet and bioenergy facilities that would potentially use the proposed rail line along with the rail-car capacities, there is potential to move 4,500 carloads per year via rail. Based on construction of three additional facilities (2 pellet and 1 chip mill) producing 150,000 tons per year per facility, another 5,475 railcars would be needed to transport the pellets and/or chips. While the bioenergy sector is believed to be the driving force for the proposed rail line, the traditional wood products sector must also be considered for this link. The proposed rail line will see little use from the existing pulp and paper industry as the current pulp and paper industry is already serviced by existing rail lines. Based on rail-car capacities and forest industry survey responses, it is estimated that from the current traditional forest products companies with potential direct rail access to the proposed rail line, 20% of forest products produced will be shipped via rail on the proposed rail link. This would result in 2,433 rail cars per year via the proposed rail line. The rail usage from pellets, wood chips, and traditional wood products totals 12,408 carloads per year which is below the Tioga study estimates of 15,000 rail carloads of forest products (Tioga 2010). However, if capacity driven production rates surpass 20%, as indicated by some industry advocates, carloads could surpass 15,000. In addition, if the housing market rebounds and trucking costs increase substantially in the future, rail usage may increase. However, at this current time, traditional forest products industries rely on trucking to reach the majority of their customer base which is located within a 500 mile radius of their facilities.

The establishment of a railroad link can improve economic competitiveness and resulting economic impacts of forest product companies in a number of ways including lowering production costs (i.e., lower input transportation costs, lower finished goods transportation costs), enabling company expansions, and attracting new forest product companies to the region. Based on the economic impact analysis using EMSI/REMI, the establishment of a rail line connecting Waynesboro and Lucedale, Mississippi that provides competitive rates for moving forest products more efficiently to the Port of Pascagoula could lead to the creation of 218 new direct jobs in the forest products sector paying an average salary of $44,321 each and another 123 indirect jobs by 2025. This would result in an estimated $883,944 annual increase in state tax revenues. There could be as much as $165 million in new investments attracted to the region and this could create over 600 temporary construction-related jobs. This forecast is based on two major predicted changes to the forest products industry derived from surveys and interviews. The first is a potential reduction in production costs due to lower transportation costs and the second is due to the potential attraction of new industries to the region.

According to MIFI data, a total of 175.4 million tons of standing timber is available in the RAEM region which could support three additional biomass facilities. The region currently grows 2.11 more tons/year than it harvests annually. Presently, it should be noted that the majority of materials the pellet and other bioenergy plants primarily use are by-products of other forest industry mills (i.e., saw dust, wood chips). Given this information, it could be possible for up to five plants to locate in the area. However, a conservative estimate is that three new facilities could be attracted to the RAEM region.

Through conducting two economic analyses with REMI and EMSI, both programs delivered similar results. Because EMSI does not have a time dimension available, it is difficult to adequately and accurately compare the two analyses. Thus, employment numbers were broken down in the REMI results to attempt to compare to the EMSI numbers. By breaking down the construction and post-construction phases of the economic analysis with REMI, it was noticed that job creation during the construction phase amounts to approximately 1,153 jobs on average, while post-construction phase jobs amount to roughly 324 jobs on average. The EMSI long-term impact, or post-construction phase, shows 303 jobs created verses REMI's 324. The short-term job creation for EMSI shows approximately 1,427 verses REMI's average of 1,153.

Conclusions:

The construction of the rail line would have a significant economic impact to a region of the state that needs economic assistance. The region currently has close to a 10% unemployment rate with 13,045 people unemployed. It is estimated that an efficient rail connection to the Port of Pascagoula will create over 300 direct and indirect permanent, well-paying jobs in the economy and improve the competitiveness of companies in the region. Over 1,000 construction jobs will be supported during the construction of the railroad and the anticipated new facilities to export wood chips and pellets. State revenues from the forest industry jobs are expected to bring the state over one million dollars in annual additional tax revenue based on the REMI model.

Customers frequently do not understand the process of shipping via rail. Often times they come to the process with unrealistic expectations that are either based upon trucking experience or other transportation modes. The short-line and other railroads have in recent times made concerted efforts to explain rail service to new customers to prepare them for the realities of shipping by rail. Additional outreach and education on behalf of the RAEM would be needed to further enhance the viability and potential usage of the proposed rail line.

The proposed rail line if connected to the Mississippi Export Rail could provide efficient access to the Port of Pascagoula. It is imperative that economic developers, railroad officials, and members of RAEM work together to make the process as efficient and economically viable for all businesses wanting to ship products via rail from their facilities to the Ports. Part of this can be accomplished through reasonable trackage right rates and transfer fees.

The success of railroads depends upon having a large changing customer base preferably representing as many different industries as possible. Based on the study of the forest industry it is apparent that expansion into other sectors is important for the success of the rail link. Other industries beyond wood and paper in the region include poultry, oil and gas, chemical and potentially other related industries which could grow from those industries. Similar education and outreach as described for forest industry would also be applicable here.

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Session B2-3

Capacity of southern mills to utilize woody residues for bioenergy production

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Abstract

Production of wood-based bioenergy has been playing an increasingly important role in diversifying energy sources, increasing energy security, lowering energy costs, and decreasing environmental impact related to carbon dioxide emissions. Mills have been utilizing woody residues for heat, electricity, and extraction of chemicals for a relatively long time. However, it is not clear if mills have capacity to increase production of bioenergy beyond their needs. The goal of this study was to determine technical and financial feasibility of utilizing additional quantities of logging residues by mills for production of bioenergy. The study surveyed 2,138 mills located in Southern United States using five mailings. The survey collected information on mills' production profiles, sources of woody residues used by mills, mills' capacity to utilize or recycle woody residues and waste, rates of woody residue utilization for electricity, woody residue gate prices, feasible hauling distances, and implemented bioenergy-related upgrades.

Session B2-4

Valuing a Timber Harvest Contract as a High-Dimensional American Call Option

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Abstract

In this study, we treated a 3-year timber harvest contract on a 30-year-old loblolly pine plantation as a high-dimensional American call option and calculated its value by the leastsquares Monte Carlo simulation technique. The estimated values of such a contract ranged from $1,693/ac to $1,984/ac under two timber price assumptions. With reasonable starting timber prices and strike price in the simulation, random timber prices led to higher contract values. Results from this study can help private landowners, timber brokers, and forest products companies better manage their business risks.

Session A3-1

Predicting Family Forest Certification Status from Forest Stewardship Plans in Arkansas

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Abstract

In the United States South, there are 4.9 million private ownerships that control 188 million acres of forestland. A relatively small percentage (5-10%) the ownerships have written management plans which include approximately 40% of private forests. In Arkansas there are 18.4 million acres of forestland of which 58% is owned by individuals and can be classified as family forests. The Arkansas Forestry Commission in 2008 had written 4,023 Forest Stewardship Plans (FSP) that included 689,000 acres of family forest. As of 2008, 889 of these plans had been certified (22%) covering 219,386 acres of forest land (32%). Certification of FSPs in Arkansas indicates significant implementation of the forest plan and is therefore an important component in achieving desired improvements in landowner objectives. FSPs from calendar years 2001 to 2005 were sampled for common characteristics. Binomial logistic regression was used to explore the relationships between certification and the independent variables. A statewide and two regional models were developed from the dataset. The results suggest that FSP implementation and certification is more likely when a state forester writes the plan rather than a private consultant. The presence of pine and pine-hardwood forest cover types in a family forest also increases the likelihood of certification, while the presence of hardwood forests actually has a negative impact on implementation and certification in Arkansas.

Session A3-2

Factors Influencing Nonindustrial Private Forest Landowner Willingness to Grow Short-Rotation Woody Crops for Bioenergy in Mississippi

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Abstract

Nonindustrial private forest (NIPF) landowners own over 70% of forest lands in the southeastern U.S. and are important to emerging biomass-based fuel and energy industries. Estimates of potential biomass supplies serving as inputs to biomass fuel and power generation would be misleading without having knowledge of NIPF attitudes and willingness to convert land to short-rotation woody crops (SRWC). Previous supply side research assumes NIPF landowner participation in emerging biomass markets without fully analyzing their attitudes, preferences, or concerns about woody biomass. Understanding whether or not, and how much land, NIPF landowners are willing to divert to SRWC is critical for estimating woody biomass supplies for biofuels and bio-power generation. Our study focuses on landowners in Mississippi and the lack of knowledge about their attitudes and concerns on this issue. The overall study objective was to contribute to a better understanding of the nature of biomass supplies from NIPF landownerships by: 1) classifying NIPF landowners based on their awareness of the significance of SRWC to produce biofuels and bio-power, and estimate the proportion of landowners willing to grow SRWC, and 2) estimating land area potentially available for SRWC, and determining the relative significance of the underlying factors. A mail survey was administered to 2,000 NIPF landowners across Mississippi who own at least 75 acres of land. Resulting data were extrapolated to the Mississippi forest landowner population. Results will determine the areal amount landowners are willing to convert to SRWC for bioenergy in Mississippi. This assessment of NIPF landowners provides information needed for estimation of the potential woody biomass supply. This information is valuable to wood products firms interested in investing in Mississippi, will guide the development of outreach SRWC publications and programs, and gleans insight into additional research needs relative to biomass supplies and landowner inclinations.

Introduction

Society, as a whole, is looking for alternative energy sources due to concerns over dwindling fossil fuel reserves and security concerns over fuel suppliers. With nonindustrial private forest (NIPF) landowners making up such a large component of the landownership, they could be an important feedstock for the emerging biomass-based fuel and power industry. By having NIPF landowners focusing on short-rotation woody crops (SRWCs), or trees intensively managed to obtain maximum yields in minimal periods, any food source competition for energy that could arise from utilization of agricultural crops would be mitigated to some extent. Additionally, SRWCs provide renewable energy feedstocks with adaptability to where they can be strategically placed in the landscape to conserve soil and water, recycle nutrients, and sequester carbon (Zalesny et al. 2012).

Estimates of potential biomass supplies could be misleading without having knowledge of private landowner attitudes and willingness to convert land to SRWCs. A clearer understanding of how much land NIPF landowners would be willing to divert to SRWCs will be utilized to better estimate potential biomass supplies in Mississippi. By determining landowner preferences about SRWCs and predicting future forest land use patterns involving SRWCs, Mississippi landowners will be better served by having access to this new information. Depending on the relative profitability of SRWCs in comparison to other land uses and landowner confidence in biomass demand, land use patterns may shift. These shifts are likely to vary across different types of landowners due to individual reasons for landownership. A variety of factors may influence NIPF landowner willingness to divert land to SRWCs. Factors could include size of landownership, perception of market risk, conflicts with other land uses and implied opportunity costs of growing SRWCs, location of bioenergy facilities, and barriers of a technical, financial, or informational nature. By achieving a better assessment of NIPF landowner concerns, Mississippi researchers, bioenergy industry stakeholders, landowners, communities, and policy makers can take steps to encourage greater strides toward renewable energy and energy security.

This study will focus on Mississippi landowners because of a lack of knowledge of landowner attitudes and concerns on this issue in the state. The overall study objective is to contribute to a better understanding of the nature of biomass supplies from NIPF landownerships by:

a) classifying NIPF landowners based on their awareness of the importance of SRWCs to produce biofuels and bio-power, and estimate the proportion of landowners willing to grow SRWCs,
b) estimating land area potentially available for conversion to grow SRWCs, and determine the relative significance of the underlying factors, and
c) analyzing NIPF landowners concerns about reliability and security of markets for biomass, conflicts with other land uses (e.g., livestock, pasture, use of marginal lands), and barriers to conversion (e.g., technical, informational, and financial needs).

Literature Review

Many studies have analyzed availability of biomass from forest lands, its impacts on regional economics, and implications of diverting agricultural and forest lands to SRWCs for commodity prices and consumer welfare. In fact, Sullivan and Amacher (1999), Perez-Verdin et al. (2008), Grebner et al. (2009), Raneses et al. (1998), and Ugarte et al. (2007) all focused on the economic impacts of conversion and industry growth and showed the potential market available for SRWCs. Landowner willingness and motivation to convert were not the focus of previous studies and concern for this oversight has emerged as a few studies have begun to evaluate NIPF landowner willingness in southeastern U.S. states. Jensen et al. (2007) analyzed Tennessee forest landowner attitudes, willingness, and motivation to divert their lands to SRWCs. Joshi and Mehmood (2009) performed a study of 1,600 randomly selected landowners from Virginia, Florida, and Arkansas and their willingness to supply woody biomass. Paula et al. (2011) conducted a mail survey of landowners in Lee County, Alabama with at least 20 acres of land to assess their willingness to convert land for biomass. Though these studies aid researchers, bioenergy industry stakeholders, policy makers, communities, and landowners to better understand attitudes, concerns, and willingness of some NIPF landowners in the southeastern United States, more research is needed especially in Mississippi.

It is rather evident that SRWCs could be beneficial to local economies and provide adequate profit to allow for growth. Studies are now focusing on who will supply SRWCs for bioenergy production, and our focus on Mississippi will allow for better insight into a potential feedstock provided by private landowners. Specifically it will contribute to a better understanding of the nature of biomass supplies from NIPF landowners by estimating willingness and conversion concerns.

Methods

Due to the diverse, yet related, study objectives a variety of descriptive and analytical statistical methods were utilized. Requisite data generated from a mail survey of Mississippi NIPF landowners was used to classify individuals, estimate potential land availability for conversion, and analyze landowner concerns. This survey was distributed among faculty members to pre-test the questionnaire for clarity and omissions of content, and then the survey was refined accordingly. To increase the response rate, the survey consisted of five mailing contacts (Dillman et al. 2008) including an introductory letter describing the study, a cover letter included with the first questionnaire, a thank you/reminder postcard, a second cover letter with replacement questionnaire, and a third cover letter with replacement questionnaire. Questionnaires were completed and returned in the provided self-addressed, stamped envelopes.

To extrapolate the research findings to the Mississippi forest landowner population, the resulting data was tested for non-response bias and representativeness. This process was performed by comparing the first sets of responses to later responses and assessing any differences. The later responses were assumed to be harder to obtain and, therefore, more like the responses of the non-respondents. If differences had arisen, additional contact with landowners who did not reply could have allowed for insight to establish a more clear representativeness.

Participants for the mail survey were selected from a list of all landowners from Mississippi's 82 counties with a substantial amount of land, at least 75 acres, to allow for a larger land base and, therefore, a higher willingness to convert any unutilized land. This list was obtained through a database available at the Forest and Wildlife Research Center, Mississippi State University. From this master list, 2,000 NIPF landowners were generated by extracting every 16th name from the list. This ensured a random pool of landowners from every county in Mississippi.

Within the questionnaire, landowners were asked to state on a scale of 1 (very familiar) to 3 (not familiar) the amount of familiarity they possess to producing alternative fuels from wood and growing SRWCs. Collected information in conjunction with socio-demographic characteristics of landowners (such as age, gender, highest level of education, current residence, community involvement, household income, and percentage derived from land activities) will serve to classify them into homogenous clusters using cluster analysis. These clusters will be distinguished as Mississippi regions, which supplemented previous research on woody biomass supplies from other sources in Mississippi.

Landowners provided information on their acreage in various land uses (e.g., pastureland, forest land, agriculture). Landowners were asked to specify the proportion of this land potentially available for SRWC production without conflicting with other land uses. Any omissions concerning individual land categories were assumed to be zeros allowing for a more precise calculation of landowners' perceived availability for conversion and accurate values for percent calculations and projections. Land available for growing SRWCs ranged from 0 to 100%, so a two-limit Tobit regression (Long 1997, Maddala 1983) will be used to explain how the percent of land potentially available for SRWCs varies in response to changes in important factors. Some of the factors expected are land productivity and location, landowner socio-demographic characteristics, and technical, informational, and financial constraints faced by landowners.

Estimation based on the two-limit Tobit is appropriate because it constrains the predicted percentages of the land base to lie between 0 and 100%, and yields unbiased and consistent parameter estimates. Following Fernandez-Cornejo et al. (2001), the model is formalized as:

$$y_i^* = \beta' x_i + \varepsilon_i \qquad i=1,2,\ldots\ldots N \qquad \text{Eq. 1}$$

where y_i^* is a latent variable representing landowner willingness to convert land to SRWCs; x_i is a vector of independent variables influencing landowner willingness; β is a vector of unknown parameters; and ε_i is a disturbance term assumed to be independently and normally distributed with zero mean and constant variance. Denoting y_i (the % of acreage on which the SRWCs will be grown) as the observed counterpart to the latent dependent variable, their relation can be compactly written as:

$$y_i = \left\{ \begin{array}{lll} 0 & if & y_i^* \leq 0 \\ y_i^* & if & 0 \leq y_i^* \leq 1 \\ 1 & if & y_i^* \geq 1 \end{array} \right\} \qquad \text{Eq. 2}$$

Last, landowners were asked to respond to a set of questions addressing their concerns about secure demand for biomass, SRWC conflicts with other land uses, and other barriers (e.g. technical, financial and informational) to growing SRWCs. Responses were invoked on a Likert scale of 1 to 5 with 1 (not concerned), 3 (concerned), and 5 (very concerned) and related to exogenous variables including ownership characteristics and landowner socio-economic and demographic characteristics. As these concerns about the implications of diverting land to SRWCs are defined on an ordinal scale, this study will use an ordered probit model written as:

$$y_i = \beta' x_i + \varepsilon_i \qquad \varepsilon_i \sim N(0,1) \qquad \text{Eq.3}$$

$$y_i = 0 \Rightarrow NC \qquad \text{if} \qquad y^* \leq 0$$

$$y_i = 1 \Rightarrow C \qquad \text{if} \qquad 0 < y^* \leq \mu_1$$

$y_i = 2 \Rightarrow VC$ if $\mu_1 < y^* \leq \mu_2$

where y_i is related to a continuous latent variable y^*, indicating how concerned a landowner is; and μ_i (mu) are the unobserved thresholds parameters defining boundaries between different levels of concern (Greene 2003).

Preliminary Results and Conclusions

Survey data shows that although the majority of NIPF landowners sampled are not familiar with growing SRWCs, or the concepts of producing alternative fuels, they are willing to grow or consider growing SRWCs. These initial results are very promising but must be further evaluated. The predominately allocated categories for conversion were pine plantations, bottomland hardwoods, and pasture or fallow fields and landowners were very concerned with market price of potential SRWCs, securing a buyer, establishment and management costs, any possible tax implications, conflicts with land uses, and last, compatibility with forest certification. Further analysis is still being performed and will include a cluster analysis to classify participants, a two-limit Tobit regression to explain how the percent of land potentially available varies in response to changes, and a landowner concerns analysis utilizing an ordered probit model.

Although survey data analysis is not complete, initial results show that Mississippi NIPF landowners were not familiar, or only somewhat familiar, with the concepts of producing alternative fuels from wood and growing SRWCs. Their major concerns hinged on this lack of knowledge. More important though, landowners were willing to convert predominantly pine plantations and pasture or fallow fields to SRWCs for biomass utilization as long as it was profitable and compatible with their existing land management plans.

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Session A3-3

Saving the Family Forest Using Tax Planning and Business Entities

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Abstract

Landowners transferring property to future generations face two problems—estate taxes and property management. The American Taxpayer Relief Act of 2012 has eliminated the estate tax problem for most landowners. But who will manage the forest after the current generation, or will it be divided and sold? By using a business entity or trust the current owner can limit management to one or more individuals he chooses and can prevent partition sales while distributing income to children who are not managers.

Introduction

Why do you own land? Surveys of small-scale, private landowners in the South, especially those who own less than 100 acres, indicate that passing the family forest to the next generation was the highest priority. They want to improve the land value for future generations but are concerned about protecting their investment. Two barriers to meeting their objectives are estate taxes and fragmentation of ownership.

A recent Congressional Research Service Report explains that the estate tax will affect less than 0.2% of decedents over the next decade. About 65 farm estates are projected to be subject to the estate tax, and less than a fourth is projected to have inadequate liquidity to pay estate taxes. (Gravelle 2013)

The larger problem may be fragmentation. For example, suppose father owned 500 acres and had 5 sons. If he gives each of those sons an equal share, then each son has 100 acres. If each of those children has five children and the parents treat them equally then each grandchild will own 20 acres. In two generations a working, 500-acre farm has been reduced to 25 twenty-acre lots that are not practical to manage for income.

Taxes

The recently-passed American Taxpayer Relief Act of 2012 has made permanent (at least until Congress changes its mind) the transfer tax system that has been in a state of flux for the past twelve years. The gift and estate taxes have been reunified with an applicable exclusion amount of $5 million indexed for inflation and a maximum tax rate of 40%. With indexing, the applicable exclusion amount for 2012 was $5.12 million and the amount for 2013 is $5.25 million. Since Congress also made portability (the opportunity for a surviving spouse to use a decedent spouse's unused applicable exclusion amount) permanent, if filed correctly, the surviving spouse has access to the "Deceased Spousal Unused Exclusion." Therefore, an individual could leave everything to a surviving spouse and pay no estate tax by using the unlimited marital deduction. Then the surviving spouse could transfer the first $10.5 million (in 2013) to children and grandchildren tax-free. This is not the estate plan we recommend.

For an individual with assets greater than $10.5 million there are several estate planning techniques that can be used to transfer assets either tax-free or at a discount to children and grandchildren as well as options to pay some of the tax in installments.

<u>Estate tax planning</u> is essentially a gifting program where assets are transferred to younger generations for no or reduced gift taxes. By transferring assets during life any future appreciation and income are excluded from the decedent's estate. Although it is generally not appropriate to make taxable transfers during life, the effective gift tax rate is lower because gift tax is paid on the amount the donee receives (tax exclusive) versus an estate where the tax is collected on the value before the transfer (tax inclusive). For example, if an individual wanted to make a taxable transfer of a tract of land worth $1 million to his children during life , he would need to have $400,000 to pay the tax owed on the transfer ($1 million gift times 40% tax rate). However the individual's estate would need to have $666,667 in cash to pay the estate tax for the

children to receive the property ($1,666,667 times 40% equals $666,667 leaving the $1 million property).

To make the decision a little more complicated, you have to consider your investment in the assets transferred (your basis). The donee (person receiving the gift) takes the donor's basis (plus tax paid on the appreciation §1015 Internal Revenue Code (IRC)), but the devisee (person receiving real property from an estate) gets a change in basis to the fair market value on the date of transfer (§1014 IRC). Suppose the $1 million asset had a basis of $600,000. Then the donee's basis would be $760,000 ($600,000 donor's basis plus $160,000 tax paid on the appreciation) while the devisee's basis would be $1 million. With a 15% long-term capital gains rate the donee would have a built-in capital gain tax of $36,000 and the devisee would have none. Overall, the lifetime, taxable transfer would save $230,667 of federal tax.

The first step in tax planning for an estate is to make use of tax-free gifts. A parent can make unlimited transfers for a grandchild's tuition (in most states college tuition is a support obligation of a parent and not a gift). A parent could also pay medical expenses of children and grandchildren, including insurance premiums, as tax-free transfers. In both cases, tuition and medical, the payment has to be made to the provider and not given to the child/grandchild (§2503(e) IRC). A parent can also make annual exclusion transfers tax-free (§2503(b) IRC) as long as the gift constitutes a present interest. The current amount is $14,000 per donee per year. If parents had two married children with four grandchildren they could transfer $224,000 tax-free this year (2 children, 2 spouses and 4 grandchildren equals 8 times $14,000 each for husband and wife).

The second step is to transfer ownership of life insurance policies. Most insurers make the insured the owner of the policy. Under §2042 IRC life insurance proceeds on policies owned by the decedent are included in his estate. If the insured has an estate tax issue, the children or grandchildren should be the beneficiaries of the life insurance, and an Irrevocable Life Insurance Trust (ILIT) should probably own the policy.

If steps one and two have not eliminated the estate tax liability, the individual should make lifetime transfers preferably using split-interest techniques (trusts) or business entities. When interest rates are low, as now, the grantor retained annuity trust (GRAT), private annuity, and maybe a charitable lead annuity trust (CLAT) are appropriate.

Split-interest techniques are more tax efficient than outright gifts. For a GRAT, an individual transfers property to an irrevocable trust and takes an annuity interest for a fixed number of years leaving a remainder interest to a beneficiary. The beneficiary's interest is a taxable gift. Because the remainder interest does not mature for some years, the value of the interest is discounted (actuarially valued) based on the current rate set by the IRS (the 7520 rate which is 120% of the mid-term applicable federal rate rounded to the nearest 0.2%) and the number of years. As an example, a 15-year, $1 million GRAT with a $50,000 annuity and a 1.4% 7520 rate (March 2013) would result in a remainder interest of $327,724. If the $1 million could be invested at an average return of 5% over the next 15 years, there would still be $1 million in the GRAT for the children. In other words, the grantor would use $327,724 of applicable exclusion amount (the amount available in 2013 for lifetime gifts is $5.25 million) so he did not pay any gift tax. He would receive $750,000 over the next 15 years, and at the end of 15 years his children would receive $1 million tax free. If the grantor does not live for the 15-year term, the technique does not work, but the grantor can pick any term keeping in mind that the longer the term the greater the benefit. It is also possible to adjust the annuity payment to create a zero-gift GRAT.

Business entities are also used to make discounted gifts. When a business owner transfers an interest to children there are discounts available for minority interests and lack of marketability. Because the minority owner has little voice in partnership operations, cannot obtain a pro rata share by compelling liquidation, cannot obtain the value of his interest by redeeming it, cannot transfer his management rights, cannot compel distributions, and must pay taxes on his allocable share, he cannot sell his interest for the value of his fractional share. The actual discount should be determined by a qualified appraiser, but discounts of 35% are not uncommon. The discount for a business entity is a frequently litigated issue, but the discount for a split-interest transfer is statutorily set.

If a farm or business entity engaged in an active trade or business constitutes 35% or more of a decedent's estate, the estate may qualify for §6166 treatment. Section 6166 entitles the estate to a 5-year deferral of the tax on the business entity and then allows the estate to pay the tax in ten annual installments. In addition, tax owed on the first $1.39 million (for 2012) of business assets accumulates interest at only 2%.

Business Entity or Trust

Management of the family forest is a typical problem for second- and third-generation owners. As the number of owners increases it becomes difficult to agree on management objectives. A trust or business entity can be used to equally benefit the children and grandchildren while vesting the management powers in one or more individuals.

The typical business entities used for estate planning are limited liability companies managed by managers and limited partnerships or more recently limited liability limited partnerships. These entities allow one or more individuals, usually parents, to manage the business while gifting interests to children and grandchildren. Even though the children have an ownership interest in the business they do not have any management rights. Other advantages of the business entity are limited liability, creditor protection, perpetual life, avoidance of ancillary probate, ease of gifting fractional interests, avoidance of partition sales, no income tax at the entity level and it can provide a succession plan. The children/grandchildren would receive income in proportion to their ownership interest thus shifting income to younger generations. One disadvantage is that after the parents are gone, the children probably control the business and have the right to liquidate it.

A <u>trust</u> is an alternative to the business entity. A trust is an agreement between the grantor who funds the trust and sets the distribution criteria and a trustee who has legal title to the assets but must follow the distribution criteria established by the grantor. The beneficiaries have what is called equitable title in the trust assets and the trustee distributes trust assets for the benefit of the beneficiaries. Although many grantors utilize "corporate" trustees (typically the trust department at a bank), a trustee can be any competent individual, such as, an attorney, account, or even two or three of the beneficiaries. The typical trust set up as an estate plan rather than for tax planning would be a revocable trust with the parents as grantors and trustees and the children and grandchildren as beneficiaries. The trust would become irrevocable upon the death of the grantors, and the successor trustees would assume ownership of the trust assets. The trustees would manage the family forest for the benefit of the beneficiaries.

The life of a trust is governed by the state's rule against perpetuities, but several states have abolished the rule against perpetuities and a trust in those states can have a perpetual life. The traditional rule against perpetuities allowed a trust to last for a life in being (child or grandchild) plus 21 years (Georgia); however, in Alabama and Florida, a trust that holds real property can last for 360 years. Even so, it is probably not practical for a parent to try to control property beyond three or four generations.

The trust would have many of the same advantages as a business entity--limited liability, creditor protection, etc. The major advantage of the trust is the inability of the children to thwart the parents' intent because they cannot change the terms of the trust as they could with a business entity. That also means there is no flexibility with the trust as there would be for a business entity.

Conclusion

It is possible to save the family forest with a little planning. It is important that you consider all of your goals when making any land management decision. But for many, tax planning can save all but the largest land holdings from being lost to estate taxes. Using a trust or business entity to own the family forest can provide a long-term management plan and prevent it from being sold in a partition sale. Before making any decisions, you should consult a professional advisor.

For more information and workshops on this and similar topics visit the Alabama Cooperative Extension System Website at www.aces.edu/gwcal/month.php.

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Session A3-4

Factors related with NIPF landowners' forestland conversion decision in Cumberland Plateau, Tennessee

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Abstract

While existing literature on land economics employed landuse change models to secondary data on landuse change but studies that directly relate landowners' forest conversion decisions with their personal and land ownership characteristics, and other factors is relatively rare. Some studies have examined the factors influencing landowners' harvesting intentions and the likelihood of participating in conservation programs, but those different from conversion, which leads to permanent removal of forest cover. Data from a survey of NIPF landowners in the Cumberland Plateau of Tennessee was used to develop a discrete choice model of the forest conversion decision. In particular, the model explained forestland conversion as a function of a number of covariates that are commonly used in economic models of land use decisions. Results from an endogenized probit model that was corrected for the endogeneity of market force variables revealed that older, male, actively employed, and less educated landowners were more likely to have converted their forestlands to alternative uses. Landowners with larger forestland holdings, purchasers, and those actively seeking management advices from forestry professionals such as loggers and extension agents (i.e., "engaged landowners") were also more likely to have converted their forestlands than their respective counterparts. Length of tenure negatively affected the likelihood of forestland conversion but its marginal effect decreased with increase in tenure. Landowner's rated importance of timber production as ownership motivation was insignificant but the motivation of legacy (i.e., passing the property to heirs) was significantly and negatively related with the probability of conversion. Landowners who suffered significant loss from tree damage due to natural hazards such as southern pine beetle were more likely to convert forestland into non-forest uses. Outreach programs to promote legacy forests among family landowners, and more effective programs to contain invasive pests, disease for loss prevention might help reduce the conversion rate. As forestry professionals and extension workers try to understand the characteristics as well as motivations of landowners who are changing their land use decisions, results from this study will be helpful in identifying and targeting appropriate audience segments, and in addressing their needs with respect to conserving and effectively managing working forests.

Session B3-1

Market Efficiency of the U.S. Forest Products Industry

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Abstract

The market efficiency of the U.S. timber industry had evolved over the past decade. In this study, entropy measurement, an econophysics model, was applied to quantify informational efficiency of timber Real Estate Investment Trusts (REITs), wood, furniture, and paper markets in the U.S. during the period from 1999 to 2011. In a relative context, the analysis indicated that the timber REIT market was considerably more informationally efficient than the Treasury market, while marginally less efficient comparing to S&P 500 stock market. The results also suggested arbitrage opportunities were present in some forest products markets.

Introduction

The economic interpretation of informational market efficiency refers to the amount information that prices in a given industry contain or incorporate. The more informational inefficient a market, the more predictable the future returns since prices only reflect a few available information, hence, they become less volatile. The practical reason for evaluating informational efficiency of the forest production industry (FPI) is to measure the opportunities of consistently outperforming the market by using information such as historical data, public news, and private information. The emphasis of the following study is confined to analyzing the weak form market efficiency which pertains only to past price behaviors (Fama, 1970).

Previous studies had primarily focused on the different stock markets and the foreign exchange market. There exist a few studies on informational efficiency of forest related markets. Washburn and Binkley indicated that thirteen timber markets in the U.S. South operated efficiently in weak-form on an annual and quarterly basis (Washburn & Binkley, 1990). The authors performed serial correlation tests on data from 1976 to 1989 and found independency in deviations from mean of the return time series. Since the results showed weak form efficiency, there was no potential gain in employing past price data. However, they also found that monthly prices did not capture all available information due to transactional costs in the process of finalizing sales.

Utilizing a different methodology, Hultkrantz argued that the markets were inefficient because the price time series was stationary with respect to a set of information including timber growth rate, capital costs and storage costs (Hultkrantz, 1993). In agreement with the later approach, several studies concurred that the presence of stationary were an indication of informational inefficiency (Prestemon, 2003; Yin & Newman, 1996).

Data

Relevant daily return data were available from July 1999 to December 2011. Forest related markets, including REIT, wood, furniture, and paper, were in the scope of the study's interest. Since timber entities converted to REIT at different timeframes, a dynamic REIT portfolio comprising Plum Creek, Rayonier, Potlatch, and Weyerhaeuser, was constructed based on their dates of conversion. REIT return series were obtained from CRSP database while the other three series were acquired from Fama-French data library.

In order to evaluate how informationally efficient each forest products industry was, S&P 500 index and 3-month Treasury bill were set as the relative thresholds for comparison purposes. The stock market data were from CRSP and T-bill rates were from FRED.

Methodology

Entropy measurement

Different from the traditional approach, entropy, or information theory, is an ecocophysic model that had recently been applied to assess performance of financial markets. The entropy values of the markets allow analyses in a relative context. Intuitively, when the entropy level is maximized, one is least certain about the outcomes and prices are most randomized. Therefore, there exists less arbitrage opportunity based on any past information.

Risso used Shannon entropy to rank stock markets of twenty countries in terms of efficiency (Risso, 2009). His results showed that the U.S. stock market was more efficient than the UK stock market but less efficient compared to Japan's market. Under the similar approach, a study revealed that the Dow Jones market's informational efficiency depended on the time scale and varied overtime (Martina, Rodriguez, Escarela-Perez, & Alvarez-Ramirez, 2011). Employing entropy measurement, the authors indicated that daily price data was more efficient than monthly or quarterly data. In addition to Shannon entropy, Renyi and Tsallis are alternative measurements of entropy (Bentes, Menezes, & Mendes, 2008).

The Shannon entropy measurement is as follows.

$$S(x) = -\sum_{i=1}^{n} p_i \log_b p_i$$

where p_i is the probability of getting return x_i.

Value of the log base, b, refers to the unit of measurement. When b equals 2, 10, or *e*, the information will be measured in bit, dit, and nat respectively. The study used base e to calculate the entropies.

Probability assessment
Each of the six price time series is divided into twenty bins. The probability density function of any given bin was calculated based on a normal distribution assumption.

$$PDF = \frac{1}{\beta\sqrt{2\pi}} \exp\left[-\frac{(x-\alpha)^2}{2\beta^2}\right]$$

where α and β are the drift and volatility parameters respectively. The study assumes prices follow a random walk; hence, the estimated parameters can be measured using the following calculations (Mei, Swinarski, Clutter, & Harris, 2011).

$$\hat{\alpha} = \frac{\mu}{\Delta} + \frac{s^2}{2\Delta} \text{ and } \hat{\beta} = \frac{s}{\sqrt{\Delta}}$$

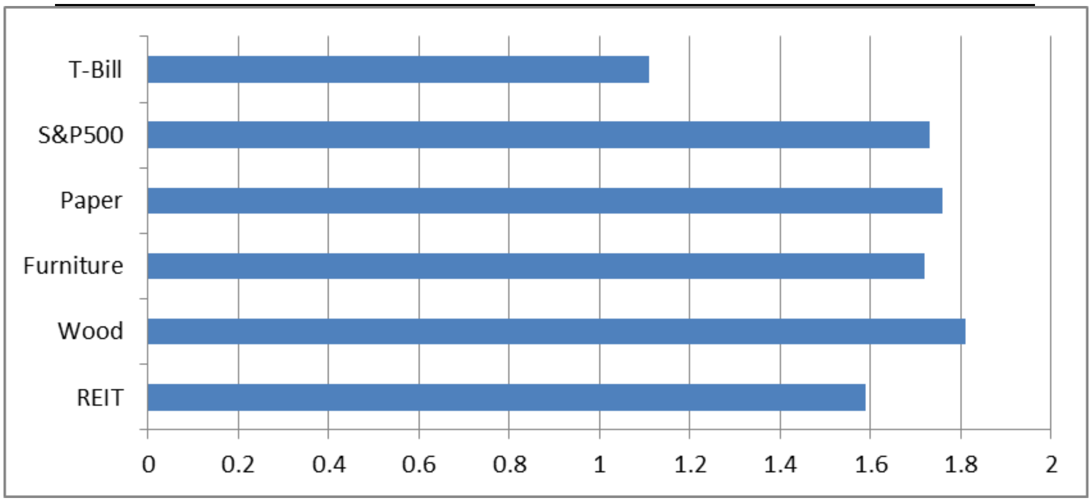
where μ and *s* are the sample mean and standard deviation respectively and Δ is the time interval of the return series.

Empirical Results

To a certain extent, Shannon entropy measurement indicated similar results to past studies. As expected, returns were more unpredictable for the S&P 500 index while least stochastic for the Treasury bill rates. Considering the entropy values of the two markets as relative minimum and maximum of informational efficiency, the REIT and furniture markets were ranked in between the thresholds but located closer to the efficient end of the spectrum. Nonetheless, the wood and paper markets appear to be more informational efficient that the stock market.

Table 1. Comparison of entropy levels for different markets (1999 – 2011)

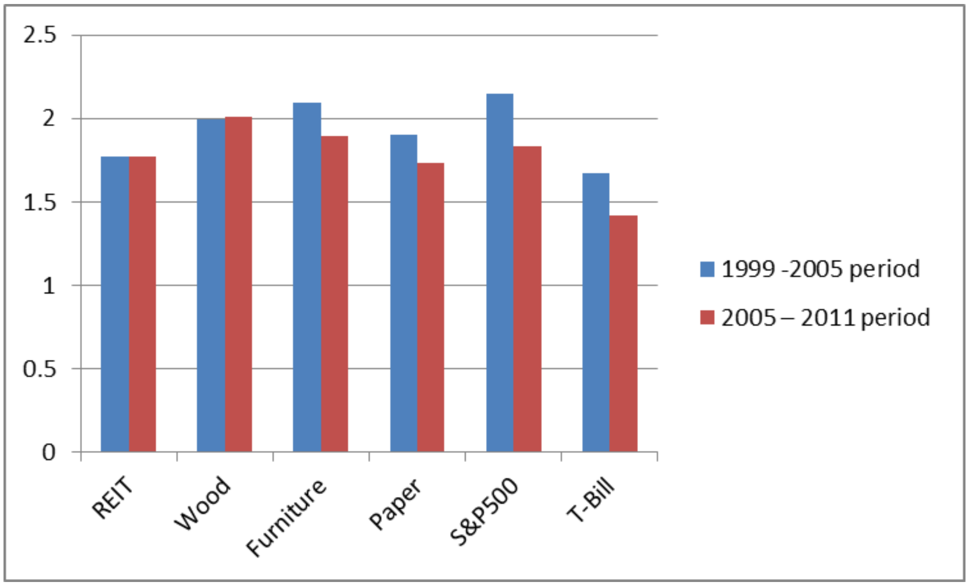
Market	Drift Parameter	Volatility Parameter	Shannon Entropy
REIT	0.00077	0.02093	1.59
Wood	0.00053	0.01855	1.81
Furniture	0.00060	0.01577	1.72
Paper	0.00069	0.01883	1.76
S&P500	0.00023	0.01370	1.73
T-Bill	0.00013	0.00260	1.11



During the course of thirteen years, the efficiency levels of each market had changed over time. With the exception of REIT and Wood indices, all other markets performed less efficiently during the later period 2006 - 2011. Nevertheless, Treasury bills time series still have the lowest entropy level in both periods. The stock market was the most efficient one during 1999 – 2005 and was ranked third in the later period. Compared to the study's two benchmarks, forest related markets are relatively efficient in both periods.

Table 2. Changes of Entropy Overtime (1999 – 2005 and 2006 – 2011)

Market	1999 -2005 period	2006 – 2011 period
REIT	1.772	1.774
Wood	1.996	2.007
Furniture	2.092	1.898
Paper	1.900	1.737
S&P500	2.150	1.830
T-Bill	1.675	1.418



Discussions

Past studies often determined the informational efficiency of timber related markets in an absolute context. Employing entropy measurement, the study indicated that the magnitude of efficiency varied across different markets. In the relative context, the REIT market was perceived to be rather efficient compared to the stock and Treasury bill markets. However, the returns did not completely reflect historical price behaviors. As an implication, there existed arbitrage opportunity to achieve excess returns in the REIT market. Nevertheless, such possibility seemed to be trivial in the lumber, furniture and paper industries. Among the three products markets, the wood price time series incorporated the most information from the past while the furniture industry appeared to be least informational efficient.

Furthermore, the results showed that market efficiency had an overall declining trend during the past thirteen years. Some studies suggested that since the global markets had become more hybrid, contemporaneous prices contained less information (Rotthoff, 2011). As the result, informational efficiency of each market had decreased.

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Session B3-2

An Econometric Analysis of Softwood Sawtimber Stumpage Market in Louisiana

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Abstract

Louisiana is one of the major sources of softwood timber production in the southern USA. Even though there are several regional as well as state-level studies on econometric analysis of timber market in the US South, no particular empirical study has been available on the softwood stumpage market in Louisiana. Following a profit maximization framework on the four-input production function, we derived extensive demand and supply models of Louisiana softwood sawtimber stumpage market. The two-stage least square technique was applied to estimate a system of demand and supply equations consistently. The annual time-series observations on timber harvest and stumpage prices were obtained from Louisiana Department of Agriculture and Forestry. Most of the estimated coefficients are statistically significant with expected sign. The results show that stumpage price is inelastic in both supply and demand models, suggesting that price changes will not result in significant stumpage harvest fluctuations. The pulpwood is a complement to the Louisiana sawtimber supply. The positive and high elasticity value of inventory estimate implies that sawtimber stumpage supply is highly driven by the standing softwood growing stock.
Keywords: Softwood Stumpage, two-stage least square, demand-supply models

Session B3-3

Pricing Forestry-Related Assets using Intertemporal Capital Asset Pricing Model

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Abstract

Forestry-related assets, especially timberland assets are regarded as good candidates for portfolio diversification because of its low correlation with market. In this paper, the intertemporal capital asset pricing model (ICAPM) is used to assess the risk-return relationship between forestry-related assets and innovations to state variables which proxy for the changes in investment opportunity set. Results in this study show that the ICAPM that includes the market excess returns and innovations to size and value effect, risk-free rate, term spread, default and consumption cannot be rejected and the model succeeds to explain more than 80% of the variation in cross-section returns of forestry-related assets. While the widely used CAPM and Fama-French three factor model are rejected. Moreover, beta loadings on market excess return, innovations to risk-free rate and default spread induce significant positive risk premiums, indicating that in determining the expected returns of forestry-related asset, innovations to these state variables are important risk factors that should be priced.

Introduction

Timberland investment has attracted more and more attention nowadays. Timberland asset has three return drivers: biological growth, timber price change and land value appreciation (Caulfield 1998). Unlike other financial investments or even real estate investments, timberland investment distinguishes itself from other assets by its biological growth, which is independent with the financial market. Many studies on the financial performance of timberland assets have found weakly correlation with financial markets and have low systematic risk. These characteristics make timberland investment play an important role in diversifying risk for portfolio investors (Healey et al. 2005; Lonnstedt and Svensson 2000; Newell and Eves 2009; Waggle and Johnson 2009; Zinkhan and Cubbage 2003). Moreover, timberland has the ability to hedge against anticipated or unanticipated inflation (Martin 2010; Wan et al. 2012; Washburn and Binkley 1993). During the past several decades, the timberland market becomes more and more competitive, which alleviates the inefficiency of the market through time (Caulfield 1998; Zinkhan 2008).

Most of the studies are based on the capital asset pricing model (CAPM) developed by Sharpe (1964) and Lintner (1965). The CAPM is a static single factor model states that the expected return of an asset is proportional to its covariance with market portfolio (Bollerslev et al. 1988). However, the CAPM assumes that investors have homogeneous expectation and ignores the time variation in expected returns, which have been criticized by many studies (Campbell 1996; Merton 1973; Roll 1977). Furthermore, many empirical tests show the failures of the CAPM (Black et al. 1972; Fama and French 2004; Gibbons et al. 1989; Merton 1971).

Due to the imperfect performance of the CAPM, Merton (1973) developed the intertemporal capital asset pricing model (ICAPM). The model is to maximize the expected utility of lifetime consumption and to assume the investors trade continuously. It states that, besides the market risk, risk of unfavorable shifts in the investment opportunity set proxied by the changes of the so-called state-variables may be contained to compensate for expected returns.

Literature Review

The ICAPM is important in the theoretical standpoint; however, it is difficult to identify the state-variables (Breeden 1979). Studies focused on the empirical testing of the ICAPM have identified significant state-variables. The real interest rate is observable and time-varing, which represents the stochastic characteristic of investment opportunity set (Abhyankar and Gonzalez 2009; Brennan et al. 2004; Campbell and Vuolteenaho 2004; Fama and French 1993; Hui 2006; Merton 1973). The aggregate real consumption rate covers a significant fraction of true consumption and adds explanatory power to the expected returns (Bollerslev et al. 1988; Breeden 1979; Hui 2006). The term spread, calculated as the difference between the 10-year Treasury bond and the 3-month Treasury bill, has negative impact in estimating the expected returns (Bali and Engle 2010; Evans 1994; Fama and French 1989). The implied volatility of the market from index options measures the market's future volatility and significantly negative relation is found between the expected returns and the implied volatility (Bali 2007; Bollerslev et al. 1988; Daly and Vo 2008; Guo and Whitelaw 2006). Other significant state-variables including the market dividend yield (Campbell and Shiller 1988; Fama and French 1988), size and book-to-market ratio (Bali 2007; Bali and Engle 2010; Kothari and Shanken 1997).

The contribution of our study is to investigate the intertemporal relation between the risk and return of the forestry-related assets using different state-variables. And the innovations to state variables are estimated using generalized autoregressive conditional heteroskedasticity model (GARCH). To our best knowledge, no work has been done by applying Merton's ICAPM framework in forestry-related field.

Methodology

ICAPM Framework

In this study, the discrete-time version of the ICAPM is assumed to account for the cross-section of asset returns. According to the ICAPM, besides the market risk, risks of unfavorable shifts in the investment opportunity set should also be contained to compensate for expected returns. Thus, assets' expected return is a linear function of the excess return on market portfolio as well as the innovations to state variables. The unconditional expected excess return can be written as:

$$E(R_i) - R_f = \beta_{i,M}\lambda_M + \sum \beta_{i,\varepsilon^k}\lambda_{\varepsilon^k}, \forall i, k = 1, 2, \cdots, K, \tag{1}$$

where $E(R_i)$ is the expected return of asset i, R_f is the risk-free rate, λ_M is the market risk premium, and λ_{ε^K} is the price of risk for innovation to state variable *k*. Coefficients beta are obtained from regressions of asset returns on market excess return and innovations to state variables:

$$R_{i,t} - R_f = \alpha_i + \beta_{i,M}(R_{M,t} - R_f) + \sum \beta_{i,\varepsilon^k}\varepsilon_t^k + u_{i,t}, \forall i, \tag{2}$$

where $R_{i,t}$ and $R_{M,t}$ are returns of asset i and market at time t, respectively. ε_t^k is innovation to state variables k at time *t* and $u_{i,t}$ is error of the regressions.

Innovation in State Variables

Innovations are the unexpected shocks to state variables, which can be represented as the difference between the actual return and expected return conditional on the given information:

$$\varepsilon_t^k = r_t^k - \mu_t^k = r_t^k - E(r_t^k \mid F_{t-1}), \tag{3}$$

where r_t^k is return of state variable k at time t, μ_t^k is the conditional mean of r_t^k given the information set available at time $t-1$, F_{t-1}. To obtain the dynamics of innovations to the state variables, we assume ε_t^k follows a GARCH (1, 1) model, then

$$\varepsilon_t^k = z_t\sqrt{h_t^k}, \tag{4}$$

$$h_t^k = \alpha_0 + \alpha_1(\varepsilon_{t-1}^k)^2 + \beta_1 h_{t-1}^k, \tag{5}$$

where $\{z_t\}$ is a sequence of iid random variables with mean 0 and variance 1. h_t^k is the conditional variance for the innovation ε_t^k given the information set F_{t-1}, $\alpha_0 > 0$, $\alpha_1 \geq 0$, $\beta_1 \geq 0$, and $\alpha_1 + \beta_1 < 1$. The maximum-likelihood method is applied to estimate the parameters in the GARCH (1, 1) model. Since the magnitudes of different state variables vary, in order to make innovations comparable among all state variables, we use the standardized innovations $\tilde{\varepsilon}_t^k = \varepsilon_t^k / h_t^k$.

Cross-sectional Regression

According to the ICAPM, the innovations derived from the GARCH (1, 1) model are risk factors in addition to the market excess returns. From equation (1), the expected excess return of asset depends on the exposures to the risk factors and the rewards for bearing such risks. To test the implication of the ICAPM as well as estimating the expected returns for assets, the 2-step cross-sectional regression procedure is used. As introduced by Fama and Macbeth (1973), this method is widely used in the analysis of cross-section of asset returns. In the first step, OLS is used to estimate a series of time-series regressions of equation (2) for each asset, which provides assets' loadings with respect to the market excess returns as well as innovations to state variables. The beta coefficients are obtained as the loadings with respect to the risk factors. In the second step, the excess returns of all the assets studied are related to their loadings on the risk factors. In another word, the prices of the risk factors are estimated using the cross-sectional regressions.

$$R_{i,t} - R_f = \lambda_{0,t} + \lambda_{M,t}\hat{\beta}_{i,M} + \sum \lambda_{\varepsilon^k,t}\hat{\beta}_{i,\varepsilon^k} + e_{i,t}, \forall i, \tag{6}$$

for $i = 1, 2, \ldots, N$ and $t = 1, 2, \ldots, T$, where $\lambda_{0,t}$ is the intercept, e_{it} is the error term, N is the total number of assets, and T is the sample length. That is, there is one regression across the N assets for each time period and there are T such regressions in total. This way, a time series is constructed for each risk premium. Then, averages are taken over the whole sample time period as $\lambda_j = \sum_{t=1}^{T} \lambda_{jt} / T$ for $j = 1, 2, \ldots, n$. In equation (6), $\hat{\beta}_{i,M}$ and $\hat{\beta}_{i,\varepsilon^k}$ are slope coefficients of market excess return and innovation to state variables that are estimated in the first step using equation (2).

As many studies indicated that, the 2-step cross-sectional regression will cause the so-called error-in-variable (EIV) problem. That is to say, betas used in equation (6) as independent variables are generated from time-series regression may contain errors. To account for sampling errors of betas when computing standard errors and overstating precision of price of risk factors, a correction method provided by Shanken (1992) is applied. Based on Shanken's correction (Shanken 1992), the EIV adjustment is yielded from combining the price of risk estimates with the sample covariance matrix of the factors. To account for EIV, the standard error of the estimates should be multiplied and the t-statistic should be divided by square root of the EIV adjustment.

Data

This study tends to explore the risk return relationship between the forestry-related assets and the innovations to state-variables. Quarterly data used in this study ranges from 1988Q1 to 2011Q4. Forestry-related assets in this study include the private- and public-equity timberland assets, forest products and timbers. Returns for private-equity timberland investments are approximated by NCRIEF (NTI) and John Hancock (JHTI) timberland indices. NTI is a quarterly reported data at the national and regional levels. Due to the data limitation, in this study, the national, the South and the Pacific Northwest levels abbreviated as NTI_US, NTI_S and NTI_PNW are used. In May 2012, NCREIF released the Timberland Fund and Separate Account Index (TFSAI), which reflects actual returns of a portfolio of timber funds and account. This index overcomes the criticized appraisal nature of the NTI and is further disaggregated into the commingled fund index (CFI) and the separate account index (SAI). In this study, the TFSAI, the

CFI, and the SAI, all net of fees, are used to represent real business returns of private-equity timberland investments. John Hancock Timber Indices, i.e., US domestic timberland return index (JHTI-US), non-US timberland return index (JHTI-NUS), and global timberland return index (JHTI-G), complied by the Hancock Timber Resource Group represent individual TIMO returns at different regional scales (Hancock Timber Resource Group 2010).[1]

Public-equity timberland investment returns (PUBLIC) are approximated by value-weighted returns on a dynamic portfolio of publicly-traded timber firms in the United States that had or have been managing timberlands. These firms include Deltic Timber, IP Timberlands Ltd., Plum Creek, Pope Resources, Potlatch, Rayonier, The Timber Co., and Weyerhaeuser. Deltic Timber and Pope Resources are natural resources companies focusing on the ownership and management of timberlands; The Timber Co. and IP Timberlands Ltd. are subsidiaries of Georgia-Pacific and International Paper that were separately listed and tracked the values and financial performances of their timberland assets; Plum Creek, Potlatch, Rayonier, and Weyerhaeuser are publicly-traded REITs that invest in timberlands. Values of these firms are defined by their market capitalizations calculated as the closing stock prices multiplied by the total shares outstanding. These data are obtained from the Center for Research in Security Prices (CRSP).

Returns of the lumber and wood products industry (WOOD), furniture and fixtures industry (FURNI), and paper and allied products (PAPER) come from French (2012) and represent the overall performance of the forest products industry. Stumpage prices for southern pines in the South (SSP), average values of timber sold on national forests in the Pacific Northwest (PNWSP), and Random Lengths Framing Lumber Composite Prices (LUMBER) represent market conditions for various forest products and are extracted from Timber Mart-South (Norris Foundation 1977-2012), Kling (2008), and Random Length (2012), respectively.

For risk factors, market returns (MKT) are approximated by value-weighted returns on all NYSE, AMEX, and NASDAQ stocks come from the CRSP. For state-variables, the macroeconomic variables (short-term Treasury bill and term spread), financial factors (size and book-to-market) and aggregate consumption rate are considered. Short-term Treasury bill (RF) is approximated by the One-month Treasury bill rate that is obtained from the CRSP. Term spread (TERM) is the return difference between the 10-year Treasury bond and 3-month Treasury bill. Default spread (DEF) is the return difference between the AAA bond rate and BAA bond rate. The data is from the H.15 database of the Federal Reserve Board. Size and book-to-market are approximated by SMB and HML factors obtained from the French website. The quarterly real personal consumption expenditures are used to represent the aggregate consumption (CONS). All level indices are converted to returns by taking differences after the logarithm transformations. In summary, there are seven proxies for timberland investment returns and 5 state-variables.

[1] Hancock Timber Resource Group is one of the largest TIMOs in the world. As of 2011, assets under management totaled $9.1 billion. These assets are located in the United States, Canada, Australia, New Zealand, and Brazil.

Empirical results

Innovations to State Variables

The innovations to state variables are used as risk factors which are estimated using a joint estimation of mean equation – GARCH (1, 1) model. The residuals from the mean equation for each state variable are standardized by their dynamic volatility from the GARCH (1, 1) model. Figure 1 show the time-series of standardized shocks to state variables. The figures show that the standardized innovations to financial factors such as size and value effect vary from negative 4 to positive 3, which have the largest variations. On the other hand, macroeconomic variables such as risk-free rate, term spread and default spread have relatively smaller variations in the standardized innovations, which are from negative 0.5 to 2. Specifically, innovations to risk-free rate are flat over time compare to other state variables. The innovations to consumption spread from negative 1 to 1.5. Although the magnitudes of the innovations to the state variables vary a lot, all variables track the shocks during financial crises around 2007.

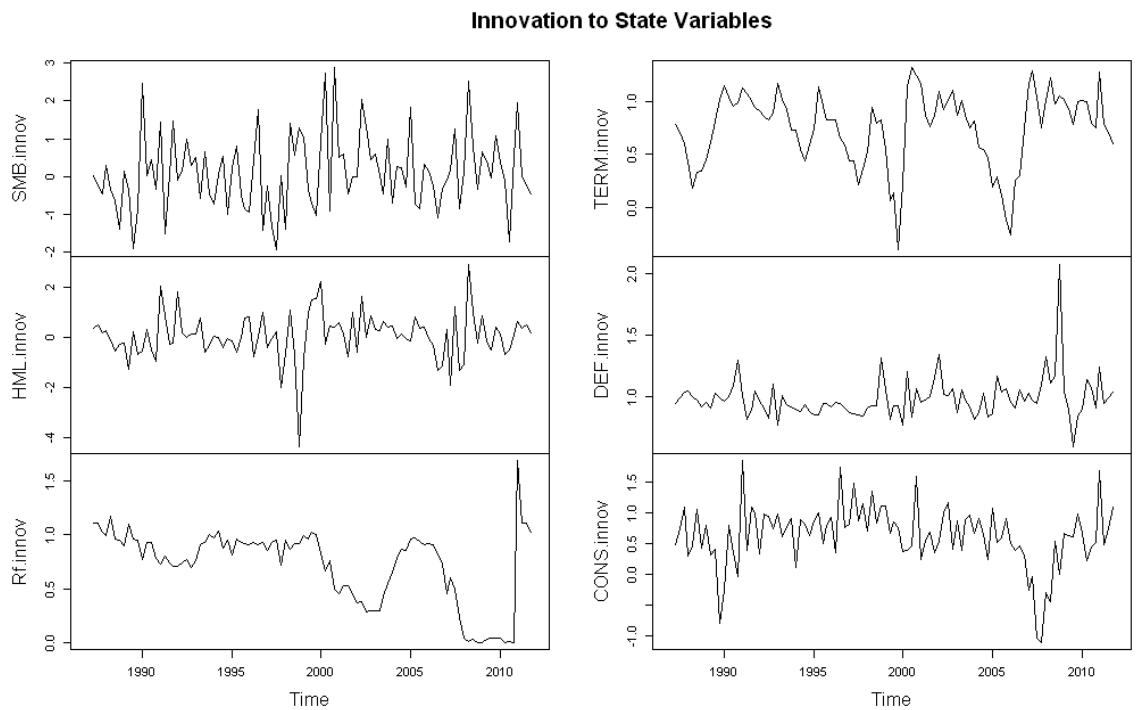

Figure 1. Innovations to state variables

Fama-Macbeth Cross-sectional Regression

To test the risk-return relationship between forestry-related assets and the innovations to state variables, the Fama-Macbeth cross-sectional regressions are conducted. Initially, we test the quarterly excess returns on the 16 forestry-related assets for the period 1988 to 2011. In the first stage, the quarterly excess returns were regressed on the market excess returns and the estimated innovations to the six state variables to obtain the factor loadings using equation (2). Table 1 reports the factor loadings on market excess returns and state variables innovations from time-series regressions.

	β_{MKT}	β_{SMB}	β_{HML}	β_{RF}	β_{TERM}	β_{DEF}	β_{CONS}
NTI_US	0.008	-0.546	-0.283	2.479	-0.704	1.160	-1.356
NTI_S	0.000	-0.390	-0.780	0.565	-1.352	1.496	-0.874
NTI_PNW	0.005	-0.585	0.248	5.340	-1.281	-0.046	-2.479
TFSAI	0.016	-0.370	-0.335	1.865	-0.816	2.200	-1.143
CFI	0.024	-0.598	-0.263	0.925	-1.022	1.591	-0.729
SAI	0.019	-0.252	-0.328	2.131	-0.740	2.315	-1.305
JHTI_US	0.027	-0.073	0.009	3.084	-1.251	-0.843	-1.329
JHTI_NUS	0.015	-0.274	0.158	3.207	1.037	-2.509	-1.034
JHTI_G	0.024	-0.113	0.039	3.109	-0.794	-1.176	-1.270
PUBLIC	0.870	-0.216	0.732	-3.261	2.962	-7.344	1.634
WOOD	1.055	-1.089	0.857	-4.575	7.599	-8.939	5.302
FURN	1.202	0.409	-0.143	-7.503	5.603	-14.812	1.838
PAPER	0.822	-0.129	-0.512	-3.272	0.964	-4.883	3.317
SSP	0.054	-0.913	0.201	0.418	-0.636	-4.728	0.636
PNWSP	-0.036	-2.798	-0.301	7.598	11.646	-6.183	-8.941
LUMBER	0.046	0.312	-0.149	-0.964	1.672	-8.496	0.189

Table 1. Factor loadings on market excess returns and innovations to state variables from time-series regressions.

Table 1 documents assets' beta loadings on market excess returns and innovations to state variables. In particular, excess returns of the appraisal and fund-level NCREIF indices and John Hancock timberland indices, have negative beta loadings on innovations to SMB, HML, term spread and consumption. Positive loadings are obtained on market excess return, risk-free rate and default spread. The results indicate that private equity timberland investments correspond negatively to the positive shocks to the size and value portfolios, term spread and consumption. The opposite is true for the positive betas. On the other hand, the dynamic portfolio of publicly-traded timberland assets and forest products perform almost reversed as compared to the private timberland assets except for the market excess returns. Be more specific, we obtain positive beta loadings on markets excess returns and innovations to SMB, term spread and consumption. Negative beta loading are found on risk-free rate and default spread. One thing to address here is, although positive betas on market excess returns are obtained for both public and private timberland assets, the magnitudes are much smaller for the private- than the public-equity timberland assets. Moreover, beta loadings for timber prices on the risk factors are not consistent with each other.

In the second stage, the risk premiums for each state variable were estimated by running the cross-sectional regressions. To correct the EIV problem, the standard error was corrected by the Shanken's correction. In addition, the widely used CAPM and Fama-French three factor model are tested as a comparison with the ICAPM using the same approach. Table 2 reports the estimated risk premiums corresponding to market excess returns and the innovation to each state variable for three models. Moreover, the t-statistics before and after Shanken's correction are reported.

	ICAPM			FF 3-Factor			CAPM		
	Estimate	FM t-stat	SH t-stat	Estimate	FM t-stat	SH t-stat	Estimate	FM t-stat	SH t-stat
λ_0	0.789	1.927	1.691	0.901	1.644	1.112	1.538	4.576	4.575
$\lambda_{\varepsilon^{MKT}}$	5.561	6.295	5.524	1.438	1.245	0.842	0.115	0.176	0.176
$\lambda_{\varepsilon^{SMB}}$	0.724	1.797	1.577	-0.651	-1.391	-0.941			
$\lambda_{\varepsilon^{HML}}$	0.477	1.014	0.890	-0.284	-0.397	-0.269			
$\lambda_{\varepsilon^{RF}}$	0.347	2.365	2.076						
$\lambda_{\varepsilon^{TERM}}$	-0.032	-0.284	-0.249						
$\lambda_{\varepsilon^{DEF}}$	0.196	2.794	2.452						
$\lambda_{\varepsilon^{CONS}}$	-0.294	-2.126	-1.865						
F-stat		9.390			0.731			0.031	
p-value		0.003			0.553			0.863	
Adj R^2		0.797			0.059			0.069	

Table2. Estimation results from cross-sectional regressions

Table 2 shows that the multi-factor ICAPM explains about 80% of the cross-sectional returns for the 16 forestry related assets. While only 6% and 7% of the variation in the cross-section returns is explained by the Fama-French three factor model and the CAPM. Moreover, p-value for F-test suggests rejecting the Fama-French three factor model and the CAPM, but fails to reject the ICAPM.

In addition, the ICAPM successfully establishes a significant relationship for the price of market risk while the other two models fail. Even corrected for the sample error in the beta loadings, a significantly positive market risk premium is obtained. The results indicate that the market risk is positively priced in the cross-section of forestry related assets using the ICAPM. The positive market risk premium is consistent with previous studies, since risk-averse investors do require positive premium for the market portfolio (Fama 1996). In addition, represented by significant Shanken's t-statistics with values of 2.076 and 2.452, innovations to the risk-free rate and default spread induce positive and significant risk premiums. On the other hand, the hypotheses of significant risk premiums for the Fama-French three factor model and the CAPM are rejected since insignificant values are observed. Moreover, since excess returns are used as dependent variables, the intercept in the second stage regressions should be zero under the null hypothesis. From the results, a t-statistic of 1.691 is obtained using Shanken's correction under the ICAPM, indicates the model fails to reject such a hypothesis, which further suggests the adequate explanatory power of the risk factors.

Overall, the multi-factor ICAPM which includes market excess returns and innovations to several state variables cannot be rejected under Shanken's t-statistics, while the Fama-French three factor model and the CAPM are rejected. Furthermore, the market excess returns and innovations to value risk-free rate and default spread provide significant systematic risk which should be priced to the cross-section returns of forestry related assets.

Conclusion

Forestry-related assets, especially timberland assets are regarded as good candidates for portfolio diversification because of its low correlation with market. However, in this study, a complicated but more accurate ICAPM is used to study the risk-return relationship between forestry related assets and innovations to state variables which proxy the change in investment opportunity set. Results show that besides the market portfolio risk, risk in innovations to risk-free rate and default spread should be priced to the cross-section returns of forestry related assets. Positive risk premiums induced by market portfolio risk is within our expectation. In the market, investors are rational and risk-averse. Therefore, they expect the market portfolio to earn a higher return than risk-free rate because of higher risk they bear. Moreover, positive risk premiums are obtained for innovations to risk-free rate and default spread from the cross-sectional regressions. This indicates that positive shocks to risk-free rate and default spread induce positive risk premiums to cross-sectional returns of forestry related assets.

In addition, beta loadings on the risk factors between private- and public-equity timberland investments show that two assets have different performance. For example, returns of both assets are positively correlated with the market portfolio; however, public-equity timberland assets are more correlated with the market than that of the private-equity timberland assets, which are shown by the larger beta loadings. This result is consistent with previous results that private-equity timberland assets are weakly correlated with the market compared with the public-equity timberland asset (Mei and Clutter 2010; Sun and Zhang 2001). Moreover, beta loadings on innovation to risk-free rate are positive for all private-equity timberland assets and negative loadings are found for private-equity timberland assets and forest products. During recession, risk-free rate will be cut to boost economics, combined with positive risk premiums induced by riskless rate factor, negative shock to risk-free rate will decrease the expected return of private-equity timberland assets and increase expected return of public-equity timberland asset and forest products. One explanation to this is that private-equity timberland assets whose returns correlate positively with innovations to risk-free rate would be seen as hedges against the risk, during bad times, such assets would be demanded more by risk-averse investors, which further drives the prices up, implying lower future average returns. Public-equity timberland asset and forest products, on the other hand, do not hedge against shocks to riskless asset. Furthermore, innovations to default spread add positive risk premium to cross-section returns of forestry-related assets. Default spread measures the yield difference between different bonds due to their different credit quality. Higher default spread indicates higher default risk, which can reflect a weakening of the macroeconomic condition. With positive shocks to default spread, expected returns of private-equity timberland assets tend to increase, which suggests a lower price of such assets. In contrast, public-equity timberland assets have negative correlation with innovations to default spread, with positive shocks to default spread, expected returns will decrease, implying higher price during weak macroeconomic condition.

In summary, the ICAPM that includes the market excess returns and innovations to size and value effect, risk-free rate, term spread, default spread and consumption cannot be rejected and the model succeeds to explain more than 80% of the variation in cross-section returns of forestry-related assets. While the widely used CAPM and Fama-French three factor model are rejected. Moreover, beta loadings on market excess return, innovations to risk-free rate and default spread induce significant positive risk premiums, indicating that in determining the expected returns of forestry-related asset, innovations to these state variables are important risk factors that should be priced.

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Session B3-4

"Animal Spirits Among Us" - A Review of Key Factors Impacting the U.S. Timberland Market 2007 – 2012

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Abstract

This paper shall review the recent boom and bust cycle within the U.S. housing market and the impacts of this cycle on the U.S. timberland market. The paper will include a general timeline and a summary of some of the key factors that impacted the U.S. housing market as well as the broader financial markets. The paper will then review how these same factors directly and indirectly impacted the U.S. timberland market and the potential long-term effects of this recent boom and bust cycle on the U.S. timberland market.

Session A4-1

Valuation of Aboriginal People Land Use Activities：A Satisfaction Calculus Approach

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Abstract

The issue of valuation of Aboriginal land use activities is critical for Aboriginal people and policy maker. The market based monetary measures of traditional cultural and land use activities are not sensitive for the Aboriginal value system. In this study we developed and applied a valuation method of Aboriginal land use activities that is consistent with Aboriginal culture and Aboriginal Rights. This approach is based on individuals' evaluations of their own well-being (or satisfaction) with life, and with various domains of life (e.g. health, income, housing, culture and social land use, etc.) A questionnaire survey data from two First Nations of Ontario and British Columbia were used. A structural simultaneous equations system was developed for modeling. Results suggest that income is not the most important component for Aboriginal wellbeing. Social, Cultural, and Land Use Activities (SCLU) domain is the most important domain with regard to Aboriginal people's general satisfaction. More specifically, trapping and gathering activities contribute the most to general wellbeing. By calculating the elasticity to general satisfaction, it is found that high-class Aboriginal people are more concern about the quality of SCLU activities and the impact of government law on land use. High-class Aboriginal people also have a high elasticity on traditional diet and social ties. On the other hand, low-class Aboriginal people are more sensitive to the improvement of government health service and housing situation.

Session A4-2

Regional Economic Contributions of Forest-based Industry in the South: 2001-2009

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Abstract

The current recession and the associated sharp decline in housing and other constructional activities have had a large impact on the forest products industry. Documentation of the economic impacts over time identifies important industry trends, updates baseline economic information, and helps policy makers formulate appropriate legislation and regulations to support the industry. The South is one of the leading timber producing regions in the world. Thus, monitoring economic contribution of the forest-based industry in the South over time is crucial. This study reports the regional economic contribution of the industry in the South in 2009 dollars and compares that with the last comprehensive study of the industry in real terms. Impact Analysis for Planning (IMPLAN), an input-output modeling system, was used to model the economic impact of the industry and to estimate the changes over time. Twenty-six IMPLAN sectors were aggregated into three broad forest-based sectors (lumber and wood products, wood furniture, and paper and allied products sectors), and employment, earnings, value of shipments, and value-added for each sector were estimated. Results revealed that the forest-based industry is still an important source of employment and income in the South despite the downturn in the economy and its disproportionate effect on the forest products industry. From 2001 to 2009, the industry's employment decreased by 33.4% and earnings decreased by 18.6% in real terms; however, value of shipments and value-added increased by 59.20% and 68.23% respectively.

Introduction

Total economic value of the global forest-based industry was US $468 billion, employing 13.7 million people in 2006 (Forest products industry technological road map 2010). The U.S. accounted for23.2% of the global forest products industry economy (FAO 2011). Eighty-nine percent of timber harvested in 2009 was industrial round wood that was used for lumber, paper, other industrial products and export (USDA 2012). The South's forests cover 46% of the total land area of the South, the largest percentage of US forest land (Alvarez 2007). The region is the leading producer of timber in the world (Prestmon and Abt 2002). The forest products industry accounted for 1.6% of total economy of the South in 2009 (Dahal et al. 2013). The South's forests provide a range of services and benefits such as recreation and ecosystem services, employments, and revenues. Thus, forest resources are major economic assets for the South.

The housing collapse in 2006 and recession from 2007 to 2009 have had a great impact on the southern forest products industry economy (Woodall et al. 2011). In the ten year period of 1999 to 2009, the South lost 1,022 mills (Brandeis et al. 2012) causing the loss of thousands of jobs. Thus, the economic contribution of the forest products industry clearly changes over time. Changes in the forest products sectors bring larger changes on state, regional, and national economies. Over the past decade, the South's forest related industries went through significant contraction. Thus, monitoring economic contribution over time is crucial.

Studies of the impacts of forest-based industries are useful for policy makers to address critical economic issues and to strengthen the economic health of these sectors. This study replicates Tilley and Munn (2007), which is based on 2001 data, and determines the economic contribution of forest-based industries using 2009 data and then compares in real terms. Results from this study provide a detailed picture of how economic changes have impacted the South's economy and how the forest products industry's contribution has changed over time. In addition, this study also documents important trends in the industry. Consequences of the housing collapse and recession effects are estimated in terms of employment, earnings, value of shipments, and manufacturing value-added.

Methodology

Economic contributions of forest-based industries for 2009 were computed using Impact Analysis for Planning (IMPLAN) version 3.0 software. With the advent of IMPLAN, an input- output modeling system that is updated annually, it has been much easier to model the economic impact of industries and to estimate the changes over time. IMPLAN was originally developed by USDA Forest Service and today consists of 440 industrial sectors. Twenty-six closely related forestry IMPLAN sectors were aggregated into four major forest-based industry sectors. These include a forestry sector (forestry, forest products, and timber tract production), lumber and wood products sector, paper and allied products sector, and wood furniture sector. IMPLAN models were then constructed for thirteen southern states and for each forest-based industry sector. The thirteen southern states were also combined to generate regional economic impact in terms of forest-based employment and earnings.

Value of shipments and manufacturing value-added for 2009 were obtained from 2009 Annual Survey of Manufacturers (American Fact Finder). Gross state products values for 2009 were obtained from U.S. Department of Commerce Bureau of Economic Analysis. North American Industrial Classification System (NAICS) codes 321 (wood product manufacturing) and 322 (paper manufacturing) were aggregated as forest-based industries.

To adjust for inflation, 2009 dollar values were deflated back to 2001 dollars using 2009 IMPLAN database deflators. Results were then compared to Tilley and Munn (2007) in real as well as in nominal terms.

Results

Forest-based industries accounted for 0.84% of the South’s total employment in 2009, down from 1.3% in 2001. In spite of a 5.25% increase in total state employment, forest-based employment decreased by 33.35%. Between 2001 and 2009, forest-based jobs decreased for all sectors except for the forestry sector (which increased by about 2,100 jobs). Lumber and wood products sector, wood furniture sector, and paper and allied products sector lost 37.28%, 36.67%, and 26.01% of jobs respectively from 2001 to 2009 (Table 1.). Forest-based earnings accounted for 0.98% of total state earnings in 2009. Average annual forest-based earning was about $55,000, about $8,000 greater than that of total state average earnings. Without taking the forestry sector into account, forest based earnings decreased by 4.86% in spite of a 39.31% increase in regional total industry earnings in nominal terms. Paper and allied products sector earnings increased by 3.23% in nominal dollars, but in real dollars earnings decreased for all forest-based sectors. Between 2001 and 2009, total industry earnings for the region increased by 7.98% while forest-based earnings decreased by 18.63%. Lumber and wood products, wood furniture, and paper and allied products sectors’ earnings decreased by 21.87%, 26.67%, and 11.29% respectively from 2001 to 2009 (Table 1.).

Table 1. Forest-based industry (FBI) employment and earnings of the South

Forest-based industry	Employment		Earnings ($MM)		
			Nominal terms (current		Real terms
	2001[a]	2009	2001[a]	200	In 2001 dollar
Forestry	6,034	8,192	NA	419.7	349.3
Lumber and wood products	254,61	159,68	8,152.8	7,095.2	6,369.6
Wood furniture	260,48	164,97	7,503.4	6,844.6	5,502.0
Paper and allied products	197,03	145,78	11,816.4	12,198.1	10,482.1
Total FBI	718,17	478,64	27,472.6	26,557.7	22,703.1
South total	54,290,94	57,143,48	1,942,181.8	2,705,636.5	2,097,201.7

[a] Tilley and Munn 2007

Forest-based value of shipments and manufacturing value-added (NAICS 321 and 322) accounted for 11.60% and 12.99% to total state value of shipments and total manufacturing value-added respectively in 2009 (Table 2.). In nominal dollars, between 2001 and 2009, forest- based value of shipments increased by 91.80% while it increased by 21.96% for all industry. However in real dollars, total industry value of shipments decreased by 5.91%, but for forest- based industry value of shipments increased by 59.20%. Forest-based industry manufacturing value-added increased by 102.68% in comparison to an increase in total industry manufacturing value-added of 13.73% in nominal dollars. In real terms, the regional manufacturing value-added decreased by 13.73%, and forest-based manufacturing value-added increased by 68.23%. Forest- based industry manufacturing value-added as a percentage of gross state product increased from 1.41% to 1.96% in nominal dollars and 2.11% in real dollars from 2001 to 2009 (Table2.).

Table 2. Value of shipments, manufacturing value-added, and gross state product of the South

Yea r	Value of shipments			Manufacturing value-added			GSP ($Bn.	Value-added as % of
	All	FBI	%	All	FBI	%		
2001	1,329.3	98.02	7.37	578.84	42.20	7.29	2,991.93	1.41
200	1,621.2	188.01	11.60	658.29	85.52	12.99	4,356.26	1.96
In 2001	1,250.7	156.05	12.48	507.87	70.98	13.98	3,360.83	2.11

[a] Tilley and Munn 2007

Discussion and Conclusions

The major objective of this study was to estimate the change in economic contribution of the forest-based industry between 2001 and 2009 in nominal as well as in real terms. Estimated results revealed two major findings. First, there was an abrupt decline in forest-based employment and earnings and second, forest-based value of shipments and manufacturing value- added increased sharply. This suggests that forest-based industries are becoming less labor dependent and that profit margins are shrinking, possibly due to increased foreign competition and the economic downturn.

Among forest-based industry sectors, the paper and allied products sector made the largest contribution to the regional economy. Sectors closely related to housing were highly negatively impacted. Although total state employment and earnings for the southern region increased, forest-based employment and earnings decreased substantially. This decrease is consistent with a longer term trend, for example, employment decreased from 770,000 direct jobs in 1997 (Abt et al. 2002) to 718,000 in 2001 (Tilley and Munn 2007) and then to 573,000 in 2004(Brandeis et al.2012), however, it was much greater in the recent downturn (Hodges et al. 2007). This suggests that the recent recession and associated sharp decline in housing and other constructional activities had a disproportionately large negative impact on forest-based industries. Thus, recovery of housing and other constructional activities is critical to reviving the southern forest economy.

Social Accounting Matrix (SAM) multipliers for forest-based industry sectors were higher in 2009 in comparison with 2001 (Dahal et al. 2013) and average annual earnings was $12,000 higher than total state average earnings. Thus, although the forest-based industry may be shrinking in the South, forest-based industry is still one of the major contributors to the South's economy. In addition, forest-based industries have higher impacts in terms of employment than hunting, fishing, and wildlife-associated recreational activities. For example, Poudel et al. (2013) reported employment SAM multiplier for hunting recreational activities of 1.94 and Dahal et al. (2013) reported lumber and wood products, wood furniture, and paper and allied products sector's employment SAM multiplier of 2.53, 2.05, and 4.02 respectively. This indicates forest- based industries generate more additional jobs than forestry related recreational activities.

The findings of this study reveal that the forest-based industry is one of the major contributors to the South's economy; however, the size of that contribution has decreased in recent years. This study provides an update to baseline economic information on the forest-based industry, which can be helpful in guiding government policies designed to help restore forest-based industry's economic contribution.

Future research

This study should be periodically updated to identify and detail changes to the impact of forest- based industry. Future research should also concentrate on the causes of change in the industry so that appropriate actions can target the root causes of any negative changes. In addition, focus should also be made on non-market contributions like environmental services and recreational activities. New opportunities like wood-based bioenergy from unused mill residue might be helpful in increasing economic activity. Therefore, future research should also address emerging opportunities in relation to southern forest-based industries so that optimum use of forest resources can be made which can reinvigorate forest-based industry's economic impact in the South.

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Session A4-3

Economic Impacts of the Forestry and Forest Products Industries on the Alabama Economy

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Abstract

This study examined the contribution of the forestry and forest products industries to the overall Alabama economy, utilizing the IMPLAN model and database. The economic impacts were evaluated in term of total industry output, value-added, employment, and labor income. The total economic impacts are the sum of direct effects, indirect effects, and induced effects. Indirect effects represent the changes in economic activities in industries supplying goods and services to forestry and forest products industries, while induced effects represent the changes in economic activities resulting from consumption of goods and services using incomes generated from forestry and forest products industries and supporting industries. The 2011 data were used for this study. The results were also compared with previous research to show the changes in total economic impacts of Alabama's forestry and forest products industries.

Session A4-4

Factors Influencing Household Income of Indigenous People in Bangladesh

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Abstract

Living in proximity to the forest, indigenous people of Bangladesh are considerably dependent on forest resources in a number of ways. Homestead forests are one of the major sources of their livelihood. In order to identify the potential role of forests on homestead dwellers, an empirical field investigation was conducted in five districts of Bangladesh where three indigenous communities are mostly found. Using Tobit model in LIMDEP, we found that the size of homestead forest ownership and their occupation significantly contributed to the proportion of total income from forestry. Training in basic forest management was also found to be significant. An ordinary least square model on total household income was also estimated. The results showed that education, size of family, forest land ownership, access to credit, and ratio of forest trees on land contributed significantly to increase total income. There was also a significant regional difference in total income.

Session B4-1

Application of real options theory in loblolly short rotation biomass plantation in AL

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Abstract

We explore foresters' reluctance to plant short rotation loblolly biomass even when market available, expressed as net present value (NPV) of future streams which is in deterministic settings, assumed decision makers have perfect foresight to future conditions. However, variability in returns and decision making flexibility may play a role in land use decisions. This research built upon previous short rotation plantation setting in two regions located in AL; Piedmont, and Coastal, applying stochastic real option model to include the value of flexibility in land use choices and harvest responses in stochastic biomass prices in AL. We assumed biomass price behavior would be similar to pulpwood price distributed as random walk with drift and mean reversion processes. Two managerial flexibilities in biomass thinning and pulpwood thinning were included. Option values were evaluated from binomial option pricing model. We found that values of project increase with real option approach with stochastic biomass price, and with flexible land use choices. Sensitivity analysis with lower volatility, lower random walk drift term and lower long term mean also show the consistent option values.

Session B4-2

Timberland Ownerships and Reforestation in the Southern United States

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Abstract

Timberland owners often have different objectives and apply different management methods and intensity to their lands. In this study, we look into the reforestation behavior of various timberland owners in the southern United States based on plot-level data from the latest complete USDA Forest Service Forest Inventory and Analysis (FIA) cycles. Our results show that, after controlling for market and locational variables, the probability of reforestation was higher for institutional and industrial owners than for non-industrial private forest landowners and was highest for timberland real estate investment trusts (Timberland REITs). These findings imply that the emerging institutional timberland owners do reforest and embrace sustainable forestry practices.

INTRODUCTION

One of the critical decisions in forest management in the southern United States is whether to replant after timber harvesting. Often forest landowners have different management objectives, technical know-how, and constraints, and thus apply different management methods and intensity to their lands—including whether to reforest (Newman and Wear 1993; Li and Zhang 2007). While many previous studies on reforestation in the U.S. (e.g., Lee et al. 1992; Li and Zhang 2007) have focused on forest industry and non-industrial private forest landowners, forest landownership has changed in the country in the past decade (Sun and Zhang 2011). In particular, most industrial timberlands, previously owned by vertically integrated forest products companies, have been sold to institutional investors or have been converted to timberland real estate investment trusts (Timberland REITs). The institutional investors that bought the industrial timberland typically include pension funds, endowments, foundations, and insurance firms that favor diversified portfolio. These institutional investors often hire Timberland Investment Management Organizations (TIMOs) to manage their timberland. Timberland REITs, on the other hand, is mostly controlled by another institutional entity—mutual funds (Gunnoe 2012; Zhang et al. 2012). It is unknown whether results from previous studies hold for these two new groups of timberland owners, commonly known as TIMOs and Timberland REITs, which are collectively called institutional timberland owners in this paper.

Further, reforestation is a long-term investment. As most institutional investors owning timberland through TIMOs often have a limited investment period of 5 to 15 years, they would not do long-term investment such as reforestation unless they can get an acceptable rate of return for their investment when they sell their timberlands. On the other hand, Timberland REITs are obliged to pay some 90% of their dividends back to their investors and often want to keep their regular dividend payments, especially when timber markets are down, by cutting spending, including their spending on reforestation. They, too, may behave differently from traditional forest products companies that own timberlands mainly to secure timber supply for their mills and that do not have to pay dividends on a regular basis (Zhang et al. 2012). Finally, the rise of institutional timberland ownership raises public interest in this new group of landowners and their attitudes towards forest sustainability, and reforestation is an indicator of forest sustainability.

The purpose of this paper is to study the reforestation behavior of four main private forest landowners groups in the U.S. South: industrial, TIMOs, Timberland REITs, and most importantly, other private that are roughly corresponding to the traditional concept of non-industrial private forest (NIPF) landowners. The last group is composed primarily of families and individuals, and is perhaps better called family forest owners (Butler 2008). Zhang et al. (2012) call for research on the behavior of the newly emerged forest landowners, which is one source of motivations for this study. By using a profit-maximizing approach and plot-level data that cover one cycle (5-7 years in between measurements) for each of the 9 southern states (Alabama, Arkansas, Florida, Georgia, North Carolina, South Carolina, Tennessee, Texas, and Virginia) in the USDA Forest Inventory Analysis (FIA) surveys, we were able to estimate determinants of reforestation among these private landowners. Our results show that Timberland REITs reforest more often than all other landowners and that industrial owners and TIMOs are more likely to reforest than NIPF (or family) landowners. Further, variations in landowners' reforestation behavior are found to be related to market conditions and geographical locations.

The next section provides a brief literature review, followed by analytical framework, methodology, data, and results. The final section provides a summary and discussion.

LITERATURE REVIEW

While many studies have focused on ownership and timber supply (e.g., Binkley 1981; Kuuluvainen et al. 1996; Amacher et al. 2003; Jin and Sader 2006; Favada et al. 2009), several studies have focused on the reforestation behavior of forest industry and NIPF landowners (e.g., Lee et al. 1992; Li and Zhang 2007). Often this behavior is modeled as a binary choice: to reforest or not to reforest. Royer (1987), for example, employed a logistic regression to model NIPF reforestation probabilities. Income, reforestation costs, government cost-sharing, technical assistance, and pulpwood price were found to be related to reforestation. Hyberg and Holthausen (1989) and Straka and Doolittle (1988) used a similar approach to investigate harvest timing and reforestation choices of nonindustrial private landowners and reached similar conclusions.

Other approaches have included ordinary least square (OLS) (e.g., Lee et al. 1992), two-step selectivity (e.g., Zhang and Flick 2001), and panel data (e.g., de Steiguer 1984; Li and Zhang 2007) models. The most recent and relevant one to this study is perhaps Li and Zhang (2007) who controlled for spatial correlations and analyzed the tree planting activities of NIPF and forest industry owners in U.S. South. They concluded that sawtimber price, income, cost of capital, and cost-share programs were significantly related to NIPF tree planting, and stumpage prices and reforestation costs significantly influenced forest industry tree planting.

To the best of our knowledge, there has not been a reforestation study based on plot-level data, although reforestation studies based on landowner surveys is close to plot level. In addition to the above variables often used in reforestation analysis, locational variables have been included in many studies on timber supply and land use changes. Finally, it is noted that population growth and migration accelerate the conversion of forest lands for urban uses, which increases the opportunity cost of forest management, including reforestation (e.g., Prestemon and Wear 2000; Kline et al. 2004; Nagubadi and Zhang 2005; Polyakov and Zhang 2008).

ANALYTICAL FRAMEWORK AND HYPOTHESES

Using the widely accepted approach—the Faustmann model which assumes that private forests are managed on the basis of maximizing the expected net present value of future cash flow associated with a forest, Hyde (1980) and Chang (1983) show that reforestation investment or tree planting is positively related to timber stumpage prices and negatively to planting costs and costs of capital. Zhang and Pearse (2011) demonstrate algebraically that these results hold for all silvilcultural investment. Our analytical framework is based on these results.

We argue, however, that the realized (after-tax) timber stumpage prices, planting costs, and especially interest rates differ among the four types of landowners. Consequently the behavior in reforestation and other forest management activities varies.

For after-tax stumpage prices, all Timberland REITs and most TIMOs pay no taxes on timberland income; NIPF landowners pay capital gain tax on timber income which is lower than ordinary income and corporate income; and forest industry often pays corporate income taxes that are close to 35% (Lehman Brothers 2006). Thus, all other things being equal, the realized, after-tax stumpage prices are higher for Timberland REITs and TIMOs than NIPF and industrial landowners, and industrial landowners are the most-disadvantaged group of the four.

On the other hand, industrial, Timberland REITs, and TIMOs possess a scale economy in site preparation and planting activities and have a lower per-unit planting cost than NIPF owners. While some NIPF landowners in the U.S. South do receive subsidy in tree planting from government cost-share programs (Zhang 2004), such subsidies are mostly reserved for conservation-oriented tree-planting or afforestation activities, not for reforestation.

Finally, the cost of capital may be lower for TIMOs and REITs than for forest industry. This is because timberland investment has a lower risk and offers better diversification potentials than investment in forest industry (Binkley et al. 1996). In fact, one of the main reasons that industrial timberland owners started to sell their timberlands is that raising capital through divesture of timberland is less costly than that from equity or debt markets (Rinehart 1985). Empirically, while the required rate of return for TIMOs is often stated at 5-8% in real terms, the cost of capital for forest industrial firms has been harboring around 8 to 11% in the last decade (Robert et al. 2004; Lehman Brothers 2006). NIPF landowners have the greatest number and are the most diverse among the four groups. Although the average cost of capital for this group of landowners is unknown, individual families and family corporations that own forestland, because they are typically small, might have higher costs of capital than corporate owners.

Based on this discussion, we hypothesize that the propensity of reforestation is the highest for TIMOs and REITs and the lowest for NIPF landowners. Industrial landowners have advantage in planting costs. They also have an added benefit or another motivation for owning timberland: they need timber as insurance against vagaries of timber markets. Thus, their propensity for reforestation should be higher than NIPF landowners.

METHODOLOGY AND DATA

Our study method is logistic regression. Specifically, landowners maximize their expected profits by choosing whether to replant their newly harvested timberland. The probability of a plot (tract) being reforested after timber harvesting is

$$P_i = Prob\ (Y_i^* \geq 0) \qquad [1]$$

where *i* denotes the i^{th} plot. Y_i^* is the expected profit of reforestation activity on the i^{th} plot, which is not directly observable, but can be approximated by market conditions, stand characteristics (e.g., site productivity, stand slope, location of the tract), and landowner characteristics that control for variations in ownership objectives and constraints. So when a reforestation takes place on the i^{th} plot, $P_i = 1$, it can be readily seen that

$$Prob\ (P_i = 1) = Prob\ (Y_i^* \geq 0) = \beta' x_i + \epsilon_i \qquad [2]$$

where x_i are independent variables that cover market conditions, stand characteristics, population density, and ownership, β are parameters to be estimated, and ϵ_i is a residual, $\epsilon \sim N(0,1)$.

Equation [2] is a logistic model that is used to estimate the determinants of the probability of reforestation. The cumulative distribution of the logistic function is

$$Prob(P_i = 1) = \frac{e^{\beta' x_i}}{1+e^{\beta' x_i}} = \Lambda(\beta' x_i) \qquad [3]$$

Estimation of binomial model is usually based on the maximum likelihood method (Greene 2003). Although systematic differences in the distribution of Y^* across plots might not meet the optimality properties of maximum likelihood estimation (Greene 2003), the large sample for all ownerships used in this study negate this issue.

As noted earlier, our data are at the plot (stand) level and are from FIA. FIA is charged with assessing the country's forest resources, including ownership changes, and has established a grid of permanent inventory plots across the country (Bechtold and Patterson 2005). There is one sample plot per approximately 6,000 acres and the plots are re-measured once every 5 to 7 years in the eastern U.S. For every forested plot that is encountered, the ownership is determined from tax records and forest mensuration data is collected in the field.

Prior to 2007 (e.g., Smith et al. 2004), FIA reports classified private timberland landowners into industrial and NIPF owners. Starting with the 2007 report which covers the period from 2003 to 2007 (Smith et al. 2009), private landowners were classified into corporate and non-corporate ownerships. The corporate owners include all firms such as industrial, TIMOs, REITs, other forestry corporations (forestry consultants, loggers, and tree farmers), incorporated family operations (such as Johnson Farm, LLC), and non-forestry corporations (such as utility, mining, real estate). The non-corporate owners include individuals (or families) and entities such as conservation organizations, unincorporated partnerships (associations and clubs), and tribal. Zhang et al. (2012) provided a method and classified all private landowners into industrial, TIMOs, REITs, and NIPF. This allows us to focus on the main private timberland ownership categories: forest industry, TIMOs, REITs, and NIPF landowners, which collectively own about 90% of all forestland in the region.

The sample plots of softwood and hardwood covered in this study are all clear-cut during the most recent inventory cycles. A clear-cut harvest is defined by FIA as the removal of the majority of the merchantable trees on a plot. Although reforestation behavior is not necessarily undertaken immediately upon harvesting (Amacher et al. 2003), tree planting is significantly and positively related to previous-year harvest (Li and Zhang 2007). Further, the majority of landowners who reforest their lands do so within 1 year after timber harvesting (Sun et al. 2008).

Particularly, Equation [2] is expressed as:

$$P_i^* = \omega_{0i} + \omega_{1i} SawtimberPrice + \omega_{2i} PulpwoodPrice + \omega_{3i} Cost + \omega_{4i} Distance + \omega_{5i} Slope + \omega_{6i} Coastal + \omega_{7i} Productivity + \omega_{8i} Density + \omega_{9i} Ownership + \epsilon_i \quad [4]$$

where *Sawtimber Price* is defined as the average of real prices for sawtimber during the re-measurement period, *Pulpwood Price* is defined as the average of real prices for pulpwood during the re-measurement period, and $Cost$ is expressed as reforestation cost in real term. *Distance* is equal to one if horizontal distance from the plot to an improved road is less than or equal to 0.5 miles and zero otherwise, *Coastal Plain* is a dummy variable indicating whether the plot is sampled from coastal plains, *Slope* expresses the angle of slope of the plot condition, and *Productivity* is equal to one if the potential growth capacity of industrial wood is more than or equal to 85 cubic feet/acre/year and zero otherwise. *Density* is population density in the county where the plot is located and is a proxy for urbanization, and *Ownership* are three dummy variables representing industrial, TIMOs, and REITs, respectively[1]. The specific form of Equation [4] is (introducing the ownership category index, *j*):

$$P^*_{k|j} = \omega_{0k|j} + \omega_{1k|j} SawtimberPrice + \omega_{2k|j} PulpwoodPrice + \omega_{3k|j} Cost + \omega_{4k|j} Distance + \omega_{5k|j} Slope + \omega_{6k|j} Coastal + \omega_{7k|j} Productivity + \omega_{8k|j} Density + \epsilon_{k|j} \quad [5]$$

where $k \mid j$ denotes the plot k under the timberland ownership category j.

We used the most recent and complete inventory cycles with the fixed radius plot design across nine southern states: Alabama cycle 8 (2001-2005), Arkansas cycle 8 (2000-2005), Florida cycle 8 (2002-2007), Georgia cycle 8 (1998-2004), North Carolina cycle 8 (2003-2007), South Carolina cycle 9 (2002-2006), Tennessee cycle 8 (2005-2009), Texas cycle 8 (2004-2008; east Texas only), and Virginia cycle 8 (2002-2007). USFS FIA provides data for all variables, except stumpage prices, reforestation costs, and county population density.

The two price variables of softwood and hardwood (for sawtimber and pulpwood) were used in Equation 4. Nominal stumpage prices for sawtimber and pulpwood during the re-measurement period for each survey unit were obtained from Timber-Mart South (TMS). Reforestation costs included mechanical site preparation and hand planting. Nominal reforestation costs for forestry practices in the South during the re-measurement period were obtained from the Cost and Cost Trends series produced on two-year intervals (Dubois et al. 1995; Dubois et al. 1997, 1999, 2001; Dubois et al. 2003; Folegatti et al. 2007). For the unreported years, reforestation cost was calculated by averaging the costs over the 2 years in-between. Real prices and costs, expressed in 1992 dollars were calculated using the Producer Price Index. Real stumpage prices and reforestation costs during the re-measurement period for a plot were taken as the average annual index-deflated stumpage prices and reforestation cost. For example, if a plot in Alabama was measured in 2005 during the FIA cycle 8 and the number of years between measurements is 6, the real stumpage prices and reforestation cost were averaged over the year 2000 through 2005. Finally, the variable *Density* was obtained from the 2010 complete economic and demographic data source (CEDDS) to indicate urbanization level by county.

RESULTS

Table 1 provides descriptive statistics of our sample. Of the 1202 plots included in this study, 493 were replanted following a clear-cut. For 45% of the 1202 plots, pine was the predominant forest type. Of the softwood plots, about 75% were replanted following a clear-cut. Of the hardwood plots, about 14% were replanted. The average stumpage prices were $58/cubic meter and $3/cubic meter for sawtimber and pulpwood, respectively. The average reforestation cost $300/hectare in 1992 dollars. The predominant mileage of horizontal distance to improved road for 86% landowners was less than or equal to 0.5 miles. Average angle of slope, in percent, of the site condition was 4.7. About 55% of the plots were in Coastal Plains while the remainder was in either Piedmont, or mountain, or delta physiographic regions. Of the 1202 plots, about 45% were capable to grow 85 cubic feet/acre/year or more industrial woods. County population density averaged 77 persons/square mile.

Table 2 presents the descriptive statistics for the variables by the ownership group. About 67% of timberland plots were owned by NIPF landowners, 15% by forest industry, 11% by Timberland REITs, and 7% by TIMOs. The reforestation probability was 0.60 for forest industry, 0.58 for TIMOs, 0.65 for REITs, and 0.31 for NIPF landowners. In addition, we used pair-wise wald test statistics to examine the difference of independent variables among the four types of ownership. *Distance* for institutional plots was significantly shorter than for both NIPF and industry-managed plots at the 10% level or better. Industry and TIMOs-managed lands were more capable to grow industrial woods than NIPF lands at the 10% significant level or better. In addition, NIPF plots were located in the counties with higher population density than industry, TIMOs, and REITs plots. Because these and other factors differ among the four types of ownership, inferences about the effect of ownership on reforestation call for additional econometric analysis.

Table 3 reports maximum likelihood estimation of a logit model of reforestation for all plots included in this study. The *Chi-square* of the logit model was significant at the 1% significant level, indicating that the model fits well. The coefficients for *Industry*, *TIMOs*, and *REITs* were positive and significant, with marginal effects of 0.25, 0.29, and 0.26, respectively. This implies that, all else being equal, industry and institutional timberland investors were more likely to conduct reforestation than NIPF landowners.

As expected, all market factors have significant impacts on reforestation behavior. *Satimber Price* and *Pulpwood Price* positively influenced the replanting probability, and *Reforestation Cost* had a negative effect, with marginal effects equal to 0.01, 0.14, and -3.95, respectively. Therefore, each additional dollar increase in pulpwood price per cubic meter was associated with a 0.14 increase in the predicted reforestation probability. Among the stand characteristics, *Distance*, *Coastal Plain*, and *Productivity* significantly had a positive impact on the replanting probability. The marginal effects of these three variables were 0.08, 0.08, and 0.06, respectively. The predicted reforestation probability was 0.08 greater for plots in coastal plain region than for plots in Piedmont, mountain, or delta physiographic regions. The coefficient for *Density* was significantly negative at the 5% level.

These results indicate that, after allowing for other influences, institutional and industrial landowners are more likely to reforest than NIPF landowners. Using the results in Table 3, we predicted the probability of reforestation for each plot and then tested whether the predicted probabilities are significantly different among landowner groups. Not surprisingly, the results of pair-wise wald test statistics again show that predicted reforestation probabilities for industry and institutional plots are significantly higher than for NIPF plots at the 1% level (Table 4). The predicted reforestation probability for REITs was higher than, and significantly different from, those for Industry and TIMOs (with p value = 0.008 for REITs vs. TIMOs and p value = 0.01 for REITs vs. Industry, respectively). Yet, the predicted probabilities for Industry and TIMOs were not significantly different (p value = 0.52). This implies that, all else being equal, timberland REITs had a high propensity to reforest than the traditional forest industry owners and TIMOs. Figure 1 shows the average predicted probability of reforestation with plot deviation and the range between minimum and maximum probability for all four landownerships to display the distribution of the predicted replanting probability. There was substantially more variation for the full range of the replanting probability (from min to max) on NIPF land which ranged approximately from 0.02 to 0.95, whereas the replanting probability for the middle half of the plots fell within 0.40 and 0.79 for Industry, 0.39 and 0.77 for TIMOs, and 0.46 and 0.84 for REITs.

Table 5 reports the maximum likelihood estimates of logit models of the replanting probability for all plots by forest type (softwood vs. hardwood). Generally speaking, softwood plots managed by Industry, TIMOs, and REITs were associated with a higher replanting probability than owned by NIPF, with marginal effects of 0.12, 0.19, and 0.10, respectively, while there was no significant difference for hardwood plots between NIPF and the other three ownership groups. In addition, for softwood, *Pulpwood Price*, *Coastal Plain*, and *Productivity* had a positive and significant impact on the predicted replanting probability, whereas *Density* adversely affected the replanting probability. For hardwood, only *Distance* significantly and positively influenced the replanting probability.

We also applied the logit model to each of the four ownerships, and the results are presented in Table 6. All models have relatively good fit at the 5% significant level or better. Among the market variables, *Sawtimber Price* had a positive and significant impact on the replanting probability for industry and NIPF, and *Pulpwood Price* for TIMOs and REITs. *Reforestation Cost* significantly and adversely affected the replanting probability for industry, REITs, and NIPF plots, with the marginal effects of -6.07, -4.27, and -3.00, respectively. Among the plot characteristics, *Distance* had positive and significant effect on the probability of replanting for TIMOs and REITs, and the marginal effects were 0.48 and 0.32, respectively. *Coastal Plain* had a positive impact on the replanting probability for TIMOs, with the marginal effects of 0.27, and *Productivity* was significantly and positively associated with the replanting probability for industry. Moreover, *Density* adversely affected the reforestation probability for NIPF.

SUMMARY AND DISCUSSION

In this study we use a binomial logit model to examine the probability of reforestation among timberland ownership groups. Our results show that industrial and institutional timberland owners, especially those have timber land owned by Timberland REITs, do reforest more often than non-industrial forest owners shortly after timber harvesting. These results are indirectly confirmed in a survey conducted by Rogers and Munn (2003), which reveals that institutional timberland owners manage their timberland as intensively as industrial owners in Mississippi, and are similar to Lee, Kaiser, and Alig (1992) and Li and Zhang (2007) regarding reforestation by industrial and non-industrial forest owners. Despite the fact that institutional investors often invest in timberlands for a specified period of time, their reforestation activities—a long-term investment—demonstrate that they are not constrained by their investment periods. At a minimum, it appears that TIMOs and REITs believe that their investment in reforestation will bring them adequate returns in capital appreciation even though their trees may not be mature when they decide to sell their timberlands (Zhang et al. 2012).

Three factors might have contributed to the institutional investors' inclination to reforestation. First, the current capital gain tax and certain tax exemption policy allow institutional investors to obtain a greater return in long-term silvicultural investment. Second, institutional investors may not have the capital constraints as some NIPF landowners might have (Browne 2001). Further, they are able to move their capital into management practices with relative ease, in comparison with traditional C-corporations. Finally, as Siry and Cubbage (2001) and Zhang et al. (2012) note, planted pine dominates the holdings of many TIMOs, and pine plantations are more likely to be followed by another plantation.

Thus, as far as the reforestation aspect of forest sustainability is concerned, the institutional timberland owners are at least up to the standard of traditional industrial owners and are doing better than NIPF landowners in terms of replanting. This does not suggest that NIPF landowners do not manage their lands less sustainable than institutional owners because the formers own more natural forests. A more critical question is whether institutional timberland owners are more likely to convert forest lands to non-forest uses, which often represent a permanent forest loss. This could be a question for future research. Future studies could also look into variations among landowners in other silvicultural treatments, such as the use of prescribed fire, fertilization, and herbicide, and into the environmental impacts of their forest practices.

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Table 1. Description and statistical summary for all ownerships

Variable	Definition	Mean	S.D.
Reforestation	Reforestation probability	0.41	--
Sawtimber Price	Sawtimber real price ($/cubic meter)	58.03	20.04
Pulpwood Price	Pulpwood real price ($/cubic meter)	3.17	1.17
Cost	Reforestation real cost (1,000 $/hectare)	0.30	0.08
Distance	Dummy: 1 if horizontal distance to improved road was less than or equal to 0.5 mile, and 0 otherwise	0.86	--
Slope	The angle of slope of the plot	4.71	8.95
Coastal	Dummy: 1 if coastal plain; 0 otherwise	0.55	--
Productivity	Dummy: 1 if the potential growth capacity of industrial wood is more than or equal to 85 cubic feet/acre/year, 0 otherwise	0.45	--
Density	Population density in the county (persons/square mile)	76.64	113.35
Industry	Industrial: 1 if industry landowner; 0 otherwise	0.15	--
TIMOs	Timberland Investment Management Organizations (TIMOs): 1 if TIMOs; 0 otherwise	0.07	--
REITs	Timberland real estate investment trusts (REITs) : 1 if REITs; 0 otherwise	0.11	--

Table 2. Sample statistics by each type of ownership

	Industrial		TIMOs		REITs		NIPF	
Variable	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Reforestation	0.60	--	0.58	--	0.65	--	0.31	--
Sawtimber Price	59.66	18.89	55.55	19.06	58.48	23.82	57.83	19.68
Pulpwood Price	3.24	0.96	2.92	0.83	3.44	1.24	3.13	1.23
Cost	0.30	0.08	0.29	0.08	0.29	0.10	0.31	0.08
Distance	0.82	--	0.91	--	0.93	--	0.84	--
Slope	4.28	7.46	5.05	10.70	1.46	3.69	5.34	9.58
Coastal	0.56	--	0.48	--	0.55	--	0.56	--
Productivity	0.52	--	0.52	--	0.46	--	0.43	--
Density	54.66	60.47	57.00	78.30	60.42	80.00	86.58	128.53
Obs. #	186		81		138		797	

Table 3. A logit regression model estimating reforestation probabilities for ALL sampled plots located in the 9 southern states

Variable	Coefficient	*z*-test	Marginal Effect
Constant	-0.64	-1.56	--
Sawtimber price	0.04***	4.86	0.01
Pulpwood price	0.60***	6.26	0.14
Cost	-16.61***	-8.77	-3.95
Distance	0.35*	1.75	0.08
Slope	-3.77E-3	-0.42	--
Coastal plain	0.32*	1.90	0.08
Productivity	0.24*	1.67	0.06
Density	-1.58E-3**	-2.02	-3.76E-4
Industry	1.07***	5.73	0.25
TIMOs	1.21***	4.97	0.29
REITs	1.09***	4.64	0.26
Log likelihood	-644.80		
Chi-square	337.69***		
Number of obs	1202		

***, **, and * indicate statistical significance, different from zero at the 1%, 5%, and 10%, respectively.

Table 4. Pire-wise comparison of predicted reforestation probabilities between landowners

	Industry vs. TIMOs	Industry vs. REITs	Industry vs. NIPF	TIMOs vs. REITs	TIMOs vs. NIPF	REITs vs. NIPT
Difference on average reforestation probability	0.02	-0.06	0.29	-0.07	0.27	0.34
t-ratio	0.64	-2.55**	17.23***	-2.68***	11.28***	18.09***

***, **, and * indicate statistical significance, different from zero at the 1%, 5%, and 10%, respectively.

Table 5. A logit regression model estimating reforestation probabilities by forest type in the 9 southern states

Forest Type	Variable	Coefficient	*z*-test	Marginal Effect
Softwood	Constant	0.69	0.93	--
	Sawtimber price	-0.02	-0.98	--
	Pulpwood price	0.54***	3.60	0.09
	Cost	-3.13	-0.77	--
	Distance	-0.10	-0.32	--
	Slope	-1.52E-3	-0.09	--
	Coastal plain	0.51*	1.85	0.09
	Productivity	0.45**	2.02	0.08
	Density	-3.36E-3***	-2.57	-5.79E-4
	Industry	0.67**	2.43	0.12
	TIMOs	1.12**	2.49	0.19
	REITs	0.61**	1.97	0.10
	Log likelihood	-272.27		
	Chi-square	61.62***		
	Number of obs	538		
Hardwood	Constant	-2.62***	-3.50	--
	Sawtimber price	0.02	1.43	--
	Pulpwood price	-0.13	-0.81	--
	Cost	-1.85	-0.54	--
	Distance	0.66*	1.68	0.07
	Slope	-0.02	-1.17	--
	Coastal plain	0.21	0.75	--
	Productivity	-0.14	-0.58	--
	Density	-1.08E-3	-0.88	--
	Industry	0.55	1.57	--
	TIMOs	0.24	0.47	--
	REITs	0.62	1.42	--
	Log likelihood	-256.71		
	Chi-square	13.51**		
	Number of obs	664		

***, **, and * indicate statistical significance, different from zero at the 1%, 5%, and 10%, respectively.

Table 6. A logit regression model estimating reforestation probabilities by each type of ownership in the 9 southern states

Ownership	Variable	Coefficient	*z*-test	Marginal Effect
Forest Industry	Constant	1.35	1.23	--
	Sawtimber price	0.08***	3.18	0.02
	Pulpwood price	0.32	1.18	--
	Cost	-25.70***	-4.39	-6.07
	Distance	0.37	0.83	--
	Slope	0.02	0.89	--
	Coastal plain	0.44	1.03	--
	Productivity	0.75**	2.04	0.18
	Density	-1.32E-3	-0.44	--
	Log likelihood	-104.45		
	Chi-square	41.94**		
TIMOs	Constant	-5.24**	-2.30	--
	Sawtimber price	0.03	0.94	--
	Pulpwood price	1.86***	3.00	0.43
	Cost	-12.75	-1.56	--
	Distance	2.06**	2.07	0.48
	Slope	-0.02	-0.55	--
	Coastal plain	1.17*	1.64	0.27
	Productivity	-0.36	-0.63	--
	Density	1.46E-3	0.42	--
	Log likelihood	-40.83		
	Chi-square	28.54***		
REITs	Constant	-0.34	-0.26	--
	Sawtimber price	0.04	1.18	--
	Pulpwood price	0.86**	2.01	0.18
	Cost	-20.63***	-3.14	-4.27
	Distance	1.53*	1.71	0.32
	Slope	-0.08	-1.45	--
	Coastal plain	-0.16	-0.22	--
	Productivity	0.62	1.35	--
	Density	6.81E-4	0.22	--
	Log likelihood	-70.09		
	Chi-square	38.13***		
NIPF	Constant	-0.47	-0.98	--
	Sawtimber price	0.04***	3.39	0.01
	Pulpwood price	0.60***	5.34	0.12
	Cost	-14.93***	-6.70	-3.00
	Distance	0.11	0.49	--
	Slope	-1.91E-3	-0.18	--
	Coastal plain	0.31	1.48	--
	Productivity	0.15	0.83	--
	Density	-1.76E-3**	-1.98	-3.55E-4
	Log likelihood	-416.61		

Chi-square	150.29***

***, **, and * indicate statistical significance, different from zero at the 1%, 5%, and 10%.

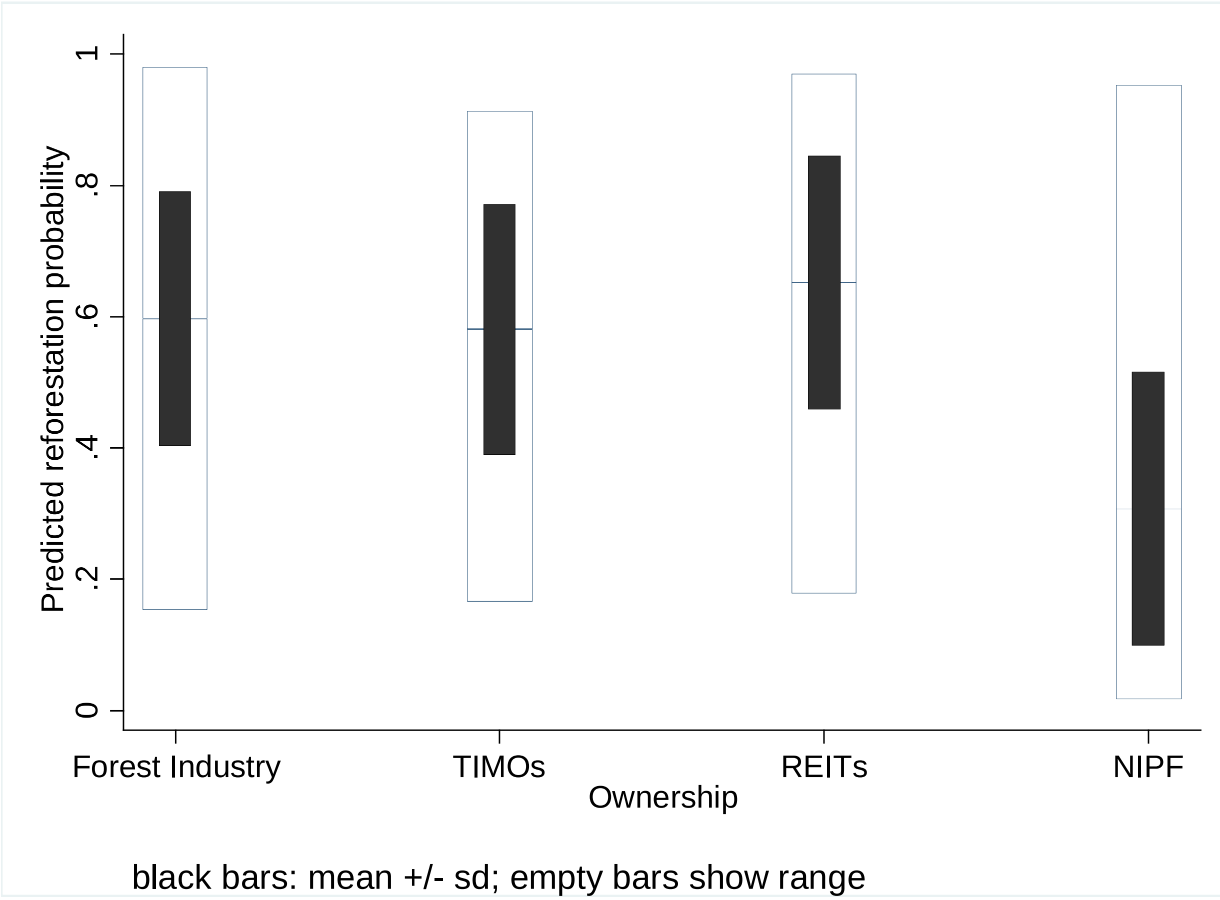

Figure 1. Average predicted probability among timberland owners

Footnotes

FIA collects and maintains the name and address information from tax records since 2004, while the study period of this paper is from 1998 to 2009. Among the plots with which we could identify ownership in both FIA cycles, about 13% had different ownership categories between the two FIA cycles. Since we do not know exactly which year the legal transformation of timberland ownership took place, we have treated the ownership of all plots the same as in the last FIA cycle in our study period.

Session B4-3

Eucalyptus plantations in Florida USA: Economic Analysis of Current and Potential Uses

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Abstract

The history of introduction of *Eucalyptus* in Florida USA began in the 1870's. During the decade of the 1960's, with the advent of large scale eucalypt plantations for pulping in Spain, Portugal, Brazil, South Africa and other countries, there was a large effort to achieve success with eucalypt plantations in Florida. Cold temperatures, lack of adequate eucalypt plantation culture techniques as well as limited availability of improved seed or clones made these early efforts largely unsuccessful. An area of eucalypt plantations that were begun in the 1960's by Lykes Brothers in southern Florida were successful and now approach 8,000 ha in extension.
In the first years of the 2000 decade there was renewed interest in eucalypt plantations in Florida for mulch, pulp and especially for bio-energy. Developments in bio-energy national and international markets for wood pellets, biofuel, combined heat and power as well as co-generation have promoted the use of short rotation and coppice management in eucalypts in Florida. The eucalypt species showing promise have been *E. benthamii*, *E. macarthurii*, *E. grandis*, *E. amplifolia* and the hybrid *E. urograndis* (*E. grandis* x *E. urophylla*). Current success in eucalypt plantations involves improvement in weed control, fertilization, nursery practice and the availability of local and imported improved seed and clones.

Eucalypt wood yields in Florida are lower in the northern part of the state (MAI 9-18 green tons/ha/year with a rotation of 8-10 years) compared to the southern part of the state (MAI 18-36 green tons/ha/year with a rotation of 6-8 years). Production costs of eucalypt plantation stumpage vary from US$4-10/green ton. Discussion will focus on eucalypt plantation techniques utilizing improved seed or clones, fertilization, site preparation, harvesting techniques and wood utilization for various commercial end uses.

Session B4-4

Economic Returns to Uneven- and Even-Aged Management of Southern Bottomland Hardwoods

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Abstract

Many of the commercially desirable southern hardwood species are shade intolerant and require even-aged management to efficiently regenerate stands capable of producing high volumes of quality timber. Putnam et al. (1960) provide growth and volume estimates for well-managed even and uneven-aged southern bottomland hardwood stands. Based on this information, the economic returns for both even and uneven-aged hardwood management will be estimated for several commercially valuable hardwood species using a range of species-specific growth rates and required rates of return. Land expectation values will be calculated for even and uneven-aged stands dominated by desirable hardwoods or mixtures that include less-desirable species spanning a range of shade tolerances. The implications of regenerating shade tolerant species versus shade intolerant hardwood species will also be discussed in the valuation of both uneven and even-aged hardwood management systems.

Session A5-1

Economic Contribution of Fishing and Wildlife Watching Activities on Southern US

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Abstract

Hunting, fishing and wildlife-associated recreation expenditures have played an important role in the U.S economy and help promote conservation and environmental goals. The 2006 U.S Fish and Wildlife Service (USFWS) survey reported 87.5 million people aged 16 and above participated in wildlife-associated recreation activities, spending $122.4 billion on trips and equipment. This is a 13 percent increase in spending since 2001. Periodic assessment of economic impacts associated with wildlife recreation expenditures provides a consistent perspective on forest and wildlife resource management. This research quantified economic impacts of fishing and wildlife watching expenditures for the thirteen states in the U.S South. IMPLAN models were developed for each state using the 2006 National Survey of Fishing, Hunting and Wildlife-Associated Recreation data to determine the indirect and induced effects of these expenditures. This approach enabled comparison of the relative importance of fishing and wildlife watching expenditures to the various southern states. In particular, the comparison revealed how differences in the individual states' economies and levels of expenditures affect the total economic impacts of wildlife-associated activities. Differences in the impacts of various recreational activities, both among activities and among states, illustrate the importance of understanding intra-regional variations in establishing wildlife programs and policies.

Session A5-2

Input-Output modeling of wood-based bioenergy Industries in Mississippi

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Abstract

The southern region of the United States, which includes Mississippi, has abundant forest resources that provide an opportunity to establish a wood-based bioenergy industry in the region. This study estimated the direct, indirect, and induced economic impacts associated with establishment of wood-based bioenergy facilities in Mississippi. Three potential wood-based bioenergy facilities: wood-pellets, bio-oil, and methanol-based gasoline were considered. The requisite cost information pertaining to the construction and operation of selected wood-based bioenergy facilities were obtained from various secondary sources. Construction activities would impact the economy for a shorter period of time. Results showed operation of a wood-pellet facility would contribute 83 full- and part-time jobs and $12 million worth of economic output to the state economy. Likewise, operation of a bio-oil facility would provide 165 new full- and part-time jobs and an economic output of $17 million. Similarly, an economic output of $96 million and 795 more full- and part-time jobs would be added to the Mississippi economy by establishing a methanol-based gasoline facility. Clearly, these impacts are substantial and are likely to draw the attention of policy makers and investors towards developing wood-based bioenergy opportunities in Mississippi.

Session A5-3

China Appetite for Global Timber

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Abstract

The growth of China's economy in recent years has resulted in a fast increase in timber consumption. About 40% of China's timber demand has been met by imports. As a result, China has become the largest timber importer worldwide in recent years, with an annual import value of over eight billion dollars. In this study, the supplying sources and timber product types imported by China are analyzed within an import demand system. China's major timber suppliers are Russia, Malaysia, Papua New Guinea, New Zealand, and Gabon. Among various timber products, coniferous wood has an average share of 36% from 1996 to 2012, tropical broadleaved wood of 17%, and other nonconiferous wood of 38%. Furthermore, timber imports by China have demonstrated various degrees of substitution among supplying sources and product types.

Session B5-1

Auction mechanisms for standing timber and forestland in Southern China's collectively-own forest areas

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Abstract

Various auction mechanisms are used to privatize the public or collective-owned natural resources, either in total or some components, and to transfer the property rights between households and private firms. In the case of forest resources, auctions could help to formulate the competitive stumpage rate as well as optimal reserve price policy, and develop a credible benchmark for standing timber and forestland transactions such that the seller's revenue and the welfare of the society are maximized. In this paper, we first briefly review timber auction studies in a few developed countries which focused on the performance assessment of different auction formats and main methodological progresses of the econometrics of auctions. Then this research will use the transaction data of Southern Forest Property Rights Trade Center in Jiangxi province to assess the well-functioning of this market based on a comparison of the revenue and allocation efficiency implications in open and sealed bid auctions. The data included more than 1000 standing timber and forestland parcels purchased from 2010 to 2012. We hope this study would help improve future research and application of effective and efficient forest property rights transactions in China.
Keywords: auction theory; informational structures; open and sealed bid auction

Session B5-2

Identifying Private Forest Owner Differences for Effective Policy Decisions: A Case Study in Southeast Europe

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Abstract

The forest-related policies of southeast European countries have changed considerably in the past few decades, particularly due to the unprecedented scale of socio-political changes. The collapse of Yugoslavia in the early 1990s forced a significant evolution of private forest policies in the countries arising from the break up – Bosnia-Herzegovina, Croatia, Republic of Macedonia, Montenegro, Serbia and Slovenia. During the Yugoslavia years, private forest ownership was unattended or even ignored by national forest policy. As a result, few policies existed in the new countries to guide decision makers on private forest management, and the resulting initial policies were developed with little or no consideration of or input from private owners. Furthermore, the new countries were also faced with the task of returning large portions of the state forests to the original private owners. The results of the restitution, privatization, and denationalization process, and the development of private forest policies, are mixed across the former Yugoslavian countries. The aims of this paper are to 1) describe a classification of the private forest owners in Bosnia-Herzegovina and Slovenia based on actual management behaviour, landowner willingness to cooperate, and their expectations for this cooperation; 2) assess the importance of ownership, property, and socio-demographic characteristics in the classification and 3) identify policies to address the needs and concerns of the various groups. Three owner clusters - drivers, supporters, and free riders - were identified in each country. The results reveal that several policy types are needed to reach the three landowner types and this variety of “Smart Regulation” policy options covers a wide range of policy approaches.

Session B5-3

Political economoy of forestry

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P1

Life cycle impact of Loblolly pine (Pinus taeda) management on carbon sequestration in the Southeastern United States

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Abstract

Carbon dioxide is one of the major greenhouse gases which cause global warming. One strategy to slow down the concentration of carbon dioxide is to store carbon in forests but carbon emissions and other environmental impacts occur during forest management. Diesels, fertilizers and other inputs have been the sources of emissions during silvicultural operations. On the basis of a cradle to gate LCA (Life Cycle Assessment) approach for environmental impact assessment and carbon balance model to calculate the carbon sequestration in the loblolly pine plantation, it was found that the carbon (C) cost from silvicultural practices is minimal compare to *in situ* C production at the end of the rotation.

Environmental impact and carbon emissions from the transportation and diesel use in harvesting machinery were found higher. Use of the fertilizer had a significant effect on environment and it was found that fertilizer's contribution on environmental impact increases when the management shifts from lower to higher intensity of management. Nitrogen has the highest impact on the highest number of environmental categories among the three macro nutrients. The total C cost due to silvicultural activities was found to be 1.2% and 0.4% of the total *in situ* in high and low intensity management and the contribution is increased to 2.5% and 1.4% while considering transportation. The C cost of high intensity was three times higher than low intensity management. Forest management practices with the better application rate and efficient use of fertilizers could reduce the fertilizers' effect. Increasing the fuel efficiency of trucks and harvesting machine could decrease the total fuel consumption. Proper route planning during the transportation could increase the loading factor which eventually reduces diesel consumption during the transportation.

P2

Integrating the American Tree Farm System Certification into a University Capstone Forest Resource Management Plans Course

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Abstract

Forest resource management planning was focused primarily on timber production until the late twentieth century. The focus then moved to multiple-use and sustainable forest management. Today forest certification plays a major role in ensuring forest sustainability. The concepts of forest sustainability and forest certification are commonly integrated into the upper level forestry courses in a modern forestry curriculum. Most forestry curricula have a capstone forest resource management plans or planning course. Clemson University is using its forestry capstone course to integrate forest sustainability requirements of the American Tree Farm System into the forest management planning process. We discuss sustainable forest management, forest certification, the American Tree Farm System, and how all three are molded into a capstone forest management plans course. Clemson's forestry students are presented an opportunity to broaden their background on these important topics while working with family forest owners on actual tree farm properties. This real-world experience greatly enhances their grasp of a complex nature of modern forest resource management planning.

Introduction

Many forestry and natural resource management curricula culminate with a forest or natural resource management plans and planning course. Usually this is a capstone course, intended to integrate the prior specialized course work and add breath to curricula that tend to be single discipline-focused. At one time these courses emphasized timber management and planning and centered on timber production objectives; gradually nontimber objectives (like wildlife habitat, recreation, water quality, and aesthetics) became important components of the plans and a multiple-use approach became the norm (Straka, 1993; Fisher, 1996).

Some forestry and natural resource management programs integrate course work within the curriculum (Gilbert et al., 1991; Fox et al., 1996) and other programs tend to stress integration at some point in the curriculum, and it is commonly the function of the capstone course (Petersen, 1993). Integration is crucial if the students are to synthesize their prior coursework from fields like forest management, biometrics, silviculture, forest economics and valuation, wildlife management, soils, forest protection, and forest harvesting and operations (Brown and Lassoie, 1998). With the forestry capstone course all this prior course work is incorporated in one harmonious forest resource management planning project or exercise.

Various approaches have been used for this capstone course. Prior to the multiple-use approach, forestry schools stressed traditional timber management plans. These were often developed on university forests in a simulated management environment. This would develop practical field skills necessary for working on industrial and USDA Forest Service timberlands. Since many forestry graduates found employment on these types of timberlands, this approach developed marketable graduates. Gradually the USDA Forest Service moved towards multiple-use and timber values lost their predominance; family forest owners were recognized as having considerable interests beyond timber management (Thrift et al., 1997); and industrial timberlands began to be managed in a much more environmentally sensitive manner (Straka, 1993). Employers expected forestry and natural resource management graduates to have a much-broader perspective (Brown and Lassoie, 1998; Luckai, 2002).

Private forest land accounts for 56% of total forest land in the United States. Family forest owners account for 62% of that private forest land ownership (Butler, 2008). This means many foresters can expect to directly or indirectly work on family forest lands, perhaps as a consulting forester, county forester, or extension forester. The faculty at forestry schools recognized that a broader focus on these family forest landowners was necessary if forestry students were to be introduced to what was likely to be their clients (Tombaugh, 1998). There also was a recognized need with family forest owners; only 17% of their forest land was managed under a written management plan (Butler, 2008). Forestry students needed to develop the communication skills to talk to these landowners and the ability to develop management plans for their small properties (Egan, 1996). Direct involvement of forest landowners became common in these capstone courses as a way to include complex forest management and real-life interactions with forest owners and their diverse management objectives.

As the capstone forestry and natural resource management courses began to give a priority to real world planning experiences with family forest landowners and multiple-use management objectives, various orientations developed as foundations for the capstone course. They were described in the literature as landowner-oriented approaches (Straka, 1993), landscape level planning approaches (Prokopy, 2009), multidimensional approaches (Egan, 1996), service learning approaches (Prokopy, 2009; Straka, 2005), problem-based learning approaches (Authur and Thompson, 1999; Prokopy, 2009), adaptive management approaches

(Sample et al., 1999), learning centered approaches (Thompson et al., 2003) and ecosystem management approaches (Bengston, 1994; Grumbine, 1994).

Over the last two decades the emphasis on changes to forestry programs and the capstone course has been adapting towards new paradigms, like ecosystem management and forest sustainability (Sample et al., 1999). This is an international shift in emphasis and its impact goes well beyond the American forestry schools (Rebugio and Camacho, 2005; Temu and Kiwia, 2005). Even the standard textbooks on forest management developed a strong forest sustainability perspective (Davis et al., 2001). Forestry and natural resource management seemed to be reorienting or evolving towards the ideal of forest sustainability (Jacobson and Robinson, 1990; Rebugio and Camacho, 2003; Sample et al., 1997) and forest certification, especially at the international-level, appeared to be an important part of the evolution (Konijnendijk, 2000; Temu et al. 2006).

Forest Certification and Sustainability

A formal, written management plan is necessary for compliance with all forest certification organizations. In today's environment, people are becoming more and more interested in the concept of "going green" and the idea of sustainability relating to forest resources is becoming an increasingly important issue for landowners. Forest certification is one way in which private or public landowners can ensure that their land will be managed in a sustainable manner and helps to provide a way to show public this, such as through the use of logos on commodities and signs on the land. Forest certification is defined as a process by which an independent body conducts an inspection by auditors to determine if the landowner is in conformance with a system of standards developed by the specific certification organization. All forest certification entities establish standards that ensure forest resources are managed in a manner which promotes sustainability on environmental, social, and economic levels (Cox, 2010).

Forest sustainability developed as a global problem starting in the 1980s (Kessler et al., 1992; Straka and Layton, 2010; Vogt et al., 2000; Wang, 2004). The first significant global agreement on sustainable forest management, a Statement of Forest Principles, was produced in 1992 at the Rio Conference or Earth Summit, the United Nations Conference on Environment and Development held in Rio de Janeiro (Lindenmayer and Franklin, 2003). The United Nations Forum on Forests was established in 2000 to promote sustainable forest development and in 2007 its General Assembly approved the "Forest Instrument" to serve as a global framework for sustainable forestry. Significantly, one year following the Rio Conference, an International Seminar of Experts on Sustainable Development of Boreal and Temperate Forests was held in Montréal. The criteria and indicators that are used to identify sustainable forest management, called the Montréal Process, developed from that meeting (Montréal Group, 2008).

The basis of the Montréal Process is seven key criteria and seven similar thematic areas. They are considered a foundation of sustainable forest management at the regional or national levels and form a structure for systems that certify forest sustainability. The Montréal Process is generally accepted as an implicit definition of sustainable forest management. The seven thematic areas are (1) extent of forest resources, (2) biological diversity, (3), forest health and vitality, (4) productive functions of forest resources, (5) protective functions of forest resources, (6) social and economic functions, and (7) legal, policy and institutional framework (Montréal Group, 2008).

In the two decades that preceded the Rio Conference the forest sustainability issue developed from environmental groups becoming increasingly alarmed at the massive deforestation of tropical rainforests and the rapid loss of biodiversity. They called for increased "eco-labeling" of wood products, especially those from the tropics. Eco-labeling is a "claim" (tag) attached to a product that indicated its environmental characteristics (Perera and Vlosky, 20060, allowing consumers to identify environmentally-friendly products and to direct their purchasing power to the firms producing those products. Forest certification qualifies as an eco-labeling that identifies forest products that originate from sustainably-managed forests. It is an attempt by the market place, rather than government regulation, to ensure forest products are harvested using sustainability criteria (Maser and Smith, 2001).

The United States, Canada, and Europe have substantial environmental regulations that impact both private and public forests (Fletcher and Hansen, 1999). However, many in the public, especially those in the environmental groups, felt these regulations were not effective. This was the opportunity for environmental groups to develop programs that certified forest products meeting forest sustainability requirements. Forest products trade associations quickly followed suit and developed their own certification programs, ensuring their customers that the timber that went into their products was managed correctly. Some of the certification pressure was indirect; the U.S. Green Building Council introduced Leadership in Energy and Environmental Design (LEED) to improve the environmental performance of buildings; LEED recommends the use of certified forest products in buildings (Hansen et al., 2006). Even logging organizations have developed systems to ensure that harvesting systems support sustainability objectives (Rametsteiner and Simula, 2003).

Forest certification schemes take two forms: process-based and performance-based. Process-based systems focus on a systematic approach to management and performance-based systems specify performance standards that must be met. A system can contain elements of both. Environmental groups tend to favor performance-based systems that include specific environmental protection standards (Innes et al., 2005).

There are three major forest certification organizations in the United States: the Forest Stewardship Council (FSC), the Sustainable Forestry Initiative (SFI), and the American Tree Farm System (ATFS). The FSC was established in 1993 and is performance-based (Forest Stewardship Council, 2011). FSC indirectly certifies forests; it accredits other organizations that do the actual on-the-ground certifications (called certification bodies). FSC certification covers nearly 150 million hectares of forest in over 80 countries. Its voting members compose three chambers representing commercial interests (like wood products retailers), socially beneficial forest management interests, and environmentally-friendly forest stewardship interests; this means they operate through multiple stakeholder negotiation (Cashore et al., 2004; Fischer et al., 2005). The SFI was established in 1994 by the American Forest and Paper Association, an industry trade organization (Sustainable Forestry Initiative, 2011). It was organized to promote sustainable forestry standards on forest industry lands and it has since become an independent organization that certifies about half the area of the FSC. Its standards are a hybrid process- and performance-based system, certification is by third parties, and the program is based in North America (Fischer et al. 2005).

In the United States, the ATFS dates back to 1941 (American Tree Farm System, 2011). The program originally had a wood supply orientation, but it has always promoted sustainable forestry and is one of the oldest certifiers. It has always considered multiple resources, like recreation, wildlife, and water, but its definition of sustainability has changed dramatically over time to better reflect today's standards. ATFS is performance-based and certification is based on a set of standards and guidelines, and it offers a group certification for tracts under the same management. Much of its certified forest land is owned by family forest owners and about 10 million hectares are covered by the program. Both ATFS and SFI are recognized by the Program for the Endorsement of Forest Certification schemes (PEFC). PEFC was established in 1999 as an independent non-governmental third-party umbrella organization to recognize local certification schemes. PEFC was established by landowner groups with timber production interest and forest industry; this may explain why FSC is not a member of PEFC (Fischer et al., 2011).

The objectives, standards, and criteria used by the various certification groups tend to be similar (Guynn et al., 2004; Leslie, 2004; McDonald and Land 2004; Ozinga, 2004). However, there are significant differences in terms of what is allowed on the ground, due to structural differences in the programs (Cashore et al., 2004; Holvoet and Muys, 2004). National laws or standards may cause rules to vary. These differences seem to originate from the differing focuses of the founding groups; FSC, founded by environmental groups, stresses basic goals like minimizing forest conversion, respect of worker's rights, respect of human rights, especially with regard to indigenous people, limited use of hazardous chemicals, no corruption, and special protection for significant cultural areas (Innes et al. 2005). SFI and ATFS were founded by forest industry friendly groups and tend to have a stronger timber production orientation.

Sustainable forest management and forest certification schemes have gained wide acceptance over the last twenty years (Dickinson, 1999). About 10% of the world's forest area is now under some form of forest certification (Durst et al., 2006). The area under forest certification has grown steadily and the concept has earned strong support not just from environmental groups, but also non-governmental organizations, and even forest industry/timberland investment groups (Floyd, 2002). Environmental groups have been able to gain considerable power, not from government regulation, but the marketplace (Meidinger et al., 2003). Consumers have not yet fully shown the willingness to pay for added level of certification. These certification systems can be costly; forest management activities and plans must be changed, special inventories might be needed, and tracking systems could be required (Lachapelle, 2003). Production costs can increase by as much as 25% (Viana et al., 1996.). Industrial and investment ownerships comprise most of the certified forests. However, a significant portion is in small ownerships or family forests (Rickenbach, 2002) and these owners are likely to be the next focus of growth in certification (Washburn et al., 1999).

American Tree Farm System

Forest and natural resource plans and planning courses have long utilized family forest owner approaches (Straka, 1993). This approach offers an ideal opportunity for the student and the landowner to directly interact. Of the North American forest certification schemes, the ATFS is the only one with a strong family forest focus. If forest certification was to be integrated into a forest resource management plans course, the ATFS would provide the best opportunity for interaction between forest owners and the plan preparers (students).

The ATFS forest certification scheme is based on standards of sustainability (American Tree Farm System, 2011). All forest certification schemes have a similar document (Fletcher and Hansen, 1999; Meidinger et al., 2003). The ATFS is recognized by PEFC and its standards are organized in the same manner as other forest certification schemes. Thus, these standards form an excellent basis to introduce forestry students to forest certification standards.

There are eight standards of sustainability (Table 1). Each has performance measures to help the forest auditor evaluate and judge compliance; for greater and more specific guidance, each performance measure has indicators (specific element of the management plan that indicates compliance). In addition, each indicator has detailed guidance on how to evaluate and interpret that aspect of the management plan (American Tree Farm System, 2011). Table 1 illustrates the eight standards, but does not address the performance measures and indicators. Standard 2 provides an opportunity to address these issues. Standard 2 is; "Compliance with Laws." It has one performance measure: "Forest owner must comply with all relevant federal, state, and local, laws, regulations and ordinances." This performance measure has two indicators: "forest owner must comply with all relevant laws, regulations, and ordinances and will correct conditions that led to adverse regulatory actions, if any" and "forest owner should obtain advice from appropriate professionals, or contractors who are trained in, and familiar with, relevant law, regulations and ordinances." These standards, performance measures, and indicators are summarized in the Woodlands Management Template that the ATFS provides for foresters that want to implement an ATFS forest resource management plan (Americana Tree Farm System, 2011). Table 2 summarizes the content of a management plan developed from that template.

Table 1. American Tree Farm System Standards of Sustainability for Forest Certification (American Tree Farm System, 2011).

Standard 1. Commitment to Practicing Sustainable Forestry—Forest owner demonstrates commitment to forest vitality by developing and implementing a sustainable forest management plan.

Standard 2. Compliance with Laws—Forest management activities comply with relevant federal, state, and local laws, regulations, and ordinances.

Standard 3. Reforestation and Afforestation—Forest owner completes timely restocking of desired species of trees on harvested sites and non-stocked areas where tree growing is consistent with land use practices and the forest owner's management objectives.

Standard 4. Air, Water, and Soil Protection—Forest management practices maintain or enhance the environment and ecosystems, including air, water, soil, and site quality.

Standard 5. Fish, Wildlife, and Biodiversity—Forest management activities contribute to the conservation of biodiversity.

Standard 6. Forest Aesthetics—Forest management plans and management activities recognize the value of forest aesthetics.

Standard 7. Protect Special Sites—Special sites are managed in ways that recognize their unique historical, archeological, cultural, geological, biological, or ecological characteristics.

Standard 8. Forest Product Harvests and Other Activities—Forest product harvests and other management activities are conducted in accordance with the management plan and consider other forest values.

Table 2. Forest resource management plan outline using the ATFS template (American Tree Farm System, 2011).

1. Owner name, address, telephone number, and e-mail contact information. Owner signature.
2. Plan author name, address, telephone number, e-mail contact information. Author signature.
3. Date(s) that the plan was competed and revised.
4. Property description.
   a. Location (legal description, tax map number, location map, GPS).
   b. Basic tract information (acres owned, acres forested, acres in plan, owner information).
   c. Topography, slope, roads, watershed.
5. Property history.
6. Forest management objectives and goals.
7. Forest natural resources enhancement and protection.
   a. Protect special sites and social considerations (special sites, adjacent stand or ownership concerns, recreation, and access).
   b. Air, water, and soil protection (soil protection, roads, steams, wetlands ponds, lakeshore, effects of natural disasters, and carbon sequestration (optional)).
   c. Fish, wildlife and biodiversity (Fish and wildlife, threatened or endangered species).
   d. Management of forest resources (protection from pests, reforestation and afforestation, prescribed burns (optional), management plan implementation constraints).
   e. Other.
8. Stand level information
   a. Description.
   b. Current condition.
   c. Desired future stand condition.
   d. Forest management activities.
9. Management activity schedule and tracking (management activity by scheduled date, stand, cost, and expected cost-share).
10. Signatures and approvals.
11. Appendix, tax, business.

Integrating Forest Certification into a Curriculum and Capstone Course

Starting in 2012 Clemson University began to integrate the ATFS sustainability and certification standards into its senior-level forest resource management plans course. All the current ATFS tools and procedures were used. This capstone course puts senior forestry undergraduate students into the real-life management planning process using family forest owners. Students were partnered with family forest owners to develop ATFS plans that are focused on the certification of sustainable forestry practices. A well-developed forest management plan is the basis for certification in the ATFS. Family forest landowners are unable to be certified without a proper management plan. The development of a forest management plan will help graduating students to prepare for jobs they may receive directly after college. This is a definite attempt to create a situation which incorporates all of the students' previous education and professional experience with the complex issues of the real-world that takes them out of the comforts of a traditional classroom setting.

The design of this capstone course was to have interactive real-world situations with landowners and for students to graduate as certified tree farm inspectors. The objectives of the course were (i) to give graduating seniors an introduction to the forest resource management planning process, (ii) to write a natural resource plan based on various management techniques, (iii) to review and implement knowledge acquired from previous coursework in management plan development, (iv) to provide students with field practice on NIPF landowner's property, (v) to provide students with an interactive and participatory forum for management plan development and completion, and (vi) to provide students with training and certification as ATFS auditors.

Students were paired in teams and were allowed the option of working with family forest owners that they knew, or were able to select from family forest owners who were interested in partnering with the University for developing management plans on their property. Students were assigned reading material from the ATFS website (http://www.treefarm system.org) including: "About Us", "Statistics and FAQ", a YouTube video on the "Goals and Programs of the American Forest Foundation", "About Tree Farming", " What is Tree Farming" and the "Management Plan Template" and "Certification" guidelines. The management plan template designed by the ATFS served as the foundation for the entire course. Students were asked to evaluate themselves on their knowledge level regarding each of the ATFS standards, prior to the assigned readings. This helped to provide students with a starting point and an indication of their knowledge level. In addition, the professor provided lectures on the basic components of a management plan and obstacles that many professionals face when dealing with landowners while writing their management plan. One of the main obstacles is to establish a good working relationship with the landowners in order to understand their short-term and long-term objectives for the land. This is also an area in which many of the students find challenging with this class. Historically this class just focused on creating management plans for private landowners, but this year the students were asked to add the certification component with ATFS serving as an example. Management plans will vary greatly between landowners, region, and personal preferences. All management plans share several key components including management objectives, stand descriptions and recommendations, management schedule of activities, maps and aerial photographs, and often budget guidelines (Straka, 1993).

The students contacted their landowners and scheduled on-site visitations to review the landowner objectives and to evaluate what additional measures will need to be taken to develop the management plan. Students then had to make plans for additional visits to the forest tract to accumulate forest inventory data for analysis. The students were provided with ATFS management template to use for the project and the main topics from the template are highlighted in Table 2. When completed each team submitted their plan for review. A formal class was held where commonalities and complications were discussed regarding the finalized management plans.

A scheduled time was then allotted for training provided by the ATFS for the students to become certified Tree Farm inspectors upon completion of the training course and graduating with an accredited forestry degree. Students were lead through the requirements of the ATFS and what their roles would be as auditors. Throughout the presentation, the management plans developed by the students were interwoven to provide examples and lead a more interactive and participatory discussion. Qualified ATFS training instructors presented the formal four hour training session and the inspection instructor provided feedback to each of the students. This is the first time ATFS and Clemson University have collaborated to integrate certification and inspection into classroom environment.

Conclusion

The new capstone course is still under development. All the necessary PowerPoint slides and background publications are in at least draft format. One senior class has developed ATFS type management plans on acreage owned by a tree farmer. Students, after completing the full Tree Farm Inspector Training Course, inspected the tracts with management plans prepared by other student teams. So, one early cycle of the new capstone course, with early versions of all of the new materials, has taken place.

Some issues are already apparent. The senior class used "tracts" developed from the large holdings of a well-known tree farmer. This has its advantages and disadvantages. The family forest owner who is also a tree farmer can be expected to have a high interest in forestry. He or she will likely be glad to meet the students on the property and address issues like management objectives, property concerns, and expectations. This is ideal as the forestry student will view a "real world" forest owner and gain insights into his or her thought process in developing forest management plan objectives. At the same time the forest owner might be too enthusiastic and give the students too much help in planning or want to participate with the students in some of the field work. Of course, the use of actual tree farms as the student properties is not necessary.

Student feedback on the PowerPoint slides and other materials was very good. Students appreciated the structure that the ATFS framework provided. The emphasis on tying forest resource management planning to forest certification and then, more fundamentally, tying that to forest sustainability provided structure that the students appreciated and received greater insight into both forest certification and forest sustainability. The formal four-hour workshop on tree farm inspection, structured for the practicing forester, seemed to be a perfect climax to the formal classroom instruction. By being trained as inspectors, the students gained tremendous self-confidence in the entire process.

Students used the ATFS standard management plan template to write their management plan. Forestry professors will tend to have feelings on the use of a template. It does remove some of the challenge of developing a management plan. A "fill-in-the-blank' approach relieves the students of having to develop a proper format for their first management plan. At the same time, most entry-level foresters who develop forest management plans probably use a template of sorts as a framework as most organizations have fairly standardized management plan formats. Still, the use of a template will be considered a teaching issue by some forestry professors.

The two-phase aspect of the approach is a great strength. First, the seniors develop the management plan and, second, they inspect the property and management plan of another student team. They first get the experience of developing a plan and develop some level of self-confidence in the process. But the tree farm inspection of another team's property makes them ask questions not only about the tract being inspected, but also on their own property that they just wrote a plan for. As they criticize student colleagues, they realize: "Didn't we do the same thing?" In terms of developing planning skills, the two-phase approach was highly rated by the students.

Progress with course development is ongoing. Course material will soon be available to any forestry professor wanting to use the approach. PowerPoint slides cover not only the ATFS framework, but also general forest resource management planning. Even supporting video has been prepared. Forestry professors will find this approach to be both practical and broadening.

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P3

The Escalating Impacts of Parcelization on Forestry Consultants

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Abstract

The size of forest holding/parcelization problem has been a fundamental issue in the forestry arena since the onset of the twentieth century. Research (both past and present) has identified factors such as land tenure, taxes, urbanization, income, uncertainty and cost-share programs as the drivers of this issue. Using data from the National Woodland Owner's Survey (NWOS), we examine the impacts of parcelization on forestry consultants for the state of South Carolina.

Introduction

The majority (approximately 56%) of forested landscapes in the U.S. are held by private owners who have a diverse set of motivations and objectives for their forest properties (Bliss and Martin 1989; Butler 2008). For many family forest owners, advice and services provided by natural resource professionals improves forest health and ecological productivity while generating long-term sources of income for the owners (Henly et al. 1990; Hull and Nelson 2011). However, the ongoing process of parcelization has divided many large forest holdings into smaller parcels with diverse ownerships, often preceding increased forest habitat fragmentation (Vince et al. 2005;Haines et al. 2011), as well as development and a reduction in forest area (Best and Wayburn 2001). As a result of this parcelized landscape, natural resource professionals must find new ways to help family forest owners manage small holdings in order to maintain healthy and viable forests (Sampson and DeCoster 2000).

There is increasing consensus that the forestry community must be realigned to the declining size of forest tracts and focus on the majority of landowners whose motivations for owning their forest properties differ from timber production (Germain et al. 2006; Hull 2011). However, little is known about how foresters recognize the changes associated with parcelization and whether they are adapting their business models in response to new owners and decreasing tract sizes. In this paper, we examine the National Woodland Owner Survey (NWOS) data for the state of South Carolina and discuss the potential impacts of parcelization on forestry consultants. The NWOS is the official survey of forest owners of the United States. It is created and maintained by the USDA Forest Service. The NWOS provides useful information in understanding who owns forestland, the size they own, insight into why they own forestland, and how they manage it, future intentions owner demographics, and other questions concerning the current state and future state of their forestland (Butler & Leatherberry 2004)

Forest Parcelization

Across the U.S. privately held forest properties are being divided into smaller acreages and transferred through the process of parcelization (Birch 1996; DeCoster 1998; Butler and Leatherberry 2004). With an average “family forest” size of 66 acres, South Carolina is no exception to this pattern, as forest industry divestitures and other land transactions over the last decade have increased the number of forest properties in small ownerships (SCFC 2011).

The process of forest parcelization has two distinct dimensions : (1) an activity (the subdivision of a larger forest land parcel into two or smaller parcels) and (2) an outcome (a landscape that has, with repeated subdivision of larger forested parcels, become parcelized) (Hatcher et al. 2013). And often leads to problems of economic efficiency in forest management, disincentives for investment of forest practices, and greater management problems related to wildlife, water, recreational opportunities, soils, and ecosystems services. Recent research has shown that land tenure, death, taxes, regulatory uncertainty, urbanization, and income are the major factors influencing forest parcelization in the United States (Mehmood and Zhang 2001). Examining one of the contributing factors of parcelization, owner’s age (Figure 1.), for South Carolina reveals that the majority of landowners are in the 55+ age classes. This is highly correlated to other variables such as income and death rate. In a literature review on the size of forest holding/parcelization problem in forestry (Hatcher et al. 2013), the authors cite numerous studies where asset position and age of owner influence the rate of parcelization. If these trends hold, consulting foresters in South Carolina may see turnover in both the age of owner and size of tract held as the death rate increases in the 55+ age classes.

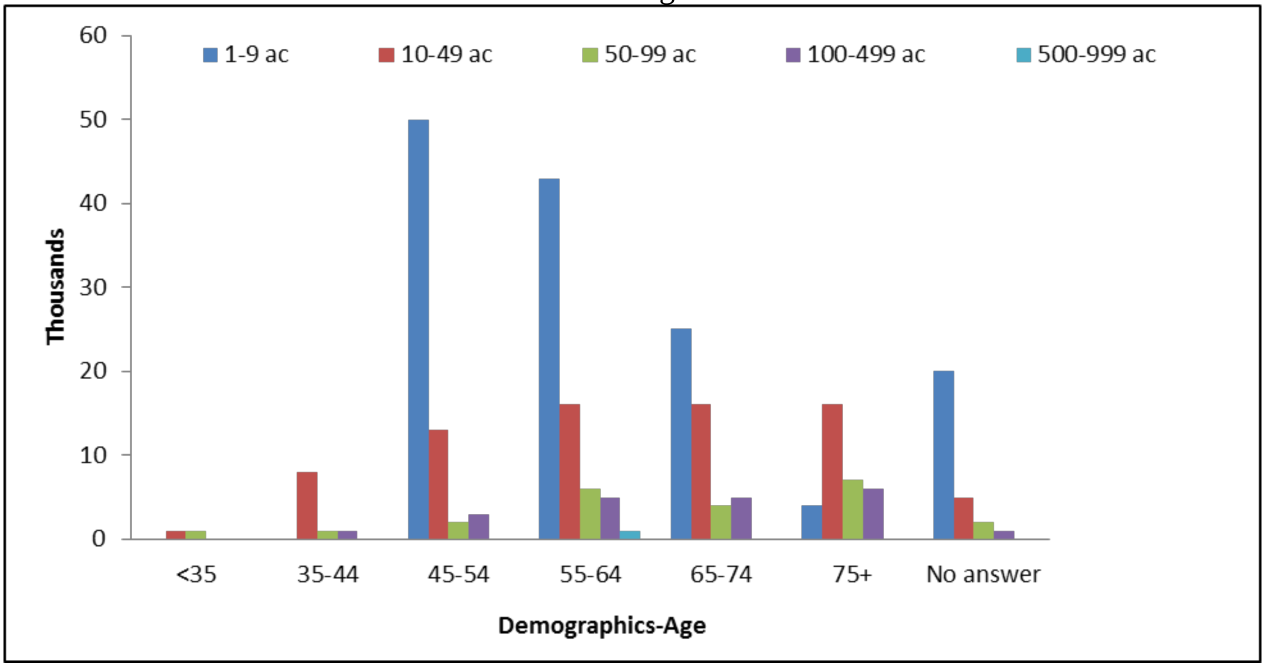

Figure 1. Age of family forest owners by number of owners and acreage class.

Many landowners are interested in improving their forests (Hull et al. 2004). However, most lack the technical knowledge necessary for most forest management projects, so they turn to a variety of information sources (Sagor 2006; Broussard et al. 2008). Figure 2 shows the various sources of information family forest owners in South Carolina use to gain knowledge about managing their forest properties. Although figure 2 indicates that family forest owners seek management advice from a variety of sources, foresters are one of the primary sources of professional land management advice to forest owners (Butler 2008, Figure 3).

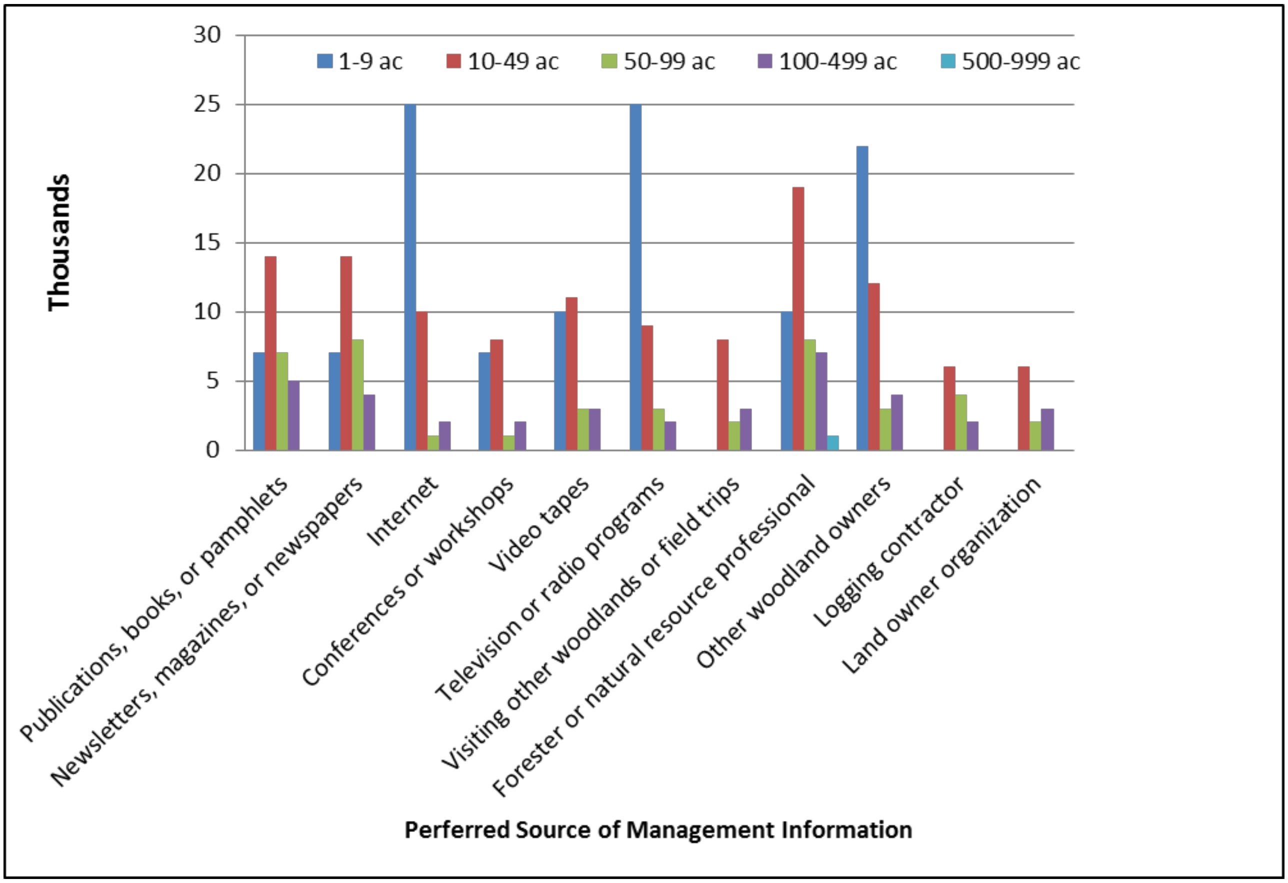

Figure 2 . Preferred sources of management information used by family forest owners.

The ability to have one-on-one access to a professional forester to "walk the land" and discuss economic issues, management alternatives, and personalized advice is one of the most important types of assistance that can be provided to family forest owners. (Toivonen et al. 2005; Kilgore et al. 2007). Professional foresters may also find it beneficial to provide information to landowners using the media outlets preferred by landowners in figure 2. Diversifying their business to include publications and workshops may result in additional clients in the future. The benefits of forestry assistance to landowners include higher payments for timber, healthier residual stands, and increased tree regeneration (Hubbard and Abt 1989; Henly et al.1990). In South Carolina, landowners may seek advice from state forestry associates, extension agents, private consultants, among others (Figure 3). And although private consultants do not work with the majority of family forest owners, they do work directly with a number of owners across moderately sized tracts and they are knowledgeable about the dynamics of local forest ownership and current management techniques. As a result, private forestry consultants possess detailed knowledge about local, social, economic, and ecological conditions that can provide a valuable perspective for understanding broad patterns of change across forested landscapes (Knoot et al. 2009).

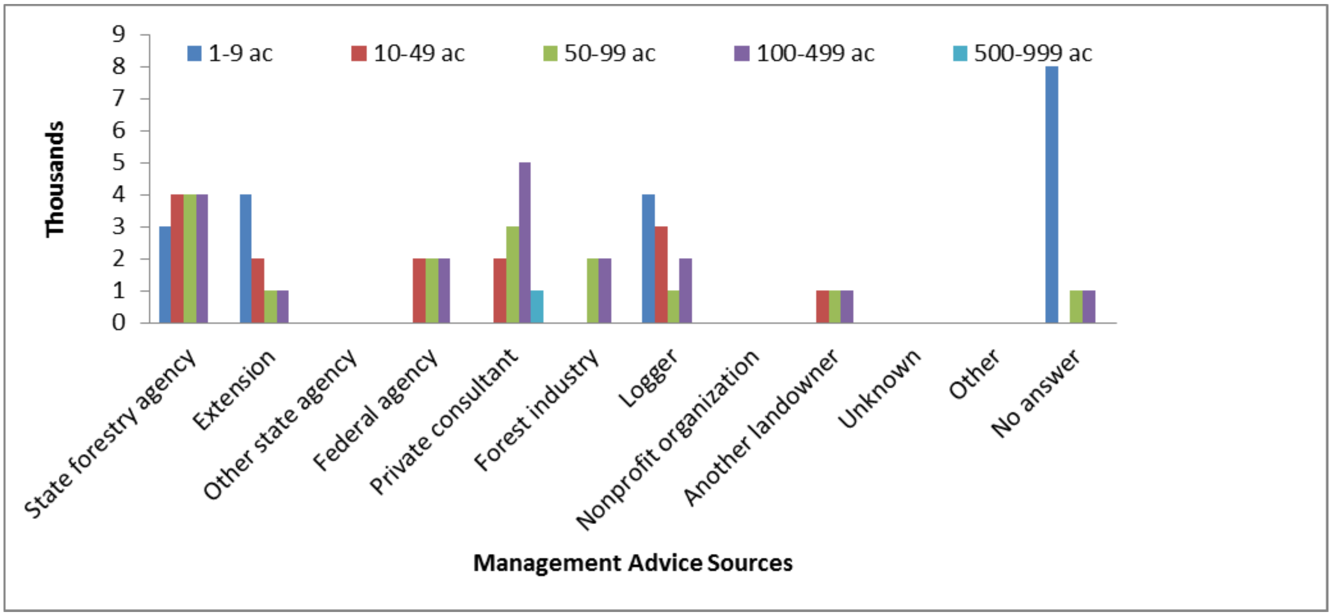

Figure 3. Sources of management advice used by family forest owners by number of owners and acreage class.

Overcoming the Obstacles

Over the last decade, researchers have posited several approaches that foresters can adopt for working in an increasingly parcelized landscape. One commonly cited solution to difficulties created by smaller properties has been to combine projects on neighboring properties, eliminating the constraining effects of property boundaries and providing timber management benefits to multiple small landowners, similar to those enjoyed by large landowners. This coordination can increase timber volume and minimize the difficulty and expense of moving equipment and labor (Hull et al. 2004; Kittredge 2005). In surveying foresters in Wisconsin, Rickenbach and Steele (2006) found that 65% had coordinated cross-boundary forestry practices for forest owners in the previous 2 years and that over 90% were likely to do so again (L'Roe and Allred 2012).. However, over a third of the foresters surveyed indicated that they had not taken on cross-boundary projects because they or their clients had no interest, foresters believed it would take too much time or be unprofitable, or they were simply unsure of how to do so (Rickenbach and Steele 2006). Only a relatively small segment of private forest owners have expressed interest in developing the cooperative planning and management strategies (Kittredge 2005; Broussard Allred et al. 2010). Furthermore, even if owners share similar problems and needs, research has shown that it is not easy to establish forest owner cooperatives (Nonic et al. 2011).

Another strategy for foresters working on small parcels is incorporating landscaping principles into existing forest management practices in order to enhance natural beauty, wildlife habitat, and recreational opportunities on small forest properties (Tyson et al. 1998, Figure 4). There is international recognition that traditional forestry, with its emphasis on timber production, is adapted to include management for multiple uses that provide social, environmental and economic benefits together (Urquhart et al. 2010). To provide a wider range of benefits, Hull and others (2004) recommended that foresters collaborate with other professions (such as landscapers and arborists), consider forest management practices beyond traditional timber production (Figure 4), develop new methods of reaching small landowners and shift away from fee structures tied only to the value of harvested timber.

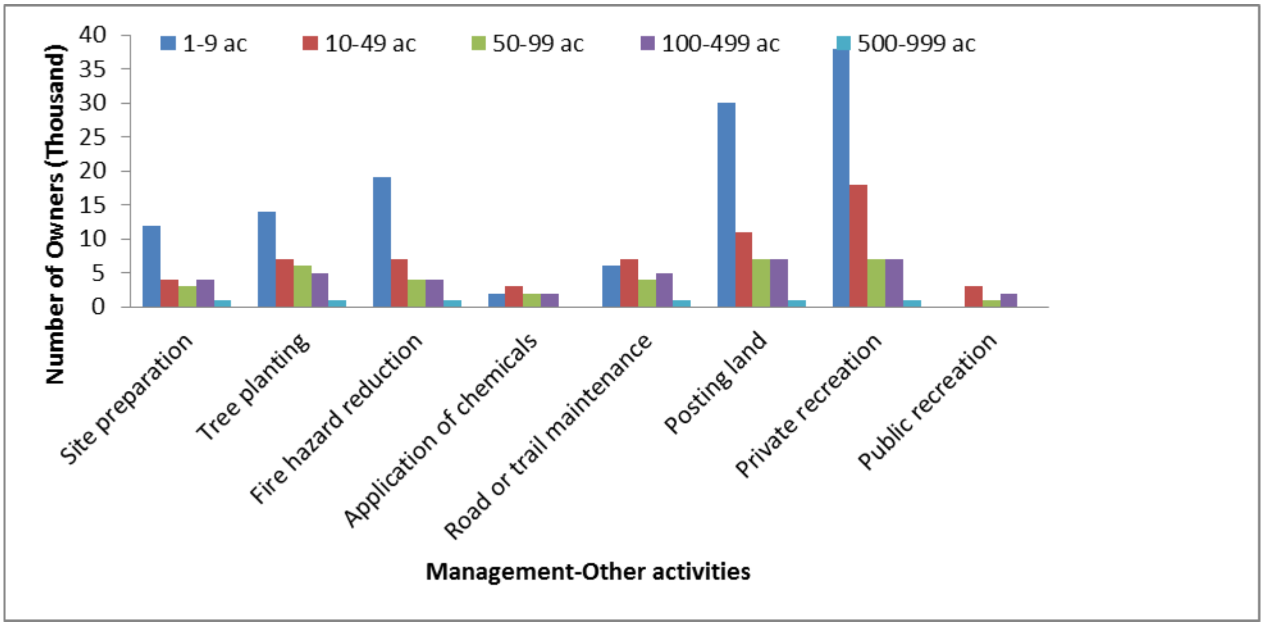

Figure 4. Types of management activities used by family forest owners by acreage class and number of owners.

Despite recommendations by researchers on private consultants may provide a wider range of services, littler research has been conducted to examine whether or not private professionals are incorporating these suggestions into their business models, or if they are diversifying their services to adapt with the ongoing process of parcelization. L'Roe and Allred (2012) conducted interviews with a number of private consultants in New York to see if they were expanding their range services to cater to landowners with smaller holdings. Some of the foresters that were interviewed mentioned changing business models to incorporate more wildlife management, techniques for improving forest aesthetics and recreational opportunities. Interviewees also mentioned using new marketing tools, changing fee schedules to include hourly rates and investing in small scale harvesting equipment.

Conclusions

Parcelization has been part of a fundamental issue in the forestry arena since the onset of the twentieth century and the rate of its occurrence has been increasing in recent decades. These shifting ownership conditions may require forestry consultants to expand their business models to include services that cater to small forested parcels held by these new owners. Policymakers, educators, and conservation professionals must also recognize the need to support sustainable management on small forest properties by encouraging forester innovations. Further research on how forestry professionals are recognizing and adapting their business models to adapt to smaller forested parcels is needed in the South Carolina is needed to fully understand the impacts of forest parcelization.

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P4

Determining Optimum Carbon Sequestration Strategies for Pine Plantations In Nonindustrial Private Forestlands Of Mississippi

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Abstract

Forest carbon sequestration is an important strategy to mitigate climate change by reducing the atmospheric concentration of carbon dioxide within terrestrial vegetation. Trees can sequester atmospheric carbon and store it in their biomass for prolonged periods; however, management strategies can alter the rate and amount of sequestration. Early studies have suggested that joint management of timber and carbon is a viable forest management strategy, but none of them has suggested optimum carbon forest management strategies for the nonindustrial private forestlands (NIPFs) in Mississippi. The forest management practices of NIPFs are important for effective climate change mitigation initiatives because they hold about 66 percent of the timberland in Mississippi. This study has found that carbon sequestration amounts increased from 86.91 C tons per acre to 118.63 C tons per acre when the rotation length was increased from 35 to 60 years respectively. In addition, the carbon sequestration amount depended on type and combination of various silvicultural treatments such as thinning, fertilization and herbicide application. The carbon amount sequestered increased from 64.74 C tons per acre for thin only treatment at a 40 year rotation to 108.50 C tons per acre for thinning, fertilization and herbicide application for a 60 year rotation. The results imply that optimum carbon sequestration strategies in pine plantations of Mississippi for climate change mitigation should not only consider extending rotation length but also practice a combination of these silvicultural treatments. The results of this study will be used to assess the willingness of NIPFs in Mississippi to practice these optimum carbon sequestration strategies in their forestland and determine their concerns to initiate such strategies. In addition, these results will provide needed information for policy development.

P5

Life Cycle Analysis of Cellulosic Bioenergy of Agroforestry System in Mississippi Alluvial Valley

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Abstract

Life Cycle Analysis (LCA) is a 'cradle-to-grave' approach in which every activity in a system, starting from collection of raw materials to the final product, is evaluated and quantified. In our study, we will evaluate the establishment, management, harvest, and processing of feedstock from agroforestry bioenergy plantations and investigate net carbon and energy balance in the system. Situated in the Mississippi alluvial valley, the agroforestry system is comprised primarily of Cottonwood and Switchgrass. Based on preliminary observation, bioenergy from agroforestry system shows the potential for improving the greenhouse gas balance by sequestering more carbon dioxide from the atmosphere than it releases. The results from this study will provide detailed information that will be useful to other researchers, policy makers, and forestry professionals.

P6

Demand drivers for Corporate Social Responsibility in North Carolina´s Small and Medium Sized Forest Products Companies

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Abstract

Corporate Social Responsibility and sustainability have become increasingly important as a part of modern corporate business practices. This is especially true in the forest sector, which is an extractive industry. Corporate Social Responsibility (CSR) can be defined as management of business activities so that profit is gained simultaneously with creation of a positive impact on society, environment, and stakeholders. CSR includes company´s voluntary actions to integrate the price of social and environmental externalities in its operations. Small and medium sized companies (SMEs) represent 99% of the companies in United States yet there are very few studies on their Corporate Social Responsibility and sustainability practices. These companies are often integral part of local communities and they seem to implement CSR in their everyday operations to some extent, but at the same time are unaware of what it actually includes. Different stakeholders are also increasingly demanding social and environmental responsibility from companies. The purpose of this study is to find out how North Carolina's small and medium-sized forest products companies perceive and practice CSR in their everyday operations. This will be done by conducting interviews with different company representatives and analyzing the interviews. Identifying and describing effective patterns and practices of CSR will help small businesses create competitive advantages in forest product marketing. These practices can then be used as building blocks for sustainable and responsible business strategy.

P7

A Game Theoretic Analysis of 2006 US-Canada Softwood Lumber Agreement

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Abstract

The ongoing softwood lumber trade dispute between the US and Canada is the most contentious and longest trade battle in the international trade history. By developing a simple Cournot-Nash equilibrium model of US and Canadian lumber-producing firms, this paper analyzes the effects of export tax on overall lumber price and profits of both US and Canadian firms. An obligatory imposition of export tax on Canadian softwood lumber exports increases the lumber price and profit of US lumber-producing firms, but reduces the profit of Canadian firms. This model provides useful insights of the decade-long trade brawl between the US and Canada.
Keywords: Softwood lumber agreement, Export tax, Cournot-Nash equilibrium, lumber market

P8

An Examination of Willingness-to-pay of Households for Wetland Conservation in the United States: A Benefit Transfer Approach

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Abstract

The main objective of this study is to develop a benefit transfer model for wetland conservation in the United States. Benefit transfer techniques are used to estimate benefit values for natural resource sites for which on-site data on benefits are unavailable (the policy sites). This is done by transferring (i.e. forecasting) benefit estimates on the basis of benefit transfer functions estimated on data collected at other similar sites (the study sites). With the beginning of non-market valuation literature in mid-80's, meta-analysis became popular as a means of conducting benefit transfer. Government planners and experts may rely on benefit transfer techniques due to constraints such as time and money.

The accuracy of benefit transfer is largely dependent on the quality of primary studies. These primary studies should be based on sound economic principles, correct empirical techniques and adequate data to reduce error in transfer. Several authors have emphasized the use of peer-reviewed journals to increase the validity or reliability of the transfer. This study reviews some of the pertinent studies in wetlands across the United States. The criteria for selection of study sites are (i) wetlands that are located within the 48 contiguous states and (ii) wetlands that are inland in geographic location.

P9

The Use of Social Media in the U.S. Forest Products Industry: Preliminary Analysis

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Abstract

The use of social media as a marketing tool has increased significantly in the past few years. While a number of studies regarding the use of social media among Fortune 500 companies have been conducted, very limited information is available regarding social media use among the U.S. forest products industry. The main goal of this study is to examine the use of social marketing tools in the U.S. forest products industry. Preliminary results show that close to 40% of those industries initially examined have used some form of social media. The most common social media tool employed was Facebook followed by Twitter. A little over 70% have employed more than 1 social media tool. More secondary forest products companies were using social compared to primary industries. The baseline information collected from this study can be used in the development of a strategy that will bring the forest products industry into the social media marketing world. In addition, results will be useful in assessing the training needs of the industries in social media marketing (e.g., use and measuring effectiveness). Accurate assessment of training needs is needed in developing innovative educational curricula (i.e., seminar/workshop) focusing the use of social media as a marketing tool in the forest products industry.

P10

Economic and Life-Cycle Analysis of Forests Carbon Sequestration and Bioenergy Production in Central Hardwood Region

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Abstract

Forests are one of the potential means to lessen the impact of climate change and are seen as an important part of any national and global strategy to reduce net greenhouse gas emissions. Storing carbon in woody biomass, using woody energy and using wood products are three potential ways to utilize forests to mitigate climate change. Hence, the main objective of this study is to use life-cycle and economic analysis to assess the impact of carbon offset payments and woody energy production on Land Expectation Value (LEV) and rotation age under two scenarios – baseline 1 (net carbon payments are obtained from year zero) and baseline 2 (net carbon payments are obtained only after baseline optimal rotation age). A modified Hartman model was used to estimate the optimal rotation age that maximizes the LEV. Life-cycle analysis was used to estimate the carbon emitted during harvest and product decay. Sensitivity analysis was conducted with a range of carbon and energywood prices. The results show that net carbon payments have more impact on LEV in the baseline 1 scenario; in contrast, woody energy production has more impact on LEV in the baseline 2 scenario under the range of carbon and energywood prices considered.

Introduction

Increasing carbon storage in standing forest biomass, using woody biomass for energy production, and using less energy intensive woody products are three strategies to use forest to reduce greenhouse gas emissions and have grabbed the attention of policy makers, scientists, and society. According to US Environmental Protection Agency (2012) data there was an increase in net carbon uptake from land-use change and forestry from 1990 to 2010 as a result of net carbon sequestration in standing tree biomass and harvested wood products. In contrast, most of the greenhouse gas emissions are released into the atmosphere due to the burning of fossil fuel for energy production. The data also showed that combustion of fossil fuels provided approximately 85% of the energy consumed in US in 2010. As a result, there has been a growing interest to promote the use of woody energy in the US along with sequestering more carbon in standing biomass and harvested products. However, forest management activities can be highly influenced by the existing carbon and the woody energy markets.

Various studies have been conducted to analyze the economic implications of sequestering carbon in standing biomass, producing woody energy, and storing carbon in harvested wood products (Stainback and Alavalapati 2002, Stainback and Alavalapati 2005, Nesbit et al. 2011, Nepal et al. 2012, Dwivedi et al. 2012, Catron 2012). Results have shown that the land expectation value (LEV) generally increases because of carbon payments and/or energywood production. However, only a few studies have assessed the combined effect of carbon and energywood markets on the forest management and LEV and only few studies have incorporated carbon emissions through silvicultural practices, harvesting, and the decay of forest products using life cycle assessment (Dwivedi et al. 2009, Dwivedi et al. 2012). Furthermore none of these studies looked at oak-dominated mixed hardwood forests in the Central Hardwood Region of the US. Thus, this study aims at partially fulfilling this research gap by assessing the impact of carbon sequestration and energywood production on the optimal rotation age and LEV of mixed hardwood forests considering emissions from harvesting operations and the decay of sawtimber and pulpwood.

Two baseline scenarios were considered - baseline 1 and baseline 2. In the former, it was assumed that the net carbon benefits were obtained from year 0 and in latter net carbon benefits were obtained only after the baseline optimal rotation age. Here, the baseline optimal rotation age is the age that maximizes LEV considering only sawtimber and pulpwood. Oak-dominated mixed hardwood forests are usually naturally regenerated therefore passive management was assumed. Sawtimber, pulpwood, and energywood were the three products considered in the model. Only emissions from the decay of sawtimber and pulpwood after harvest were considered in both scenarios. The energywood was assumed to be sold for electricity production. All computations used a real discount rate of 5%.

Model Specification

Growth and yield model

The growth and yield model data for upland oak-dominated stands was obtained from Gingrich (1971). The original data for site index 65 were fitted to the Equation 1.

$$V(t) = at^{b}e^{-ct} \quad (1)$$

where, *V(t)* refers to the volume of sawtimber or pulpwood (unit per acre), *t* is the stand age (years), and a, b, and c are the parameters to be estimated. These parameters (values shown in Table 1) were determined using non-linear regression in STATA 11.0.

Table 1: Parameters estimated for sawtimber and pulpwood

Parameters	Sawtimber (International ¼ inch bdft)	Pulpwood (cu.ft.)
a	*5.14E-18*	*0.0076*
b	*14.49376*	*3.856281*
c	*0.1837198*	*0.0508014*

The merchantable volume (sawtimber plus pulpwood) was multiplied by a factor 2.12 (Sampson and Hair 1996) to get the total aboveground tree biomass. Here, the aboveground ratio (2.12) is the average value from the South Central, Mid-Atlantic, and Central regions of the US where the central hardwood forests are situated. The amount of energywood was obtained by subtracting merchantable volume from the total aboveground tree biomass.

Net carbon benefits

The carbon sequestration benefits over one rotation was obtained using Equation 2.

$$pvc(t) = \int_0 P_c Q(t) e^{-rt} dt \quad (2)$$

where, *pvc(t)* is the present value of carbon benefits over one rotation ($/acre), P_c is the price of carbon ($/metric tons of CO_2e), *Q(t)* is CO_2e with respect to stand age (metric tons), *t* is the rotation age (years), and *r* is the real discount rate.

To determine the carbon stored in the growing stand *Q(t)*, the total aboveground tree biomass was multiplied by a factor 19.74 (Sampson and Hair 1996) which converts tree volume (cubic feet) into carbon (pounds). Since carbon is traded in terms of carbon dioxide equivalent (CO_2e), the carbon in pounds was converted into CO_2e in metric tons using simple conversion factors.

Net timber benefits

Net timber product benefits over one rotation was obtained using Equation 3.

$$pvt(t) = PQ(t)e^{-rt} - P_c D(t) e^{-rt} - P_c H(t) e^{-rt} \quad (3)$$

where, *pvt(t)* is the present value of wood products over one rotation ($/acre); *P* is the vector prices for sawtimber, pulpwood, and energywood ($/unit); *Q(t)* is the vector of volume for sawtimber, pulpwood, and energywood (unit); P_c is the price of carbon ($/metric tons of CO_2 e); *D(t)* is the vector of carbon emissions from the decay of sawtimber and pulpwood (metric tons); and *H(t)* is the amount of carbon emissions during harvesting (metric tons). The prices for sawtimber and pulpwood were taken to be $244/MBF and $5/ton respectively (Catron

2012). Two energywood prices were modeled, \$0/ton and \$5/ton.

$$N_n = N_0\, 2^{\left(-\frac{n}{half\ life}\right)} \qquad (4)$$

To determine *D(t)* in Equation 3, first CO_2e remaining in wood products through 100 years after harvest was estimated using an exponential decay function as shown in Equation 4 where, N_n is the amount of CO_2e left after *n* years of harvest and N_0 is the amount of CO_2 e left at the time of harvest. The half life for sawtimber and pulpwood were taken 100 and 2.6 years respectively (Dwivedi et al. 2012). Then, the amount to carbon emitted from decay of products through 100 years after harvest was obtained by the Equation 5.

$$D(t) = \sum_0^{100} CO_2e_{emitted\ each\ n\ year} \quad e^{(-r(n+t))} \qquad (5)$$

where, *D(t)* is the vector of carbon emissions from decay of sawtimber and pulpwood (metric tons) and *n* is the years after harvest through 100 years.

Carbon released into the atmosphere as a result of fuel consumption during harvesting was determined using Equation 6. There are various machines types and models that are used in harvesting operations. For this study, only four basic types of machines (feller buncher, skidder, knuckle boom loader, and chipper) were considered. The selection of machine types and models was based on the Certified Master Logger Program Rainforest Alliance Smart Logging RA-SL-003285 documentation (Dr. Jeffrey Stringer, Extension Professor, University of Kentucky, personal communication) and the data for fuel consumption for sawtimber and pulpwood harvests were obtained from the Wood Supply Research Institute: Auburn Stump to Mill Cost Program, Auburn University (Dr. Mathew Smidt, Associate Professor, Auburn University, personal communication). Similarly, fuel consumption for energywood harvest was taken to be 0.67 gal per ton (Groover 2011).

$$H(t) = \sum Q(t)F(t)(10.5) \qquad (6)$$

where, *H(t)* is the amount of carbon emissions during harvesting (kg); *Q(t)* is the vector of volume for sawtimber, pulpwood, and energywood (tons); *F(t)* is the fuel consumed by each machine type (gal/ton); and 10.5 (kg/gal) is the CO_2e emitted per gallon of fuel consumed by machine (Dr. Puneet Dwivedi, University of Illinois, personal communication). *H(t)* in kg was converted into metric tons using simple conversion factors.

Economic analysis

A modification of the Hartman model (Hartman 1976) was used to find the optimal rotation age that maximizes the land expectation value (LEV). Thus, if the benefits from forestry are assumed to be perpetual then, profitability of forestlands at a time (t) in terms of LEV can be expressed as in Equation 7.

$$LEV = \frac{pvc(t) + pvt(t)}{1 - e^{-rt}} \qquad (7)$$

where, *LEV(t)* is the land expectation value (\$/acre), *pvc(t)* is the net present value of carbon benefits over one rotation (\$/acre), *pvt(t)* is the net present value of timber benefits over one rotation ($/acre), *r* is the real discount rate, *t* is rotation age (years) that maximizes LEV.

Stand level supply

Stand level supply of sawtimber, pulpwood, energywood, and carbon as a function of carbon price were estimated on a per acre per year basis using formulas in Equation 8.

$$wood\ products\ supply = \frac{amount\ of\ sawtimber\ (or\ pulpwood)\ (t)}{t}$$

$$energywood\ supply = \frac{amount\ of\ energywood\ (t)}{t}$$

$$CO_2e\ supply = \frac{\sum_0^t amount\ of\ CO_2e}{t} \tag{8}$$

where, t is the optimal rotation age (years).

Scenarios and Sensitivity analysis

In the baseline 1 scenario, carbon payments (for sequestering carbon into tree biomass) and carbon penalty (for carbon emissions from decay of wood products and harvesting) was considered from year 0. Whereas, in the baseline 2 scenario, first the optimal rotation age that maximizes the LEV only from sawtimber and pulpwood was calculated. This age was considered as the baseline rotation age. Only the additional carbon sequestered annually in tree biomass after this baseline rotation age was considered for carbon payments and penalties.

The sensitivity analysis was conducted with carbon prices $0, $2, $5, $15, and $25 per metric tons of CO_2e; also with energywood prices of $0 and $5 per ton. The range of carbon prices taken were based on existing carbon markets in the US. For example, the Regional Greenhouse Gas Initiative has a clearing price of $3.08 per metric tons (Potomac Economics 2013); Mountain Association for Community Economic Development (MACED) sells carbon offsets at prices ranging from $5.57 and $16.53 per metric ton (Scott Shouse, personal communication); and the new California cap and trade program prices carbon at $14.85 per metric ton (Point Carbon 2013). The range of energywood prices were based on Nesbit et al. (2011) and from Dr. Jeffrey Stringer (Extension Professor, University of Kentucky, personal communication).

Results

Land Expectation Value ($/acre)

The results for LEV under the range of carbon and energywood prices considered for the baseline 1 and 2 scenarios are shown in Figure 1. As expected, in both scenarios, carbon payments and energywood production increased the value of forest land. Compared to the baseline 1 scenario, LEV is much less in the baseline 2 scenario. Among the price combination studied, the highest LEV in the baseline 1 and 2 scenarios was $982 and $124/acre respectively.

Within the carbon and energywood prices studied, carbon payments have more impact on

LEV compared to the energywood production in the baseline 1 scenario. For example, increasing carbon price from zero to $2/metric ton increased LEV by $67/acre at an energywood price zero. Whereas, increasing energywood price from zero to $5/ton increased the LEV only by $37/acre, when the carbon price was considered zero.

In contrast, in the baseline 2 scenario, increases in energywood price increased LEV by a greater amount than increases in carbon prices. For instance, increasing the carbon price from zero to $5/metric ton at an energywood price zero increased LEV only by $2/acre. In contrast, at a carbon price of $5 per metric ton, increasing the price of energywood from zero to $5/ton increased LEV by $34/acre. In this scenario, the influence of net carbon payments on LEV can only be seen at the higher carbon prices studied.

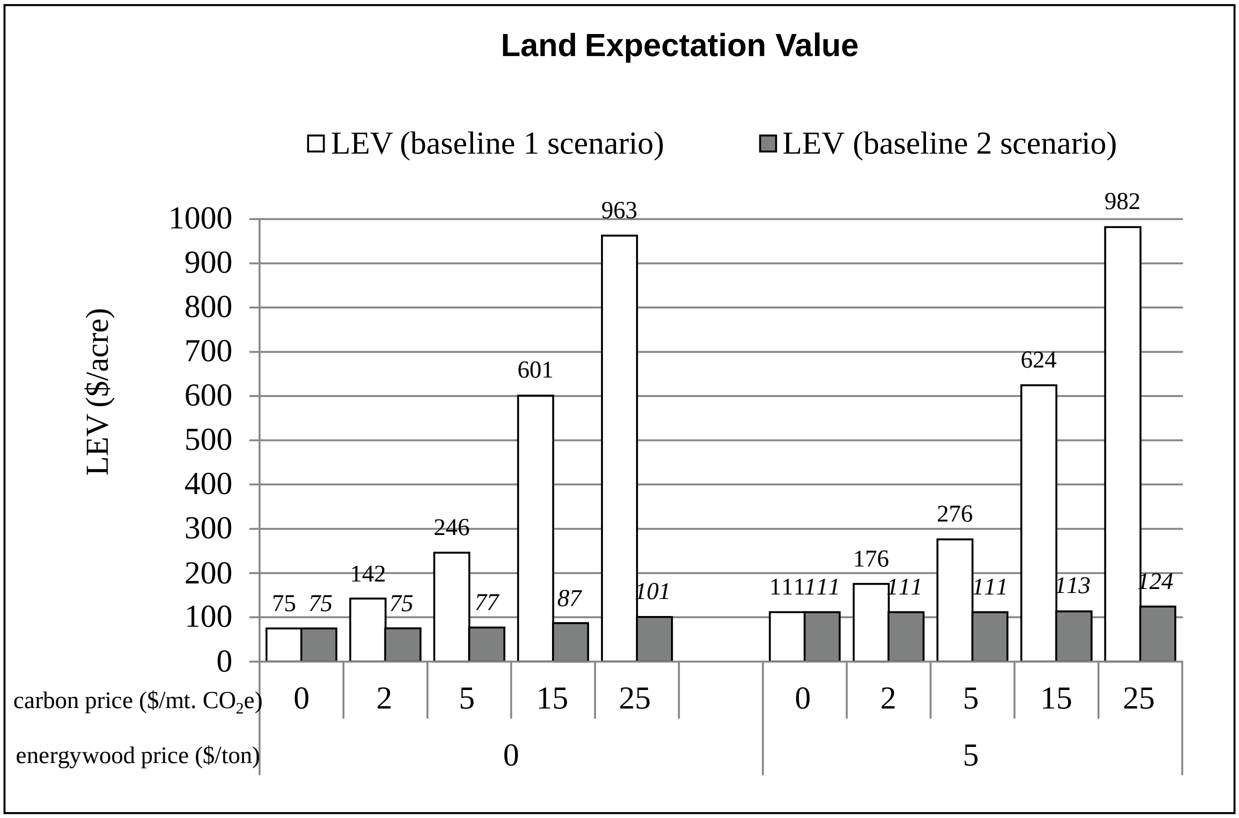

Figure 1: LEV as a function of carbon and energywood prices in the baseline 1 and 2 scenarios. The y-axis represents the LEV in $/acre. The upper x-axis represents the carbon price in $/metric ton of CO_2e and the lower x-axis represents the energywood price in $/ton.

Optimal Rotation Age (years)

Figure 2 shows the optimal rotation age that maximized LEV at the combination of carbon and energywood prices taken into consideration for the baseline 1 and 2 scenarios. The results show that in the baseline 2 scenario, forest stands are harvested early, at each price combination, compared to the baseline 1 scenario.

In the baseline 2 scenario, the baseline optimal rotation age that maximizes forest land value from sawtimber and pulpwood production was found to be 56 years. The results showed that, at zero energywood stumpage price, the forest stands are harvested beyond baseline optimal rotation age to get carbon benefits. Whereas, when the energywood stumpage price is increased to $5/ton, the forest stand is harvested before 56 years to get more benefits from energywood production rather than waiting to get carbon benefits. However, higher carbon prices, increased the optimal rotation age beyond the baseline optimal rotation age of 56 years, indicating it is more economic to get some net carbon benefits.

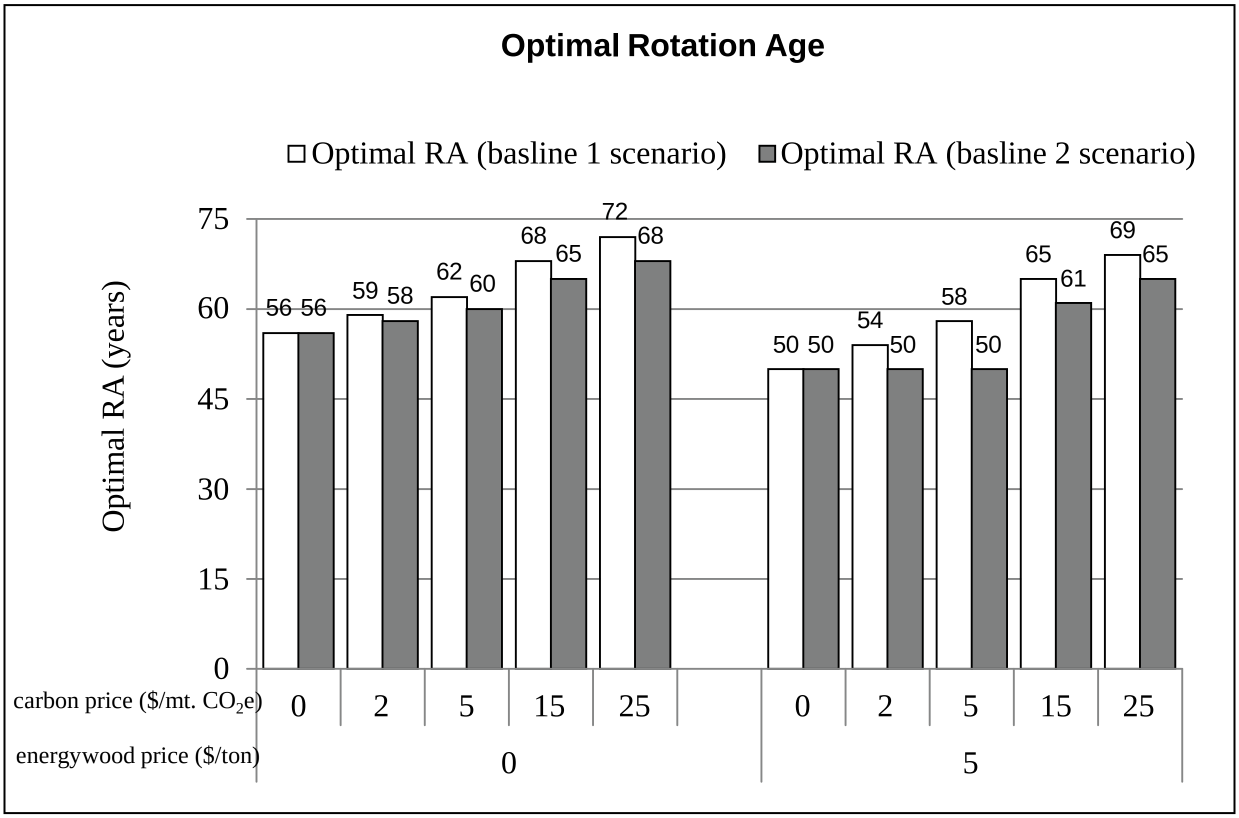

Figure 2: Optimal rotation age as a function of carbon and energywood prices in the baseline 1 and 2 scenarios. The y-axis represents the LEV in $/acre. The upper x-axis represents the carbon price in $/metric ton of CO_2e and the lower x-axis represents the energywood price in $/ton.

Stand level supply as a function of carbon prices

Sawtimber supply (MBF/acre/year) and Pulpwood supply (ton/acre/year)

The results for the sawtimber and pulpwood supply as a function of carbon price under energywood prices $0 and $5/ton for both scenarios are shown in Table 2. In general, the results show that with an increase in carbon price and at a constant energywood price, the sawtimber supply increases whereas the pulpwood supply decreases (with some exceptions at energywood price $5/ton).

The results also show that with an increase in energywood price from zero to $5/ton, the supply of sawtimber decreases. However, the supply of pulpwood increases (except at low carbon prices). This result occurs because increasing energywood price decreases the optimal rotation age causing the stand to be harvested earlier. At low carbon prices even when there is increase in energywood prices the decrease in the optimal rotation age is significant enough to decrease the supply of pulpwood because it is optimal to harvest (and receive revenue) sooner even if the amount supplied is smaller.

The results also show that sawtimber supply is greater in the baseline 1 scenario and pulpwood supply is greater in the baseline 2 scenario (with some exceptions for pulpwood).

Table 2: Stand level supply of wood products as a function of carbon prices in the baseline 1 and 2 scenarios and at energywood prices zero and $5 per ton

Baseline 1 scenario				
Energywood price ($/ton)	CO_2e price ($/metric ton)	Sawtimber (MBF/acre/year)	Pulpwood (ton/acre/year)	Energywood (ton/acre/year)
0	*0*	*0.052*	*1.577*	*1.864*
	2	*0.061*	*1.572*	*1.886*
	5	*0.069*	*1.555*	*1.892*
	15	*0.079*	*1.493*	*1.860*
	25	*0.082*	*1.434*	*1.807*
5	*0*	*0.034*	*1.548*	*1.773*
	2	*0.046*	*1.574*	*1.840*
	5	*0.058*	*1.575*	*1.880*
	15	*0.075*	*1.528*	*1.884*
	25	*0.080*	*1.479*	*1.849*

Baseline 2 scenario				
Energywood price ($/ton)	CO_2e price ($/metric ton)	Sawtimber (MBF/acre/year)	Pulpwood (ton/acre/year)	Energywood (ton/acre/year)
0	*0*	*0.052*	*1.577*	*1.864*
	2	*0.058*	*1.575*	*1.880*
	5	*0.064*	*1.568*	*1.890*
	15	*0.075*	*1.528*	*1.884*
	25	*0.079*	*1.493*	*1.860*
5	*0*	*0.034*	*1.548*	*1.773*
	2	*0.034*	*1.548*	*1.773*
	5	*0.034*	*1.548*	*1.773*
	15	*0.066*	*1.562*	*1.892*
	25	*0.075*	*1.528*	*1.884*

Energywood supply (ton/acre/year)

The results for energywood supply are shown in Table 2 above. The energywood supply increases at lower carbon prices and decreases at higher carbon prices. Analogous to the discussion of pulpwood supply above, at low carbon prices, the increase in energywood price leads to a decrease in the energywood supply due to a backward bending supply curve. Specifically, at these prices, it is financially better to harvest energywood (and receive the resulting revenue) sooner even if the supply is decreased.

Comparing baseline 1 and 2 scenarios, the energywood supply is greater at low carbon prices and less at carbon prices beyond $5/metric tons because of sharp increase in optimal rotation age.

Carbon supply (metric ton/acre/year)

Results for carbon supply are shown in Table 3. The carbon supply increases with an increase in carbon price for both scenarios. However, when energywood price is increased the carbon supply is decreased. Comparing the two baseline scenarios, carbon supply is greater in the baseline 1 scenario. This is expected because in the baseline 2 scenario net carbon payments are made only after 56 years of age.

To facilitate comparison, a modified supply from the baseline 2 scenario was estimated from year 0 even though the net carbon payments were made after the baseline optimal rotation age (56 years). The results for this are shown in Table 3 under *Baseline 2 modified* column. The results indicate that baseline 2 would result in less carbon being sequestered compared to the baseline 1 scenario. As already mentioned, it is optimal to harvest early in baseline 2 scenario to get benefits from energywood production. This early harvest lowers the amount of carbon stored in the biomass leading to decrease in carbon supply.

Table 3: Stand level supply of CO_2e as a function of carbon prices in the baseline 1 and 2 scenarios and at energywood prices zero and $5 per ton

Carbon supply (CO_2e metric ton/acre/year)				
Energywood price ($/ton)	CO_2e price ($/metric ton)	Baseline 1	Baseline 2	Baseline 2 modified
0	*0*	*66.98*	*0.00*	*66.98*
	2	*73.50*	*0.14*	*71.33*
	5	*86.86*	*0.27*	*75.65*
	15	*92.31*	*0.50*	*86.22*
	25	*99.99*	*0.58*	*92.31*
5	*0*	*53.98*	*0.00*	*53.98*
	2	*62.63*	*0.00*	*53.98*
	5	*71.33*	*0.00*	*53.98*
	15	*86.22*	*0.32*	*77.80*
	25	*94.28*	*0.50*	*86.22*

Conclusions

This study analyzed the LEV under the combination of carbon and energywood prices for two scenarios, one where net carbon benefits were assumed from year zero and another where net carbon benefits were assumed from a baseline rotation age.

As expected, net carbon payments and energywood production increase the forest land value. Also, as expected, carbon payments tend to increase the optimal rotation age and energywood production tends to decrease it. Similar results were found in other studies where net carbon payments and/or woody energy production were considered (van Kooten et al. 1995, Stainback and Alavalapati 2002, Nesbit et al. 2011, Dwivedi et al. 2012, Catron 2012).

Carbon and energywood markets also tend to impact the stand level supply of wood products and carbon as these will affect the optimal harvest age of the stand in both scenarios. Carbon markets tend to increase the supply of sawtimber and carbon by delaying the harvesting age. The supply of pulpwood decreases with increasing carbon prices with few exceptions at higher energywood prices. Energywood supply in turn increased at the lower carbon prices and decreased at higher carbon prices.

LEV was influenced more by carbon prices in the baseline 1 scenario. In contrast, energywood prices had more impact on LEV in the baseline 2 scenario. Landowners get more benefit if they get payments for carbon stored from the beginning of the rotation rather than getting payments only for the additional amount of carbon stored after the baseline rotation age. However, many carbon credit programs require that to be eligible in carbon trading, the forest stand must sequester additional carbon compared to what it would sequester anyway (Nepal et al. 2012). In this case, landowners will tend to harvest the stand early thus, influencing the supply of wood products.

Future work that incorporates the benefits associated with other not-timber forest products, penalties associated with emissions from transportation, cost associated with property taxes and transaction costs related to carbon payments would be useful.

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Integrating Management and Economics Courses Across the Forest Resources Curricula

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Abstract

Many natural resource, environmental, and forestry curricula at US universities and colleges include a sequence of courses involving multiple credit hours in managerial, policy, and economic foundations. These curricula share a commonality in the development of a microeconomic/managerial economic foundation for decision making, with a natural resources emphasis. Many of the courses in these curricula are presented in a linear format and are only partially integrated. However, a few university programs have integrated much of the coursework, with economic and managerial foundations being included throughout many courses. The research reported here investigated successful forest management curricula used in SAF-accredited programs in terms of economic foundation courses used, level of integration of management/economics into all coursework in the major, methods of integration and specific non-integrated management/economics courses required in the junior/senior years, and logistical tools used to accomplish the integration. Comparison to the curricula currently used by programs in forestry, environmental and natural resources, horticulture, and other majors at Clemson University was conducted. The development of a set of integrated courses was emphasized, with the intention of increasing curricula efficiency by reducing credit hours in curriculum and duplication in courses. A strategy for integrating Clemson's forestry program was developed. The plan describes the integration opportunities within the forestry curriculum and a process to actually implement varying levels of integration until the faculty feels comfortable with the new curriculum.

Introduction

Forestry education has undergone major changes over the last few decades. While forestry has always stressed sustained production of forest outputs, and more recently sustained multiple use outputs, the concept of sustainable forest management is relatively new. The professional judgment of foresters was rarely challenged until public perceptions of forestry evolved into broader definitions of sustainability, changing expectations of what constitutes stalwart forest stewardship, and developing methodologies to enhance decision making (Sample et al. 1999). One of the founders of the field of forestry economics, William A. Duerr, suggested restructuring the subject as early as 1990. He observed revolutionary changes in the forest products markets, globalization of forestry, changes in forest products themselves, and most importantly, a changing culture where the public, and not foresters, dictated forest management goals and objectives (Duerr 1990).

Forest economics is mostly taught at public land-grant universities in forestry schools or departments. Generally the same few textbooks are used across the United States. Much of forest economics is applied microeconomics or macroeconomics with forestry applications. There seems to be flexibility in how the course is taught, even how it might be taught in combination with other economics courses (Flick And Dunn 1998). There is a general flexibility that forestry economics faculty provide to forestry and natural resources programs. Flick and Dunn (1998) point out: "Forestry economics faculty offer forestry schools one important attribute that is often overlooked and that bears on the time a forest economist has for research. Forest economists can be used flexibly, for a variety of things, because most are trained in both forestry and social science. They can help out in statistics, biometrics, management, policy, capstone courses, research methods, recreation, industrial forestry, courses in consulting, and others. This is generally not true of other forestry professors. Forest biologists, for example, are less often asked to teach outside their specialties, while forest economists seem to bear such requests routinely." This same flexibility allows forest management/economics faculty to be the primary instructors in the areas of forest management, forest economics, forest valuation, forest policy, forest management plans, and the forestry capstone course.

What is the forest economics/management core curriculum area? Natural resources management and forestry programs (and most agricultural college majors) have some sort of required skill set in economics. The trend is to integrate these skills into a set of major courses that will enhance competency, literacy, and fluency. Depending upon program direction, this might mean courses in basic economics or ecological, environmental, natural resources, or forest economics. Each of these disciplines, while highly correlated, offers specialization for the managerial processes each type of professional might need in real world practice (Manning 2008). Outside pressures from legislators who want to reduce program costs, employers who want to hire new graduates with relevant skill sets, as well as inside pressure to maintain academic quality combine to foster an environment for integrated course work in areas like forest economics and management (Sample et al. 1999).

The changing demands of forestry and natural resources curricula are much broader than the sequence of management and economics courses. Integration across the curriculum involves many issues that impact management and economics components, but also impact the relationship of all courses. There are simple issues like integrating tools within the curricula. Spatial information technologies are now a foundation of forestry and natural resources management programs (Hess and Cheshire 2002). How are tools like these best integrated into curricula? The active involvement required in cooperative learning in natural resources education has been shown to improve academic achievement (Etchberger 2011). The integration of problem-based learning and web-based multimedia can also enhance academic achievement (Strivelli et al. 2011). Some curricula embrace an international focus (Pellek 1989). These types of innovation are valuable modifications to curricula that produce a broader based education. They do impact curricula and certainly combine with other integration efforts to affect the academic experience. Our focus will be limited to integrated forest and natural resources education, specifically within its managerial, economics, and policy areas.

There is no question that an expanding set of managerial and economic skills are necessary to meet the changing demands of foresters and natural resource professionals (Tombaugh 1998; Sample et al. 1999). In particular, today's curricula are required to "provide the breadth in natural resources to meet complex management issues and is representative of the major changes in forestry education in recent decades" (O'Hara and Redelsheimer 2012). Forestry and natural resources curricula tend to be have weak requirements in social sciences in general (Vonhof 2010). This is not just an American problem; the importance of a broad set of managerial and economic skills is recognized internationally (Leslie, Wilson, and Starr 2006; Vanclay 2007). That forestry educational standards keep up with the changing social and political requirements is critical, and integration of skill sets will be necessary (Tombaugh 2001).

What is the Integrated Curriculum Approach?

An integrated curriculum approach is nothing new and has been applied across many disciplines. Rather than discuss the approach in general, we will concentrate on forestry and natural resources management curricula and how integration might be applied there. Vaux (1975) discussed the topic almost forty years ago, starting with the definition of integration as "combining to form a more complete, harmonious, or coordinated entity." Using his definition, the thing being integrated is the program of study with a goal of providing the professional educational framework to produce a forester or natural resources manager. He recognized that one form of integration was incorporating new knowledge into the curriculum. That is, keeping the subject matter "current."

A second kind of integration is the one that is relevant here. It is based on identifying commonalities between and within the curriculum disciplines. An example might be silvicultural practices, forest management, and forest economics. Each is a separate discipline. The curriculum might recognize that silviculture and forest management must interact to form management alternatives and forest economics might provide the criteria that allows for selection of the optimum alternative. Vaux (1975) notes that integration of areas that are biological, soils, growth, and ecosystem based are not that difficult. However, integration of those that are social science based is difficult to accomplish. The social science areas are people-based. Culture, personal preferences, and values come into play.

Vaux was clearly correct. Since he wrote that article, forestry and natural resources management issues have become of great concern to the general public (clearcutting, endangered species, and loss of forest land). Today's forest managers need grounding in ecosystem management, interdisciplinary thinking and planning, landscape ecology, and adaptive management (Gilbert et al.1993). When forestry leaders were asked in 1991 to identify the critical elements of a forestry curriculum the results were integrative, not discipline-focused, and stressed basic competencies (rather than traditional courses), education (rather than training), a balanced natural resource perspective (rather than a timber focus), global awareness, social responsibility, knowledge of the political process and ability to navigate in it, theory and practice, increased program flexibility to allow for minors and other options, current issues focus, and the ability to work in teams (Gilbert et al. 1993). To develop the broad skills and capabilities necessary to meet those critical elements, an integrative approach is almost mandatory. Our focus is on integrating a portion of a curriculum. Thus, our discussion on integrated programs will be brief. Obviously, integrating a discipline area or two closely allied discipline areas is not as challenging as integrating an entire program. However, the same types of problems arise and the same advantages can be accomplished, just at a more modest level. To provide insight into integration of curricula a few examples will be briefly discussed.

Washington State University developed a new integrated curriculum in 1990. Traditional fields of forestry, wildlife management, range management, and wildland recreation management were merged into a department that offered a B.S. degree in natural resource management (with majors in forest management, range management, wildlife management, or wildland recreation management) or natural resource sciences majors in plant or wildlife sciences). All students start out taking the same educational foundation courses. They also take a set of natural resources core courses, including Introduction to Natural Resources Management I, II, III and IV. These are broad integrative courses, so a student could easily switch majors at this early stage. Next, the forestry students move to a set of forestry core courses, but at the same time also complete other natural resource core courses. These natural resource core courses often cover topics that were traditional forestry courses, but from a broad landscape management viewpoint. Finally, there are courses that offer forestry options in business, wildlife, management, and directed study (Gilbert 1993).

The best example of an integrated forestry curriculum is likely Northern Arizona University. It was the first university to adopt this approach in 1972. Their professional program is divided into three integrated 16-credit courses, referred to as Semesters A, B, and C. In 1996 the program was entirely revamped with an emphasis on adaptive curriculum management where the three semesters are continually reviewed (for issues like delivery methods, prerequisites, academic content, and emphasis of subdisciplines). Courses use a strong team teaching approach (Fox, Kolb, and Kurmes 1996; Sample et al. 1999; Covington et al. 2000).

The University of Vermont's School of Natural Resources provides a program where goals are met through interdisciplinary exchange. No courses were added to its existing curricula; instead, the School developed an integrated core curriculum for use by all six of its B.S. programs (including its then Society of American Foresters accredited forestry program). Their approach was retrospective: first, by setting goals for student achievement, and then, second, by developing a core curriculum that met those goals. The key was use of a process that encouraged interdisciplinary exchange and avoided departmental fragmentation (Ginger, Wang, and Tritton 1999; Sample et al. 1999).

Auburn University adopted a new forestry curriculum about 20 years ago (Flick et al. 1995). They identified four types of forestry programs: (1) "forestry in a larger whole" where forestry becomes part of a larger comprehensive environmental, ecological, or natural resources identity, (2) "many forestries" with multiple curricula in timber management, wildlife, recreation, and such, (3) "integrated forestry" where traditional forestry's subdivisions and disciplines are abandoned for a holistic approach, and (4) "bulging forestry" where more and more courses are added to the traditional forestry curriculum. They claim all four approaches are unsatisfactory as the first abandons forestry, the second defines forestry as timber management, the third breaks "with historical continuity concerning subjects and academic disciplines, making it difficult to understand what is happening,' and the fourth is undisciplined. The Auburn University approach was one that focused on core principles and placed forestry at the center—"not subjugated to natural resource management, environmental management, or another concentration."

The Auburn University faculty recognized that "the theory of forestry involves primarily three disciplines: biology, economics, and measurements. Biology includes soils, ecology, silviculture, and protection. Economics includes policy and managerial sciences. Measurement includes land and forest measurements as well as sampling and growth and yield (Flick et al. 1995). Integration does occur in their curriculum, but between courses, to make up the traditional whole of forestry. Their definition of economics would include the traditional forestry courses of forestry economics, forest management, forest valuation, forest policy, forest management plans and planning, forest operations and procurement, and business. While the key question is how to integrate within and across the three disciplines, we will focus our discussion on how best to integrate solely within the economics discipline, while recognizing that the other two disciplines have the same integration problems (Kobziar et al. 2009; Temesgen et al. 2011).

Integrating the Economics Discipline into the Forestry/Natural Resources Curriculum

Integration within or across disciplines can be viewed in terms of both breadth and depth (Ginger, Wang, and Tritton 1999). There is a perceived tradeoff between producing graduates with skill sets needed to perform professional work (depth), and those with broad foundations able to solve complex social and technical problems (breadth), but this does not have to be the case (Hosner 1993; Perry, Vanderklein, and Ek 1994). Integration can help develop both breadth and depth across "cross-discipline and cross-value natural resource management" (Jensen, Doescher, and Shelby1998). Our discussion on integrating the economics discipline into forestry and natural resources management courses will focus on both depth and breadth in recognizing that single disciplines are now expected to have some level of integration within and across other disciplines. Forest valuation is no longer totally concerned with wood value and forest management; it is now impacted by social and political pressures that did not exist a few decades ago (Fisher 1996).

The management/economics discipline in forest and natural resource management programs usually consists of introductory economics courses (either an economics concepts course, principles of microeconomics, principles of macroeconomics, or an applied economics foundation course). Using the Clemson University Catalog as representative of a land grant university, these courses would be ECON 200 – Economics Concepts, a general course that introduces both microeconomics and macroeconomics, not intended for economics majors; ECON 211 – Principles of Microeconomics, a foundation course for economics majors; ECON 212 - Principles of Macroeconomics, a foundation course for economics majors; and AP EC 202 – Agricultural Economics, an applied microeconomics course similar to ECON 201, but with agricultural applications (Clemson University 2012). Two other general natural resource economics courses are offered at Clemson University: AP EC 257 – Natural Resources, Environment, and Economics and AP EC 357 – Natural Resources Economics. These two courses could relate to any environmental, natural resources, or forestry curriculum. In addition, there are many applied economics courses that relate to specific agricultural situations.

Many of the majors in Clemson University's School of Agricultural, Forest, and Environmental Sciences use these foundation courses in the economics/business components of their curricula. Agricultural Mechanization and Business requires ECON 211 or APEC 202; Environmental and Natural Resources requires AP EC 257 or ECON 211; Forest Resource Management requires AP EC 257 or ECON 200 or ECON 211 or ECON 212; Soils and Sustainable Crop Systems requires either AP EC 202 or ECON 211; and Wildlife and Fisheries Biology requires AP EC 257.

This would be typical for a land grant university: many of the curricula have business or economic components and most of them require either principles of microeconomics/macroeconomics or applied principles of microeconomics/macroeconomics course as the foundation for additional economics work. That applied microeconomics course is usually applied agricultural economics for the general agricultural fields and usually applied natural resources economics for the natural resources fields. An upper level general natural resources course is also common for the natural resources fields.

The Sequential Model

Though some variation is bound to exist within the forestry programs of each university, those that share a more sequential commonality tend to have a similar trend in class progression. In order for a school's curriculum to be grouped in the sequential category, a clear succession of courses must be present.

The general flow of courses begins with a fundamental economics course which is usually taken in the sophomore year. The economics requirement is typically microeconomics, macroeconomics, or an introductory applied economics course. Other combinations exist within different curricula. Most universities only require that one foundational economics course be taken, but other programs require a more intensive study of economics with two courses. Juniors will then take a forest economics course which applies economic principles to forestry related dealings such as investment theory, resource supply, economics of conservation, and taxation principles. The function and structure of forest product markets are also examined. The purpose of forest economics is to narrow the broad field of microeconomics into material that is more related to forest activities. The typical sequential program will then require seniors to take a forest management course as well as a natural resource/forest policy class. As stated before, each university presents different sequences of courses, but for the most part they each follow a similar trend. Refer to Figure 1 for a diagram of a typical management/economics series of classes for the sequential model.

Classifying the curricula of Society of American Foresters (SAF) accredited programs

After examining the curricula of the 46 SAF accredited universities, five different sequence models were constructed; sequential, quasi sequential, combination, quasi integrated, and fully integrated. Because there was no existing formula for deciphering which curriculum series belonged to each model, personal judgment had to be used to decide what category each fit into. Because the same person investigated and placed each of the schools into the different models, there was no bias and results remained consistent. Examples of a sequential and fully integrated model are presented in Figures 1 and 2, but there are many programs that did not necessarily fit into either category. The curriculum pattern that falls within the quasi sequential model most often follows the sequential pattern closely, but may contain a class which combines two subjects such as forest economics and valuation. For a curriculum to be classified as quasi integrated, it typically exhibits a pattern that does not have the natural flow of succession such as a sequential approach or may contain some sort of capstone class which integrates multiple disciplines. It was necessary to create a combination model for those programs that did not fit the criteria of either sequential or integrated platforms. While it is easier to classify programs which fall into one extreme or the other, the grey area in between is often harder to categorize. Refer to Figure 3 for an illustration of how many schools fell into each of the five categories.

Figure 2 illustrates the structure of a fully integrated forestry curriculum. Just as with the sequential model, the students gain a basic understanding of economic principles by taking an introductory microeconomics course in their second year of study. During the spring term of their junior year, the students experience the integrated approach to learning forest management. The management sequence draws from prerequisites such as ecology and silviculture and also has corequisites that must be taken in concurrence with other integrated classes. In addition to the 13 units of integrated forest management, the students have the option to take an additional 3 units of liberal studies, a diversity elective, or a certificate course.

Example of Sequential Model
Clemson University
Bachelor of Science:
Forest Resource Management

Freshman

Economic Concepts
ECON 200 (3 credit hours)
One-semester survey of basic economic concepts that offers an overview of both microeconomics and macroeconomics. Not intended for business majors or other students seeking a comprehensive introduction to economic analysis and its applications.

Junior

Forest Resource Economics
FOR 304 (3 credit hours)
Economic problems and principles involved in the utilization of forest resources and distribution of forest products. Includes analysis of integrated forest operations.
Preq. Econ 200

Forest Resource Valuation
FOR 418 (3 credit hours)
Analysis of capital investment tools and their application to decision making among forestry investment alternatives; valuation of land, timber, and other resources associated with forestry, including the impact of inflation and taxes.
Preq. For 304 (forest econ)

Senior

Forest Resource Management and Regulation
FOR 417 (3 credit hours)
Fundamental principles and analytical techniques in planning, management, and optimization of forest operations.
Preq. For 302 (biometrics) 308 (remote sensing) 418 (valuation) 465 (silviculture)

Forest Policy and Administration
FOR 416 (3 credit hours)
Introduction to the development, principles, and legal provisions of forest policy in the United States and an examination of administrative and executive management in forestry
Preq. None

Forest Resource Management Plans
FOR 425 (2 credit hours)
Development of multiple resource forest management plans. Economic and environmental impacts of implementing management plans.
Preq. For 417 (forest mgt.)

Figure 1. Example of Sequential Model

Example of Fully Integrated Model:
Northern Arizona University
Bachelor of Science
Forestry

Year 2, Term 2 (Spring)

Principles of Economics: Micro
ECO 284 (3 units)
Overview of a market economy; analysis of supply and demand; using graphical techniques; consumer behavior; production and costs; determination of prices in various product and resource markets; causes and consequences of income distribution, international economics.
Preq. Mat 114 (quantitative reasoning)

Year 4, Term 2 (Spring)

Natural Resources Policy
FOR 360 (3 units)
Overview of a market economy; analysis of supply and demand; using graphical techniques; consumer behavior; production and costs; determination of prices in various product and resource markets; causes and consequences of income distribution, international economics.

Year 3, Term 2 (Spring)

Forest Management I
FOR 323 W (3 units)
Studies techniques and skills needed to manage complex forested ecosystems for the generation of goods and services.
Preq. For 313 (forest ecology) 314 (forest ecology II) 315 (silviculture practices) 317 (silviculture applications)

Forest Management II
FOR 324 W (3 units)
Studies role of human needs and values in the management of forested ecosystems.
Preq. For 313 (forest ecology) 314 (forest ecology II) 315 (silviculture practices) 317 (silviculture applications)
Coreq. For 323 W

Forest Management III
FOR 325 W (3 units)
Evaluates interactions between and among competing and complementary uses of forested ecosystems within a human context.
Preq. For 313 (forest ecology) 314 (forest ecology II) 315 (silviculture practices) 317 (silviculture applications) Coreq. For 324 W

Forest Management IV
FOR 326 W (4 units)
Integrates principles of forest ecosystem management across spatial, temporal, and geopolitical scales.
Preq. For 313 (forest ecology) 314 (forest ecology II) 315 (silviculture practices) 317 (silviculture applications)
Coreq. For 325 W

Figure 2. Example of Fully Integrated Model

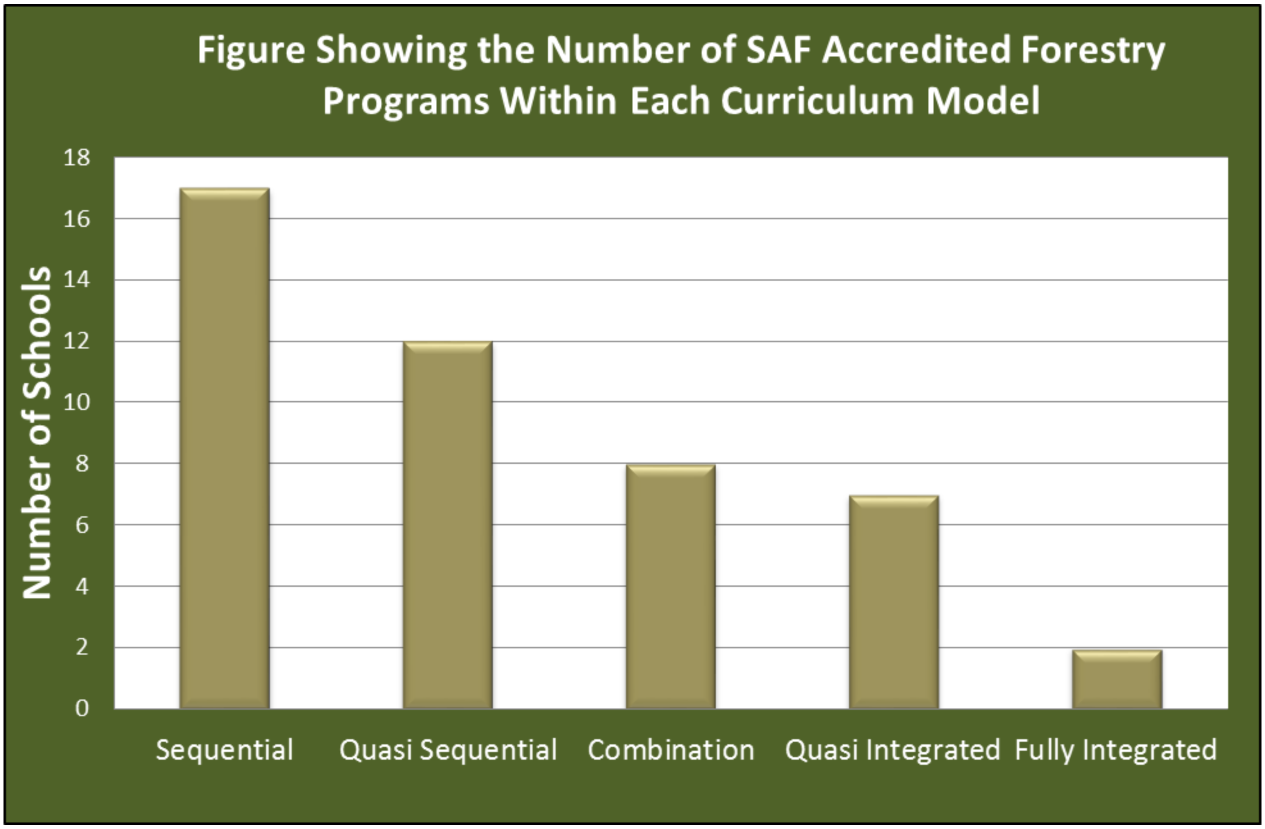

Figure 4. Graph Illustrating the Economics Requirement of the 46 SAF Accredited Programs

Of all the SAF accredited universities, most require some form of basic economics class. The majority of forestry programs allow the students to choose which economics course they wish to take. Nineteen schools (41%) had the option to take microeconomics/macroeconomics/ or a basic agricultural economics course that is micro/macro based. Though microeconomic principles and theories are more relevant to the field of forestry, there must be an underlying reason why different universities allow other economics courses to be taken. One explanation for the variance might be that incoming transfer students may have already taken an outside economics course and the flexible requirements allow their coursework to be accepted. Thirty percent of the schools do require that students take microeconomics. At 13%, there were a surprising number of programs that did not require any basic economics classes to be taken. Of the eight remaining programs, different combinations of requirements existed; two schools required their students to take macroeconomics, three required both microeconomics and macroeconomics, and three schools required a basic agricultural economics course. This is shown in Figure 4.

Conclusion

The changing perception of the forestry profession demands that a broader view be taken rather than just the input and output of forest products. While the foundational scientific courses of forestry practices such as dendrology, ecology, and silviculture will always be fundamental in any forestry program, so too will social sciences such as economics and policy. The fact that the overwhelming majority of SAF accredited forestry programs require some form of foundational economics course proves this notion. Another avenue that universities take to present the "big picture" to students is by requiring a forest policy class. Coursework in this field provides a background from both a current and historical standpoint on how many resource related policies came to be. Finally, there must be an adequate managerial approach to any natural resource program. Many universities are able to adopt subject matter from a broad range of topics such as planning and optimization of forest operations into their management class in order to bring multiple subject matters together. The management class will also often include financial matters that are pertinent for the professional forester to use in the decision making process.

The integrated approach to curriculum has gained popularity in recent times. Though it has been illustrated that the majority of universities are tending towards a sequential approach, the integrated curriculum is here to stay and many programs have adopted a partially integrated platform in some of their coursework. The capstone course that many universities offer is a prime example of bringing together multiple disciplines into one class to bridge the gap between subject matter.

The slow adoption of the integration may be due to internal issues within the particular university. When each course is individualized within the sequential model, the professor teaching each is typically specialized in that particular field. In order to integrate various material into one class, the course must be team taught or be led by an instructor with a vast and varied knowledge in an array of different fields.

Another challenge to converting to an integrated curriculum is the slow adoption of faculty members to a new way of presenting information. The classic sequential approach is a condensed, 'cut and dry" process of teaching. Often, professors will not have to stray too far out of the breadth of each course's particular subject. If an integrated model were to be adopted, the entire structure of each course would have to be altered. If the course is to be team taught, a deal of synergy would have to exist amongst the faculty. Varied opinions on how to present topics, what content is important, and countless other issues could become a point of friction between instructors.

The sequential approach is the time-tested, most popular way of presenting different subjects. Each course can be taught by someone who has a particular specialty in that area without having to be versed on many different subject matters. This is an advantage to the students because they can learn from someone who is an expert on that focus. The students learn about one particular topic and then move on to the next in the series laid out before them based on what courses constitute as prerequisites for the next course. Though each different class within a forestry curriculum stresses different topics, there is often an overlap of material in certain courses. Often, content within courses such as forest economics, management, and valuation can be markedly similar, if not the same. Because the different instructors have similar programs to teach and stress what they deem important, the student may see a redundancy in content. While it is not necessarily bad to be refreshed on past topics, taking a more integrated approach may be more conducive to the student's learning.

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2013 Survey of Mississippi Consulting Foresters

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Abstract

Detailed information about the services provided by consulting foresters and their related fees is useful information for nonindustrial private forest (NIPF) landowners. This information is also valuable to consulting foresters to assess which services they should provide and fees to charge. A survey of Mississippi's consulting foresters was conducted to determine the management services they provide to NIPF landowners and the associated fees. The survey was designed based on previous consultant surveys and input from consulting foresters. The survey included a wide variety of services dealing with forest management, timber sale administration, timber cruising, and other forestry activities. Summary statistics depicting the services provided and typical fee structures will be computed. Effects of professional qualifications on fees will also be analyzed.