Family Forest Landowner Research: Attitudes About Forest Management and Information Needs

by

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Abstract

This dissertation provides three manuscripts further assessing family forest landowners based on results from the National Woodland Owner Survey (NWOS) and Forest Inventory Analysis (FIA) unit of the United States Department of Agriculture, Forest Service. The first chapter looks at landowner differences among FIA regions using measures from the NWOS. In the second chapter, the information uses of landowners are examined along with their future preferences for receiving advice concerning their forestland. Logistic regression is used to assess how to more efficiently target these landowners with information they find valuable. Finally, in the third chapter, a method is provided for estimating the amount of merchantable timber volume available in a three state region based on family forest landowner willingness to provide. Results from these three chapters are intended to further assist in understanding landowners and better targeting extension to serve family forest landowner needs while promoting forest management.

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Introduction

Over 264 million acres of forestland in the United States are owned by family forest landowners (Smith et al. 2007). This number represents approximately 35 percent of the forests in our nation. The majority of this family forestland is in the southeastern United States, approximately 215 million acres (Wear and Greis 2002). The forestland owned by these family landowners in the South is some of the most productive forestland in the United States and is expected to become increasingly important to ensuring a sustainable timber supply for the nation and world (Wear and Greis 2002; Zhang and Nagubadi 2005).

Private forestland is increasingly being controlled by these family forest landowners (Butler and Leatherberry 2004). This is due to many reasons ranging from division among heirs to divestiture of once large industrial holdings to smaller private landowners. Family landowners are increasingly moving to rural areas as primary residences in effect creating increased demand for homes in forested areas (Levitt 2002). This rise of family forest landowners raises concerns and many opportunities for researchers, policy makers, communities, and others interested in the future of family forestland. With an increase in family forestland owners there is a decrease of large acreage tracts as parcelization of forested land occurs (Wear and Greis 2002). This leads to many different motivations and objectives for forest ownership and management. Also, a landowner's options for certain uses of their land diminish with parcelization due to tract size and adjacent tract sizes (Wear and Greis 2002). Reaching out to forest landowners with assistance in achieving their objectives is becoming increasingly difficult with these changes in landowner and land dynamics.

Kittredge (2004) wrote that family forest landowners were a moving target when it came to disseminating information concerning the management of their forestland. This was due to the landowners entering and exiting the population making it difficult to ascertain who

landowners are. As indicated by Pan et al. (2007), Majumdar et al. (2008), and Kaetzel et al. (2011), among others, landowners in the South have diverse reasons for forestland ownership.

This dissertation is comprised of three chapters that set out to describe in more detail these family forest landowners using results from the National Woodland Owner Survey (Butler and Leatherberry 2004). Results presented provide a more detailed description of characteristics of these family forest landowners and their forestland. Also, results should be useful in disseminating information to family forest landowners that will help with their ownership goals while also helping to promote forest management.

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Chapter 1 – Regional differences among family forest landowners using National Woodland Owner Survey results

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Abstract

Family forest landowners have traditionally been considered fairly homogenous. A number of new studies in the past decade, however, demonstrate that landowners and their reasons for owning forestland differ substantially. These landowners own approximately 35 percent of our nation's forestland and further research is warranted concerning these differences. So far there has been no substantial examination of regional differences among family forest owners considering landowner characteristics. Individuals own forestland for a variety of reasons (aesthetics, income etc.), and many external considerations may affect how they manage (such as proximity to neighboring lands and mimicking neighboring land management regimes). National Woodland Owner Survey (NWOS) results are used along with previously assigned motivation clusters regarding why family forest owners own their woodland. This article examines landowner characteristics along with the existing literature and attempts to weave together an explanation regarding regional differences among family forest owners. Results indicate that there are differences among family forest owners from region to region and these can possibly be explained in the context of the literature. The results could be useful in the future as resource professionals attempt to target appropriate information to landowners concerning sustainable forest management.

Introduction

There are approximately 751 million acres of forestland in the United States (Smith et al. 2007) under a diverse ownership ranging from public to private industrial and family forestland. However, just as diverse as the range of ownership is the range of characteristics of these owners and the land itself. Butler and Leatherberry (2004) provide insight into one specific group of landowners, the family forest landowners, and their characteristics. This group of landowners owns approximately 35 percent of the nation's forestland, 264 million acres (Smith et al. 2007). Butler and Leatherberry (2004) define family forests as,

> …at least 1 ac[re] in size, 10 [percent] stocked, and owned by individuals, married couples, family estates and trusts, or other groups of individuals who are not incorporated or otherwise associated as a legal entity. (p.4)

Because the nation depends on the environmental services provided by forests, government agencies and many others have substantial interest in understanding what motivates private forest landowners and their plans for managing their lands in the future. Enhancing our ability to understand the management objectives of forest landowners and the kind of support that will allow them to achieve their ownership goals is important to efficient formulation and delivery of sustainable forestry programs. Kittredge (2004) supplies reasons to understand family forest landowners, "[f]amilies are making decisions about roughly 40 [percent] of America's forestland nationally, and in some states that proportion is much higher" (p.17).

Many family forest landholdings were traditionally consolidated into large tracts. However, over the last few generations, these tracts have been broken into smaller parcels of forestland among many landowners with differing objectives. Both Levitt (2002) and Kittredge (2004) indicate that the urban-rural interface is posing threats to forestland as second-homes in rural areas are becoming primary homes bringing an influx of new citizens. With this

parcelization and the influx of new landowners/development, there is no guarantee that they will continue to implement sustainable forest practices or manage their forests, and, in fact, forestland may be lost to development or conversion to agriculture.

Private forestland ownership varies regionally. The western section of the United States - the Pacific and mountain regions - has 25 percent of its forestland under private ownership. However, the central hardwood region - the northeast and southeast and most of the south central and north central regions - has 75 percent of its forestland under private ownership (Hicks 1998). The population of family forest landowners in a particular region may also have an effect on management attitude of an individual landowner. Rickenbach and Kittredge (2009) concluded that relationships among landowners, especially in areas with a high density of private forest landowners, can influence landowner behavior and attitudes due to cooperation. This could in effect create attitude islands from region to region as landowners collaborate and share management/ownership goals for their forestland.

Research a few decades ago characterized non-industrial private forest (NIPF) landowners as one homogenous group. There was very little research that focused on NIPF landowner motivations and behaviors (Majumdar et al. 2008; Schelhas et al. 2003). Timber harvest (Binkley 1981; Boyd 1984; Dennis 1990; Hyberg and Holthausen 1989) was the major focus of NIPF landowner research. More recent studies have shown that many of these landowners are underserved, implying they lack knowledge and training ordinarily provided by government agencies and/or resource managers concerning active and effective management of their forestland (Arano and Munn 2006; Hughes et al. 2005; Measells et al. 2005). Schelhas et al. (2003) have noted that, "[s]tudies of NIPF landowners have consistently shown that they have diverse reasons for owning forest land, they value many different benefits from their lands….

One clear need is for better understanding of land management styles clusters of practices and management objectives…" (p.65). In order to better understand and assist landowners, it is important to cater their services to the differing needs of landowners (Kittredge 2004).

Substantial research has been conducted in recent years regarding factors that influence behavior of private forest landowners with the underlying goal of identifying more effective ways of communicating and encouraging family forestland owners to actively practice sustainable forest management. More recent studies have focused on attitudes and motivations for forest ownership (Kendra and Hull 2005; Butler et al. 2007; Majumdar et al. 2008), demographic characteristics (Kluender and Walkingstick 2000; Butler and Leatherberry 2004), and forest management program awareness and assistance (Kaetzel et al. 2009; Steele et al. 2008). It is widely agreed that "one size fits all" policies are not effective in promoting sustainable forest management (Schelhas et al. 2003; Kittredge et al. 2004; Majumdar et al. 2008). More recently, researchers have developed useful landowner typologies based on their motivations (Kline et al. 2000; Kluender and Walkingstick 2000; Kendra and Hull 2005; Butler et al. 2007; Majumdar et al. 2008) with the hopeful objective of using the typologies to more efficiently target assistance and education efforts. In one study, Gentle et al. (1999) examined regional differences in attitudes about public access to private land for recreation in the United States. However, an explicit investigation of regional differences in attitudes toward forest management and future intentions of family forest landholders in the United States is lacking in previous studies.

There are many different reasons why landowners own forestland, and there are many factors that influence if and how landowners manage their forestland. Majumdar et al. (2009) used NWOS results to examine inheritor versus non-inheritor landowners in the United States.

Results indicated that inheritors continue to practice active forest management providing both timber and non-timber products, whereas non-inheritors were more interested in managing for aesthetics and NTFP (non-timber forest product) values of the land. Family forest landowners' proximity to their forestland has been found to influence management behavior – i.e., whether landowners actually live on the land or in the same county as their forestland. Salmon et al. (2006), as well as Surendra et al. (2009), found that amenity focused and passive landowners usually lived in another county away from their forestland. Management decisions may also be based on proximity to timber markets and the economic situation of the family. In three southeastern states (Alabama, Georgia, and South Carolina) there is a prevalent timber motivation for woodland ownership (Majumdar et al. 2008) of family forestland. This region of the country has some of the most productive land in the United States, strong timber markets, and is expected to become increasingly important to providing a sustainable supply of timber for the nation (Wear and Greis 2002; Zhang and Nagubadi 2005). Markets and market signals have an impact on landowner forest management decisions – with clear market signals landowners are more likely to harvest timber (Pan et al. 2007).

Butler and Leatherberry (2004) presented aggregate level land and landowner characteristics of the Forest Inventory and Analysis (FIA) regions for the United States based on NWOS results. This article provides similar land and landowner statistics but at a disaggregated level – i.e., considering that landowners are not one homogenous group. Using NWOS data as a representative sample of family forest landowners within the conterminous United States, the objective of this study is to examine differences among landowner characteristics in six geographic regions. This objective was accomplished by using five measures of landowner characteristics to assess if differences exist among family forest landowners in the regions

presented. Also, landowner motivations for forest ownership were assessed across the six regions. Results presented will be used as a springboard for further research to assess how resource managers can better serve family forestland owners while estimating and ensuring a sustainable supply of timber**.**

Data and Methods

The purpose of the NWOS is to determine, "…who are the forest-land owners; why are forest lands owned; how are forest lands used; and what are the owners' plans for their forest lands" (Butler et al. 2005, p.1). This survey was administered as a mail-out survey to private landowners with follow-up telephone interviews to non-respondents from the mailed survey. The mailed survey consisted of 30 questions covering forest land and landowner characteristics, forest use and management, and concerns and issues of landowners. The response rate of the initial mailed survey was 51.3 percent of the original 17,363 owners surveyed (Butler et al. 2005). The NWOS is administered annually with states being surveyed between every 5 to 10 years (Butler and Leatherberry (2004). Butler and Leatherberry (2004) write that the NWOS is the social -complement of the FIA forest resource survey. NWOS observations, i.e., forest landowners, are the representatives of FIA plots since the same sampling frame was utilized. For the forest resource survey, 6,000 acre non-overlapping hexagons were delineated and remote sensing was utilized to establish forested sample points for FIA. If the point was identified as forested then landowner information was obtained from public property records for contact (Butler et al. 2005). The probability of a landowner being included in the sample increases as their acreage approaches and/or exceeds 6,000 acres.

FIA regions were used as the basis of our regional comparisons (Table 1-1). The southern region was broken into two regions, the southeast and south central regions, to enhance

understanding of differences among family forest landowners in this important national wood basket. Observations were assigned to appropriate regions from the pooled data by Federal Information Processing Standard (FIPS) state codes. Family forestland owners were selected from the responses by discarding forest industry, real estate investment trusts, and timber investment management organizations. The sample was then restricted to family forestland owners that owned at least 25 acres of forestland. This reduced the sample to approximately half of the original responses. Finally, clusters were assigned to family forest landowners with no missing data on the eight attitudinal questions. An observation was discarded if the respondent neglected to answer one of the eight questions regarding reasons for owning woodland on Question 9 (Table 1-2).

Observations were previously assigned into clusters describing landowner motivations for forestland ownership (Table 1-3) using SAS with K-Means Cluster Analysis on eight attitudinal questions from the NWOS for the Southeastern United States. For more details on how the clusters were assigned see Majumdar et al. (2008). Similar approaches for assigning clusters using K-Means Cluster Analysis have been used in Kuuluvainen et al. (1996) and Kluender and Walkingstick (2000). Cluster analysis is a statistical method used for establishing meaningful groups by placing *n* observations in *k* clusters/groups. These clusters were assigned using principal components analysis (PCA), another statistical tool, in which the eight questions of interest were grouped together into components. PCA is a method for reducing data into a concise set of variables. In PCA, variables that have more in common with one another than other variables are consolidated using this method (Meyers et al. 2006). These clusters represent the ownership attitudes of family forestland owners. For the purposes of this paper, the clusters assigned by Majumdar et al. (2008) are applied to family forest landowner respondents of the

NWOS in all 48 measured states to assess differences in the distribution of landowners and their associated motivations/characteristics among the six FIA regions.

Analysis of Variance (ANOVA), a statistical tool that uses sample means and variances to compare multiple categories for differences (Moore and McCabe 2003), was used in this paper to determine if there were significant differences in the means for five variables (*sec_res, inherit, age, income,* and *tenure*) that indicate whether the landowner owns their forestland as a secondary residence, if the landowner inherited the forestland, the age of the landowner, income of the landowner, and the amount of time the landowner has owned the land for the six geographic regions, respectively. Similarly, Pan et al. (2007) used ANOVA to assess differences among landowners in Alabama over a ten year time period. We expected that there would be significant differences between the regions based on the above mentioned variables. We hypothesized that landowners in the southeastern United States were primarily interested in consumptive uses of their land due to factors mentioned above, such as ownership as a primary residence and the nature of how the land was acquired (Kluender and Walkingstick 2000). We expected that more of these landowners live on or near their land and are more likely to be intergenerational owners, implying they inherited the land or have a long tenure on the land (Majumdar et al 2009). Landowners in the western United States were hypothesized to be least likely to actively manage their land due to its ownership as a secondary residence. Landowners in that region were also expected to mimic the management regimes of public land surrounding them like the neighbor effect explained by Rickenbach and Kittredge (2009), although constructing a test for that effect was not possible.

Results

At the national level the largest group of landowners is the non-timber group, which constitutes 37.4 percent of family forest owners (Table 1-3). The non-timber group owns land primarily for non-consumptive uses such as aesthetics, promoting biodiversity and privacy. The smallest group of family landowners, although they own the most forestland, is the timber group. Landowners with a timber motivation make up 25.9 percent of family landowners; however they own 47.1 percent of family forestland (Table 1-3). Timber motivated landowners primarily own land for consumptive purposes including timber production, as a financial investment, and as a legacy to leave to their heirs. Finally, the multiple-use family forest owners are the second largest group of landowners. These landowners own their land for a mix of consumptive and non-consumptive reasons. Multiple-use landowners make up 36.8 percent of family forest owners nationally (Table 1-3).

The non-timber motivation for owning forestland is prevalent among family landowners throughout much of the United States (i.e., the mountain, north central, northeast, and Pacific regions) (Table 1-4). However, in the southern United States the multiple-use motivation is most prevalent among landowners in the south central region and the timber motivation is most prevalent among family landowners in the southeastern region (Table 1-4).

There are five dependent variables chosen for ANOVA. All five variables have means that vary significantly across the six regions (α=.01) (Table 1-5). The first variable *sec_res* is a measure of whether the landowner owns their forestland as a secondary residence. Landowners in the mountain region are more likely to own their forestland as a secondary residence (40 percent of landowners) while landowners in the southeastern and south central regions are the least likely to own their land as a secondary residence (22 percent and 26 percent of landowners,

respectively). *Inherit* indicates that landowners in the south central and southeastern regions are more likely to have inherited their land (58 percent and 43 percent of landowners, respectively). Landowners in the southeastern and south central regions are slightly older than landowners in the other four regions, as indicated by *age*. The income of landowners is the highest in the Pacific and mountain regions and the lowest in the northeast and north central regions as indicated by *income*. Finally, landowners in the southeastern and south central regions have slightly longer tenure, as measured by the variable *tenure*.

Discussion

By all indications, landowners in the southern United States, collectively the southeastern and south central regions, are more likely to manage their forestland for consumptive purposes as pointed out by the predominant timber and multiple-use clusters (Table 1-4). Southern landowners tend to live near their land as indicated by the low percentage of landowners owning land as a secondary residence (Table 1-5). Also, southern landowners are more likely to have inherited their land and have a slightly longer tenure as well as older age (Table 1-5). This is consistent with the findings of authors already cited (Salmon et al. 2006; Majumdar et al. 2009; Surendra et al. 2009). Landowners that inherited their land are more likely to actively manage their land, whereas landowners who owned their land as a secondary residence and are from urban areas were more interested in amenity values. These southern landowners, as indicated by *tenure* and *age*, have mostly lived in or near rural areas surrounding their forestland and possibly continue managing the family land. Also, as pointed out by Wear and Greis (2002) and Zhang and Nagubadi (2005), the southern United States has a strong timber economy. Pan et al. (2007) point out that market signals from a strong economy can influence management decisions (e.g. higher prices, forest management assistance).

Schelhas (2003) refers to an emerging paradigm change concerning forest management. This is especially salient when concerning public lands where just a short half century ago maximum sustained yield was the norm. Today, however, public lands, in the publics' interests, are more focused on sustainable forest management (factoring in non-timber values). This paradigm shift has changed the landscape regarding public lands management. In the western states, as indicated by Table 1-4, landowners are predominantly interested in non-consumptive uses of their land (the non-timber motivation). This can be explained possibly by the attitudinal islands effect described by Rickenbach and Kittredge (2009). Landowners cooperate and influence one another's decisions, primarily among private landowners. However, it is possible that landowners are also affected by public lands management due to the high percentage of public land in the western United States. Most private landowners are neighbors to or live in close proximity to public lands.

This new paradigm that Schelhas (2003) refers to likely affects private landowner motivations. Landowners in the mountain and Pacific regions are more likely to own their land as a secondary residence and have higher mean incomes than landowners in other regions (Table 1-5). As articulated by Salmon et al. (2006) and Surendra et al. (2009), landowners who own their land as a secondary residence are most interested in their land primarily for its amenity values and are usually very passive concerning forest management. These landowners also had higher mean income (Table 1-5) than other regions, which may indicate more disposable income, and less reliance on the forest as a provider of income. Family forest owners in the northeastern and north central regions appear as sort of a cross between the western and southern owners. Landowners in these two regions are predominantly interested in non-consumptive uses of their land (as indicated by the predominant non-timber motivation) (Table 1-4). Landowners in this

region, collectively, are less likely to own their land as a secondary residence compared to landowners in the West, but they are more likely to own their land as a secondary residence compared to landowners in the South (Table 1-5). Northern landowners, collectively, have the lowest mean income and slightly lower age and tenure compared to the other four regions (Table 1-5).

Conclusion

Landowner characteristics such as whether they own the land as a secondary residence, whether they inherited the land, how long they have owned the land, their age, and income can be used to explain some of the regional differences in the motivations of non-industrial private forest owners in different parts of the country. Family forest owners in the United States are not a homogenous group. They have differing reasons for owning woodland and these differences can be seen at the regional level and across regions. Landowners who live near their land, have held the land for longer periods of time and/or have inherited the land may be more likely to actively manage their land – these are primarily southern owners when considering this paper's results. Landowners that have higher incomes and own their land primarily as secondary residences may not manage their land as actively – private landowners in the West.

Family forest landowners in the southeastern United States are increasingly needed to provide a sustainable supply of wood to the nation. Results indicate that landowners in this region are more willing to provide wood as shown by motivation results in Table 1-4. Southeastern landowners typically live near their forestland and have been tied to their land longer (indicating they have long tenure and/or have inherited the land). Landowners in this region may feel an obligation to manage their land (Kaetzel et al. 2011).

Results can be used to help develop appropriate communication/extension efforts to increase management. For example, urban, more affluent, small-acreage owners that own their land as a secondary residence (such as western landowners) may be better served by mail-outs and web based extension materials (Brunson and Price 2009). Also, older landowners in the South may be interested in mail-outs; there is a small but significant difference in average ages among regions (Table 1-5) (Bardon et al. 2007). Southern landowners may be more willing to manage their forestland and provide timber (Kaetzel et al. 2011). These landowners may be better served by direct contact with a forester or other natural resources manager to meet their management goals.

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Tables

Table 1-1. Geographic regions and respective states used for analysis.

Northeast	North Central	Southeast	South Central	Mountain	Pacific
Connecticut	Illinois	Florida	Alabama	Arizona	Alaska
Delaware	Indiana	Georgia	Arkansas	Idaho	California
Maine	Iowa	North Carolina	Kentucky	Colorado	Hawaii
Maryland	Kansas	South Carolina	Louisiana	New Mexico	Oregon
Massachusetts	Michigan	Virginia	Mississippi	Montana	Washington
New Hampshire	Minnesota		Oklahoma	Nevada	
New York	Missouri		Tennessee	Utah	
Pennsylvania	Nebraska		Texas	Wyoming	
Rhode Island	North Dakota				
Vermont	Ohio				
	South Dakota				
	West Virginia				
	Wisconsin				

Table 1-2. Eight attitudinal questions used for cluster analysis.

9. "People own woodland for many reasons: How important are the following as reasons for why you own woodland?"
a. To enjoy beauty or scenery
b. To protect nature or biologic diversity
c. For land investment
d. For privacy
e. To pass land on to my children or other heirs
h. For production of sawlogs, pulpwood or other timber products
i. For hunting or fishing
j. For recreation other than hunting or fishing

There were two other questions (f and g) that pertained to non-timber products and biofuel that were not able to be used in cluster analysis.

Table 1-3. Percentage of landowners in each motivation cluster at national level and amount of forestland acres owned.

Cluster	n	%	Acres Forestland	% Forestland
Timber	1,195	25.9	1,441,518	47.1
Mutiple-use	1,698	36.8	973,262	31.8
Non-timber	1,727	37.4	648,519	21.2

Table 1-4. Percentage of landowners in each motivation cluster by region.

Region/Cluster	Timber	Multiple-Use	Non-Timber
Mountain	25.42%	29.66%	44.92%
North Central	20.51%	36.76%	42.73%
Northeast	24.02%	37.21%	38.77%
Pacific	29.70%	31.68%	38.61%
South Central	34.97%	37.88%	27.15%
Southeast	40.76%	36.97%	22.27%

Table 1-5. ANOVA results for regions with variables measuring whether landowners owned their land as a secondary residence, if the landowner had inherited their land, age of the landowner, landowner's income, and tenure of ownership.

Dependent Variables	Forest Inventory Analysis Regions						
	Mountain	North Central	Northeastern	Pacific	Southeastern	South Central	F-Statistic
sec_res***	0.406	0.315	0.313	0.314	0.220	0.258	5.53
	(0.493)	(0.465)	(0.464)	(0.467)	(0.415)	(0.438)	
inherit***	0.280	0.201	0.286	0.310	0.575	0.429	72.73
	(0.451)	(0.401)	(0.452)	(0.465)	(0.495)	(0.495)	
age***	60.364	59.180	59.715	60.957	61.995	62.612	12.33
	(10.660)	(11.817)	(11.725)	(11.920)	(11.500)	(11.628)	
income***	83.177	60.213	67.251	92.874	79.030	74.717	19.39
	(62.799)	(48.260)	(55.241)	(68.51)	59.292	(58.684)	
tenure***	25.127	24.005	24.002	25.525	26.637	27.404	8.46
	(16.001)	(13.939)	(14.240)	(16.066)	(15.259)	(15.521)	

*** indicates significance (α=.01) across regions for respective independent variable
Standard deviations in parentheses

Chapter 2 – Using extant data along with National Woodland Owner Survey results to discern landowner uses of extension and perceived usefulness for future extension contact

Abstract

Family forest landowners own approximately 42 percent of private forestland at the national level, and in some regions this is much higher (Butler and Leatherberry 2004). It is important to target landowners with information regarding forestland management in efficient and effective ways. These family forest landowners are a heterogeneous group with varying reasons for forestland ownership and goals for forestland management (Kittredge 2004; Salmon et al. 2006; Butler et al. 2007; Majumdar et al. 2008). For this reason it has become increasingly difficult to target landowners with information. Research has been done segmenting family forest landowners to understand their motivations for ownership and preferences for extension related information using primary data as a result of surveys. However, surveys can be time consuming and expensive. This paper is aimed at using extant data, i.e. secondary data, as a more effective and efficient means of targeting family landowners with appropriate information.

Methods examine whether extant data explaining biophysical, demographic, and socioeconomic characteristics of the land and landowners can be used to determine the appropriate delivery method for conveying extension information to family forest landowners. Results would be beneficial to extension agents as well as resource managers in targeting landowners in a more efficient manner with information landowners perceive as useful.

Introduction

Previous research has shown that there are different motivations for forestland ownership among family landowners. Forest landowners are a heterogeneous group that can be classified as timber, non-timber and multiple-use owners of forestland (Bliss and Martin 1989; Measells et al. 2005; Salmon et al. 2006; Pan et al. 2007; Majumdar et al. 2008; Kaetzel et al. 2011). Timber motivated landowners own land primarily for consumptive purposes (i.e. timber production, financial investment), and non-timber motivated landowners own land for non-consumptive purposes (i.e. amenity values, biodiversity). Multiple-use landowners own forest land for a mix of both consumptive and non-consumptive reasons. As a result, there are many family forest landowners with differing objectives and motivations for forestland ownership.

Forest landowners have various reasons for acquiring forestland. Many landowners are intergenerational landowners, i.e., inheritors (Majumdar et al. 2009a). Other landowners are buying land for new and/or secondary homes to move away from urban centers (Carrion-Flores and Irwin 2004). This is primarily due to the amenity values of rural forest areas such as recreation opportunities and scenery (Libby 2003; Brockett and Wilkinson 2006). Both Levitt (2002) and Kittredge (2004) indicate that the urban-rural interface is posing threats to forestland as second-homes in rural areas are becoming primary homes, bringing an influx of permanent landowners. Mode of acquisition of forestland has been linked to objectives and motivations for forestland ownership (Gardner 2005; Majumdar et al. 2009a). Landowners that have inherited land, as well as older landowners that have long land tenure, are more likely to actively manage their forestland. Landowners that have acquired rural land for a second home, or as a first time home for younger landowners, are more likely to be interested in amenity values, i.e., more passive land managers (Salmon et al. 2006). There are many other factors that influence

landowner management decisions. Family forest landowner proximity to their forestland has been found to influence management behavior – i.e., whether landowners actually live on the land or in the same county as the forestland. Salmon et al. (2006) found that amenity focused non-timber landowners usually lived in another county/away from their forestland – sometimes in more urban areas owning the forestland for 'getaway' purposes (i.e. secondary residence). This result is also found in Surendra et al. (2009). Management decisions may also be based on proximity to timber markets and the economic situation of the family. The southeastern region of the nation has a strong timber market, and is expected to become increasingly important to providing a sustainable supply of timber for the nation (Zhang and Nagubadi 2005). This is likely one reason for the prevalent timber motivation for forestland ownership of family forestland in the region (Majumdar et al. 2008).

Family forest landowners have diverse reasons for forestland ownership and diverse motivations/goals for forest management. These goals range from doing nothing, in the case of passive landowners as described by Salmon et al. (2006), to timber and multiple-use management focused on both consumptive and non-consumptive uses of the land, as described by Majumdar et al. (2008) and Majumdar et al. (2009b). With the increase in family forest landowners and their differing motivations, it is becoming exceedingly difficult to provide useful extension materials in an efficient manner. Kittredge (2004) raises the concern that, "[f]amilies are making decisions about roughly 40 [percent] of America's forestland nationally, and in some states that proportion is much higher" (p.17). Kittredge (2004) also notes that, "the audience is a moving target… [t]he result is that effective outreach to family forest owners is becoming more difficult due to more of 'them' and fewer of 'us' to send the message" (p.16). This is based on landowners moving and out of the population leading to demographic shifts. Also, as pointed

out by Kittredge (2004), there are "…more of 'them' and fewer of 'us'" (p.16). Therefore, it is imperative that efficient methods are used to target and disseminate information that realizes the manpower constraint (i.e. 'us').

There is no single direct approach that can be used to influence private forest landowners' management decisions. As noted by Rodenwald (2001), many methods of contact must be used to assure that a broad audience is reached effectively. The literature, especially in the *Journal of Extension*, has been very divisive on this issue suggesting there are many useful methods of contact via extension (e.g. Bardon et al. 2007; Steele et al 2008). At one time it seemed reasonable to use a one-size fits all approach to communicating with private landowners (then categorically referred to as NIPFs). The steady increase in the number of landowners and myriad of reasons for woodland ownership suggests change is necessary (perhaps this myriad always existed and was not acknowledged). Approaches will have to vary for different audiences. Results in many recent *Journal of Extension* articles conclude that young landowners are more interested in indirect contact, such as the internet (e.g. Bardon et al. 2007). These landowners tend to migrate from urban settings and have smaller forests. Brunson and Price (2009) surveyed small landowners in 4 fast growing Utah counties; their results indicated a preference for web-based materials:

> [s]hifting our attention from how landowners get their information to how they *want* to get their information, perhaps the most striking finding is the preference in each study area for Web-based products over all other sources. This reflects a gradual shift in how all Americans—but perhaps especially the urban migrants who comprise a large percentage of small acreage owners—use information (p.6).

To efficiently and effectively influence how private family forest landowners manage their land, market segmentation may be necessary. Each audience may require a different mode of communication. Communication is not just necessary for encouraging good forest

management but also for protecting resource laden lands from parcelization and development (Haines et al. 2011).

One means of learning about landowners' previous uses of information and their preferences for future contact is via surveys. Surveys are the most common tool for understanding landowners. However, surveys can be time consuming and expensive. Using data already available from surveys, such as the National Woodland Owner Survey (NWOS) (Butler et al. 2005) can help understand landowners at particular points in time, as has been done in previous studies (Butler and Leatherberry 2004; Majumdar et al. 2008). Analysis done with data from this survey, and other surveys, as mentioned above, has helped to classify landowners' different motivations for woodland ownership. Given a basic understanding of landowner motivations, it should be possible to begin using extant data, secondary data, to further understand landowner preferences for receiving information.

Majumdar et al. (2009b) were able to use extant data to classify landowners' management direction. Their study found that certain biophysical, socioeconomic, and demographic information allowed them to successfully classify landowners as being timber, non-timber, or multiple-use forestland owners. Extant data were obtained from Forest Inventory and Analysis (FIA) plots concerning biophysical attributes. Socioeconomic and demographic data were obtained from the United States Census Bureau and USDA Economic Research Service (ERS). Majumdar et al. (2009b) used discriminant analysis (DA) to obtain their results. Results from their study show that biophysical variables such as slope, site and tree species were significant indicators of a landowner's motivations for forestland ownership. They found that slope had a negative significant impact (a higher slope meant a landowner was less likely to be timber motivated), while site and tree species had a positive significant effect (landowners with good

site quality and pine were more likely to be timber motivated). Their results also showed that a landowner was more likely to have a timber motivation for ownership in areas with lower population density and away from population centers (variables measuring population gravity index and population density). Non-timber owners were more likely to live near population centers and have a higher median household income. Other studies have looked at forest landowner management behavior such as stand regeneration and active management habits using extant data (Greene and Blatner 1986; Arano et al. 2004).

This research focuses on continuing to identify the most effective and efficient manner of contacting family forest landowners using extant data. Following Majumdar et al. (2009b), secondary data is used concerning biophysical, demographic, and socioeconomic characteristics of the land and landowners to determine the best methods of conveying extension related information to family forest landowners. Analysis is conducted for three states in the southeastern region of the United States (Alabama, Georgia, and South Carolina).

Data and Methods

Data

This research uses data from the NWOS conducted by the USDA Forest Service, FIA. The purpose of the NWOS is to determine, "…who are the forest-land owners; why are forest lands owned; how are forest lands used; and what are the owners' plans for their forest lands" (Butler et al. 2005, p.1). NWOS is administered as a mail out survey to private landowners with follow up telephone interviews to non-respondents from the mailed survey. The survey consisted of 30 questions covering forest land and landowner characteristics, forest use and management, and concerns and issues of landowners. The response rate of the initial mailed survey was 51.3 percent of the original 17,363 surveyed (Butler et al. 2005). NWOS is

administered annually with states being completed between every 5 to 10 years (Butler and Leatherberry (2004). Butler and Leatherberry (2004) assert that the NWOS is the social complement of the FIA. Accordingly, FIA uses the same sampling frame for NWOS as it uses for forest resource inventory (Butler and Leatherberry (2004)):

> [t]he United States was divided into nonoverlapping, 6,000 ac hexagons. Within each hexagon, a sample point was randomly selected. This resulted in a grid of points that, on average, was 3.25 miles apart. Using remotely sensed imagery and/or ground reconnaissance, each point was identified as forest or non-forest. For all forest sampling points, the names and addresses of the forest-land owners were obtained from tax records…. The identified private owners and the land they owned were the basis for estimating attributes of interest (p.13).

Family forests were defined by Butler and Leatherberry (2004) as, "…at least 1 ac in size, 10% stocked, and owned by individuals, married couples, family estates and trusts, or other groups of individuals who are not incorporated or otherwise associated as a legal entity" (p.4). For the purpose of this research the same procedures used by Majumdar et al. (2009a) were utilized, "[ignore] the inclusion of forest industry, timber investment management organizations, and real estate investment trusts… (p. 426)" in the analysis so that only family forest landowners were analyzed. Family forest parcels, again following Majumdar et al. (2009a), are at least 10 hectares (approximately 25 acres) in size due to, "the economic inefficiencies associated with managing such smaller parcels…" (p. 179). This reduced the sample size used for analysis in this paper (n=748). Supplemental data (extant data) were obtained from the ERS and FIA.

Data were analyzed using STATA Intercooled version 10 developed at Texas A&M, College Station, Texas.

Objective 1 - Using extant data to assess previous uses of advice regarding forestland

An econometric model was estimated to determine which biophysical, demographic, and socioeconomic variables (all extant data) best describe a family forest landowner's receipt of

information regarding their woodland(s) in a three-state region (Alabama, Georgia and South Carolina) in the past five years. Logistic regression is a form of DA that allows examination of differences between groups, or factors, using descriptive variables. Similar models have been used to examine explanatory variables influence on timber harvesting, reforestation, and silvicultural treatments that have taken place (for a comprehensive review see Beach et al. 2005). Also, these types of regression (logistic and multinomial logistic) have been used in previous forestry studies to assess control efforts for spruce budworm (Hughes et al. 1991), and in assisting in projecting timber inventories (Teeter and Zhou 1999). Most recently, these forms of discriminant analysis have been used to assess urbanization effects on timberland ownership class (Nagubadi and Zhang 2010), and to assess the relationship of land and landowner characteristics with NIPF landowner motivations for woodland ownership (Kaetzel et al. 2011). Often, these models rely on both survey data of forest landowners and on secondary (extant) data explaining resource characteristics (Beach et al. 2005). This was the case in this research. We were unable to find prior research utilizing extant data along with DA to assess landowner assistance/extension needs. Therefore it is difficult to have *a priori* expectations for the econometric model provided here. The logistic regression equation can be defined as,

Equation 2-1. $Prob(Y = 1|x) = \frac{e^{x'\beta}}{1+e^{x'\beta}}$ (Greene 2003).

This model assumes a binary dependent variable (0/1). The logistic model includes a vector of explanatory values, x, and unknown parameters, β. In this model, the dependent variable is a measure of a landowner having received information/advice regarding their forestland in the previous five years. The independent variables are measures of demographic, socioeconomic, and biophysical characteristics such as mill gravity index (mgi), median household income, slope, forest type, distance to improved road, and site productivity (Table 2-1). Biophysical

variables come from FIA data. Each observation in the NWOS survey is linked to an FIA plot by a plot identification number. It is possible, using the plot identification number, to obtain from FIA forest resource inventory records the forest stand characteristics, i.e. slope, tree species and site productivity. The theoretical equation can be shown as,

Equation 2-2. ADVICE = f (MD, OC, PR).

This is a version of a theoretical equation presented in Beach et al. (2005). In this equation, having received advice in the previous five years is a function of market drivers (MD), owner characteristics (OC), and plot/resource conditions (PR). MD is measured by the variable *mgi* which is a measure of access to mills (higher value indicates more/better access as a function of distance and number of mills) (Table 2-1). *Inc* is used as a measure of OC as reported by the ERS (Table 2-1). Finally, PR data were obtained from the FIA, these include: *slope*, *fortyp*, *rddist*, and *siteclcd* (Table 2-1). Advice came from a state agency forester, extension forester or other state employee, Natural Resource Conservation Service, Soil and Water Conservation District, or Farm Service Agency employee, private consultant, such as a forester or wildlife biologist, a forester from a company that produces forest products, logging contractor, employee of a non-profit group, other forest landowner, neighbor, or friend.

These independent variables were chosen using a stepwise estimation procedure joined with logistic regression. Stepwise estimation with forward selection was used keeping only variables that are significant at the .10 level (α=.10) or higher. In stepwise regression, an attempt is made to find the best explanatory variables for the model – more specifically, in forward selection, variables are introduced one at a time to increase the estimated sum of squares (Gujarati 2003). This can lead to possible problems with multicollinearity, however this was

examined, and found not to be an issue, by estimating the variance inflation factors (VIFs) after a standard ordinary least squares (OLS) regression (Menard 2002, Gujarati 2003).

Objective II – Methods for assessing usefulness of future extension related information

This objective examines effective and efficient means of delivering extension information to landowners based on landowner preferences for receiving information in the future. For this objective, multivariate discriminant function (DF) analysis was utilized. The theoretical model of usefulness of advice concerning management can be represented as,

Equation 2-3. USEFULNESS = f (MD, OC, PR).

Mgi is the independent variable being used as a measure of MD (Table 2-1). The variable being used as a measure of OC is *inc* (Table 2-1). Finally, the variables *siteclcd* and *stdszcd* are measures of PR (Table 2-1). These variables were assigned by using a stepwise estimation joined with logistic regression independently for each component.

Components explaining landowners' perceived usefulness, the dependent variable, of future information regarding management of their forestland were assigned using Principle Component Analysis (PCA), with orthogonal rotation (Varimax), to identify how information sources can be classified into j components. PCA is a DF method for reducing data into a concise set of variables. In PCA, variables that have more in common with one another than other variables are consolidated (Meyers et al. 2006). These consolidated groups of variables are referred to as components. These components are based on landowner responses to question 20 on the NWOS survey, "How useful would the following ways of learning about managing your woodlands be for you?" (Butler et al. 2005, p.26). Respondents are asked to rank 11 information outlets on an 8-point Likert scale (1-7, don't know). Finally, a post estimation test was used to determine how reliable the sample was for PCA. This test, the Kaiser-Meyer-Olkin (KMO) test,

uses partial correlations to determine if the variables will factor well. The higher the KMO statistic, the more adequate these correlations are (Meyers et al. 2006).

Results

Objective I Results

Logistic regression results for all landowners can be found in Table 2-2. Since stepwise regression was used, all six independent variables are significant at differing levels.

The MD and OC independent variables and were both found to have negative correlations with the dependent variable. The MD variable, *mgi* (α=.10), is a measure of access to mills. As *mgi* increased, a landowner was less likely to have received prior advice concerning their forestland. *Inc* (α=.05), the OC variable, is a measure of median household income by county. As *inc* increased, a forest landowner was less likely to have received prior advice concerning their forestland.

For the PR independent variables, *slope* (α=.01) was found to have a negative correlation with whether a landowner had received advice in the previous five years. As slope increases, a landowner was less likely to have received prior advice. The variable *fortyp* (α=.01) has values ranging from 100 to 999 for non-stocked. Values between 100 and 391 indicate softwood stand types, values between 400 and 409 indicate mixed hardwood and pine stand types, and values between 500 and 995 indicate hardwood stand types. As the value for *fortyp* increased, a landowner was less likely to have received prior advice. Distance to an improved road, as measured by *rddistcd* (α=.05), had a positive correlation with the dependent variable. A landowner was more likely to have received advice as the horizontal measured distance to an improved road increased. Finally, the independent variable *siteclcd* (α=.10) is a measure of site

productivity and has values ranging from 1 to 7, with 7 being the least productive. As *siteclcd* increased, a landowner was less likely to have received prior advice.

The overall logistic regression model using landowners in all three clusters was highly significant as indicated by the Likelihood-Ratio Chi-square. The model was able to correctly classify 65.80 percent of observations (i.e. using extant data, the model was able to correctly identify whether or not 65.80 percent of observations had received prior advice based on their known responses).

After the initial regression, a second regression was estimated using the same criteria but only for landowners with a motivation for active management, timber and multiple-use motivations, as defined by Majumdar et al. (2008). Forest management in a broad sense is intended to address social and economic concerns as well as timber management (Bettinger et al. 2009). However, it is possible that survey participants could misconstrue forest management as only timber management. Therefore, it is important to assess advice trends for landowners that have a motivation for timber management (landowners in the timber and multiple-use clusters). In this model, timber and multiple-use classified landowners having received advice in the previous five years was only a function of the PR variables *fortyp*, *rddistcd*, *slope*, and *siteclcd* (Table 2-3). The correlations between the independent variables in this second regression and the dependent variable are the same as in the first regression (the directional effect).

Objective II Results

After an initial estimation of PCA, eigenvalues were observed using a post estimation scree plot output from STATA to assess how many components met Kaiser's Rule (Meyers et al. 2006). Analysis of the scree plot resulted in keeping the first three components. Component one had an eigenvalue of approximately 5.7 while two others, components 2 and 3, had approximate

eigenvalues of .96 and .94, respectively. The second and third components, while they do not have eigenvalues of one, are close enough, as indicated by the scree plot, and make sense when looking at the component scores assigned to them for each variable. These three components explain approximately 75.91 percent of the landowners preferred methods of extension (i.e. 75.91 percent of landowners can be classified into one of these components).

The component scores for each of the 10 variables used in PCA can be found in Table 2-4. The variable concerning membership in a landowner organization had to be dropped since it could not be successfully classified into one of the three components. This specific information variable did not have a score of at least .30 for any of the three components. Component 1 is made up of the variables indicating the internet/web, conferences, workshops, video conferences, video tapes for home viewing, television or radio programs, and visiting other woodlands or field trips. The second component is composed of only two of the information variables: publications, books, or pamphlets and newsletters, magazines, or newspapers. Finally, talking with a forester or other natural resource professional, talking with other woodland owners, and talking with a logging contractor make up the third component. Approximately 30.50 percent of landowners prefer the contact methods in component 1, 23.01 percent of landowners prefer the contact methods in component 2, and 22.40 percent of family forest landowners prefer contact methods in component 3. Approximately 24.08 percent of landowners could not be classified into one of the 3 components from PCA. The KMO test indicates that the correlations were satisfactory for factoring using PCA.

Logistic regression results for the landowners described by Component 1 can be found in Table 2-5. *Inc* had a negative correlation (α=.05) with whether a landowner found sources of information in this component useful. However, *siteclcd* had a positive correlation (α=.05). *Inc*

indicates that as median household income by county increases a landowner is less likely to find the five types of communication indicated above useful for information regarding managing their woodland. Independent variable *siteclcd* is a measure of site productivity and has values ranging from 1 to 7, with 7 being the least productive. As the value for *siteclcd* increased a landowner was more likely to find these sources useful. This model was highly significant (α=.01) as shown by the Likelihood Ratio Chi-square and was able to correctly classify 58.40 percent of observations correctly.

Table 2-6 indicates that only one variable, *mgi*, was significant (α=.10) in describing whether a landowner preferred publications, books, or pamphlets and newsletters, magazines, or newspapers useful. As *mgi*, a weighted measure of access to mills, increases a landowner is more likely to find these sources of information useful for managing their woodland. This model was significant (α=.10) and was able to classify 80 percent of observations correctly.

The final logistic regression estimated indicates that three variables are significant for predicting whether a landowner finds talking with a forester, other woodland owners, and/or a logging contractor useful (Table 2-7). The independent variable *inc* had a negative correlation (α=.10) indicating that as income increased a landowner was less likely to find these sources useful. *Siteclcd* (α=.05) also had a negative correlation indicating that as the site became less productive a landowner was less likely to find these sources of information useful. The final independent variable, *stdszcd* (α=.10), is measured on a scale of 1 to 5 where 1 indicates stands stocked with at least 50 percent large diameter trees and 5 indicates a non-stocked stand. The correlation for this variable indicates that as the value for *stdszcd* increases to 5 a landowner is more likely to find these sources of information useful in managing their woodland. This model was significant (α=.05) and was able to classify 72.80 percent of observations correctly.

Discussion

Results indicate, in both objectives, that extant data can be used as a means of identifying whether landowners had received any advice previously and future landowner information preferences. As described by Beach et al. (2005), landowners' uses of advice, and perceptions of usefulness of future contact sources, can be described by a few functions looking at market drivers, owner characteristics, and plot resources/conditions. In this paper these factors were assessed using variables measuring access to mills, median county income, site productivity, forest type, distance to paved roads, slope, and site stocking.

As noted in the introduction, little research has been done using extant data to characterize landowner information trends and perceptions of information usefulness. With the diversity of landowners due to changing demographics (Butler and Leatherberry 2004; Kittredge 2004), the diversity of land use patterns and sizes as a result of increased urban expansion/land fragmentation and inheriting of land (Levitt 2002; Majumdar et al. 2009a), and the diversity of motivations for ownership constituted by these patterns (Salmon 2006; Majumdar et al. 2008; Kaetzel et al. 2011), it will become increasingly difficult to assess how to target effective information to landowners that helps them accomplish their ownership goals while also promoting sustainable forest management. This paper outlines a method using extant data that can be used as a possibly more effective means of targeting landowners. Majumdar et al. (2008) wrote that they hoped their results and methods, "may help improve communications and development of effective outreach and education programs" (p. 879). The results provided here should be a step in the right direction toward achieving that goal.

Results for the initial logistic regression in Objective 1, found in Tables 2-2 and 2-3, indicate that a landowner with better access to mills, as indicated by *mgi*, and with higher income

will be less likely to have received prior advice (in the past five years). Access to mills and higher income have already determined their options and indicate they are aware of their woodland's possibilities. This could be due to having prior contact with a company forester, outside of the five years, or having hired a consultant previously to help write and institute a management plan. In both the first and second regressions, increased slope and/or decreased site productivity correlated with a landowner being less likely to have received advice in the past five years. These landowners, due to site quality and characteristics, do not have a motivation to manage their land, and therefore would not have sought advice, as these results mirror those found in Majumdar et al. (2009b) regarding non-timber landowners. Alternatively, the landowner may have viewed management as economically infeasible and not sought advice. In both regressions, it makes sense since the region is dominated by a softwood lumber market (Zhang and Nagubadi 2005), that as the forest type code increased, meaning the land is more hardwood dominated rather than mixed or softwood, that the landowner was less likely to have received prior advice. Landowners are more inclined to manage and therefore seek advice for their land if it is primarily softwood/pine.

Objective 2 results indicate that extant data can be used to assess landowner's perceived usefulness of extension related information. Three components (categories) of information were described using discriminatory function analysis. These components can be used to classify approximately 75.91 percent of landowners. These three components can be described as modern modes of communication including electronic media such as television, radio, and the internet (as well as field trips), traditional print communication including publications (pamphlets and books) and newsprint (magazines and newspapers), and finally one-on-one contact with natural resource professionals, loggers, and other landowners. Landowners that

prefer electronic media types of communication (results in Table 2-5) live in counties with lower median household incomes and own land with less favorable site classes. Those that prefer traditional print communication (results found in Table 2-6) live in closer proximity to a mill, as indicated by *mgi*. This may be due again to an inference made in Objective 1 – these landowners have already (more than five years ago) had direct contact concerning their woodland and only need supplemental information in print form. Finally, those landowners that prefer direct contact (results found in Table 2-7) are more likely to have stand types that are low and/or non-stocked and dominated by a softwood/pine type. These landowners are also more likely to own land in counties with lower median household incomes. The direct contact with a forester, logger, or other landowner would be beneficial in restocking these softwood/pine stands. As pointed out by Majumdar et al. (2008), this region is dominated by a timber motivation for ownership – these landowners are likely to be seeking direct contact as a means of increasing forest cover and forest management on their property.

Conclusion

There are many reasons for owning woodland in the United States, and this is especially true in the southern states. As pointed out in the literature, landowners in these states own their land for various reasons, and there are various modes of acquisition that explain how forestland is obtained, which help to explain the varied management behaviors of non-industrial private landowners. As pointed out by Kittredge (2004), there are more of them (i.e. family forest landowners) than there are of us to meet their needs. Therefore it is increasingly important to find more efficient and cost-effective means of meeting landowner needs for information.

As pointed out by Brunson and Price (2009), the focus must be shifted from how landowners have received information to how they wish to receive future information. This

paper examined how extant data could be used to determine each. Extant data, from the United States Department of Agriculture and United States Census Bureau were useful in determining which landowners had previously sought advice (past five years) and in determining which sources of information they found useful for future contact.

Extension and outreach programming should be developed to best respond to identified needs. It is anticipated that the public will increasingly prefer electronic media types of communication to traditional ones as a way to receive forestland management information (Bardon et al. 2007). Indeed, this current research finds that those landowners who may be in the most need (lower income and site quality) already find this method to be the most beneficial. Therefore cooperative extension professionals should address this need proactively by rethinking the way they present extension and outreach programming.

One way this need could be addressed is through a combination of traditional and modern media techniques. Web based extension is becoming increasingly popular (Harder and Lindner 2008; Herring 2008), whereas traditional contact such as direct mail (Cartmell et al. 2006) and direct contact (Steele et al. 2008; Brunson and Price 2009) are still preferred mediums of contact concerning forestland management. Social networking sites should be used to inform landowners of more traditional continuing education opportunities such as short courses, landowner meetings and field days. These sites can also work as an effective method of providing information to raise awareness and provide links to more detailed information that will encourage future participation and involvement in active land management. Short video clips that include demonstrations of forest management practices such as regeneration and herbicide application should also be linked to these sites. Similarly, webcasts of short course classroom lectures may be combined with an associated field trip. As both human and financial resources

become increasingly scarce, this combination of techniques limits both travel time and the time an extension professional is away from the office, while still providing beneficial one-on-one contact to address follow-up questions and real-world demonstrations of topics presented in the webcast.

As this research suggests, extension and outreach professionals need to continue to promote traditional workshops and publications for local audiences who may indeed be more informed about land management practices. However, information from these traditional outreach materials should be also published in web-based formats so that they can be highlighted on state and national websites such as eXtension.org to facilitate wide exposure. All possible methods of outreach should be used to target as many landowners as possible (Rodenwald 2001).

Finally, results indicate that it is possible for extension personnel to use maps produced from GIS and satellite imagery along with supplemental county level information to determine the most effective and efficient means of contacting forest landowners. Also, zip code maps should be overlaid to target information efficiently. As an example, if the county in question had a low median household income then it is possible to assume they prefer media and/or direct contact. If in addition, looking at the individual zip codes within that county it is possible to assess that stands are low stocked then it can be assumed that landowners prefer direct contact. If there is a mill within a zip code, then it can be assumed that print/mail outs may be all that is necessary for the area in question. Further research should be done to assess how to reach out to an audience where these components overlap.

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Tables

Table 2-1. Independent variables used in logistic regression.

Variable	Description	Mean	Standard Deviation
mgi	Mill gravity index	2.49	11.18
inc	Median household income by county	32601.20	6910.43
slope	Percent slope (angle)	6.36	9.00
fortyp	Forest type (values range 1-3)	1.97	0.92
rddistcd	Distance to improved road from plot center	4.25	1.44
siteclcd	Site productivity class code	4.42	0.91
stdszcd	Stand-size class code	2.05	0.83

Table 2-2. Logistic regression results for all landowners that have previously received advice.

	advice
mgi	-.0182*
	(.9820)
inc	-.0000**
	(1.0000)
slope	-.0346***
	(.9660)
fortyp	-.3357***
	(.7148)
rddistcd	.1498**
	(1.1616)
siteclcd	-.1743*
	(.8400)
constant	2.3731***
Observations	725
Likelihood-Ratio Chi^2	63.49***
Correctly Classified	65.80%

***significant at .01 ** significant at .05 * significant at .10
Odds ratios are in parentheses

Table 2-3. Logistic regression results for timber and multiple-use classified landowners that have previously received advice concerning their forestland.

	advice
slope	-.0310***
	(.9695)
fortyp	-.3491***
	(.7053)
rddistcd	.1879***
	(1.2067)
siteclcd	-.2440**
	(.7835)
constant	1.4527***
Observations	514
Likelihood Ratio Chi^2	39.60***
Correctly Classified	60.89%

***significant at .01 ** significant at .05 * significant at .10
Odds ratios are in parentheses

Table 2-4. Components and their scores after principal components factor analysis.

Ways of Learning	Component 1	Component 2	Component 3
Publications, books, or pamphlets	-0.0057	**0.6285**	-0.0013
Newsletters, magazines, or newspapers	0.0457	**0.6386**	-0.0822
Internet/web	**0.5092**	0.1068	-0.2138
Conferences, workshops, or video conferences	**0.3974**	0.0347	0.1221
Video tapes for home viewing	**0.5263**	-0.0579	0.0427
Television or radio programs	**0.4126**	-0.0404	0.1325
Visiting other woodlands or field trips	**0.3186**	0.0798	0.1098
Talking with forester or other natural resource professional	-0.1458	0.2695	**0.4700**
Talking with other woodland owners	-0.0651	0.2078	**0.4940**
Talking with a logging contractor	0.0801	-0.2397	**0.6606**
Total percent explained	30.50%	23.01%	22.40%

Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy = 0.8431 ("Meritorious" sample)

Table 2-5. Logistic regression results for landowners in Component 1.

	Component 1
inc	-.0000**
	(1.0000)
siteclcd	.4505**
	(1.5692)
constant	-4.5040
Observations	125
Likelihood-Ratio Chi^2	12.22***
Correctly Classified	58.40%

***significant at .01 ** significant at .05 * significant at .10
Odds ratios are in parentheses

Table 2-6. Logistic regression results for landowners in Component 2.

	Component 2
mgi	.0648*
	(1.0670)
constant	-1.4823
Observations	125
Likelihood-Ratio Chi^2	3.10*
Correctly Classified	80.00%

***significant at .01 ** significant at .05 * significant at .10
Odds ratios are in parentheses

Table 2-7. Logistic regression results for landowners in Component 3.

	Component 3
inc	-.0000*
	(.5785)
siteclcd	-.5474**
	(.9999)
stdszcd	.4367*
	(1.5476)
constant	2.5066*
Observations	125
Likelihood-Ratio Chi^2	10.56**
Correctly Classified	72.80%

***significant at .01 ** significant at .05 * significant at .10
Odds ratios are in parentheses

Chapter 3 – Landowner willingness to provide timber in Alabama, Georgia, and South Carolina

Abstract

The southeastern region of the United States is important to ensuring a sustainable supply of timber for the nation. Forest ownership in this region is very diverse with one major ownership group being family landowners. Family forest landowners are a subgroup of non-industrial private forest (NIPF) landowners that possess their woodland for a number of consumptive and non-consumptive purposes. The purpose of this research is to assess the quantity and composition of available timber in three southern states (Alabama, Georgia, and South Carolina) based on social availability, i.e. whether a family landowner is willing to provide timber.

Introduction

There are many different reasons why family forest landowners own forestland, and many factors that influence if and how these landowners manage their land. Studies have examined ownership and management behavior of these family landowners (Salmon et al. 2006; Majumdar et al. 2008; Joshi and Arano 2009; Majumdar et al. 2009; Surendra et al. 2009; Joshi and Mehmood 2011). One region of particular interest for family landowner studies has been the resource laden southeastern United States. This particular region has been referred to as the timber basket of the nation (Zhang and Nagubadi 2005). This region has a strong timber market and forest economy with strong competition between differing forest products (Paula et al. 2011). For this reason, it is advantageous to understand characteristics of these landowners and to assess whether they are willing to conduct silvicultural activities and supply their timber.

The availability of timber from family forestland is a vital area of interest in this region. The southeast has some of the most productive land in the nation, a strong timber market, and as mentioned above, is expected to become increasingly important to providing a sustainable supply of timber for the nation (Wear and Greis 2002; Zhang and Nagubadi 2005; Arano and Munn 2006). Approximately 62 percent of our nation's wood supply originates in this area (Smith et al. 2009). There are three general factors that determine whether timber is readily available from family forest landowners. These three factors are (Butler et al. 2010):

1) biological, i.e. composure, stand size,
2) physical, i.e. slope, site productivity, and
3) social, i.e. landowner willingness to harvest, political constraints, such as riparian areas and regulations, and finally financial constraints such as acreage, accessibility and development pressure.

Of major interest in research presented here is the social factor of availability. Looking at other factors may pose concerns for analysis as it would be difficult to control for differing political

constraints across states and/or regions, such as streamside management zone sizes and other regulations. Also, technology, physical constraints, and/or access to markets differ by states and/or regions. Understanding landowner objectives is a very critical point to promoting a sustainable supply of timber in these states.

As mentioned above, studies have examined management and ownership objectives of family forest landowners. Majumdar et al. (2009) used National Woodland Owner Survey (NWOS) results to look at inheritor versus non-inheritor landowners in the United States. Results indicated that inheritors continued to practice active forest management providing both timber and non-timber products, whereas non-inheritors were more interested in aesthetics and non-timber values of the land. Joshi and Arano (2009) found that younger landowners were more willing to conduct a timber harvest than older landowners in West Virginia. Also, they found that landowners with higher education and higher income were more likely to implement silvicultural practices e.g. forest management. Joshi and Arano's (2009) results also showed that acreage was negatively correlated to silvicultural activities – and those that had purchased their land were more likely to implement forest management than inheritors, contrary to Majumdar et al. (2009). Family forest landowner proximity to their forestland has been found to influence management behavior – i.e. whether landowners actually live on the land or in the same county as their forestland. Salmon et al. (2006) and Surendra et al. (2009) found that amenity focused and passive landowners usually lived in another county away from their forestland.

Butler et al. (2010) looked at availability of woody biomass in the northern United States. Their results indicated that much of the woody biomass was not available due to differing constraints such as parcel size and lack of landowner willingness to harvest (social and physical constraints). Technical timber models also have been used in recent years. Abt et al. (2009)

used a sub-regional timber supply model for twelve southern states (south central and southeast regions) to determine timber supply from both private and corporate forestland over a 25 year span (until 2030). This model relied on data from Forest Inventory Analysis (FIA) plots. Results from this study posited that a United States recession would lead to shifts in harvests by region, products harvested and lower prices. This would lead to higher forest stocking/inventory for southern states. Similarly, results from Teeter et al. (2006) projected a 25 and nine percent increase for softwood and hardwood inventories, respectively, in the southeastern United States through 2025 using an interregional supply model in which states were treated as interconnected markets.

Most recently, Paula et al. (2011) looked at the willingness of landowners in Lee County, Alabama to supply timber for biofuel. Not surprisingly, they found that one of the strongest indicators of whether a landowner would supply timber was, "the desire for income from timber sales" (p. 95). This article indicates that there will be a supply of timber as long as there are sufficient market signals (i.e. generous prices). However, Paula et al. (2011) also pointed out, as did Majumdar et al. (2008), among others, that there were many non-timber objectives for owning forestland among Alabama's landowners. Joshi and Mehmood (2011), likewise, looked at family landowner willingness to supply timber for bioenergy. Using a cluster based approached, much like the one used by Majumdar et al. (2008), Joshi and Mehmood (2011) found three groups of landowners in a three state study (Arkansas, Florida, and Virginia) describing landowner objectives and motivations. The group they labeled as multiple-objective landowners were found to be possibly the most favorable to supplying timber for bioenergy. Again, they pointed out that economic benefits were essential to these multiple-objective landowners supplying timber.

Management decisions may be based on proximity to timber markets and the economic situation of the family. Markets and market signals have an impact on landowner forest management decisions – with clear market signals landowners have been found to harvest timber (Pan et al. 2007). As pointed out by Paula et al. (2011), the United States south is rich in forest resources with strong competing forest product markets between bioenergy, pulpwood, and sawtimber. There are strong timber markets in Alabama, Georgia and South Carolina. In Alabama, there were 145 wood processing plants in 2005 (Hartsell and Johnson 2009). The Alabama Forestry Commission reports that forestry is the state's number one manufacturing industry (Alabama Forestry Facts 2011). There were 181 wood processing mills in Georgia in 2004 (Harper et al. 2009). Finally, there were approximately 75 mills (saw and pulp mills) in the state of South Carolina in 2005 (Conner et al. 2009). A 2011 fact sheet from the South Carolina Forestry Commission indicated that forestry was the number one manufacturing industry in the state with timber being the state's number one commodity (State of South Carolina's Forests 2011). These operations indicate an existent market for family landowners and more than likely influence the prevalent motivation for woodland ownership geared toward timber management and harvesting among family landowners as described by Majumdar et al. (2008).

The purpose of this research is to quantify the amount of available merchantable timber in the three states mentioned above, Alabama, Georgia, and South Carolina. Most timber supply studies assume all timber is available for harvest, using FIA measures of the most recent inventories. This study presents a method for adjusting that inventory to reflect the unwillingness of some family landowners to harvest their timber.

Data and Methods

FIA inventory and NWOS survey results for Alabama, Georgia, and South Carolina were used for this study. While the purpose of FIA is to assess the trends in forest area (e.g. growth and removals, species composition, forest health etc.), the purpose of the NWOS is to determine, "…who are the forest-land owners; why are forest lands owned; how are forest lands used; and what are the owners' plans for their forest lands" (Butler et al. 2005, p.1). NWOS is administered as a mail out survey to private landowners. The survey consists of 30 questions covering forestland and landowner characteristics, forest use and management, and concerns and issues of landowners. NWOS is administered annually with states being completed between every 5 to 10 years. NWOS is the social complement of the FIA, and accordingly, FIA uses the same sampling frame for NWOS as it uses for forest resource inventory (Butler and Leatherberry 2004):

> [t]he United States was divided into nonoverlapping, 6,000 ac hexagons. Within each hexagon, a sample point was randomly selected. This resulted in a grid of points that, on average, was 3.25 miles apart. Using remotely sensed imagery and/or ground reconnaissance, each point was identified as forest or non-forest. For all forest sampling points, the names and addresses of the forest-land owners were obtained from tax records…. The identified private owners and the land they owned were the basis for estimating attributes of interest (p.13).

It is assumed that NWOS responses are truly representative of the states surveyed as FIA plots are randomly selected and considered representative of the forests in each state. All private landowners were assumed to have a non-zero probability of being selected for the NWOS. Private landowner probability of being selected increased as their forest acres increased toward 6,000 acres (Butler and Leatherberry 2004). This sampling frame was used to ensure that results could be generalized to the wider population.

The sum of family forest acres for each of the three states owned by family forest landowners can be seen in Table 3-1. In Alabama, there were approximately 22.7 million acres of forestland (approximately 68 percent of the state's land area); approximately 25 percent of this was in plantations (i.e. pine), or approximately 6 million acres (Hartsell and Johnson 2009). Of the total forestland in Alabama, approximately 67 percent was owned by family forest landowners (approximately 15.3 million acres) (Table 3-1). In 2010, there was approximately 34.1 billion cubic feet of volume in Alabama's forests (Miles 2011) (Table 3-2). Of this volume, 20.4 billion cubic feet was in hardwoods, and 13.7 billion cubic feet was in softwood species.

In 2005 Georgia had 24.7 million acres of forestland (approximately 67 percent of the state's land area) (Harper et al. 2009) (Table 3-1). Hardwoods make up the majority of Georgia's forest composition, as noted in the report from the USDA Forest Service Southern Research Station,

> Despite what seems to be favoritism toward southern yellow pine, Georgia timberland area contains more hardwood area. Oak-pine is included in the hardwood forest types causing total hardwood area to exceed softwood area by 2.4 million acres. (Harper et al. 2009, p.8)

Of this forestland, approximately 54 percent could be categorized as family forestland (approximately 13 million acres) (Table 3-1). In 2010, there was approximately 17.7 billion cubic feet of softwood timber, dominated by loblolly pine (*Pinus taeda*) (Miles 2011) (Table 3-2). There was approximately 23.5 billion cubic feet of hardwood timber (no dominant species).

South Carolina's forests occupy 67 percent of the state's land area (Conner et al. 2009). This amounts to approximately 12.9 million acres (Table 3-1). The most common species in the state was loblolly pine, and dominant hardwoods were the red and white oaks (*Quercus spp*). Of South Carolina's 12.9 million acres, family forest landowners controlled 59 percent (approximately 7.6 million acres) (Table 3-1). In 2010, there was an estimated 23.7 billion

cubic feet of live volume in South Carolina's forests (Miles 2011) (Table 3-2). Of this volume, approximately 13.1 billion cubic feet was in hardwoods, and the remaining 10.6 billion cubic feet was in softwood species (Table 3-2).

Majumdar et al. (2008) used a cluster analysis approach to characterize three motivations describing family forest landowner reasons for owning their woodland. Conclusions regarding the characterizations (and the assignment to clusters) were based on the responses of 1,085 family forest owners in Alabama, Georgia, and South Carolina who participated in the NWOS in 2002, 2003, and 2004. The analysis was based on landowner responses to question nine on the NWOS (Table 3-3). The question used a Likert scale to measure how important different reasons for ownership were to the landowner (i.e. the reasons presented were rated by the respondents using an ordinal scale from 1 to 7 where 1 reveals the strongest motive or "Very Important" and 7 reveals the weakest motive or "Not Important"). The three resulting motivations for forestland ownership were described as timber, non-timber, and multiple-use. Those that were best described as being non-timber landowners were more interested in owning their woodland for privacy, promoting biodiversity, recreation, and aesthetics (a, b, d, and j in Table 3-3). The non-timber family forest landowners put the least amount of emphasis on the importance of timber as a reason for forest ownership. Landowners that were categorized as being timber and multiple-use oriented had motivations that were more utilitarian such as ownership as an investment or for timber (c and h in Table 3-3), although some multiple-use reasons for ownership overlap with non-timber motivations (e.g. privacy and aesthetics).

Each NWOS respondent was asked to identify how many acres of forestland he/she owned. Family forest landowners reported they owned approximately 1.2 million acres of forestland in the three states of interest (Table 3-4). In Alabama, family forest landowner

respondents indicated they owned approximately 308,383 acres, however only 95.7 percent of this would be considered harvestable (Table 3-4). This is based on the assumption that non-timber landowners, whom own 13,396acres (or 4.3 percent), would not harvest timber while those categorized as having timber and multiple-use motivations for ownership would harvest timber. Family forest landowners in Georgia owned approximately 534,070 acres of forestland (Table 3-4). Of these 534,070 acres, however, only 92.9 percent would be considered harvestable (Table 3-4). Finally, in South Carolina family forest landowners owned approximately 332,950 acres of forestland, but only 91.4 percent would be considered harvestable when taking out the portion of non-timber acres (Table 3-4). These results from NWOS should be considered representative of all family forest landowners in each state due to the unbiased nature of the FIA sampling frame.

Merchantable timber volume on family forestland was calculated by first identifying the ownership of FIA plots in the three states (i.e. whether they were industry, public, or family owned) (Zhang, personal communication, September 2, 2011). This was done using information from the NWOS. Each FIA plot is comprised of many subplots (24-foot radius) and microplots (6.8-foot radius). Data were collected by FIA at the subplot level including tree height, tree diameter, tree species, and tree class (e.g. growing stock). Besides tree level data, other data were collected concerning plot condition (e.g. slope, aspect, land use, and stand origin). Only trees five inches in diameter (i.e. at least pole timber for both hard and softwoods) or greater were tallied in the 24 foot radius subplots. These trees (at least five inches in diameter) are considered merchantable for the analysis in this paper. Depending on the species of tree, there

are various volume equations necessary to calculate volume in cubic feet per tree[1]. The volume equations for each species were used in a spreadsheet to calculate the respective volumes of each tree in the subplot. Finally, expansion factors are available from FIA to expand the subplot information (i.e. volume) to per acre/per plot basis dependent on the size of the plot.

Merchantable timber volume results are presented in Table 3-5. Family forest landowners in Alabama own approximately 19.6 billion cubic feet of merchantable timber (Table 3-5). Family forest landowners in Georgia owned approximately 21.7 billion cubic feet of merchantable timber in the state's forests (Table 3-5). While in South Carolina, family forest landowners owned approximately 12.3 billion cubic feet of merchantable timber in their state's forests (Table 3-5). Volumes are based on 2010 FIA data for Alabama and Georgia and 2009 FIA data for South Carolina.

In order to estimate the amount of socially available merchantable timber volume on family forestland it is assumed that site class, species composition, volume etc. are equal across all family forest acres. Using the data and information provided above, estimates were made of available merchantable timber volume based on family forest landowners' willingness to provide (social availability). The percentage of acres designated as being owned by family landowners with a non-timber motivation for ownership (Table 3-4) is used as the adjustment factor for assessing available timber volume. The volume of timber associated with those acres is removed from the total timber volume owned by family landowners to arrive at our estimate of timber that is socially available for harvest. Given the assumption that all family forest acres are equally productive, and that the NWOS is unbiased, this method yields estimates of socially available volumes for all three states in the region.

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[1] As an example of the general form of a gross volume (GV) equation: $GV = \beta_0 + \beta_1 DBH^{\beta 2} + \beta_3 DBH^{\beta 4} BL^{\beta 5}$, where $\beta_1, \ldots \beta_5$ are estimated parameters, DBH is diameter at breast height, and BL is bole length (Scott 1979)

Results

Approximately 4.3 percent of family forestland acres are considered non-timber in Alabama (Table 3-4). It is assumed that approximately 95.7 percent of the merchantable timber volume on family forestland is available. Of the approximately 34.1 billion cubic feet of merchantable live timber in the state of Alabama (Table 3-2), 19.6 billion cubic feet is owned by family forest landowners (Table 3-5). However, only 18.8 of 19.6 billion cubic feet of timber can be considered socially available (Table 3-6). The majority of this available volume is in hardwoods, 11.3 billion cubic feet, while the remaining 7.5 billion cubic feet is in softwoods.

In the state of Georgia, non-timber motivated family forest landowners owned 7.1 percent of the acres (Table 3-4). There was an estimated 21.7 billion cubic feet of merchantable timber on family forestland in Georgia, out of a total of 41.2 billion cubic feet. However, only 92.9 percent of the merchantable volume on family forestland can be considered socially available. Therefore, the supply of merchantable timber in Georgia that family landowners may be willing to supply is approximately 20.2 billion cubic feet (Table 3-6). Hardwoods make up the majority of this volume with 11 billion cubic feet while the remaining 9.2billion cubic feet is made up of softwoods.

South Carolina non-timber family forest landowners owned approximately 8.6 percent of acres in their state (Table 3-4). These family landowners possessed approximately 12.3 billion cubic feet (Table 3-5) of the 23.7 billion cubic feet (Table 3-2) of merchantable timber volume in South Carolina. However, of this estimated 12.3 billion cubic feet of merchantable timber on family forestland, only approximately 11.2 billion cubic feet is considered socially available (Table 3-6). Hardwoods make up approximately 5.6 billion cubic feet of this available merchantable volume while the other 5.7 billion cubic feet is made up of softwood species.

Discussion and Conclusion

Results indicate that family forestlands do contain the majority of merchantable volume on forestlands in the three states analyzed. Comparing the amount of socially available merchantable volume from family forestlands (50.2 billion cubic feet, Table 3-6) with the total amount of merchantable volume on family forestland (53.6 billion cubic feet, Table 3-5), we find that approximately 93.7 percent of volume on family forestland is socially available (e.g. family forest landowners have expressed harvesting timber is important to them). Likewise, when compared to total merchantable volume for these three states across all ownerships (99 billion cubic feet, Table 3-2), family forest acres that are considered available account for approximately 51 percent of merchantable volume. Interpreted differently, approximately 3.4 (53.6-50.2) billion cubic feet of merchantable volume is not available due to its presence on non-timber family oriented acres, therefore only approximately 97 percent of the previously anticipated volume is available (assuming volumes on all other ownerships, i.e. non-family forestland, is readily available). As pointed out by Paula et al. (2011) and Joshi and Mehmood (2011), this is not surprising given the strong market presence in this region.

Family forest landowners in this region own approximately 60 percent of the total forestland in Alabama, Georgia, and South Carolina. Furthermore, their land contains approximately 54 percent of the total merchantable volume of timber in these three states. Using inventory and NWOS data from FIA, this this paper presents a method of estimating the amount of available merchantable volume on these family forest landowners' lands. After adjusting for non-timber landowners, results indicated that approximately 50.2 (Table 3-6) of the estimated 53.6 billion cubic feet (Table 3-5) of merchantable timber volume is available for harvest based on landowner's possible willingness to harvest. As pointed out above, that is approximately 93.7

percent of the merchantable timber volume on family forestland in these three states. One salient issue is how does the 6.3 percent of merchantable volume on non-timber oriented family landowner land become available. As these landowners die, and their land is sold and inherited the future of their land is uncertain. Likewise, even for the 93.7 percent of volume that is merchantable, current markets may shift, and as we have seen in recent years timber prices are unstable. This has an impact on the estimate presented in this study, as timber and multiple-use oriented family landowners may be less willing, at the current time, to sell their timber. Family landowners, again from Paula et al. (2011) and Joshi and Mehmood (2011), will sell their timber if the price is right and strong market indicators are present. Perhaps if/when prices rise, non-timber oriented landowners may view harvesting timber as a viable management option. While natural resource managers do not see the options in Table 3-3 as being mutually exclusive, it is possible that family forest landowners, especially those that are non-timber oriented, do see timber harvesting and management as being a mutually exclusive management option from promoting recreation and biodiversity (among other options). So, perhaps also with outreach it may be possible to promote timber harvesting and management as a means to achieving other goals to these specific forest landowners.

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Tables

Table 3-1. From FIA, amount of forestland by state.

State	Total forestland (million acres)	Family forestland (million acres)
Alabama	22.7	15.3
Georgia	24.7	13.0
South Carolina	12.9	7.6
Total	60.3	35.9

Table 3-2. 2010 volume for all forestland by state.

State	Hardwood Volume (billion ft^3)	Softwood Volume (billion ft^3)	Total Volume (billion ft^3)
Alabama	20.4	13.7	34.1
Georgia	23.5	17.7	41.2
South Carolina	13.1	10.6	23.7
Total	57	42	99

Table 3-3. Eight attitudinal questions used for cluster analysis.

9. "People own woodland for many reasons: How important are the following as reasons for why you own woodland?"
a. To enjoy beauty or scenery
b. To protect nature or biologic diversity
c. For land investment
d. For privacy
e. To pass land on to my children or other heirs
h. For production of sawlogs, pulpwood or other timber products
i. For hunting or fishing
j. For recreation other than hunting or fishing

There were two other questions (f and g) that pertained to non-timber products and biofuel that were not able to be used in cluster analysis.

Table 3-4. From NWOS, family forestland acres in non-timber category as a percentage.

State	Family forestland (acres)	Non-timber (acres)	Non-timber as % of family forestland
Alabama	308,383	13,396	4.3
Georgia	534,070	38,060	7.1
South Carolina	332,950	28,671	8.6
Total	1,175,403	80,127	6.8

Table 3-5. 2010 merchantable volume for family forestland for each state.

State	Hardwood Volume (billion ft^3)	Softwood Volume (billion ft^3)	Total Volume (billion ft^3)
Alabama	11.8	7.8	19.6
Georgia	11.8	9.9	21.7
South Carolina[1]	6.1	6.2	12.3
Total	29.7	23.9	53.6

[1]South Carolina merchantable volume is for the year 2009

Table 3-6. Socially available volume of merchantable timber on family forestland.

State	Hardwood Volume (billion ft^3)	Softwood Volume (billion ft^3)	Total Volume[1] (billion ft^3)
Alabama	11.3	7.5	18.8
Georgia	11.0	9.2	20.2
South Carolina[1]	5.6	5.7	11.2
Total	27.9	22.4	50.2

[1]Numbers across rows may not add up exactly due to rounding