

To the Graduate Council

I am submitting herewith a dissertation written by Kevin Patrick Hoyt entitled “A Socioeconomic Study of the Non-industrial Private Forest Landowner Wood Supply Chain Link in the Cumberland Plateau Region of Tennessee”. I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy with a major in Natural Resources.

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**A Socioeconomic Study of the Non-industrial Private Forest Landowner
Wood Supply Chain Link in the Cumberland Plateau Region of Tennessee**

**A Dissertation
Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville**

**Kevin Patrick Hoyt
December 2008**

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ABSTRACT

The Cumberland Plateau in Tennessee currently is experiencing widespread forest parcelization and changes in species composition as a result of changes in land use and ownership. These changes can be attributed partially to industrial forest land divestiture, the lingering effects of the 1998 – 2002 Southern Pine Beetle (SPB) epidemic, and expanding development due to increasing population growth. The region has recently become a focus of debate concerning land use change, land management practices, and the effects on biodiversity.

A stratified random sample of 1600 Nonindustrial Private Forest (NIPF) landowners owning 40 or more acres of forestland were surveyed obtaining a 39 percent response rate. The survey was undertaken to gain new insight on the socio-demographics of Plateau NIPF landowners and to understand their forest management objectives and intentions for future timber harvesting activities.

The findings reveal almost 50 percent of respondents were retired or employed as professionals and lived on or within 60 miles of their forest land. Ninety-one percent of all respondents had either purchased or inherited their forest land, and the majority indicated they intended to pass their forest land on to their heirs. The top three non-consumptive ownership objectives were to enjoy scenery ($m = 3.98$), for peacefulness ($m = 3.94$), and to preserve nature ($m = 3.83$). Timber management was ranked as only moderately important ($m = 2.60$). Forty-five percent of all respondents indicated that they had previously sold or harvested timber from their forest land, but only 30 percent indicated they intended to sell timber in the future.

Logit regression (n = 438) and factor analysis (n = 344) were used to model the respondents' willingness to sell timber in the future. NIPF landowners who indicated they would most likely consider a future timber sale had sold timber in the past, had a higher interest in timber production, had received forest management advice in the past, and had a higher interest in maintaining the health of their forest. Factor analysis revealed landowners most likely to consider selling timber in the future fit into three principle component groupings: 1) Improvers; 2) Investors; 3) or Legacy Owners.

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CHAPTER 1

INTRODUCTION

The Cumberland Plateau in Tennessee currently is experiencing widespread forest parcelization and changes in species composition as a result of changes in land use and ownership. These changes can be attributed partially to industrial forest land divestiture, the lingering effects of the 1998 – 2002 Southern Pine Beetle (SPB) epidemic, and expanding development due to increasing population growth. For this study, the Cumberland Plateau in Tennessee was defined by the USDA Forest Service 16 contiguous county survey unit, which lies east of Cookeville and west of Harriman, Tennessee. The region has recently become a focus of debate concerning land use change, land management practices, and the effects on biodiversity. Nonindustrial Private Forest (NIPF) landowners are caught in the crossfire as they control the majority of the forestland on the Plateau that both the forest industry and society need and value.

Rapid population growth, urban sprawl, and the changing demographics from rural to urban (Dwyer and Stewart 1999) may be affecting an attitude shift from timber to non-consumptive management objectives among the region's NIPF landowners (Butler 2008). Given this premise, the intensity level of timber management practiced on Plateau NIPF landholdings may dictate the future availability of fiber and solid wood to keep the regional forest products industry sustainable into the future.

This study was conducted in order to: (1) build a socio-economic model of the region's NIPF landowners; (2) evaluate their opinion on the importance of timber and

non-consumptive use management objectives; and (3) develop a behavioral utility model to assess their willingness to sell timber.

Research Objectives

The primary research objectives of the study were to:

1. assess demographic characteristics of NIPF landowners on the Cumberland Plateau and compare these characteristics for landowners of the northern and southern Plateau counties;
2. evaluate Plateau NIPF landowners opinions and attitudes concerning forest management knowledge and objectives;
3. determine what motivates Plateau NIPF landowners to select timber harvesting over other non-consumptive management objectives; and
4. evaluate how demographic characteristics, forest land variables, and past experience with timber sales/harvesting might influence the future availability of timber flow from the Cumberland Plateau.

Specific benefits of the study include:

1. Forest Resource Values: more up to date information on the state of knowledge regarding how NIPF landowners value their forest land on the Cumberland Plateau.
2. Decision Support Models: increased information to better inform stakeholders of alternative management regimes associated with NIPF lands.
3. Collaborative Planning: increased knowledge base concerning how the health and viability of the wood supply chain might impact the future of forest-based communities of the region.

4. Human Dimensions: determine Cumberland Plateau NIPF landowner's forest management objectives.

The Cumberland Plateau

This study area is Tennessee's Cumberland Plateau, a 16-county region containing 3.06 million acres of forestland (Figure 1.1), of which more than 72 percent is under NIPF ownership (Schweitzer 2000). As of 1999, more than 71 percent of the land area was forested, with 88 percent classified as hardwood forests. Schweitzer also estimated the growth to removals ratio for hardwood to be 2.15:1, while the growth to removals for softwood was 1.81:1. Selecman (2006) conducted a spatial analysis and estimated that more than 2.5 million acres on the Plateau may be available for timber harvest. Finally, English et al. (2004) reported that the Plateau region's logging sector contributed over \$48 million in economic activity (29.1% of the state total), and \$908 million of value added forest products in 2000.

Early accounts give witness to a blanket of Virginia and shortleaf pine covering much of the Cumberland Plateau during the pre-fire control days in Tennessee (Clatterbuck 2006). Modern fire fighting techniques, forest fire education efforts, and increased fire suppression have virtually eliminated uncontrolled wild fire on the Plateau, allowing hardwood forests to crowd out much of the once dominant pioneering pine trees. Walker and Oswald (1999) made mention of the vast Virginia pine stands that once dominated the pre-fire control era on the Cumberland Plateau.

Human-induced succession has been well documented as well in recent history through forest harvesting practices, particularly clear-cutting. The percentage of pine has stayed relatively constant during the last several decades at approximately 10 percent. However, wide-scale loss of native and planted pine has been well documented in Morgan and Cumberland counties, among other Plateau areas, during the most recent Southern Pine Beetle epidemic. Moreover, the Tennessee Department of Agriculture, Forestry Division has reported that the Cumberland Plateau sustained over 1,900 beetle spots from 1998 – 2002 (Table 1.1), with an associated estimated standing pine timber loss of \$166.8M dollars (C. Strohmeier, personal communication, July 29, 2008)¹.

Cassidy (2004) further reported that the 1998 – 2002 epidemic was the state's worst outbreak since 1976, with a total estimated loss of over 390,000 acres statewide. Oswalt (2007) reported that preliminary findings indicate that the net growth to removal ratio for pine on the Plateau (encompassing some parts of Alabama, Georgia, Kentucky and Virginia) is now closer to 0.37:1. An impending USFS report (Oswalt et al. 2008), regarding the health of Tennessee's forests indicates that the net growth to removals for hardwoods has remained positive, while the net growth to removals for pine is now negative, probably due to the SPB outbreak.

¹ Personal correspondence received from Clinton Strohmeier – Tennessee Department of Agriculture – Forestry Division, July 29th, 2008.



Figure 1.1 Tennessee's Cumberland Plateau (shaded region)

Table 1.1 Cumberland Plateau Southern Pine Beetle Spots - 2002

North Plateau				South Plateau			
County	Spots	\$ Amount	\$ Percent	County	Spots	\$ Amount	\$ Percent
Campbell	129	11,326,375	6.79	Bledsoe	175	8,759,999	5.25
Cumberland	166	20,345,980	12.20	Franklin	98	1,965,129	1.18
Fentress	55	31,244,443	18.73	Grundy	171	5,423,726	3.25
Morgan	54	28,569,462	17.13	Marion	360	10,603,056	6.36
Overton	33	4,744,451	2.84	Sequatchie	308	4,978,464	2.98
Pickett	17	2,615,888	1.57	Van Buren	182	3,691,349	2.21
Putnam	47	4,058,043	2.43	Warren	47	3,472,845	2.08
<u>Scott</u>	<u>49</u>	<u>22,244,668</u>	13.34	<u>White</u>	<u>51</u>	<u>2,763,310</u>	1.66
Total	550	125,149,310		Total	1392	41,657,877	

Data source: The Tennessee Department of Agriculture – Forestry Division (2008)
 Sampled aerial detection spots in 16 Tennessee Cumberland Plateau counties

The Nonindustrial Private Forest (NIPF) Landowner

McEvoy (2004) reported approximately 75 percent of all U.S. timberland is privately held by more than 10 million individual owners; Wear and Greis (2002) reported NIPF owners control more than 67 percent of the productive forestland in the southeastern United States. Siry et al. (2006) noted southern NIPF landowners own 88 percent of the forest land in a region that produces 18 percent of the global industrial roundwood production. Additionally, Schweitzer (2000) reported NIPF ownership accounts for 79 percent of all forestland in Tennessee. It can then be inferred that NIPF landowners control the majority of forestland and its timber production in the southeastern US, including Tennessee.

During the past 50 years, the U.S. forest products industry has migrated from the Pacific Northwest to the southeastern United States in search of a sustainable raw material supply. This 13-state area, scattered from Virginia to Texas, produced nearly 60 percent of the nation's timber output in 1997 (Prestemon and Abt 2002). Alig (2004) reported that the total US NIPF landholdings experienced a 14 million acre reduction from 1952 through 1957, with the South experiencing a 6 percent loss in total acres over the same time period. Alig and Plantinga (2004) assessed land-use change, estimating that total U.S. forest land would decrease by 26 million acres by 2030 as a result of population growth and development, the largest part of this conversion taking place in the South (10 million acres). Moreover, Wear et al. (2007) recently reported that the southern industrial forestland base may have fallen from 40 million acres to 20 million acres from 1999 to 2005.

In light of these recently documented large-scale industrial forestland divestitures, it is highly likely NIPF landholdings will become the target of a higher aggregate demand by the forest products industry in the future. Given these premises, the intensity of timber management on southern NIPF landholdings and landowner willingness to sell their timber will likely dictate the future availability of fiber and solid wood to sustain the industry into the future. Although NIPF timber is sold and harvested on a daily basis throughout the southeastern United States, it is often a one-time activity in the life of the landowner. Given that timber production appears to not be the prime management objective of most landowners, this assumption suggests the timber sale decision may be related more to need than to a long-term timber management strategy.

Theoretically, the forest products industry should emphasize the behavioral aspects of NIPF ownership, given the wide-scale forest parcelization brought on by urban sprawl and the associated land development pressures. The paradox in this scenario is the forest products industry continues to sell off land holdings, disband landowner assistance programs, and reduce wood procurement staff, despite increasing plant production capacity. This documented series of events may have long-term catastrophic effects on the future wood supply, if NIPF behavior truly favors non-consumptive objectives over timber management.

Baughman et al. (1996) surveyed 1000 NIPF landowners in Minnesota, targeting their reasons for owning land. As with many past landowner studies, timber management was not ranked in the top five choices. Objectives such as hunting, wildlife, and recreation were the most common reasons given. A recent Washington State University publication (2001) reported Lewis County NIPF landowners indicated the satisfaction of

just owning the land was their top choice, with timber production second. Kittredge (2004) discussed that NIPF forest landowners are now placing a higher priority on aesthetics, family legacy, and recreation than traditional forest management.

Butler and Leatherberry (2004) reported NIPF landowners included in the National Woodlands Owners Survey controlled 262 million acres, with nearly 90 percent owning land in the eastern United States. Ninety percent of these owners control 49 acres or less. The most common reasons for ownership are to enjoy scenery, to protect nature, or the acreage is part of a farm. Only 9 percent nationally indicated timber production is a management objective, but 41 percent of southern owners indicated timber production is an important reason for land ownership.

Butler (2005) reported the level of NIPF landowner timber management increases with tract size, but Pennsylvania NIPFs continue to rank timber management well below other non-consumptive objectives as the main reason for owning land. Donnay et al. (2005) surveyed over 350 landowners in St. Louis County, Minnesota and reported the most important reason for acquiring land is for recreation, investment, and establishing a second permanent home site. Salmon (2006) reported a recent forest landowner survey in Utah revealed that the respondents place the highest priority for land ownership on recreation, scenery, and privacy. Cordell and Tarrant (2002) reported southern NIPF landowners rank environmental benefits (i.e., clean air, scenic beauty, and heritage) over the production of wood as their primary management objective. Mercker (2006) similarly reported that West Tennessee NIPF landowners rank timber production behind scenery, wildlife, and passing the land onto heirs.

An excerpt from a recent literature review by Hodgden and Tyrell (2003) on NIPF characteristics and behavioral patterns is provided below to support the hypothesis that long-term overall U.S. timber availability may be at risk given industrial land divestiture, forest parcelization, and urban sprawl:

- The number of NIPF owners is increasing annually with greater parcelization of forestlands throughout the U.S.;
- NIPF owners tend to be older, better educated and more wealthy than the general population;
- The values, motivations and objectives for owning forest vary widely, reflecting the huge diversity of NIPF owners;
- Most NIPF owners rank factors such as aesthetics, recreation, wildlife viewing, and part of residence as the most important reasons for owning forestland;
- Timber production is usually a low priority, although many owners surveyed in the various studies reviewed have harvested timber;
- Most NIPF owners do not have written forest management plans;
- Most have not sought professional advice from a forester or utilized public assistance programs for forest management— on the other hand owners of larger tracts of land are more likely to seek assistance;
- The importance of commercial timber production is positively correlated with acreage of holding, as it is with the likelihood that the owner has used professional forestry advice and/or public assistance programs;
- There is a need to mix qualitative and quantitative methods in carrying out research on family forests, especially for those undertakings that aim to analyze the values and motivations of such owners;
- Many of the papers reviewed make statements about demographic characteristics or motivations of forest owners that are not backed up by data; and
- State and regional studies are not comparable due to differing questions and methods.

Wells (1977) studied the willingness to sell as a variable affecting NIPF timber availability in a middle Tennessee wood basin. He reported that the market withholding of timber may be based on the timeliness of financial needs of the owner, other non-timber objectives of the owner, and past experiences with timber sales and/or timber management experiences. Wiggins (1977) also assessed willingness to sell by comparing urban to rural NIPF landowner responses using a “Willingness Score” model for predictability. He concluded urban resident owners are less likely to sell timber than their rural counterparts. Similarly, Hickman (1984) conducted a study of NIPF owners in the east Texas “Piney Woods” region in an attempt to model landowner motivation to sell timber. He found they are primarily interested in the income-producing potential as opposed to consumptive use of their woodlands, and almost without exception, interest in timber harvesting is positively related to the amount of forest land owned.

Birch and Pywell (1986) reported that although timber production did not rank in the top five management objectives of Pennsylvania NIPF landowners, 73 percent of the state’s forest products were produced from private holdings. He suggested that Pennsylvania landowners are willing to harvest timber, if they need money or are offered a good price, even though timber management is not their primary forest management objective.

Parker (1984) commented on a number of studies conducted in Michigan to gauge NIPF willingness to sell timber, concluding that many were not interested in selling timber. Tract size less than 300 acres and absentee landownership were both cited as negative deterrents to private timber availability. Parker’s targeted study of 516 landowners on the Lower Michigan peninsula focused on their willingness to sell

fuelwood. He reported only 20 percent of the respondents are willing to sell fuelwood, but that increasing stumpage prices may drive an additional 25 percent to consider a sale. More than 70 percent of the respondents are more interested in timber stand improvement and wildlife management than generating timber sale income. Clements (1987) concluded roundwood supply in southwestern Virginia was linked to landowner willingness to sell timber, which is dependent on stumpage prices and their alternative rate of return. Conway (2002) reported that Virginia and Mississippi NIPF landowners with small tracts and a large number of heirs are less likely to sell timber at prevailing market prices. Moreover, she reported that NIPF landowners involved in non-consumptive objectives are more likely to require extremely high per acre bids before they would consider selling timber.

So what will ultimately drive NIPF owners to sell timber on the open market if they do not rank timber management as a top ownership objective? Given that we know: 1) NIPF landowners control the bulk of the forestland in the southeastern U.S.; 2) industry has migrated to the southeastern U.S. in search of sustainable wood and fiber sources; 3) the forest products industry is in a climate of land divestiture; and 4) hundreds of mills procure wood everyday to meet production requirements, then we know NIPF landowners are still selling wood. Therefore we can hypothesize that despite recent survey data indicating NIPF owners do not rank commercial timber production as a high priority, they will still sell timber to meet their individual financial needs.

The NIPF – Logger Relationship in the Wood Supply Chain

The southern forest products industry also remains extremely dependent on a vast network of highly-skilled, extremely diverse independent contractors who move the industry's aggregate mill demand of wood furnished from the stump to the mill gate. These independent logging contractors, wood dealers, and woodyards supply much of the industry's wood requirements through the NIPF resource base.

The Sustainable Forestry Initiative (SFI) program, established in 1995 by the American Forest & Paper Association (AF&PA), is a sustainable forest management and certification program that seeks to expand the practice of sustainable forestry in North America. SFI member companies, numbering some 204 program participants, currently process an estimated 50 percent of the roundwood and 85 percent of U.S. pulp and paper production (Wallanger 2003). Since many forest products companies purchase the bulk of their wood needs from NIPF lands through independent wood suppliers, they still have no legal right to dictate the forest management practices on these lands. Sampson (2004) further commented on the issue timber purchasers face as they are challenged to promote the concepts of forest sustainability to NIPF landowners. This challenge in question is being exacerbated by forest parcelization, the associated impacts of more owners and smaller tracts, and the impending changes in ownership demographics.

Therefore, the viability of these NIPF lands (called family forests by the AF&PA) and the private independent professional wood suppliers who deliver the wood to mills mandates the need for long-term planning horizons and 'win-win' partnerships. The SFI Standard further recognizes the need for landowner outreach and increased

professionalism among the wood producer supply force. The American Forest & Paper Association (2000) performance measures mandate specific requirements for SFI program participants to establish and support state groups for both landowner and logger outreach & training programs in the areas of Best Management Practices (BMP's), tree regeneration, wildlife biodiversity, business, and public outreach.

As a result of the SFI movement, The Tennessee Master Logger program was initiated in the early 1990s to develop professionalism and safety standards among the independent Tennessee logging force (1995 Guide to Loggers). Early public sponsors of the program included the Tennessee Division of Forestry, Tennessee Forestry Association, the Tennessee Valley Authority, and the Tennessee Wildlife Resources Agency, USDA Forest Service, and The University of Tennessee. The program also included cooperation from private forest industry. The focus of the five-day training program consists of Safety, Best Management Practices, Forest Management, First Aid, and Business Management. The program has graduated more than 2,000 loggers, foresters, and private landowners. Clatterbuck and Hopper (1996) reported demographic data revealing the typical Tennessee Master Logger graduate was a 37-year old business man, had an annual gross income of more than \$167,000, and had \$1.4 million invested in their logging equipment.

NIPF landowners and logging contractors truly form the first few links within the forest operations supply chain, moving forest products from the “stump to the mill”. Mentzer et al. (2001) defines a supply chain as a set of three or more companies directly linked by one or more upstream and downstream flow of products. They further define supply chain management as a systematic, strategic coordination of the traditional

business functions within a particular company for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole.

Rotherham (1999) defined supply chain management as the optimization of all components of the system to ensure that all participants are as satisfied with the products or services being traded and their relationships with people and organizations participating in a the supply chain. Lewis (2004) commented on the Forest Resources Association's definition of the wood fiber supply chain as being a series of links from the raw material to the consuming mill. He went on to state these components all too many times operate as silos rather than links.

The forest products industry relies on a long-term wood supply chain, due to the long planning horizons for forest growth. These planning horizons may range from short-term loblolly pine plantation fiber production to long-term southern Appalachian hardwood management. Given these constraints, long-term strategic relationships between wood-consuming mills, NIPF owners, and independent logging contractors are paramount, both on a cost and volume basis, as well as on issues of quality and timing of deliveries. Rotherham (1999) further commented about the importance of implementing certification standards by the forest industry, such as ISO 14001 or SFI, to ensure that sustainable forest management principles are performed within the supply chain. These expert opinions appear to link NIPF outreach, forest certification, and wood suppliers into a long-term strategic supply chain relationship.

Numerous studies have focused on the wood supply chain over the past 15 years, possibly driven by the increasing environmental pressures the forest products industry experienced during the same time period. Harris et al. (2003) discussed the association

between the NIPF forest resource and the wood supply system that delivers forest products to consuming mills. They reported forest products operations in the eastern half of the United States may procure 80 to 90 percent of all roundwood needs from NIPF owners. Because of the dependence on open-market wood suppliers, the quality of forest management associated with industry's wood supply has been in question, and a driver for certification systems such as SFI.

Harris and Germain (2001) also assessed the importance of harvesting practices on NIPF lands, and the impact to the forest industry's changing wood procurement policies to improve the management of the total supply chain. The main focus of the study was to empirically measure environmental management systems within the forest product industry as it related to: 1) landowner assistance program deployment; 2) public outreach/education programs; 3) use of foresters within the supply chain; 4) wood supplier selection based on training and skill level; 5) continuing education of wood procurement staff; 6) defined harvesting standards; and 7) supply source monitoring.

Their study (Harris and Germain 2001) indicated NIPF owners in the United States control over 59 percent of all U.S. timberlands and produce close to half of the industry's wood needs. This situation has led to a fragmented supply chain because the bulk of the forest industry's wood supply is harvested from millions of NIPF acres, processed by thousands of independent logging firms, and transported by numerous transportation intermediaries to meet consuming mills' annual raw material requirements. Given NIPF landowners control the goods the industry wants and needs, a symbiotic integrated wood supply chain scenario is dependent on the effects of landowner behavior, wood supplier capability and mill demand. Therefore, one cannot fully understand the

movement of wood from the forest to the mill gate without studying the first link in the chain.

Research Questions

As the literature review illustrates, NIPF landowners do not rank timber as their top management objective. Wildlife management, recreation, and aesthetics often are ranked as some of the top ownership reasons. Schelhas et al. (2003) suggested that more social research on how NIPFs use, relate to, and value their forestland holdings is warranted in order to understand how these private holdings will ultimately benefit society.

Utility theory is a useful approach to evaluating landowner behavior because landowners derive various levels of satisfaction from the consumption of their lands' goods and services. These varying consumption levels are directly related to their ownership objectives and can be both income-generating as well as non-income generating.

Mathis and Koscianski (2002) define utility as the satisfaction that a consumer receives from consuming varying amounts of goods and services. A general utility function is expressed as: $U = U(X, Y, Z)$, where U is the dependent variable representing some measure of a consumer's utility, and X, Y, Z as independent variables, representing the consumption levels of various goods and services. Consequently, if one assumes a constant level of income, as the consumption of one good increases the consumption level of an alternative good must decrease.

Binkley (1981) developed a utility model of landowner behavior depicting NIPF landowners deriving utility from the consumption of both timber and non-timber land outputs (e.g. investment, hunting, recreation). He further illustrated that decreases in ownership size subsequently decrease the emphasis on timber harvesting activities. Other results from his study are that increases in timber prices result in increases in timber harvesting, only if income gained offsets the utility lost from the other non-consumptive uses.

Wear and Flam (1993) linked landowner utility with a timber supply model based on NIPF ownership classifications and reported the greater the tract size, the greater the probability timber harvesting will rank as a primary ownership objective. They evaluated a number of variables in their study, including price and ownership variables. A third set, collectively called site variables, included slope, distance to public roads, distance to markets and elevation. Their model further evaluated the likelihood of timber harvest (forest disturbance) relative to private vs. public properties in southern Appalachia. All site variables are negatively correlated to the probability of disturbance. The logical explanation for this is that as logging costs increase, stumpage value decreases. Lower stumpage values serve as a disincentive for landowners to sell timber.

Kennedy (2001) theorized the relationship between tract size and timber production is attributed to the decreasing marginal utility of non-market benefits. As tract acreage increases, owners have more incentive to produce timber because other amenities can still be met with other portions of their forest. He concluded the decision to accept low timber bids was correlated with the landowner's number of children, income level, and tract access.

Thus, as Binkley (1989), Wear and Flam (1993) and Kennedy (2001) have illustrated, NIPF landowners are faced with maximizing the utility they derive from their forests from both consumptive (timber) and non-consumptive benefits. An NIPF landowner may have multiple management goals for their forest land holdings, but usually are constrained by resources such as time, tract size, and available funding. Thus, they must make decisions on how to allocate limited resources among competing management objectives. If they choose timber management as their primary goal, they will have to allocate less to other management objectives.

Although Cumberland Plateau NIPF landowners hold some of the same opinions and attitudes regarding forest management goals and objectives, they still must possess a high willingness to sell timber, given the Plateau produces more than 29 percent of the state's logging operations output (English et al. 2004). This study employs a utility framework to assess the probability of NIPF landowners selling timber from their property. This directed study represents a research question that has troubled natural resource economists for years – What, if any, is the link between actual and intended timber harvesting behavior of NIPF landowners.

Conceptual Framework

By definition, a conceptual framework is a representation of the main research variables and their presumed relationship with each other (Punch 2004). Punch further describes this framework as the conceptual status of the variables being studied and their relationship to each other, an example of which might be how survey participant

responses are used to model the variance between the independent variables and the dependent variable of interest. Specific survey questions of interest can then be used to link a “conceptual definition” to concrete indicators for answering a practical question of interest.

For this research project a series of questions with coded survey responses that reflected reality were used. A specific example for this study is how the willingness to sell timber by a respondent was measured using a score from a situational objective scale. For example, landowners were asked to respond to a series of questions, rating their individual opinions and attitudes about forest management and timber harvesting situations and strategies.

For this study “opinion” is defined as a person's beliefs or ideas held with confidence but not substantiated by direct proof or knowledge (Webster's II 1984), and is easier to measure since it is directly related to what a person says (Owings 1979). The definition for “attitude” is a person's viewpoint or disposition toward a particular person, thing or idea, etc. (Gall et al. 2003). The study assessed NIPF landowner opinions about timber harvesting and selling timber from their forest land, an example of which is potential respondents being asked their opinion on the quality of their most recent timber harvest and/or the logger who did the harvesting. The study also attempted to assess NIPF landowner attitudes toward forest management, timber harvesting, and alternative non-timber landowner objectives. Potential respondents were given multiple responses to gauge their attitudes towards a specific objective (i.e. for timber management, investment, wildlife habitat).

The remainder of the dissertation is written in journal format, consisting of two chapters that describe the results of the analysis, and a concluding chapter summarizing the findings and implications of the overall research. Chapter 2 is focused on investigating the socio-demographic characteristics of Plateau NIPF landowners and attempts to correlate those variables to opinions and attitudes regarding their forest management objectives and reasons for forest landownership. Chapter 3 describes a conceptual model for predicting Plateau NIPF landowners' willingness to sell timber in the future. Logit regression and factor analysis were used for comparison and further investigation.

CHAPTER 2

NIPF LANDOWNERSHIP DEMOGRAPHICS ON THE CUMBERLAND PLATEAU: WHO ARE THEY AND WHY DO THEY OWN FORESTLAND.

Abstract

The Cumberland Plateau in Tennessee currently is experiencing widespread forest fragmentation and changes in species composition as a result of changes in land use and ownership. These changes can be attributed partially to industrial forest land divestiture and the lingering effects of the 1998 – 2002 Southern Pine Beetle (SPB) epidemic. The region has recently become a focus of debate concerning land management practices and the effects on biodiversity. Nonindustrial Private Forest (NIPF) landowners are caught in the cross-fire as they control the majority of the forestland on the Plateau that both the forest industry and society need and value. A random sample of 1600 NIPF landowners with 40 or more acres of forestland were surveyed obtaining a 39.0 percent response rate.

Socio-demographic findings indicate that almost 50 percent of all respondents were either retired or employed as professionals and lived on or within 60 miles of their forest land. Ninety-one percent of all respondents had either purchased or inherited their forest land, and the majority indicated they intended to pass their forest land onto heirs. The mean age of all respondents was 61 years. The top three non-consumptive objectives were: to enjoy scenery ($m = 3.98$), for peacefulness ($m = 3.94$) or to preserve nature ($m = 3.83$). Timber management was ranked as only moderately important ($m = 2.60$). Forty-five percent of all respondents indicated that they had previously sold or harvested timber from their forest land, but only 30 percent indicated they intended to sell timber in the future.

Introduction

During the past 50 years, the U.S. forest products industry has migrated from the Pacific Northwest to the Southeast in search of a sustainable raw material supply. This 13-state area, extending from Virginia to Texas, was estimated to produce nearly 60 percent of the nation's timber output in 1997 (Prestemon and Abt 2002). Johnson and Steppleton (2007) reported the total southern pulpwood production accounted for 169.3 MM tons in 2005. Wear et al. (2007) reported the southern industrial forestland base may have fallen from 40MM acres to 20MM acres from 1999 to 2005. Rapid population growth and the changing demographics from rural to urban are thought to be fueling the attitude shift from timber to non-consumptive management objectives among the region's NIPF landowner base (Dwyer and Stewart 1999). Given this premise, the intensity level of timber management practiced on southern NIPF landholdings may dictate the future availability of fiber and solid wood to keep the industry sustainable into the future.

Given the phenomenal population growth rates and housing starts of the southern U.S., coupled with the changing demographics of NIPF landowners, much interest has been generated over the past several decades on both the physical and behavioral aspects of these diverse land holdings. Theoretically, the forest products industry should consider placing a greater emphasis on the behavioral aspects of NIPF ownership, given the wide-scale forest parcelization brought on by the urban sprawl effects from the decade-long housing boom. The paradox in this scenario is that the forest products industry continues to sell off land holdings, disband landowner assistance programs, and cut back on wood procurement staff, despite increasing plant production capacity. This series of events may

have long-term catastrophic effects on future wood supply, if NIPF behaviors truly favor non-consumptive management objectives over timber management.

Cordell and Tarrant (2002) reported southern NIPF landowners rank environmental benefits (i.e., clean air, scenic beauty, and heritage) over the production of wood as their primary management objective. Butler and Leatherberry (2004) reported that family forest landowners included in the National Woodlands Owners Survey control over 262 million acres, with approximately 90 percent of the land in the eastern United States. Of these owners, 90 percent control 49 acres or less. The most common reasons for ownership are to enjoy scenery, to protect nature, and that the acreage is part of a farm. However, only 9 percent nationally indicated that timber production is a management objective, but 41 percent indicated that timber production is an important reason for land ownership.

Moreover, Butler (2005) reported that the level of NIPF landowner timber management increases with tract size, but that Pennsylvania NIPFs continue to rank timber management well below other non-consumptive objectives as the main reason for owning land. Donnay et al. (2005) surveyed more than 350 landowners in St. Louis County, Minnesota and found that their most important reasons for acquiring the land is for recreation, investment, and establishing a second permanent home site. Moser et al. (2005) reported that Midwest NIPFs rank being “part of farm” (40% of respondents) and “to enjoy the woods” (8%) as the two most popular ownership objectives. Salmon (2006) reported that in a recent forest landowner survey in Utah, respondents place the highest priority for land ownership on recreation, scenery, and privacy. Mercker (2006) similarly

reported that West Tennessee NIPF landowners ranked timber production behind scenery, wildlife, and passing the land onto heirs.

Baughman et al. (1996) surveyed 1000 NIPF landowners in Minnesota, targeting their reasons for owning land. As with other past landowner studies, timber management was not ranked in the top five choices. Objectives such as hunting, wildlife, and recreation are the most common reasons given. Moreover, Kernan (2001) reported that Lewis County NIPF landowners indicated the satisfaction of just owning the land is their top choice, with timber production being second. Kittredge (2004) related the implications of timber harvesting by family forest landowners in that they are now placing a higher priority on aesthetics, family legacy, and recreation than traditional forest management.

Although NIPF timber is sold and harvested on a daily basis throughout the southeastern United States, it is often a one-time occurrence during the life of the landowner. The literature review indicates that timber production is not the prime objective of many NIPF landowners, which suggests that timber sale decisions may be related more to need, than a long-term timber management strategy. The author's experience as a wood procurement forester supports the assumption that NIPF landowners usually sell timber to meet a short-term financial need.

Wells (1977) studied the "Willingness to Sell" as a variable affecting timber availability in a middle Tennessee wood basin. He reported that the market withholding of timber may be based on the timeliness of financial needs of the owner; other non-timber objectives of the owner; and past experiences with timber sales and/or timber management experiences. Wiggins (1977) also studied willingness to sell by comparing

urban to rural NIPF landowner responses using a “Willingness Score” model for predictability. He found that urban resident owners are less likely to sell timber than their rural counterparts. Similarly, Hickman (1984) conducted a study of NIPF owners in the east Texas “Piney Woods” region. He found that almost without exception, interest in timber harvesting is positively related to the amount of forest land owned.

Parker (1984) commented on a number of studies conducted in Michigan to gauge NIPF willingness to sell timber which indicated that many are not interested in doing so. Small tract size and absentee landownership were both cited as negative deterrents to private timber availability. Similarly, Clements (1987) concluded that roundwood supply in southwestern Virginia is linked to landowner behavior toward their willingness to sell timber, which is dependent on stumpage prices and the alternative rate of return. Conway (2002) reported that Virginia and Mississippi NIPF landowners with small tracts and a large number of heirs are less likely to sell timber at prevailing market prices.

Forest land investments are unique in they are both a productive enterprise with the ability to produce income from timber sales and a consumptive good providing direct utility to owners through other non-timber amenities. Therefore, a landowner is faced with multiple management decisions regarding how harvesting their timber could impact the land’s ability to produce other non-timber values.

The purpose of this paper is to investigate the socio-demographic characteristics of Plateau NIPF landowners and to correlate the demographic variables to their opinions and attitudes regarding their forest management objectives and reasons for forest landownership.

Study Area

The study area was Tennessee's Cumberland Plateau, a 16-county region containing 2.99 million acres of forestland, of which more than 72 percent is under NIPF ownership (Schweitzer 2000) (Figure 2.1). Clatterbuck et al. (2006) described the Cumberland Plateau as being greater than 2 million acres, with 59 percent in private forestland ownership. As of 1999, the land area is over 71 percent forested, with 88 percent in hardwood forest stocking. Schweitzer further estimated the growth to removals ratio for hardwood as 2.15:1, while the growth to removals ratio for softwood was estimated to be 1.81:1. Moreover, Selecman (2006) used GIS spatial analysis to estimate there may be only 2.5 million acres actually available for timber harvesting on the Cumberland Plateau due to the presence of steep slopes, urban interface issues and required stream side management zones (Figure 2.1).

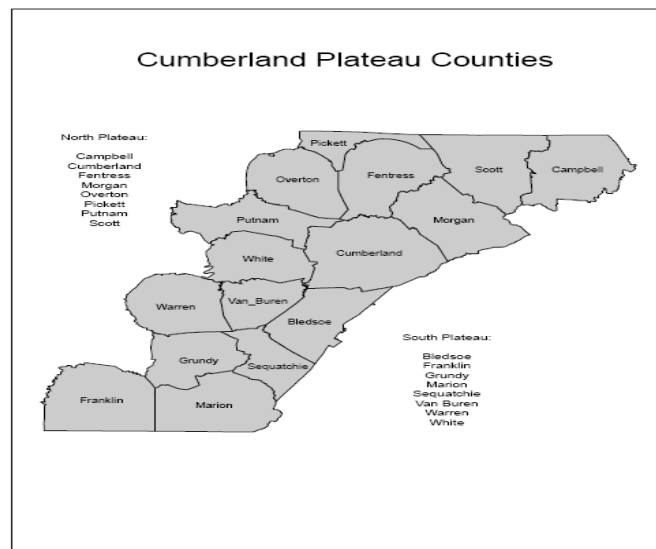


Figure 2.1 North and South Cumberland Plateau counties

Methods and Procedures

Data for the study were collected via a mail survey following Dillman's (2000) Tailored Designed Method. The targeted population for the study was all NIPF landowners owning 40 acres of land on the Cumberland Plateau, with at least 10 acres of forest cover. An ownership directory was compiled using property tax records for the 16-county area. The University of Tennessee Department of Forestry, Wildlife and Fisheries' Human Dimensions Research Lab reformatted the lists and performed the random sample. Under the 16-county scenario, the estimated target number of required respondents was 383 from a total of 1,097 surveys based on a 50:50 split and a 5 percent sampling error (Sallant and Dillman, 1994). As a result, we chose to mail out 100 surveys in each of the 16 counties, for a total of 1,600 potential respondents.

Likert-scale questions were formulated to assess the opinions and attitudes of NIPF owners concerning their forest management objectives. Categorical, demographic, and open-ended questions were used to obtain the needed information. The questionnaire was comprised of 33 questions designed to capture NIPF landowner demographics, landownership history, reasons for ownership, and management objectives. Standard frequencies were computed for the demographic characteristics, forestland descriptors, reasons for ownership, and management objectives. Chi-square was used to detect differences between North and South Plateau NIPF landowners ($\alpha < .05$).

The draft survey was developed during the spring of 2006 and was carefully scrutinized for errors and validity by personnel within the Human Dimensions Research Laboratory and other researchers familiar with survey research. The survey then was pre-

tested a small group of Cumberland Plateau NIPF owners in August 2006. Mailings took place during the second quarter of 2007. The survey procedure consisted of an initial mailing of the questionnaire and a cover letter stating the purpose of the study to all 1,600 landowners in the sample population (see Appendix I). Follow-up post cards were mailed to all 1,600 after one week, thanking those who had responded and asking those landowners who had not responded to do so. A second copy of the questionnaire and a cover letter explaining the importance of their participation was mailed to all non-respondents after three weeks. A final post card was sent four weeks later, with a request to return the questionnaire or call the Department of Forestry, Wildlife and Fisheries for a duplicate questionnaire.

Results

Two hundred and forty-six individuals were deemed to be ineligible for the survey (163 indicated they did not own forest land, 6 did not own land on the Plateau, 9 were deceased, 6 had sold their land, and 62 were undeliverable as addressed). This brought the eligible target population to 1,354. A total of 528 individuals returned questionnaires for a total response rate of 39 percent.

This response rate was consistent with those by Hickman (1984), Walkingstick et al. (2001), and Measells et al. (2005) for similar NIPF landowner studies. An initial mailing wave of 2,400 surveys was begun in March but a sampling error was found indicating landowners with less than 40 acres of land were included in the sample. One hundred sixty-seven surveys from the original mailing were found to be from owners

with 40 acres or greater and were used in the analysis (Table 2.1). The initial mailing wave was abandoned in favor of an entirely new sample as stated above.

Potential non-response bias was analyzed by comparing selected demographic variables ((OCCUPATION ($\chi^2 = 12.622$, $P = .180$), EDUCATION LEVEL ($\chi^2 = 6.725$, $P = .242$), INCOME LEVEL ($\chi^2 = 2.637$, $P = .620$), %INCOME FROM FARMING ($\chi^2 = 1.094$, $P = .895$), TRACT SIZE ($\chi^2 = 5.861$, $P = .556$), FORESTLAND ACQUISITION, ($\chi^2 = 8.257$, $P = .409$)) between the first wave and second wave of the respondents. No significant differences were detected between the waves using chi-square analysis ($\alpha < .05$). This extrapolation method was suggested by Armstrong and Overton (1977) as a viable alternative to additional phone surveys for non-respondents.

The results have been sub-grouped into the following sections: Section 1 – Sociodemographics, Section 2 – Forestland Ownership Variables, Section 3 – Forest Management Objectives, Section 4 – Non-timber Objectives, and Section 5 – Respondent Past Timber Sale Experience.

Table 2.1 Response rate of the Cumberland Plateau NIPF Landowner survey

North Plateau			South Plateau		
County	Frequency	Percent	County	Frequency	Percent
Campbell	35	5.1	Bledsoe	49	7.1
Cumberland	48	7.0	Franklin	26	3.8
Fentress	50	7.3	Grundy	56	8.1
Morgan	48	7.0	Marion	38	5.5
Overton	50	7.3	Sequatchie	53	7.7
Pickett	54	7.8	Van Buren	27	3.9
Putnam	41	6.0	Warren	17	2.5
<u>Scott</u>	<u>57</u>	<u>8.3</u>	<u>White</u>	<u>39</u>	<u>5.7</u>
Total	383	55.6	Total	305	44.3

(n = 689)

Section 1. Sociodemographics

There were no significant differences between the North and South geographic areas regarding employment status, but several key occupational groupings are worth noting because of the potential impact on the level and type of future forestland management activities. More than 33 percent of all landowners in the study were retired, with a higher percentage of landowners in the South indicating they were part of that occupational group (Table 2.2). Professional/management (15.1%) and owners of a business (11.4%) also made up other large occupational groupings for all respondents.

Significant differences were found between the two groups when comparing their age categories ($\chi^2 = 13.305$, $P = .038$). More than three-fourths of all landowners were more than 50 years old and over half of all respondents were more than 60, representing potential retirement status. The mean age of all respondents was 61.9, with a median of 61.0 (Table 2.3). More than 38 percent had obtained a college degree, received graduate school training, or completed an advanced degree. Twenty-four percent of all respondents had obtained at least a high school education. (Table 2.4).

There were no significant differences between the levels of education of the two geographic groups. There also were no significant differences between the 2006 gross income levels of the two geographic regions. Only 18.4 percent of all respondents had annual incomes of less than \$25,000, while over 19 percent earned more than \$100,000 per year (Table 2.5).

Table 2.2 Occupations of Cumberland Plateau NIPF landowners

		Geographic Location		Total
		North	South	
Current occupation	Owner of business	11.8%	10.9%	11.4%
	Professional/management	16.3%	13.6%	15.1%
	Clerical or office worker	1.1%	1.3%	1.2%
	Craftsman/blue collar	5.3%	7.0%	6.1%
	Farmer	8.0%	5.3%	6.8%
	Forestry/logging/mining	1.3%	.3%	.9%
	Homemaker	1.1%	1.3%	1.2%
	Government employee	5.6%	2.3%	4.1%
	Retired	30.2%	37.4%	33.4%
	Other	19.3%	20.5%	19.8%
Total		100.0%	100.0%	100.0%

(n = 677)

Table 2.3 Age distribution of Cumberland Plateau NIPF landowners

		Geographic Location		Total
		North	South	
Age Categories	<30	.8%	.7%	.8%
	31-40	4.4%	5.8%	5.0%
	41-50	13.9%	17.2%	15.3%
	51-60	31.3%	20.6%	26.6%
	61-70	29.7%	30.6%	30.1%
	71-80	13.9%	20.3%	16.7%
	>80	6.0%	4.8%	5.5%
Total		100.0%	100.0%	100.0%

Significant differences found between the two groups ($\chi^2 = 13.305$, $P = .038$)

(n = 689)

Table 2.4 Education levels of Cumberland Plateau NIPF landowners

		Geographic Location		Total
		North	South	
Highest grade of school completed	Less than high school	10.8%	7.1%	9.1%
	High school grad/GED	21.8%	27.0%	24.1%
	Some college or VO-tech training	28.0%	27.7%	27.9%
	College graduate	17.5%	16.2%	16.9%
	Some graduate	4.9%	6.1%	5.4%
	Graduate degree	17.0%	15.9%	16.5%
Total		100.0%	100.0%	100.0%

(n = 668)

Table 2.5 Income levels of Cumberland Plateau NIPF landowners

		Geographic Location		Total
		North	South	
2006 gross annual income	Less than \$25,000	16.3%	21.1%	18.4%
	\$25,001-\$50,000	28.5%	25.6%	27.2%
	\$50,001-\$75,000	23.4%	16.5%	20.4%
	\$75,001-\$100,000	13.4%	15.0%	14.1%
	More than \$100,000	18.4%	21.8%	19.9%
Total		100.0%	100.0%	100.0%

(n = 604)

NIPF landowners have different backgrounds, experiences, and objectives that influence how they manage their forest land. The top three reasons for ownership among the respondents were: 1) “To enjoy scenery”, 2) “For peacefulness and tranquility”, and 3) “To preserve nature” (Table 2.6). These findings were similar to that of Salmon (2006), Mercker (2006), and Hodgden and Tyrell (2003). Of all the reasons for owning forestland, only one selection ranking was found to be significantly different between the two geographic groups: “It connects me to the past” ($\chi^2 = 11.424$, $P = .022$).

Table 2.6 Reasons for ownership by Cumberland Plateau NIPF landowners

5 – Point Scale
1 = Not important; 5 = Extremely important

	N	Mean	Std. Deviation
To enjoy scenery	629	3.98	1.112
For peacefulness and tranquility	634	3.94	1.196
To preserve nature	634	3.83	1.094
For privacy	638	3.77	1.316
It connects me to nature	619	3.58	1.296
Part of farm or home site	639	3.53	1.452
Pass on to heirs	655	3.47	1.380
Enjoy working on the land	631	3.44	1.398
It connects me to the past	614	3.21	1.521
For wildlife management	620	3.14	1.336
For financial investment	631	3.03	1.364
For other recreation	607	2.83	1.358
For hunting and fishing	635	2.71	1.480
For timber production	621	2.60	1.360
Inherited the land	536	2.46	1.668
For grazing and livestock	620	2.17	1.397

Significant differences found between “it connects me to the past”($\chi^2 = 11.424$, $P = .022$)

Section 2. Forestland Ownership Variables

The research also sought to obtain information regarding landownership characteristics that may influence the level of forest management or potential future timber harvesting activities between the two groups. As expected the largest percentage of tract ownership size was in the 10 – 50 acre size class (Table 2.7). More than two-thirds of the tracts owned were between 10 – 100 acres, with significantly declining ownership percentages for the remaining size classifications. No significant differences were found between the two north and south ownership groups regarding tract size.

More than two-thirds of the surveyed landowners indicated they purchased their landholdings while over 20 percent obtained their forestland through inheritance (Table 2.8). No significant differences were found between the two groups. These acquisition findings were found to be consistent with those reported by Mercker (2006).

Table 2.7 Tract ownership size of Cumberland Plateau NIPF landowners

		Geographic Location		Total
		North	South	
# of acres of forest land	Less than 10 acres	3.2%	3.6%	3.4%
	10-50 acres	47.9%	51.0%	49.3%
	51-100 acres	23.9%	21.9%	23.0%
	101-150 acres	12.1%	8.6%	10.6%
	151-200 acres	2.1%	2.6%	2.3%
	201-250 acres	2.6%	1.7%	2.2%
	251-300 acres	1.6%	1.3%	1.5%
	more than 300 acres	6.6%	9.3%	7.8%
Total		100.0%	100.0%	100.0%

(n = 683)

Table 2.8 Forest land acquisition method by Cumberland Plateau NIPF landowners

		Geographic Location		
		North	South	Total
Acquired majority of forest land	Purchased it	70.0%	73.9%	71.7%
	Inherited it	21.6%	20.5%	21.1%
	Traded		.3%	.1%
	Gift	1.8%	1.0%	1.5%
	Foreclosure		.3%	.1%
	Tax assessor sale	.5%		.3%
	Other	1.6%	.3%	1.0%
	Purchased it and Inherited it	3.9%	3.6%	3.8%
	Divorce	.5%		.3%
Total		100.0%	100.0%	100.0%

(n = 684)

Most studies have reported that landownership tenure has long thought to influence forest management activities and timber harvesting. There was a skewed bi-modal land tenure grouping (family tenure – often with multiple generations), with the 26.9 percent of land ownership in the 0 – 10 year category and 23.1 percent in the >60 year category (Table 2.9). Although no significant differences were found between the two groups, these tenure grouping findings are of practical significance in that the two age groupings are likely to have distinct differences in ownership objectives. Three-fourths of all of the landowners indicated they only owned one tract of forest land (Table 2.10). Additionally, more than one-half of all respondents indicated they maintained their primary residence on their forestland tract (Table 2.11). No significant differences were found between the two geographical groups for both of the response variables.

Table 2.9 Ownership tenure of Cumberland Plateau NIPF landowners

		Geographic Location		
		North	South	Total
Years Owned	0-10	27.2%	26.6%	26.9%
	11-20	13.0%	23.5%	17.8%
	21-30	10.8%	7.3%	9.2%
	31-40	9.6%	7.3%	8.6%
	41-50	9.3%	8.7%	9.0%
	51-60	5.4%	5.5%	5.5%
	>60	24.6%	21.1%	23.1%
Total		100.0%	100.0%	100.0%

(n = 643)

Table 2.10 Multiple tract ownership by Cumberland Plateau NIPF landowners

		Geographic Location		
		North	South	Total
Own more than one tract of forest land	No	76.4%	73.7%	75.2%
	Yes	23.6%	26.3%	24.8%
Total		100.0%	100.0%	100.0%

(n = 682)

Table 2.11 Primary residence on forestland by Cumberland Plateau NIPF landowners

		Geographic Location		
		North	South	Total
Primary residence on forest land	No	46.2%	50.5%	48.1%
	Yes	53.8%	49.5%	51.9%
Total		100.0%	100.0%	100.0%

(n = 685)

Section 3. Forest Management Objectives

More than 25 percent of the South group indicated they had received forest management advice as compared to only 18.2 percent for the North group (Table 2.12), which was statistically significant ($\chi^2 = 5.430$, $P = 0.02$). Similarly, more than 42 percent of the South group reported they had a written forest management plan, compared to only 21.5 percent of the North group (Table 2.13), which was also statistically different ($\chi^2 = 6.852$, $P = 0.009$). More than 90 percent of the respondents (Table 2.14) had not participated in any forest management cost-share programs.

Another important aspect of the study was to assess the impacts of the 1998 – 2002 Southern Pine Beetle epidemic on Cumberland Plateau forestland owners, since the loss of the pine resource would have a negative impact on timber flow from the region. An earlier Associated Press article (Figure 2.2) indicated the Tennessee Division of Forestry had estimated that more than 50 percent of the standing pine inventory had been lost as a result of the epidemic (Kauffman 2002), at which time only 10 – 15 percent of the affected timber was salvaged. More than 45 percent of the total survey respondents reported losses from the epidemic (Table 2.15) and only 11 percent of the respondents reported (Table 2.16) they were able to salvage any of their infected pine timber. Moreover, of the respondents who indicated that they were able to salvage part of their infected timber, only 7.7 percent of the North group and 26.7 percent of the South group elected to plant pine seedlings in the salvage sale area upon completion of harvesting activities (Table 2.17).

Table 2.12 Forest management advice received by Cumberland Plateau NIPF landowners

		Geographic Location		Total
		North	South	
Received forest management advice	No	81.8%	74.3%	78.5%
	Yes	18.2%	25.7%	21.5%
Total		100.0%	100.0%	100.0%

Significant differences found between the two groups ($\chi^2 = 5.430$, $P = .02$)
(n = 674)

Table 2.13 Written forest management plans received by Cumberland Plateau NIPF landowners

		Geographic Location		Total
		North	South	
Written forest management plan	No	78.5%	57.5%	67.4%
	Yes	21.5%	42.5%	32.6%
Total		100.0%	100.0%	100.0%

Significant differences found between the two groups ($\chi^2 = 6.852$, $P = .009$)
(n = 138)

Table 2.14 Cost-share program participation by Cumberland Plateau NIPF landowners

		Geographic Location		Total
		North	South	
Participated in government cost-share programs	No	94.7%	93.6%	94.2%
	Yes	5.3%	6.4%	5.8%
Total		100.0%	100.0%	100.0%

(n = 677)

Southern Pine Beetle in Tennessee 2001

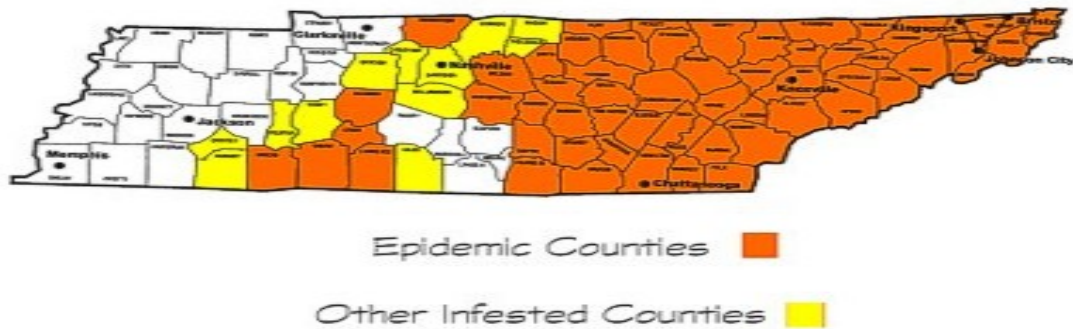


Figure 2.2 Tennessee's SPB epidemic counties - 2001

Table 2.15 Pine timber loss by Cumberland Plateau NIPF landowners during the 1998 – 2002 Southern Pine Beetle epidemic

		Geographic Location		Total
		North	South	
Lost pine trees during Southern Pine Beetle epidemic	No	46.2%	64.5%	54.4%
	Yes	53.8%	35.5%	45.6%
Total		100.0%	100.0%	100.0%

(n = 665)

Table 2.16 Timber salvage efforts by Cumberland Plateau NIPF landowners after the 1998 – 2002 Southern Pine Beetle epidemic

		Geographic Location		Total
		North	South	
Salvage timber sale during Southern Pine Beetle epidemic	No	89.3%	86.7%	88.4%
	Yes	10.7%	13.3%	11.6%
Total		100.0%	100.0%	100.0%

(n = 302)

Table 2.17 Tree planting efforts by Cumberland Plateau NIPF landowners after the 1998 – 2002 Southern Pine Beetle epidemic

		Geographic Location		
		North	South	Total
Plant pine trees in affected	No	92.3%	73.3%	85.4%
Pine Beetle areas after sale	Yes	7.7%	26.7%	14.6%
Total		100.0%	100.0%	100.0%

(n = 41)

Section 4. Non-timber Objectives

Another aspect of the study was to obtain information from the NIPF landowners regarding their level of interest in various non-timber aspects of forestland management. This information was used to compare non-timber aspects to timber management and harvesting activities.

More than 82 percent of both the North and South group ranked protecting water quality as “some to high interest” (Table 2.18), while more than 78 percent of both groups ranked maintaining forest cover as “some to high interest (Table 2.19). Protecting rare species which, was the third highest non-timber category, had over sixty-six percent of both groups ranked as “some to high interest” (Table 2.20).

Table 2.18 Importance of protecting water quality for Cumberland Plateau NIPF landowners

		Geographic Location		
		North	South	Total
Protecting water quality	No interest	6.2%	7.0%	6.6%
	Slight interest	4.8%	9.4%	6.9%
	Some interest	31.7%	27.6%	29.9%
	High interest	56.9%	55.9%	56.5%
Total		99.6%	99.9%	99.9%

Total does not equal 100% as some respondents coded questionnaire incorrectly (n = 628)

Table 2.19 Importance of maintaining forest cover for Cumberland Plateau NIPF landowners

		Geographic Location		
		North	South	Total
Maintaining forest cover for aesthetics	No interest	8.6%	9.4%	9.0%
	Slight interest	12.8%	9.4%	11.2%
	Some interest	36.0%	34.9%	35.5%
	High interest	42.3%	46.3%	44.1%
Total		99.7%	100.0%	99.8%

Total does not equal 100% as some respondents coded questionnaire incorrectly (n = 615)

Table 2.20 Importance of protecting rare species for Cumberland Plateau NIPF landowners

		Geographic Location		
		North	South	Total
Protecting rare species	No interest	9.6%	17.1%	12.9%
	Slight interest	19.7%	16.4%	18.2%
	Some interest	31.9%	27.4%	29.9%
	High interest	38.6%	39.1%	38.8%
Total		99.8%	100.0%	99.8%

Total does not equal 100% as some respondents coded questionnaire incorrectly (n = 627)

Section 5. Past Timber Sale Experience

Significant positive correlations were found between the age categories, current occupation, and percent of income from farming with the respondent's past experience with timber sales (Table 2.21). There were no significant differences between the North and South geographic areas. A significant positive correlation was found between the number of generations of ownership and the respondent's past experience with timber sales (Table 2.22).

Several key demographic comparisons are worth noting because of their relationship with past timber sales. As expected, older NIPF landowners and farmers were more likely to have experience with timber sales. More than 58 percent of the 61 – 70 year old class indicated past experience with timber sales (Table 2.23).; as well as 62.2 percent of the farmer occupation group (Table 2.24) who earned 75% of their income from farming were the most likely groups to report past timber sale experience (Table 2.25). A significant positive correlation was found between the respondent's plan to harvest timber in the future and their past experience with timber sales (Table 2.26). There were no significant differences between the North and South geographic areas (Table 2.27).

Over 69 percent of respondents who had harvested timber in the past indicated they had cut a sale area of 1 – 50 acres in size (Table 2.28). No significant differences were found between the two groups. Hardwood sawtimber (N = 236, multiple selections) was the driver for the reported harvesting activity (Figure 2.2). Only 22 percent of all respondents reported the visual quality of the sale area as being poor (Table 2.29). No

significant differences were found between the two groups. Finally, only 87 NIPF landowners indicated that they had retained the services of a professional forester during the timber sale operations (Figure 2.3).

Table 2.21 Significant correlation of demographic variables to past experience with timber sales of Cumberland Plateau NIPF landowners

			Sold or harvested timber from forest land	Age Categories	Current occupatio	% of total income from farming
Spearman's rho	Sold or harvested timber from forest land	Correlation Coefficient	1.000	.123(**)	.093(*)	.183(*)
		Sig. (2-tailed)	.	.002	.017	.045
		N	676	646	664	121

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 2.22 Significant correlation of tract variables to past experience with timber sales of Cumberland Plateau NIPF landowners

			Sold or harvested timber from forest land	# of generations owned forest land
Spearman's rho	Sold or harvested timber from forest land	Correlation Coefficient	1.000	.182(**)
		Sig. (2-tailed)	.	.001
		N	676	335

** Correlation is significant at the 0.01 level (2-tailed).

Table 2.23 Age category comparison to past experience with past timber sales of Cumberland Plateau NIPF landowners

Age Category			Geographic Location		Total
			North	South	
<30	Sold or harvested	No	33.3%	100.0%	60.0%
	timber from forest land	Yes	66.7%		40.0%
	Total		100.0%	100.0%	100.0%
31-40	Sold or harvested	No	60.0%	64.7%	62.5%
	timber from forest land	Yes	40.0%	35.3%	37.5%
	Total		100.0%	100.0%	100.0%
41-50	Sold or harvested	No	58.8%	62.0%	60.4%
	timber from forest land	Yes	41.2%	38.0%	39.6%
	Total		100.0%	100.0%	100.0%
51-60	Sold or harvested	No	53.1%	69.5%	58.7%
	timber from forest land	Yes	46.9%	30.5%	41.3%
	Total		100.0%	100.0%	100.0%
61-70	Sold or harvested	No	58.5%	55.1%	56.9%
	timber from forest land	Yes	41.5%	44.9%	43.1%
	Total		100.0%	100.0%	100.0%
71-80	Sold or harvested	No	38.0%	43.9%	41.1%
	timber from forest land	Yes	62.0%	56.1%	58.9%
	Total		100.0%	100.0%	100.0%
>80	Sold or harvested	No	52.4%	25.0%	42.4%
	timber from forest land	Yes	47.6%	75.0%	57.6%
	Total		100.0%	100.0%	100.0%

(n = 676)

Table 2.24 Occupation comparison to past experience with past timber sales by Cumberland Plateau NIPF landowners

Current occupation			Geographic Location		Total
			North	South	
Owner of business	Sold or harvested timber from forest land	No	67.4%	54.5%	61.8%
		Yes	32.6%	45.5%	38.2%
	Total		100.0%	100.0%	100.0%
Professional/management	Sold or harvested timber from forest land	No	65.0%	58.5%	62.4%
		Yes	35.0%	41.5%	37.6%
	Total		100.0%	100.0%	100.0%
Clerical or office worker	Sold or harvested timber from forest land	No	50.0%	75.0%	62.5%
		Yes	50.0%	25.0%	37.5%
	Total		100.0%	100.0%	100.0%
Craftsman/blue collar	Sold or harvested timber from forest land	No	60.0%	76.2%	68.3%
		Yes	40.0%	23.8%	31.7%
	Total		100.0%	100.0%	100.0%
Farmer	Sold or harvested timber from forest land	No	36.7%	40.0%	37.8%
		Yes	63.3%	60.0%	62.2%
	Total		100.0%	100.0%	100.0%
Forestry/logging/mining	Sold or harvested timber from forest land	No		100.0%	16.7%
		Yes	100.0%		83.3%
	Total		100.0%	100.0%	100.0%
Homemaker	Sold or harvested timber from forest land	No	50.0%	75.0%	62.5%
		Yes	50.0%	25.0%	37.5%
	Total		100.0%	100.0%	100.0%
Government employee	Sold or harvested timber from forest land	No	42.9%	42.9%	42.9%
		Yes	57.1%	57.1%	57.1%
	Total		100.0%	100.0%	100.0%
Retired	Sold or harvested timber from forest land	No	60.2%	57.1%	58.6%
		Yes	39.8%	42.9%	41.4%
	Total		100.0%	100.0%	100.0%

(n = 664)

Table 2.25 Percent income from farming comparison with past timber sale experience by Cumberland Plateau NIPF landowners

% of total income from farming			Geographic Location		
			North	South	Total
None	Sold or harvested timber from forest land	No	50.0%	50.0%	50.0%
		Yes	50.0%	50.0%	50.0%
		Total	100.0%	100.0%	100.0%
Less than 25%	Sold or harvested timber from forest land	No	37.8%	46.2%	41.3%
		Yes	62.2%	53.8%	58.7%
		Total	100.0%	100.0%	100.0%
25-49%	Sold or harvested timber from forest land	No	33.3%	44.4%	38.9%
		Yes	66.7%	55.6%	61.1%
		Total	100.0%	100.0%	100.0%
50-75%	Sold or harvested timber from forest land	No	20.0%	28.6%	23.5%
		Yes	80.0%	71.4%	76.5%
		Total	100.0%	100.0%	100.0%
More than 75%	Sold or harvested timber from forest land	No	14.3%	28.6%	21.4%
		Yes	85.7%	71.4%	78.6%
		Total	100.0%	100.0%	100.0%

(n = 121)

Table 2.26 Significant correlation between planning to harvest timber in the future to past experience with timber sales by Cumberland Plateau NIPF landowners

			Planning to harvest timber from forest land	Past experience with timber sales
Spearman's rho	Planning to harvest timber from forest land	Correlation Coefficient	1.000	.168(**)
		Sig. (2-tailed)	.	>.000
		N	619	514
		N	514	568

** Correlation is significant at the 0.01 level (2-tailed).

Table 2.27 Comparison of planning to harvest timber from forestland to sold timber in the past by Cumberland Plateau NIPF landowners

Sold or harvested timber from forest land			Geographic Location		Total
			North	South	
No	Planning to harvest	No	82.2%	84.7%	83.3%
	timber from forest land	Yes	17.8%	15.3%	16.7%
	Total		100.0%	100.0%	100.0%
Yes	Planning to harvest	No	54.8%	50.0%	52.7%
	timber from forest land	Yes	45.2%	50.0%	47.3%
	Total		100.0%	100.0%	100.0%

(n = 608)

Table 2.28 Past timber sale harvesting area by Cumberland Plateau NIPF landowners

		# of acres in sale area					Total
		1-25 acres	26-50 acres	51-75 acres	76-100 acres	More than 100 acres	
Geographic Location	North Count	76	39	19	18	16	168
	% within Geographic Location	45.2%	23.2%	11.3%	10.7%	9.5%	100.0 %
	South Count	67	25	9	9	18	128
	% within Geographic Location	52.3%	19.5%	7.0%	7.0%	14.1%	100.0 %
	Total Count	143	64	28	27	34	296
	% within Geographic Location	48.3%	21.6%	9.5%	9.1%	11.5%	100.0 %

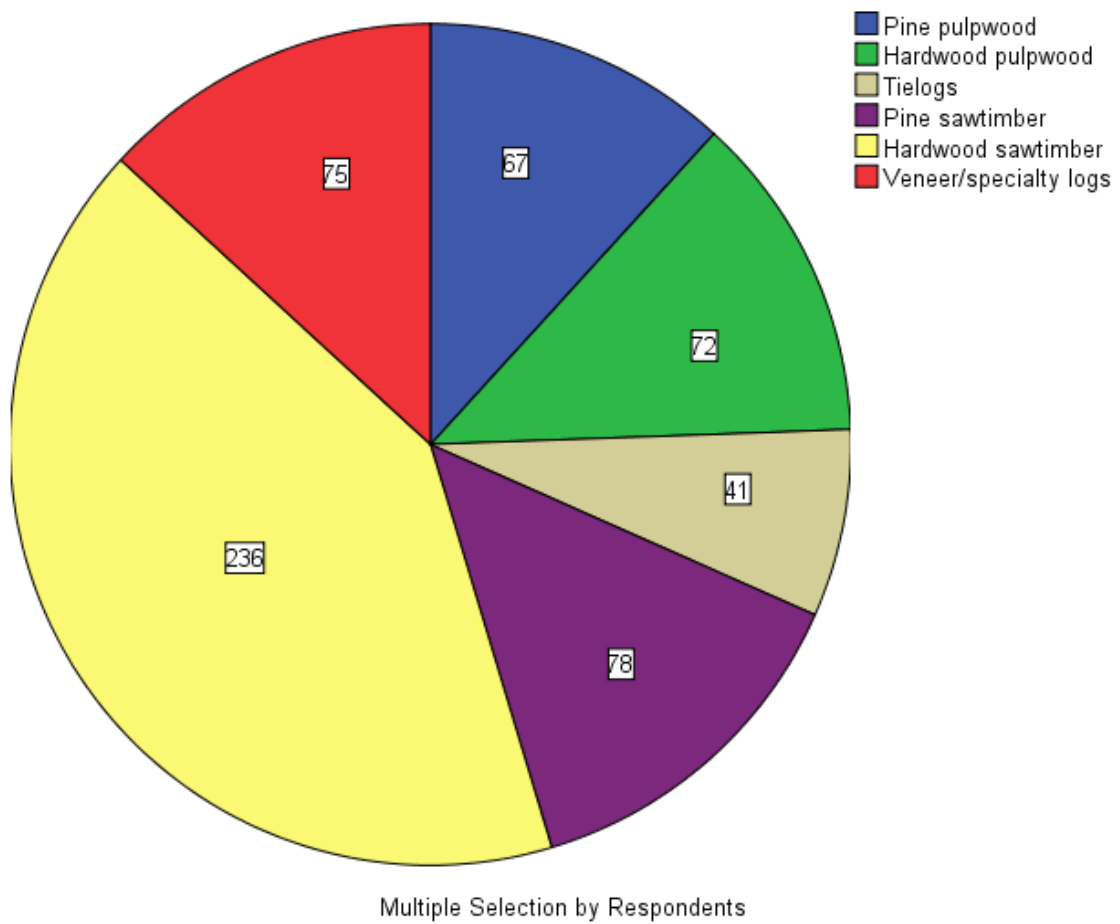


Figure 2.3 Forest products harvested by Cumberland Plateau NIPF landowners - 2007

Table 2.29 Visual quality opinion of timber harvest by Cumberland Plateau NIPF landowners

		Visual quality opinion of timber harvest area after logging				
		Poor	Fair	Good	Excellent	Total
Geographic Location	North Count	42	49	63	14	168
	% within Geographic Location	25.0%	29.2%	37.5%	8.3%	100.0%
	South Count	26	41	51	12	130
	% within Geographic Location	20.0%	31.5%	39.2%	9.2%	100.0%
	Total Count	68	90	114	26	298
	% within Geographic Location	22.8%	30.2%	38.3%	8.7%	100.0%

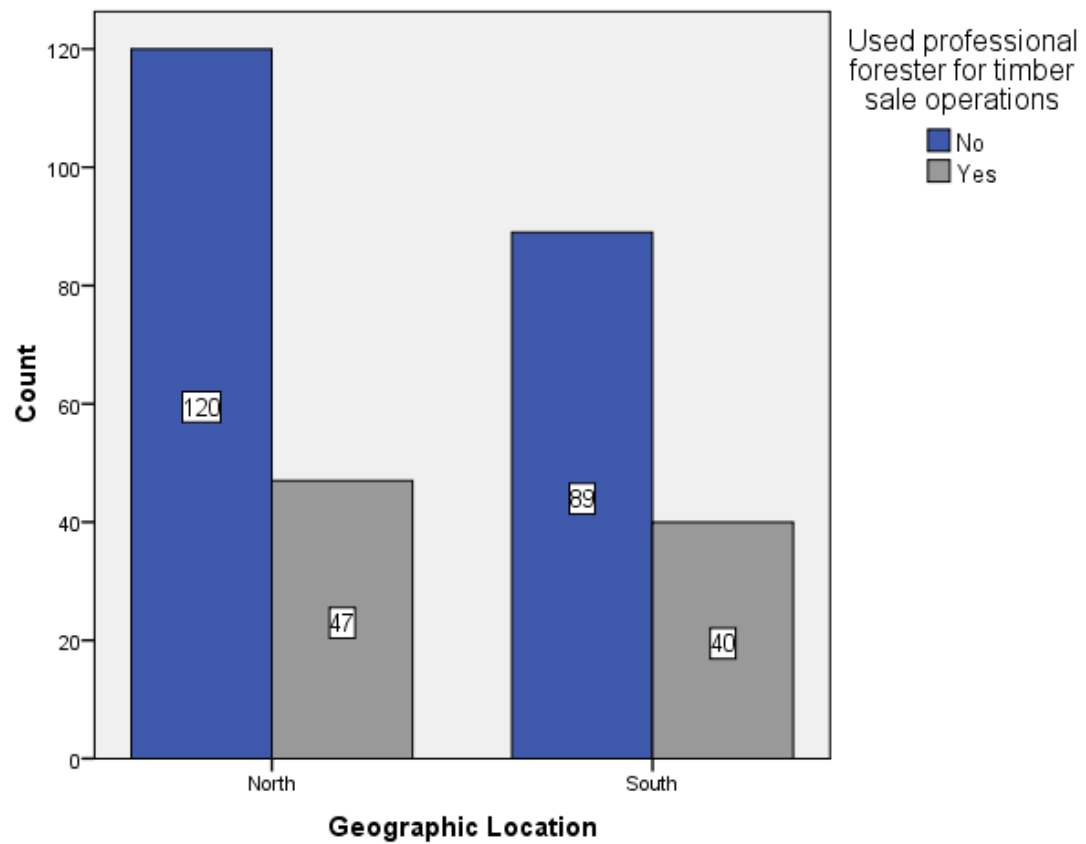


Figure 2.4 Use of professional forestry services during harvesting operations by Cumberland Plateau NIPF landowners - 2007

Discussion and Conclusions

The study provided information on the NIPF landowners of the 16-county Tennessee Cumberland Plateau region. The findings indicate there were few major regional differences between the northern and southern Plateau regions. The socio-demographic information reveals the average landowner was 61.9 years old; had a high probability of being employed as a professional, manager, or business owner; and possessed at least a high school education. Moreover, the average landowner earned more than \$25,000 in 2006 and ranked non-consumptive management objectives over those of timber management. The average NIPF landowner owned between 10 – 100 acres and owned only one tract of forestland. Land tenure (single owner or multi-generational as defined in the survey) had a skewed bi-modal grouping, with 26.9 percent of the 0 – 10 year category and 23.1 percent in the >60 year category. These ownership grouping findings are of practical significance in that the two groupings are likely to have distinct differences in ownership objectives.

There is a high probability that few landowners would have received forest management advice, most would not have a written forest management plan, and few would have received any type of cost-share funding. The small percentages for forest management advice and the implementation of written forest management plans are consistent with Measells et al. (2005) and Butler and Leatherby (2004). There is also a moderate probability that they lost pine trees during the 1998 – 2002 Southern Pine Beetle epidemic, a high probability they were not able to salvage any timber; and a low probability they elected to re-plant pine seedlings on the infected timber stand area.

Finally, there is a high probability they would rank water quality, maintaining quality forest cover, or protecting rare and endangered species as a top non-timber management objective.

As expected the study revealed that NIPF landowners who had past experience with timber sales were more likely to consider timber sales in the future. Contrary to expectations, however, there were no significant differences between the North and South Plateau groups. Owners who had the most experience with past timber sales were 60 years or older and derived 50 – 75% of their annual income from farming. Those owners that had harvested timber in past did so mainly on tract sizes of 1 – 50 acres, and primarily harvested hardwood sawlogs. Only 22.8% reported the visual quality of the sale as being poor quality and only 29% reported they utilized the services of a professional forester during the timber sale/harvesting activities. These findings still give merit to the idea there still is a potential to increase the level of forest management and timber harvesting on the Cumberland Plateau. Given the average age of NIPF landowners was 61.9, a large number of tracts will change ownership. The impending change of ownership, recent high land prices, and development interest will likely drive many new owners to consider selling the land, timber, or both.

The paradox is that timber management was not highly ranked by the respondents as the main reason for ownership. Since they ranked scenery, peacefulness, and protecting nature as the top three management objectives, most owners will not be considering timber production as part of their long-range planning. Thus they are not likely to entertain a timber sale, unless they have an unforeseen financial need. Moreover, given few respondents have ever received forest management advice and lack a written

forest management plan, most will be practicing a “no management” mode of operation. No plan, no knowledge base, and no direction might eventually lead to another catastrophic insect or disease outbreak, which could further curtail the future forest-based economic impact from the Cumberland Plateau region.

Management Implication

The demographic shift from older to younger NIPF landowners might become a short-term boost to potential wood supply, but also might constrain the long-term supply. Younger owners, especially through inheritance, are likely to consider selling the land, timber, or both due to a lack of interest in landownership or financial need. However, new owners moving to the region are likely to be seeking forest land for the scenery, privacy, and solitude, or to protect nature. This will likely further restrict the available resource base from future timber management and forest harvesting operations.

The author’s experience as a wood procurement forester supports the assumption the NIPF landowners usually sell timber to meet short-term financial needs. During numerous personal timber negotiations conducted in the early 1990s, landowners regularly stated they would not be considering selling their timber if they were not experiencing an urgent financial need. Unsuccessful negotiations were usually sealed with comments from landowners stating they were either “holding the timber to pass down to their children” or “not interested in cutting the wood at any time” due mainly to their negative perception of timber harvesting activities. These responses give further

personal support that timber management may not be the prime objective of many NIPF landowners.

In order to overcome the potential shortfall of wood and fiber flow, caused by changing regional demographics, state and private professional foresters will have to work more closely in providing education, outreach, and professional services emphasizing multiple-use forestry practices. This can be accomplished through many of the existing programs such as The University of Tennessee Extension programs, Tree Farm, and the Sustainable Forestry Initiative. Industry foresters will need to be engaged in these programs and be more creative with their individual landowner discussions to ensure NIPF landowners understand the benefits timber management has on other non-consumptive objectives. It might ultimately be time to reinvigorate industry-based forest land-owner assistance programs.

CHAPTER 3

MODELING NIPF LANDOWNER BEHAVIOR: DEVELOPING “A WILLINGNESS TO SELL TIMBER” IN THE FUTURE MODEL

Abstract

The Cumberland Plateau in Tennessee currently is experiencing wide-spread forest parcelization and changes in species composition as a result of changes in land use and ownership. These changes can be attributed partially to industrial forest land divestiture and the lingering effects of the 1998 – 2002 Southern Pine Beetle (SPB) epidemic. A random sample of 1600 NIPF landowners owning 40 or more acres of forestland were surveyed which obtained a response rate of 39.0%. Forty-five percent of all respondents indicated that they had previously sold or harvested timber from their forest land, but only 30 percent indicated they intended to sell timber in the future. Logit regression ($n = 438$) and factor analysis ($n = 344$) were used to model the respondents' willingness to sell timber in the future. Landowners most willing to consider a future timber sale on their property had sold timber in the past, tended to own their land for timber production, had received forest management advice in the past, and had a high interest in maintaining the health of their forest. Factor analysis revealed that landowners most likely to consider selling timber in the future would fit into one of three components: 1) Improvers; 2) Investors; 3) or Legacy owners.

Introduction

Forest land investments are unique in that they are both a productive enterprise with the ability to produce income from timber sales, and a consumptive good providing direct utility to owners through recreation, aesthetics and other non-timber amenities. Therefore, a landowner is faced with multiple management decisions regarding how harvesting their timber could impact the land's ability to produce other non-timber related activities during the reforestation, assuming he/she elects to reforest the property. Many smaller NIPFs may face economies of size issues, both in favor of a timber sale decision (i.e., having enough volume per acre to entice a logger to cut it); and having enough acreage (i.e., strategic fit opposed to other management objectives) on a particular tract to even consider a timber sale in light of other management objectives.

Although NIPF timber is sold and harvested on a daily basis throughout the southeastern United States, it is many times a one-time activity in the life of the landowner. Bulter (2008) suggests that timber production is not the prime objective of many NIPFs (Butler 2008), which gives rise that the timber sale decision might be related more to financial need, than a long-term timber management strategy.

Wells (1977) studied the "Willingness to Sell" as a variable affecting timber availability in a middle Tennessee wood basin. He reported the market withholding of timber may be based on: the timeliness of financial needs of the owner; other non-timber objectives of the owner; and past experiences with timber sales and/or timber management experiences. Wiggins (1977) also studied willingness to sell by comparing urban to rural NIPF landowner responses using a "Willingness Score" model for

predictability. He reported urban resident owners are less likely to sell timber than their rural counterparts. Similarly, Hickman (1984) conducted a study of NIPF owners in the east Texas “Piney Woods” region in an attempt to model landowner motivation to sell timber. He noted they are primarily interested in the income-producing potential as opposed to consumptive use of their woodlands and almost without exception; interest in timber harvesting is positively related to the amount of forest land owned.

Binkley (1981) contends NIPF forest landowners derive utility from the consumption of non-timber land outputs, such as recreation and aesthetics, and the owner’s decision to harvest timber is subject to two constraints. First, expenses cannot exceed timber sale income. Second, the combinations of timber and non-timber outputs are limited to those technically feasible. Wear and Flam (1993) linked landowner utility with a timber supply model based on NIPF ownership classifications, and reported the greater the tract size, the greater the probability timber harvesting will rank high as a main ownership objective. Vokoun et al. (2005) studied NIPF “willingness to accept price offers” in western Virginia. They found landowners who deem a “price acceptable for harvesting”, generally rely on the size of forested ownership, length of ownership, presence of existing structures, and whether the landowner is absentee (i.e. residing more than 50 miles from their parcel).

Landowners derive various levels of satisfaction from the consumption of resources from their landholdings, which are directly related to their ownership objectives, and can be both income-generating (i.e. timber harvesting/sales) and non-income generating goods such as recreation, hunting, and nature watching. These diverse levels of satisfaction among NIPF landowners present a dilemma for the southeastern

U.S. forest products industry, because industry relies heavily on NIPF wood sources that comprise 67 percent of the productive forestland in the region (Wear and Greis 2002). This paper describes an analysis of landowner willingness to sell timber based on landowner and land characteristics, ownership motivations, and other past management decisions.

The purpose of this paper is to develop a “willingness to sell” predictor model using logit regression and factor analysis that can be used by natural resource managers, extension personnel, policy makers, and industrial foresters to select NIPF landowners who would most likely harvest timber in the future. Models were developed to predict the probability of NIPF landowners harvesting timber from their lands in the future using demographic characteristics, forestland tract variables, management objectives, and their opinions and attitudes concerning hypothetical scenarios.

Methods and Procedures

Data for the study were collected via a mail survey following Dillman’s (2000) Tailored Designed Method. The targeted population for the study was all NIPF landowners owning 40 acres of land on the Cumberland Plateau. At least 10 acres of the ownership had to consist of forest cover. An ownership list was compiled using property tax records for the 16 counties. The University of Tennessee Department of Forestry, Wildlife and Fisheries Human Dimensions Research Lab reformatted the lists and performed the random sample. Under the 16-county scenario, the estimated target number of required respondents was 383 from a total of 1,097 surveys based on a 50:50

split and a 5 percent sampling error (Sallant and Dillman, 1994). As a result, we chose to mail out 100 surveys in each of the 16 counties, for a total of 1,600 potential respondents.

Likert-scale questions were formulated to assess the opinions and attitudes of NIPF owners concerning their forest management objectives. Categorical, demographic, and open-ended questions were used to obtain the needed information. The questionnaire was comprised of 33 questions designed to capture NIPF landowner demographics, landownership history, reasons for ownership, and management objectives. The respondent's hypothetical reasons for considering a future timber sale were investigated. Logit regression and factor analyses were used to build comparison models to predict the respondent's willingness to sell timber in the future.

The draft survey was developed during the Spring of 2006 and was carefully scrutinized for errors and validity by personnel within the Human Dimensions Research Lab and other researchers familiar with survey research. The survey was pre-tested with a small group of Cumberland Plateau NIPF owners in August 2006. Mailings took place during the second quarter of 2007. The survey procedure consisted of an initial mailing of the questionnaire and a cover letter stating the purpose of the study to all 1,600 landowners in the sample (see Appendix I). Follow-up post cards were mailed to all 1,600 after one week, thanking those who had responded and asking those who had not responded to do so. A second copy of the questionnaire and a cover letter explaining the importance of their participation was mailed to all nonrespondents after three weeks. A final post card was sent four weeks later, with a request to return the questionnaire or call the Department of Forestry, Wildlife and Fisheries for a duplicate questionnaire.

Future harvest (FH) was the dependent variable, defined as the participant's binary "yes/no" response on the survey question: "Are you planning to harvest timber from your forest land in the future?" FH was created by assigning a value of 1 to any respondent who indicated that they were considering a future timber sale on their forestland. If the respondent indicated they were not planning to harvest timber in the future, 0 was assigned.

Twenty-six independent variables were evaluated by a theoretical logit model: sold timber in the past (ST), acres owned (AO), multiple tracts (MT), financial investment (FI), timber production (TP), enjoy scenery (ES), for peacefulness (FP), residence on tract (RT), management advice (MA), selling price (SP), forest health (FH), logger reputation (LR), timber stand improvement (TS), hunting lease (HL), past experience with timber sales (PE), water quality (WQ), poor wood utilization (PW), beauty affected (BA), wildlife habitat (WH), enhance for birds (EB), company payment (CP), NIPF associations (NA), NIPF workshops (NW), talk with forester (TF), education level (EL), and age categories (AC) .

Logistical regression was used because it fits a regression surface to data in which the dependent variable is dichotomous (Howell 2002). Prior to running the reduced model, SPSS diagnostic tests were used to assess multicollinearity between the predictors, a condition where predictor variables are highly correlated and exhibit a strong linear relationship with each other (Field 2005). The theoretical model evaluated was:

$$\begin{aligned}
\text{Future Harvest (FH)} = & \beta_0 + \beta_1\text{ST} + \beta_2\text{AO} + \beta_3\text{MT} + \beta_4\text{FI} + \beta_5\text{TP} + \beta_6\text{ES} + \beta_7\text{FP} \\
& + \beta_8\text{RT} + \beta_9\text{MA} + \beta_{10}\text{SP} + \beta_{11}\text{FH} + \beta_{12}\text{LR} + \beta_{13}\text{TS} + \beta_{14}\text{HL} + \beta_{15}\text{PE} + \beta_{16}\text{WQ} \\
& + \beta_{17}\text{PW} + \beta_{18}\text{BA} + \beta_{19}\text{WH} + \beta_{20}\text{EB} + \beta_{21}\text{CP} + \beta_{22}\text{NA} + \beta_{23}\text{NW} + \beta_{24}\text{TF} + \\
& \beta_{25}\text{EL} + \beta_{26}\text{AC} + \varepsilon,
\end{aligned}$$

where, β s are model coefficients, and ε is the error term.

Factor analysis modeling was selected to reduce a second set of independent variables to a smaller number of possible underlying factors (Kim and Mueller 1978) and to extract the set of significant eigenvalues that had a variance > 1.0 , which determined the significant factors for further investigation. For this analysis, 35 independent variables from the questionnaire were considered (Table 3.1). Bartlett's test of sphericity was used to insure the R-matrix was not the identity matrix and that relationships existed between the variables in the analyses (Field 2005).

Table 3.1 Independent variables of Cumberland Plateau NIPF landowners used for factor analysis modeling

	.Component							
	1	2	3	4	5	6	7	8
For peacefulness and tranquility	.881							
To enjoy scenery	.857							
It connects me to nature	.829							
For privacy	.751							
To preserve nature	.662							
Enjoy working on the land	.583							
Using partial cut harvesting methods		.737						
Following Best Management Practices		.718						
TN Master logger harvests timber		.665						
Getting a timber appraisal		.600		.466				
Negotiating directly with a buyer		.592						
Past experience with timber sales		.542						
For timber stand improvement			.785					
For forest health			.769					
For wildlife habitat improvement			.735					
The reputation of the logger								
Using a sealed bid process				.686				
Using clear cut harvesting methods				.642				
Professional forester administers sale		.428		.632				
Selling timber on lump sum basis				.562				

Table 3.1 Independent variables of Cumberland Plateau NIPF landowners used for factor analysis modeling (continued)

To convert from hardwood to pine		.423	
To clear land for farming			.758
For grazing and livestock			.653
An urgent financial need			.568
Part of farm or home site	.474		.487
For real estate development		.425	
For hunting and fishing			.793
For wildlife management			.669
For other recreation	.445		.563
For financial invest.			.750
For timber production			.706
Motivated by price			.554
Inherited the land			.825
It connects me to the past	.413		.700
Pass on to heirs			.453

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a Rotation converged in 9 iterations.

Results

Two hundred and forty-six individuals were deemed to be ineligible for the survey (163 indicated they did not own forest land, 6 did not own land on the Plateau, 9 were deceased, 6 had sold their land, and 62 were undeliverable as addressed). This brought the eligible target population to 1,354. A total of 528 individuals returned questionnaires for a total response rate of 39 percent.

This response rate was consistent with those by Hickman (1984), Walkingstick et al. (2001), and Measells et al. (2005) for similar NIPF landowner studies. An initial mailing wave of 2,400 surveys was begun in March but a sampling error was found indicating that landowners with less than 40 acres of land were included in the sample. One hundred sixty-seven surveys from the original mailing were found to be from owners with 40 acres or greater and were used in the analysis. The initial mailing wave was abandoned in favor of an entirely new sample as stated above.

Potential non-response bias was analyzed by comparing selected demographic variables ((OCCUPATION ($\chi^2 = 12.622$, $P = .180$), EDUCATION LEVEL ($\chi^2 = 6.725$, $P = .242$), INCOME LEVEL ($\chi^2 = 2.637$, $P = .620$), %INCOME FROM FARMING ($\chi^2 = 1.094$, $P = .895$), TRACT SIZE ($\chi^2 = 5.861$, $P = .556$), FORESTLAND ACQUISITION, ($\chi^2 = 8.257$, $P = .409$)) between the first wave and second wave of the respondents. No significant differences were detected between the waves using chi-square analysis ($\alpha < .05$). This extrapolation method was suggested by Armstrong and Overton (1977) as a viable alternative to additional phone surveys for non-respondents.

The results have been sub-grouped into the following sections: Section 1 – Respondent’s Opinions about Future Timber Sales, Section 2 – Reduced Logistic Regression Model, Section 3 – Factor Analysis

Section 1. - Respondent’s opinions about future timber sales

Respondents were asked about their opinion regarding future timber sales based on potential reasons for harvesting timber, requirements for a successful sale, perceived risk with harvesting timber, and their top choices for learning more about timber harvesting operations. The top three reasons for considering a future timber sale were: 1) “To improve forest health”, 2) “For wildlife habitat improvement”, and 3) “For timber stand improvement” (Table 3.2). The top three requirements for a successful future timber sale were: 1) “Following best management practices”, 2) “Using partial cut harvesting methods”, and 3) “Getting a timber appraisal” (Table 3.3). The respondent’s top three rankings associated with potential future timber sale risk issues were: 1) “Beauty of area affected”, 2) “Damage to residual trees”, and 3) “Property damage” (Table 3.4). The respondent’s top choices for learning about timber sale/harvesting operations were: 1) “Talking with professional forester”, 2) “Extension publications”, and 3) “Web linked workshops” (Table 3.5).

Respondents most willing to harvest timber in the future tended to own 10 – 50 acre tract sizes (Figure 3.1). Additionally, those who indicated a willing to sell in the

future tended to rank the importance of partial harvesting methods on the high side (Figure 3.2) and clear cut harvesting methods as not important (Figure 3.3).

Table 3.2 Reasons for a future timber sale by Cumberland Plateau NIPF landowners

5 – Point Scale
1 = Not important; 5 = Extremely important

	N	Mean	Std. Deviation
To improve forest health	617	3.35	1.132
For wildlife habitat improvement	613	3.14	1.268
For timber stand improvement	616	3.07	1.229
The reputation of the logger	602	2.90	1.595
An urgent financial need	615	2.61	1.413
Motivated by selling price	620	2.58	1.374
To clear land for farming	608	1.68	1.069
For real estate development	605	1.50	.957
To convert from hardwood to pine	599	1.36	1.406
Valid N (listwise)	566		

Table 3.3 Requirements for a successful future timber sale by Cumberland Plateau NIPF landowners

5 – Point Scale
1 = Not important; 5 = Extremely important

	N	Mean	Std. Deviation
Following Best Management Practices	582	3.67	1.256
Using partial cut harvesting methods	593	3.59	1.298
Getting a timber appraisal	612	3.51	1.341
Negotiating directly with a buyer	601	3.36	1.285
Past experience with timber sales	568	2.78	1.497
TN Master logger harvests timber	554	2.67	1.453
Selling timber on lump sum basis	579	2.64	1.332
Using a sealed bid process	575	2.21	1.293
Using clear cut harvesting methods	556	1.78	1.282
Valid N (listwise)	502		

Table 3.4 Ranking of risk associated with a future timber sale by Cumberland Plateau NIPF landowners

5 – Point Scale
1 = No risk; 5 = Very high risk

	N	Mean	Std. Deviation
Beauty of the area affected	634	3.98	1.097
Damage to residual trees	620	3.52	1.136
Property damage	625	3.46	1.143
Water quality impacts	620	3.26	1.255
Poor wood utilization and waste	605	3.25	1.149
Landowner liability	605	3.14	1.185
Timber being stolen	620	2.66	1.205
Valid N (listwise)	576		

Table 3.5 Education preferences regarding timber sale/harvesting operations by Cumberland Plateau NIPF landowners

5 – Point Scale
1 = Not useful; 5 = Extremely useful

Descriptive Statistics

	N	Mean	Std. Deviation
Talking with a professional forester	608	3.29	1.384
Extension publications	598	2.95	1.327
Web Link Workshops	573	2.37	1.341
Forest Landowner Associations	580	2.42	1.274
Landowner workshops/field days	578	2.43	1.298
Valid N (listwise)	563		

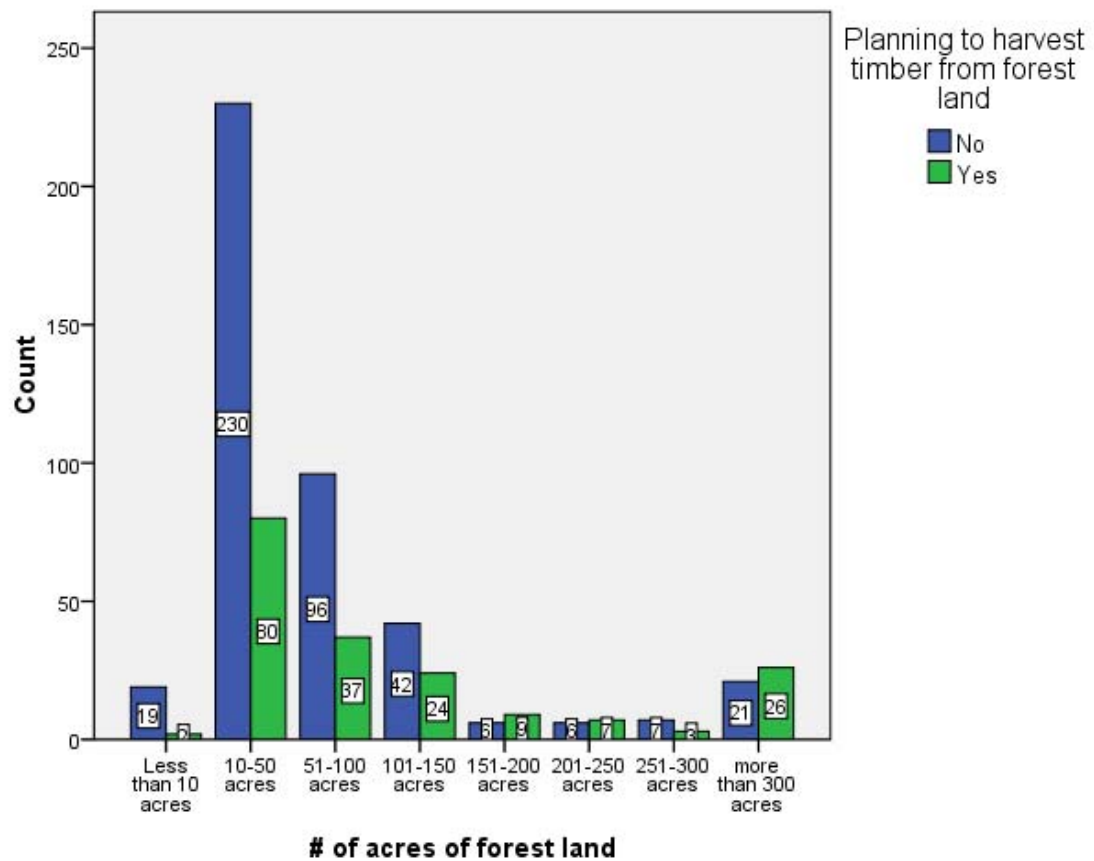


Figure 3.1 Comparison of tract size to harvesting timber in the future by Cumberland Plateau NIPF landowners - 2007

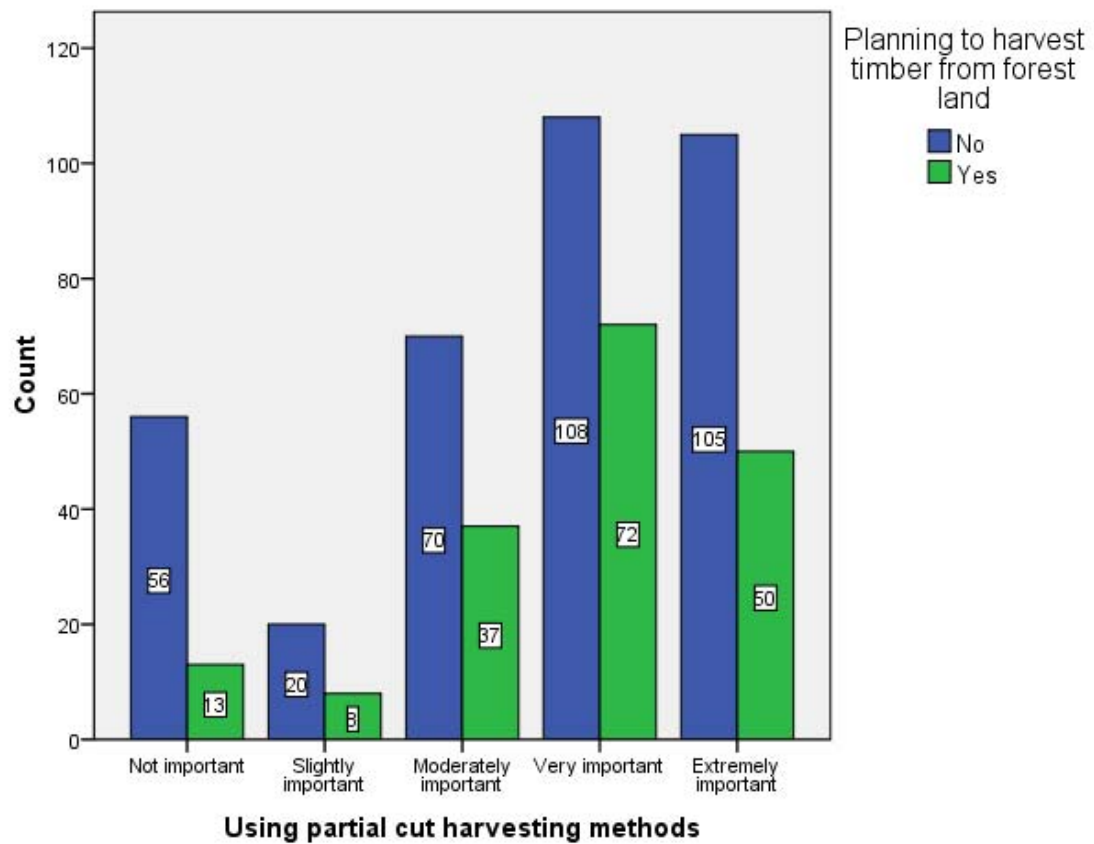


Figure 3.2 Comparison of importance of using partial cut harvesting methods to harvesting timber in the future by Cumberland Plateau NIPF landowners - 2007

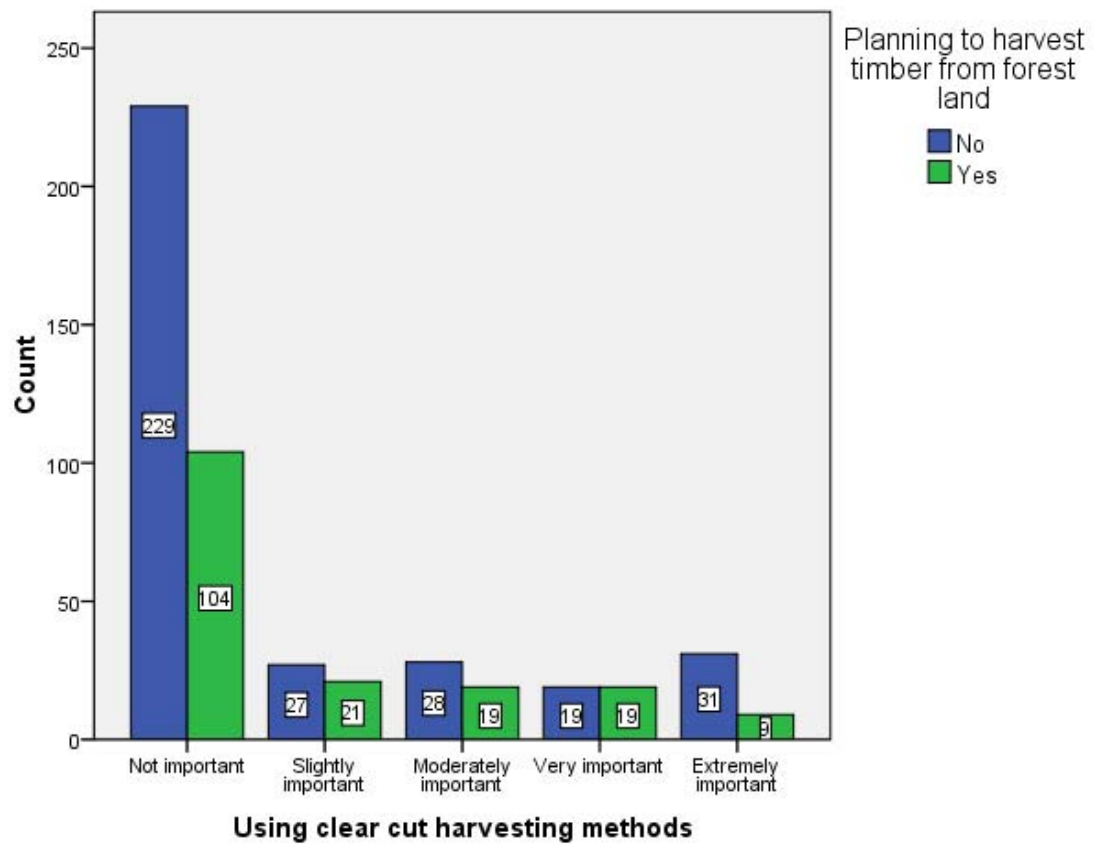


Figure 3.3 Comparison of using clear cut harvesting methods to harvesting timber in the future by Cumberland Plateau NIPF landowner - 2007

Section 2. - Reduced Logistical Regression Model

Eighteen of the theoretical independent variables were eliminated prior to further model iterations because they did not meet the minimum significance level of $\alpha < .05$, yielding a total of eight independent variables (Table 3.6). None of the selected independent variables for the model were found to be exceeding VIFs > 5.0 (Table 3.7) so all were retained for the reduced logistical regression model run.

The reduced model with the eight significant independent variables was defined as:

$$\text{Future Harvest (FH)} = -.884 + .977\text{ST} + .999\text{TP} - .537\text{FP} + .585\text{MA} - .239\text{PE} + .695\text{FH} - .386\text{PW} - .411\text{AC}, (R^2_N = .508)$$

Field (2005) defines the Exp β as the indicator of change in odds resulting from a unit change in the predictor in logistic regression: if the value is greater than 1 then it indicates that as the predictor increases, the odds of the outcome occurring increases. An Exp β value less than 1 indicates that as the predictor increases, the odds of the outcome occurring decreases, and the farther the odds ratio (Exp β) from 1, the more influential the predictor variable (Brown 2004). The Hosmer and Lemeshow test results were .907 indicating that the model adequately fits the data and that all eight of variables were significant at the $\alpha < .05$ level. The -2 log likelihood improves from 560.318 without the predictors in the model to 360.483 with the predictors in the model.

The reduced model (Table 3.8) indicated that ST: $\beta = 2.657$, $\alpha = .001$, TP: $\beta = 2.715$, $\alpha < .000$, FP: $\beta = .585$, $\alpha < .000$, MA: $\beta = 1.795$, $\alpha = .054$, PE: $\beta = .788$, $\alpha = .023$, FH: $\beta = 2.003$, $\alpha < .000$, , PW: $\beta = .680$, $\alpha = .004$ and AC: $\beta = .663$, $\alpha < .000$. Thus, NIPF landowners who actually have sold timber in the past were 2.7 times more likely to

harvest timber in the future. Those NIPF landowners with timber production as a primary ownership objective were 2.7 times more likely to harvest timber in the future than those with other objectives. Those NIPF landowners who had received forest management advice in the past were 1.8 times more likely to harvest timber in the future than those who had not. Finally, those interested in improving the forest health of their forestland were 2.0 times more likely to harvest timber in the future than those with other objectives.

Comparatively, those NIPF landowners who own their forest land for peacefulness and tranquility were .585 times as likely to harvest timber in the future. Those NIPF landowners who felt that past experience with timber sales was important were .788 times as likely to harvest timber in the future. Those NIPF landowners that felt poor wood utilization was a risk with timber sales were .680 times as likely to harvest timber in the future. Finally, those NIPF landowners in younger age classifications were .663 times as likely to harvest timber in the future. The final iteration of the reduced model correctly classified 80.6 percent of the 438 observations as opposed to 66.2 percent without the predictors in the model.

Table 3.6 Theoretical logistical model run

		B	S.E.	Wald	Df	Sig.	Exp(B)
Step 1	ST	-.887	.361	6.059	1	.014	.412
	AO	.117	.097	1.466	1	.226	1.124
	MT	-.564	.353	2.548	1	.110	.569
	FI	-.075	.136	.301	1	.583	.928
	TP	.873	.162	28.936	1	.000	2.394
	ES	.130	.236	.305	1	.581	1.139
	FP	-.661	.226	8.527	1	.003	.516
	RT	-.047	.359	.017	1	.895	.954
	MA	.777	.388	4.009	1	.045	2.175
	SP	.074	.147	.256	1	.613	1.077
	FH	.768	.265	8.374	1	.004	2.154
	LR	.181	.119	2.320	1	.128	1.199
	TS	-.109	.221	.246	1	.620	.896
	PE	1.144	.590	3.762	1	.052	3.141
	WQ	-.086	.169	.261	1	.609	.917
	PW	-.531	.195	7.432	1	.006	.588
	BA	-.255	.190	1.805	1	.179	.775
	WH	.274	.170	2.600	1	.107	1.315
	EB	-.234	.210	1.244	1	.265	.791
	CP	.149	.122	1.476	1	.224	1.160
	EL	.108	.120	.804	1	.370	1.114
	AC	-.476	.143	11.106	1	.001	.621
	NA	.213	.202	1.120	1	.290	1.238
	NW	.011	.200	.003	1	.957	1.011
	TF	-.172	.165	1.089	1	.297	.842
	HL	.247	.735	.113	1	.737	1.281
	Constant	-.484	1.601	.092	1	.762	.616

Table 3.7 Collinearity statistics for the reduced logistical regression model for Cumberland Plateau NIPF landowners

		Coefficients ^a						
	Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.317	.115		2.749	.006		
	ST	.128	.042	.135	3.077	.002	.761	1.313
	TP	.150	.016	.431	9.593	>.000	.727	1.375
	FP	-.070	.017	-.171	-4.132	>.000	.860	1.162
	MA	.091	.045	.083	2.045	.041	.895	1.117
	FH	.079	.018	.183	4.357	>.000	.828	1.208
	PE	-.028	.014	-.089	-2.050	.041	.778	1.285
	PW	-.042	.017	-.102	-2.439	.015	.844	1.185
	AC	-.053	.015	-.138	-3.539	>.000	.958	1.044

a. Dependent Variable: Planning to harvest timber from forest land

Table 3.8 Analysis of maximum likelihood estimates for the reduced logistical regression model for Cumberland Plateau NIPF landowners

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
								Lower	Upper
Step 1	ST	.977	.295	10.941	1	.001	2.657	1.489	4.741
	TP	.999	.128	61.242	1	>.000	2.715	2.114	3.486
	FP	-.537	.131	16.891	1	>.000	.585	.453	.755
	MA	.585	.303	3.723	1	.054	1.795	.991	3.253
	PE	-.239	.105	5.165	1	.023	.788	.641	.968
	FH	.695	.153	20.641	1	>.000	2.003	1.484	2.703
	PW	-.386	.133	8.487	1	.004	.680	.524	.881
	AC	-.411	.112	13.562	1	.000	.663	.533	.825
	Constant	-.884	.812	1.185	1	.276	.413		

$R^2_N = .508$

Section 3. - Factor Analysis

Bartlett's Test results indicated a $p\text{-value} = .000 < .05$, such that factor analysis was appropriate for the 35 variables being evaluated in this study (Table 3.9). Principle Component Analysis (PCA) was used to extract the significant eigenvalues that had a variance > 1.0 , which determined the significant factors for further investigation (Table 3.10.). The scree plot (Figure 3.1) supports the selection of the significant eight factors indicated by the point of inflection. Kline (2005) and Field (2005) both suggest using a Scree Plot to help graphically test significant eigenvalues found from PCA.

Principle components were then ranked from largest to smallest in terms of variance. Varimax rotation was selected for the analysis. Rotated factor loadings for this analysis are illustrated in Table 3.11. Factor loadings for the independent variables were grouped into the following named components of; 1) Preservers, 2) Timber1, 3) Improvers, 4) Timber2, 5) Agrarian, 6) Recreation, 7) Investors, 8) and Legacy owners for further analysis. Kline (2005) defines factor loadings as the regression coefficient of a variable for a model that describes a latent variable or factor in factor analysis.

Table 3.9 Bartlett's Test of Sphericity

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.			.850
Bartlett's Test of Sphericity	Approx. Chi-Square	5802.920	
	Df	595	
	Sig.	>.000	

Table 3.10 Total Variance Explained - Top Rated Eigenvalues > 1.0 for Cumberland Plateau NIPF landowners

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cuml. %	Total	% of Variance	Cuml. %	Total	% of Variance	Cuml. %
1	7.644	21.840	21.840	7.644	21.840	21.840	4.667	13.336	13.336
2	4.132	11.805	33.645	4.132	11.805	33.645	3.457	9.878	23.214
3	2.531	7.232	40.877	2.531	7.232	40.877	2.661	7.603	30.817
4	1.846	5.274	46.151	1.846	5.274	46.151	2.384	6.812	37.628
5	1.814	5.183	51.334	1.814	5.183	51.334	2.248	6.423	44.051
6	1.359	3.883	55.217	1.359	3.883	55.217	2.172	6.205	50.256
7	1.192	3.405	58.622	1.192	3.405	58.622	2.074	5.926	56.182
8	1.132	3.234	61.857	1.132	3.234	61.857	1.986	5.675	61.857

Extraction Method: Principal Component Analysis.

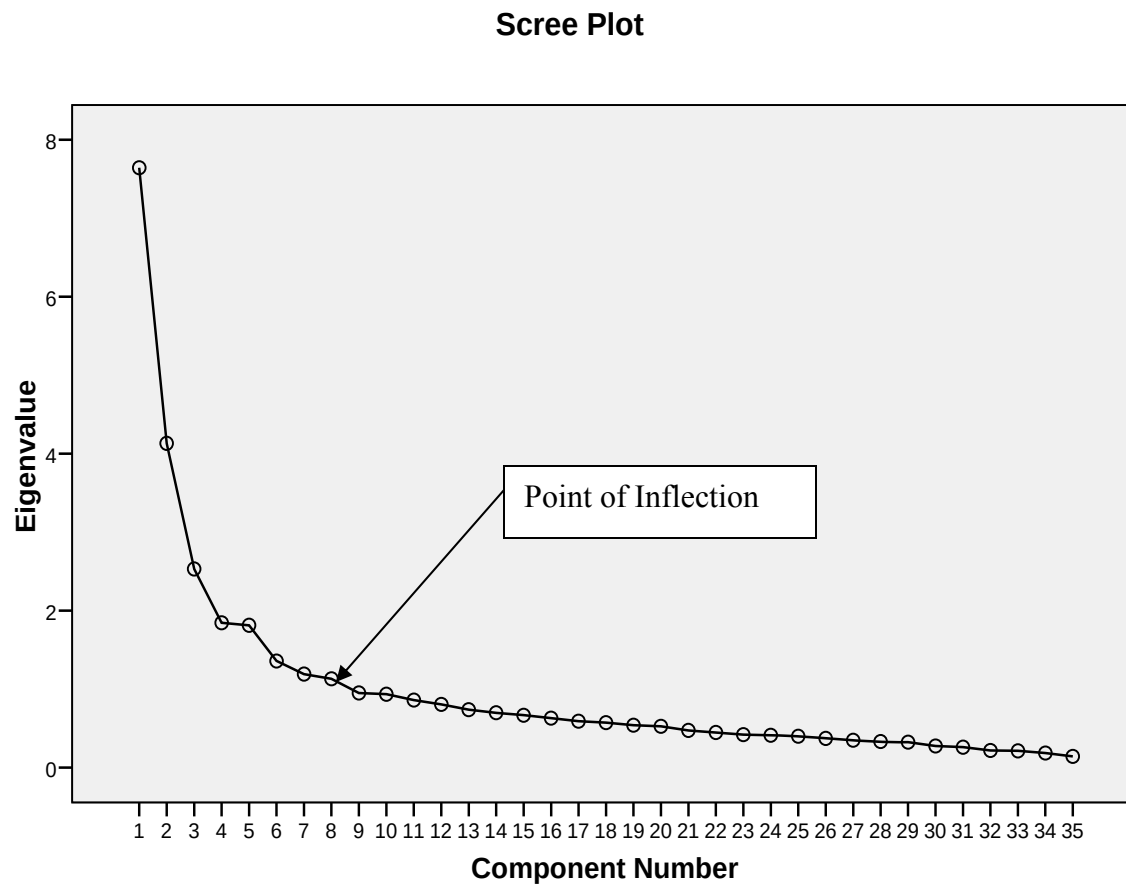


Figure 3.4 Scree plot of top rated eigenvalues

Table 3.11. Rotated Component Matrix of Cumberland Plateau NIPF landowners

	.Component							
	1	2	3	4	5	6	7	8
For peacefulness and tranquility	.881	}	Preservers					
To enjoy scenery	.857							
It connects me to nature	.829							
For privacy	.751							
To preserve nature	.662							
Enjoy working on the land	.583							
Using partial cut harvesting methods		.737	}					
Following Best Management Practices		.718						
TN Master logger harvests timber		.665						
Getting a timber appraisal		.600		.466				
Negotiating directly with a buyer		.592						
Past experience with timber sales		.542	Improvers					
For timber stand improvement				.785				
For forest health				.769				
For wildlife habitat improvement				.735				
The reputation of the logger								
Using a sealed bid process				.686				
Using clear cut harvesting methods				.642				
Professional forester administers sale		.428		.632				
Selling timber on lump sum basis				.562				

Table 3.11. Rotated Component Matrix of Cumberland Plateau NIPF landowners (continued)

To convert from hardwood to pine		.423		
To clear land for farming		.758	Agrarian	
For grazing and livestock		.653		
An urgent financial need		.568		
Part of farm or home site	.474	.487		
For real estate development		.425		
For hunting and fishing		.793	Recreation	
For wildlife management		.669		
For other recreation	.445	.563		
For financial invest.			Investors	.750
For timber production				.706
Motivated by price				.554
Inherited the land			Legacy Owners	.825
It connects me to the past	.413			.700
Pass on to heirs				.453

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 9 iterations.

The full regression model with the eight significant independent components is defined as:

$$\text{Future Harvest (FH)} = -.0991 -.621\text{PR} + .133\text{T1} + .748\text{IM} - .201\text{T2} + .167\text{AG} + .211\text{RE} + 1.143\text{IV} + .371\text{LO}, (R^2_N = .396)$$

where PR = preservers, T1 = timber1, IM = improvers, AG = agrarian, RE = recreation, IV = investors, and LL = legacy owners.

The full logit regression model indicated only four components were significant at the $< .05$ level (Table 3.12). The four following independent components were retained for the reduced logit regression model run; PR (independent component loaded on variables associated with NIPF objectives towards preservation of their forest land): $\beta = .551$, IM (independent component loaded on variables associated with NIPF objectives towards improvement of their forest land): $\beta = 2.005$, IV (independent component loaded on variables associated with NIPF objectives towards investment as an ownership objective): $\beta = 3.104$ and LO (independent component loaded on variables associated with NIPF objectives of leaving a legacy for their heirs): $\beta = 1.435$.

For peacefulness, to enjoy scenery, connects me to nature, for privacy, to preserve nature, and enjoy working the land were identified with the factor associated with the “preserver” component; Timber stand improvement, forest health, and improving wildlife habitat were identified with the factor associated with the “improver” component; financial investment, timber production, and motivation by price were identified with the factor associated with the “investor” component; and forest land inheritance, ownership connects me to the past, and pass onto heirs were identified the “legacy owner” component.

The reduced logit regression model with the four significant independent components is defined as:

$$\text{Future Harvest (FH)} = -.958 - .596\text{PR} + .720\text{IM} + 1.133\text{IV} + .361\text{LO}, (R^2_N = .318)$$

where PR = preservers, IV = investors, LL = legacy leavers, and IM = improvers.

The reduced logit regression model (Table 3.13) run outcome indicated that; PR: $\beta = .551$, $\alpha < .000$, IM: $\beta = 2.055$, $\alpha < .000$, IV: $\beta = 3.104$, $\alpha < .000$, and LO: $\beta = 1.435$, $\alpha = .008$. The Hosmer and Lemeshow test results were .927 indicating that the model adequately fits the data and that all four of variables were significant at the $\alpha < .05$ level. The -2 log likelihood improves from 438.383 without the predictors in model to 330.366 with the predictors in the model.

The reduced model indicates that NIPF landowners those who indicated an improver component were 2.0 times more likely to harvest timber in the future than those who do not have an improver component. Those NIPF landowners with an investment component were 3.1 times more likely to harvest timber in the future than those who do not have an investment component. Those NIPF landowners who had indicated a legacy owner component were 1.4 times more likely to harvest timber in the future than those who do not have a legacy leaver owner.

Comparatively, those NIPF landowners who indicated a preserver component were .551 times as likely to harvest timber in the future. The final iteration of the reduced model correctly classified 76.5 percent of the 344 observations as opposed to 66.6 percent without the predictors in the model.

Table 3.12 Factor Analysis - Full Logit Regression Model for Cumberland Plateau NIPF landowners

		B	S.E.	Wald	Df	Sig.	Exp(B)
Step 1(a)	Preservers	-.621	.147	17.764	1	>.000	.538 ^a
	Timber1	.133	.145	.847	1	.358	1.143 ^a
	Improvers	.748	.160	21.717	1	>.000	2.112
	Timber2	-.201	.135	2.227	1	.136	.818 ^a
	Agrarian	.167	.139	1.435	1	.231	1.182 ^a
	Recreation	.211	.138	2.347	1	.126	1.235 ^a
	Investors	1.143	.165	47.872	1	>.000	3.136
	Legacy Owner	.371	.140	7.077	1	.008	1.450
	Constant	-.991	.150	43.734	1	>.000	.371 ^a

a Variable(s) entered on step 1: Preservers (PR), Timber1 (T1), Improvers (IM), Timber2 (T2), Agrarian (AG), Recreation (RE), Investors (IV), Legacy Owner (LO)
R²_N = .396

Table 3.13 Factor Analysis – Reduced Logit Regression Model for Cumberland Plateau NIPF landowners

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
							lower	Upper
PR	-.596	.144	17.139	1	>.000	.551	.415	.731
IM	.720	.156	21.450	1	>.000	2.055	1.515	2.788
IV	1.133	.163	48.546	1	>.000	3.104	2.257	4.269
LO	.361	.136	7.055	1	.008	1.435	1.099	1.873
Constant	-.958	.146	43.126	1	>.000	.384		

a Variable(s) entered on step 1: Preservers (PR), Improvers (IM), Investors (IV), Legacy Owner (LO)
R²_N = .374

Conclusions

The results of this research corroborate previous research findings that the majority of NIPF landowners do not rank timber production as the highest management objective. Based on the logistic regression model, those Plateau NIPF landowners most willing to harvest timber in the future had harvested timber in the past, favored timber management as a top ownership objective, received forest management advice in the past, and would consider harvesting timber if it improved the health of their forestland. Factor analysis revealed landowners most likely to consider selling timber in the future would fit into three main component groupings: 1) Improvers; 2) Investors; 3) or Legacy Owners.

Thus, NIPF landowners who had harvested timber in the past, those with timber production as a primary ownership objective, those who had received forest management advice in the past, and those interested in improving the forest health of their forestland, were more likely to harvest timber in the future. As a comparison, the reduced logit regression with factor scores indicated that those NIPF landowners with an improver component, those with investment component, and those with a legacy leaver component were more likely to harvest timber in the future.

The Plateau remains an important component of the Tennessee forest products industry contributing more than \$3.3 billion in economic value in 2000 (English 2004). At the same time, the Cumberland Plateau continues to experience wide-spread forest fragmentation, industrial forest land divestiture, and the lingering effects of the 1998 – 2002 Southern Pine Beetle (SPB) epidemic. Furthermore, since most Plateau NIPF landowners do not intend to harvest timber in the future, their intended actions could

negatively impact forest industry in the region and possibly even the overall forest health of the resource.

Management Implications

The research findings suggest that there is a potential to increase the level of forest management and timber harvesting on the Cumberland Plateau. Given the average age of NIPF landowners is 61.9 years, a large number of tracts are likely to change ownership in the next several decades. The paradox to this theory is that timber management was not highly ranked by survey respondents as the main reason for ownership. With so few landowners receiving forest management advice some may in effect be practicing a poor or “limited management” mode of operation. No plan, no knowledge base, and no direction might eventually lead to another catastrophic insect or disease outbreak that could further curtail the future forest-based economic impact from the Cumberland Plateau region.

On the other hand, the findings could be used by both public agencies and private sector forestry interests to increase the emphasis of forest management objectives and perpetuating the associated forest harvesting operations by Plateau NIPF landowners. Findings from this study, combined with county demographic databases and other NIPF landowner forest management data, might be used to identify those owners most likely to favor consumptive forest management practices. Using data mining techniques, a forester could reduce search time and increase the probability of a successful landowner contact

by targeting those who are most likely to pursue consumptive forest management objectives and/or are likely to harvest timber in the future.

CHAPTER 4

CONCLUSIONS

The Cumberland Plateau in Tennessee has experienced widespread forest parcelization, land-use change, and the loss of the majority of the pine resource. Because of these changes, it will likely continue to be the focus of discussion between environmentalists, resource management agencies and the forest products industry. Nonindustrial Private Forest (NIPF) landowners will continue to be caught in the crossfire as they control the majority of the forestland on the Plateau.

This study provided updated demographic information on Plateau NIPF landowners from which to draw potential forest management conclusions. The overall findings indicate there are no major regional differences between NIPF landowners in the northern and southern regions of the Cumberland Plateau. The socio-demographic information reveals the average landowner was 61.9 years old; was employed as a professional, manager or business owner; and possessed at least a high school education. Moreover, the average landowner earned at least \$25,000 and ranked non-consumptive management objectives important than that of timber management.

The average NIPF landowner controlled between 10 – 100 acres of forest, most often in one tract. Land tenure exhibited a bi-modal grouping, with the 26.9% of ownership tenure in the 0 – 10 year category and 23.1% in the >60 year category. These tenure grouping findings are of importance because the two groupings could represent distinct differences in long-term ownership objectives. Most Plateau NIPF landowners purchased or inherited their land; had not received any forest management advice; did not

have a written forest management plan; and had not received any type of cost-share funding. There also is a moderate probability they lost pine trees during the 1998 – 2002 Southern Pine Beetle epidemic, a high probability they were not able to salvage any timber, or elected to re-plant pine seedlings on the infected area. Finally, there is a high probability that water quality, maintaining quality forest cover, or protecting rare and endangered species rank highly as a top non-timber management objective.

A significant positive correlation was found between respondents who plan to harvest timber in the future with those who had harvested timber in the past, but only 30 percent of all respondents indicated they intended to sell timber in the future. Few significant differences were found between the north and south Plateau groups with respect to timber sales. Plateau owners who had the most experience with past timber sales tended to be 60 years or older, and derive over 75 percent of their annual income from farming. Those owners who harvested timber in the past did so mainly on 50 acres or less and harvested mainly hardwood sawlog products. Less than 23 percent reported that the visual quality of the sale was poor, while only 29 percent reported they utilized the services of a professional forester during the timber sale/harvesting activities.

The logistic regression results confirmed that landowners most willing to harvest timber in the future had harvested timber in the past, favored timber management as a primary ownership objective, had received forest management advice in the past, and would consider harvesting timber to improve the health of their forestland. Factor analysis revealed that landowners most likely to consider selling timber in the future fit into three main components: 1) Improvers; 2) Investors; 3) or Legacy Owners.

The study suggests that county-level demographic NIPF landowner databases could be combined with other federal and state NIPF landowner databases to build simplistic landowner prediction models for replication to other geographical regions. Data mining techniques and spatial analysis tools could ultimately be deployed to help identify and target NIPF landowners with the greatest probability of being motivated to pursue consumptive forest management objectives.

Given natural resource management agencies and private industry are under tighter cost and human resource constraints the deployment of landowner decision models would greatly increase the probability of selecting groups of NIPF landowners who would most likely favor consumptive management objectives. NIPF landowner education and outreach programs could also benefit from using predictor models to narrow down the total pool of potential landowners into specific component groupings for targeted programs. Time and resources could then be spent on landowners who would benefit the most from targeted education and outreach programs.

The following research objectives of this study were addressed and evaluated:

1. Demographic characteristics of NIPF landowners were assessed and comparisons between the northern and southern Plateau counties found few major significant differences between the two groups.
2. Opinions and attitudes of NIPF landowners concerning forest management knowledge and objectives were evaluated, indicating most NIPF landowners do not favor forest management as a primary ownership objective.

3. The motivations of NIPF landowners, both for and against selecting timber harvesting over other non-consumptive management objectives, were explored and documented. The top three non-consumptive ownership objectives were to enjoy scenery ($m = 3.98$), for peacefulness ($m = 3.94$), and to preserve nature ($m = 3.83$). Timber management was ranked as only moderately important ($m = 2.60$).
4. NIPF landowners demographic characteristics, forest land variables, and past experience with timber sales/harvesting were evaluated on the basis as to how they might eventually impact the future availability of timber flow from the Cumberland Plateau.
 - a) the average NIPF landowner controlled between 10 – 100 acres of forest;
 - b) most NIPF landowners purchased or inherited their land;
 - c) many NIPF landowners lost pine trees during the 1998 – 2002 Southern Pine Beetle epidemic;
 - d) Forty-five percent of NIPF landowners indicated that they had previously sold or harvested timber from their forest land;
 - e) most NIPF landowners who had experience with past timber sales tended to be 60 years or older;
 - f) those NIPF owners who harvested timber in the past did so mainly on 50 acres or less;
 - g) most NIPF landowners harvested mainly hardwood sawlog products;

- h) only 29 percent of NIPF landowners reported they utilized the services of a professional forester during the timber sale/harvesting activities;
- i) but only 30 percent indicated they intended to sell timber in the future.

Research results can be used with public and private natural resource groups to both help inform and guide planning efforts for anticipated changes in the forest resource availability due to the apparent changing NIPF owner's management objectives, ownership, and land-use on the Cumberland Plateau. Additionally, given that the research project may ultimately lead to increased awareness of NIPF landowner attitudes and opinions concerning "Willingness to Sell", it will also benefit the University of Tennessee Forestry, Wildlife and Fisheries Department's ongoing research project of "Sustaining Private Forests in Tennessee." Forest industry interests could also gain benefit from the study by using the data and research results to further develop wood procurement programs into utilizing greater collaborative relationships for longer-term management opportunities beyond just the timber sale negotiations and harvesting operations. Environmental organizations could use the research results to better understand NIPF landowner's consumption and non-consumptive objectives, especially when targeting the region for potential ecosystem services.

Ultimately, the dissertation provides a project "plan of attack" for developing similar focused "Willingness to Sell" studies for other geographic areas for natural resource agencies and private forest industry interests.

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APPENDIX

The Survey Instruments

Cumberland Plateau

Landowner Survey

2007



**Department of Forestry, Wildlife and Fisheries
The University of Tennessee**

The University of Tennessee Department of Forestry, Wildlife and Fisheries is surveying private landowner opinions concerning the future of forest land on the Cumberland Plateau. For this study **forest land** is defined as a **minimum of ten (10) acres of tree cover**. Please be assured your answers will be **KEPT STRICTLY CONFIDENTIAL** and will be used only for group comparison for statistical purposes. Thanks in advance for taking the time to fill out and complete the survey.

1. Do you own forest land in Tennessee with at least 10 acres of tree cover? (Please check one.)

- ☐ No (If you do not own forest land, there is no need to continue, but please mail the survey back in the enclosed envelope.)
- ☐ Yes

2. How many acres of forest land do you own on the Cumberland Plateau? (Please check one.)

- | | |
|---|--|
| ☐ less than 10 acres | ☐ 151 – 200 acres |
| ☐ 10 – 50 acres | ☐ 201 – 250 acres |
| ☐ 51 – 100 acres | ☐ 251 – 300 acres |
| ☐ 101 – 150 acres | ☐ more than 300 acres |

3. How did you acquire the majority of your forest land? (Please check one.)

- | | |
|---|--|
| ☐ Purchased it | ☐ Foreclosure |
| ☐ Inherited it | ☐ Tax Assessor sale |
| ☐ Traded (land swap) | ☐ Other (please specify): |
| ☐ Gift | |
-

4. How many years AND generations has your forest land been owned by you and your family?

1. _____ # of years 2. _____ # of generations

5. Do you own more than one tract of forest land on the Cumberland Plateau?

- ☐ No
- ☐ Yes

6. How important is each of the following reasons for why you own forest land on the Cumberland Plateau?

	Not Important	Slightly Important	Moderately Important	Very Important	Extremely Important
a. To pass on to heirs	☐	☐	☐	☐	☐
b. For privacy	☐	☐	☐	☐	☐
c. To preserve nature	☐	☐	☐	☐	☐
d. For financial investment	☐	☐	☐	☐	☐
e. For hunting and fishing	☐	☐	☐	☐	☐
f. For other recreation	☐	☐	☐	☐	☐
g. For wildlife management	☐	☐	☐	☐	☐
h. For timber production	☐	☐	☐	☐	☐
i. For grazing and livestock	☐	☐	☐	☐	☐
j. Part of farm or home site	☐	☐	☐	☐	☐
k. To enjoy scenery	☐	☐	☐	☐	☐
l. Inherited the land	☐	☐	☐	☐	☐
m. It connects me to nature	☐	☐	☐	☐	☐
n. For peacefulness & tranquility	☐	☐	☐	☐	☐
o. It connects me to the past	☐	☐	☐	☐	☐
p. Enjoy working on the land	☐	☐	☐	☐	☐
q. Other (please specify):	☐	☐	☐	☐	☐

7. What do you plan to do with your forest land in the future? (Check all that apply.)

- ☐ Inheritance for heirs
 ☐ Donate it to an endowment fund
☐ Develop it
 ☐ Other (please specify):
☐ Sell it for profit
-

8. Is your primary residence on your forest land on the Cumberland Plateau?

- ☐ No → I live approximately _____ miles from the property.
☐ Yes

9. Within the past five (5) years, have you converted any of your forest land to other uses or forest types?

- ☐ No conversion.
☐ Converted hardwood to pine.
☐ Converted pine to hardwood.
☐ Converted to other land uses (please specify): _____

10. In your opinion, how much of the Cumberland Plateau is currently covered by forests?

- ☐ Less than 25% ☐ 51 – 75 %
☐ 25 – 50 % ☐ More than 75%

11. What is your perception of the current level of land clearing and timber harvesting on the Plateau?

	Very Low	Low	Appropriate	High	Very High
a. Timber Harvesting	☐	☐	☐	☐	☐
b. Land Clearing	☐	☐	☐	☐	☐

12. Have you ever sold or harvested timber from your forest land?

- ☐ No → Please skip to Q13 on the next page
☐ Yes

12a. For the most recent timber sale, did you use a professional forester to administer the timber sale operations?

- ☐ No
☐ Yes

12b. Approximately how many acres were involved in the sale area?

- ☐ 1 – 25 acres ☐ 76 – 100 acres
☐ 26 – 50 acres ☐ More than 100 acres
☐ 51 – 75 acres

12c. What forest products were harvested from the sale area?
(Check all that apply.)

- ☐ Pine Pulpwood ☐ Pine Sawtimber
☐ Hardwood Pulpwood ☐ Hardwood Sawtimber
☐ Tielogs ☐ Veneer/Specialty Logs

12d. What was your opinion of the “visual quality” of the timber harvest area immediately after the logging operations were completed?

- ☐ Poor
☐ Fair
☐ Good
☐ Excellent

13. Have you ever received forest management advice or information concerning your forest land?

- ☐ No → Skip to Q14
☐ Yes

13a. From where or whom did you get the forest management information or advice? (Check all that apply.)

- | | |
|---|--|
| ☐ State Division of Forestry | ☐ University Forestry Professor |
| ☐ Forest Industry | ☐ Logger or Timber Buyer |
| ☐ Consulting Forester | ☐ Family or Friends |
| ☐ Extension Service | ☐ Other (please specify): _____ |

13b. Do you have a written forest management plan with clearly defined goals and objectives for your forest land?

- | | |
|---|------------------------------|
| ☐ No → Do you have an unwritten management plan? | ☐ No |
| ☐ Yes | ☐ Yes |

14. Have you ever participated in government cost-share assistance programs for forestry or wildlife management practices?

- ☐ No
☐ Yes → What program(s)? _____

15. Did you lose any pine trees during the recent Southern Pine Beetle epidemic in Tennessee?

- ☐ No → Skip to Q16
☐ Yes → Approximately how many acres were lost? _____ (acres)

15a. Did you have a salvage timber sale during or after the most recent Southern Pine Beetle epidemic?

- ☐ No → Please explain: _____
→ Skip to Q16
☐ Yes ↴

15b. Did you plant pine trees in any of the Pine Beetle affected area(s) at the completion of the salvage timber sale?

- ☐ No → Skip to Q16
☐ Yes

15c. How many acres were planted? _____ (acres planted)

16. There are many reasons why landowners might want to sell timber from their forest land in the future. Please indicate how important each of the following reasons for selling timber might be to you.

	Not Important	Slightly Important	Moderately Important	Very Important	Extremely Important
a. Motivated by selling price	☐	☐	☐	☐	☐
b. To improve forest health	☐	☐	☐	☐	☐
c. To convert from hardwood to pine	☐	☐	☐	☐	☐
d. The reputation of the logger	☐	☐	☐	☐	☐
e. An urgent financial need	☐	☐	☐	☐	☐
f. For timber stand improvement	☐	☐	☐	☐	☐
g. For wildlife habitat improvement	☐	☐	☐	☐	☐
h. To clear land for farming	☐	☐	☐	☐	☐
i. For real estate development	☐	☐	☐	☐	☐
j. Other (please specify):	☐	☐	☐	☐	☐

17. Are you planning to harvest timber from your forest land in the future?

- ☐ No
☐ Yes

18. Please check the box indicating how important each of the following events would be to you for a successful sale, if you were to ever consider selling some timber.

	Not Important	Slightly Important	Moderately Important	Very Important	Extremely Important
a. Getting a timber appraisal	☐	☐	☐	☐	☐
b. Using a sealed bid process	☐	☐	☐	☐	☐
c. Negotiating directly with a buyer	☐	☐	☐	☐	☐
d. Selling the timber on a lump sum basis	☐	☐	☐	☐	☐
e. Past experience with timber sales	☐	☐	☐	☐	☐
f. Tennessee Master logger harvests timber	☐	☐	☐	☐	☐
g. Following Best Management practices	☐	☐	☐	☐	☐
h. Using "partial cut" harvesting methods	☐	☐	☐	☐	☐
i. Using "clear cut" harvesting methods	☐	☐	☐	☐	☐
j. Professional forester administers sale	☐	☐	☐	☐	☐

19. In your opinion, how much do you think your timber is worth on a dollar per/acre amount? \$_____/acre

20. What dollar per/acre amount would you be "willing to accept" to sell your timber? \$_____/acre

21. Do you derive any non-timber income from your forest land?
I derive

- ☐ income from a hunting lease. → Annual Value = \$_____
- ☐ income from other non-timber activities. → Annual Value = \$_____
(please specify other non-timber activities): _____
- ☐ no non-timber income from my forest land.

22. Please check the box indicating how useful each of the following ways of learning about timber sale/harvesting operations would be for you.

	Not Useful	Slightly Useful	Moderately Useful	Very Useful	Extremely Useful
a. Extension publications	☐	☐	☐	☐	☐
b. Web Link Workshops	☐	☐	☐	☐	☐
c. Forest Landowner Associations	☐	☐	☐	☐	☐

d. Landowner workshops/field days	☐	☐	☐	☐	☐
e. Talking with a professional forester	☐	☐	☐	☐	☐
f. Other (please specify):	☐	☐	☐	☐	☐

23. Harvesting forest land has certain risks and liabilities associated with it. How much risk, if any, do you feel is associated with each item below?

	No Risk	Slight Risk	Some Risk	High Risk	Very High Risk
a. Timber being stolen	☐	☐	☐	☐	☐
b. Property damage	☐	☐	☐	☐	☐
c. Water quality impacts	☐	☐	☐	☐	☐
d. Damage to residual trees	☐	☐	☐	☐	☐
e. Landowner liability	☐	☐	☐	☐	☐
f. Poor wood utilization and waste	☐	☐	☐	☐	☐
g. Beauty of the area affected	☐	☐	☐	☐	☐
h. Other (please specify):	☐	☐	☐	☐	☐

24. Please indicate your level of interest in managing for the following non-timber uses.

	No Interest	Slight Interest	Some Interest	High Interest
a. Enhancing wildlife habitat for hunting	☐	☐	☐	☐
b. Protecting water quality	☐	☐	☐	☐
c. Storing carbon to reduce global warming by maintaining forest cover	☐	☐	☐	☐
d. Maintaining forest cover for aesthetics	☐	☐	☐	☐
e. Protecting rare species	☐	☐	☐	☐
f. Enhancing habitat for birds	☐	☐	☐	☐
g. Other (please specify):	☐	☐	☐	☐

NOTE: If you checked "No Interest" for all items in Q24, Skip to Q28. Otherwise continue with Q25.

25. How useful would you find the following financial incentives in managing for non-timber uses?

	Not Useful	Slightly Useful	Moderately Useful	Very Useful	Extremely Useful
a. Property tax incentives	☐	☐	☐	☐	☐
b. Payments from private individuals or companies	☐	☐	☐	☐	☐
c. Payments from government	☐	☐	☐	☐	☐
d. Other (please specify):	☐	☐	☐	☐	☐

26. Many of the incentive-based programs listed in Q25 place restrictions on the land. How would each of the following restrictions affect your decision to accept financial incentives to manage for non-timber uses?

	Would prevent me from accepting financial incentives to manage for non-timber uses	Would encourage me to accept financial incentives to manage for non-timber uses	Unsure
a. Allow public access to my property.	☐	☐	☐
b. Limit development of my property.	☐	☐	☐
c. Limit my timber harvesting.	☐	☐	☐
d. Prohibit new buildings on my property.	☐	☐	☐
e. Other (please specify):	☐	☐	☐

27. How useful would you find the following information sources for managing for non-timber uses?

	Not Useful	Slightly Useful	Moderately Useful	Very Useful	Extremely Useful
a. Extension publications	☐	☐	☐	☐	☐
b. Web Link Workshops	☐	☐	☐	☐	☐
c. Talking with a professional resource manager	☐	☐	☐	☐	☐
d. Workshops or field days	☐	☐	☐	☐	☐
e. Professional assistance	☐	☐	☐	☐	☐
f. Demonstration areas	☐	☐	☐	☐	☐
g. Other (please specify):	☐	☐	☐	☐	☐

Finally, we would like to learn more about your background. Please be assured your answers are **CONFIDENTIAL** and will **ONLY** be used for group comparisons. No question you answer on this survey will be linked to you personally in any analysis or report.

28. What is your current occupation? (Please check one.)

- | | |
|--|--|
| ☐ Owner of business | ☐ Forestry/Logging/Mining |
| ☐ Professional/Management | ☐ Homemaker |
| ☐ Clerical or office worker | ☐ Government employee |
| ☐ Craftsman/blue collar | ☐ Retired |
| ☐ Farmer | ☐ Other _____ |

28a. If you checked FARMER, what percentage of your total income comes from farming? (Please check one.)

- | | |
|---|---|
| ☐ None | ☐ 50 – 75 percent |
| ☐ Less than 25 percent | ☐ More than 75 percent |
| ☐ 25 – 49 percent | |

29. In what year were you born? _____

30. What is your gender?

- ☐ Male ☐ Female

31. What is your marital status?

- | | |
|--------------------------------------|-----------------------------------|
| ☐ Not married | ☐ Divorced |
| ☐ Married | ☐ Widowed |

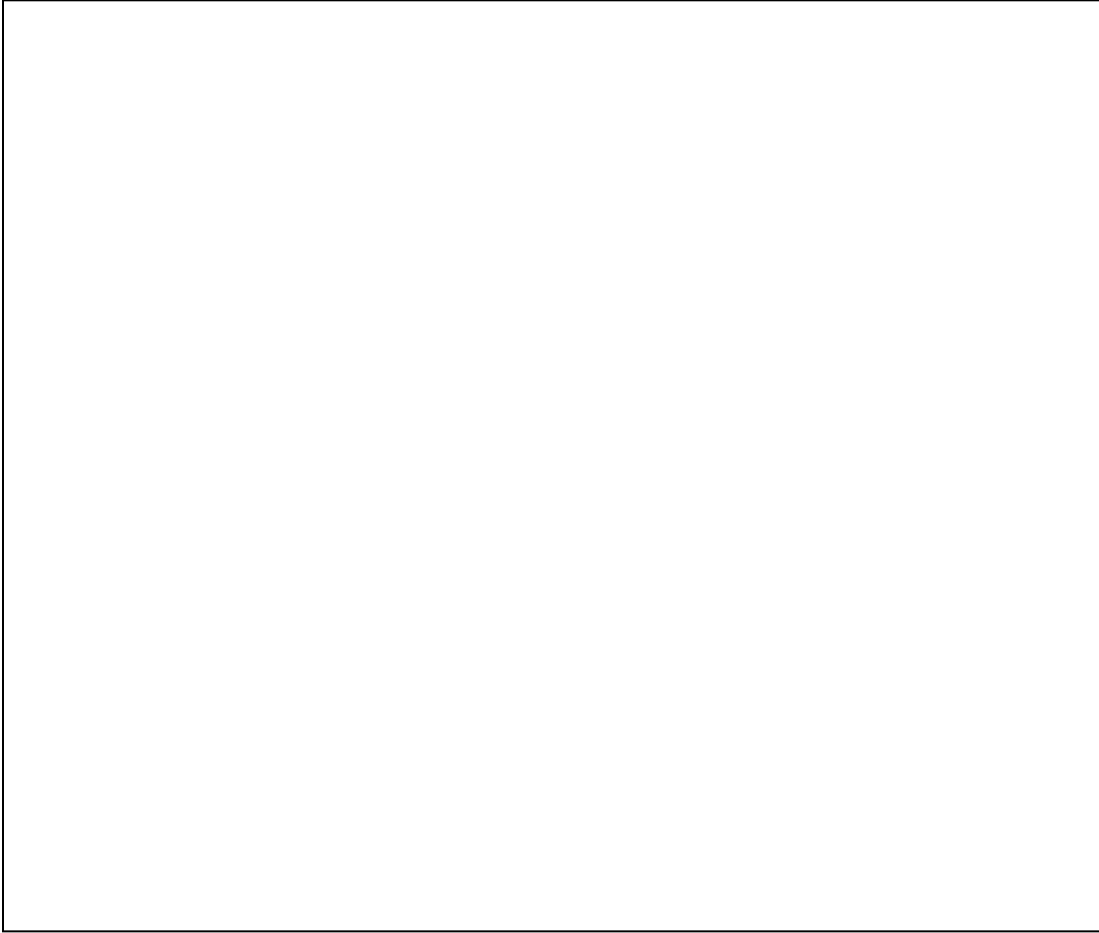
32. What is the highest grade of school you completed?

- | | |
|---|---|
| ☐ Less than High School | ☐ College graduate |
| ☐ High school graduate/GED | ☐ Some graduate school |
| ☐ Some college or Vo-tech training | ☐ Graduate degree |

33. What was your approximate 2006 gross annual income?

- | | |
|---|--|
| ☐ Less than \$25,000 | ☐ \$75,001 – 100,000 |
| ☐ \$25,001 – 50,000 | ☐ More than \$100,000 |
| ☐ \$50,001 – 75,000 | |

Thank you so much for helping with this important study. If you have comments or opinions you were not able to express in the survey, please share them with us in the space below.



**If you would like a summary of the survey results,
please place an X here_____.**

If you have any questions about the survey, please contact Dr. Don Hodges at dhodges2@utk.edu. Please return the questionnaire using the stamped, pre-addressed envelope provided or mail to:

**Cumberland Plateau Forest Landowner Survey
Department of Forestry, Wildlife and Fisheries
2021 Stephenson Dr., Ste. 131
Knoxville, Tennessee 37996**

Pre-mailing Survey Introduction Letter

March 15, 2007

Landowner name
Address
City, St Zip Code

Dear "Landowner name":

I am writing to ask for your help in a research project being conducted by The University of Tennessee, Department of Forestry, Wildlife and Fisheries. In the next few days you will receive a survey from us concerning private forest land on the Cumberland Plateau in Tennessee. The survey is being mailed to a small sample of private forest landowners on the Plateau to learn about forest related interests and activities of landowners like you.

The survey is being conducted through the Natural Resource Policy Center in the Department of Forestry, Wildlife and Fisheries. This study will help local lawmakers, government agencies, interested citizens and business interests have a better basis to establish programs and policies that reflect the interests of forest landowners like you on the Plateau.

We would greatly appreciate you taking the few minutes necessary to complete and return the questionnaire.

Thank you in advance for your help.

Sincerely,

Donald G. Hodges
Professor

Survey Introduction Letter

March 23, 2007

Landowner name
Address
City, St Zip Code

Dear "Landowner name":

The Cumberland Plateau in Tennessee is known for its tourism, outdoor recreation and its vast diversity of plant and animal life. The forests and natural resources of the region remain vital to the people living on the Plateau. Yet, forests covering the Cumberland Plateau are becoming fragmented due to the sale of sizable tracts of timberland, development, and the effects of the Southern Pine Beetle, an invasive species. For four years, beginning in 1998, the Cumberland Plateau lost many of the pine trees in the region due to the invasion of the Southern Pine Beetle. Industrial forest land sales on the Plateau have also increased forest fragmentation. These and other changes in landownership and increased growth and development are causing some concern for the Plateau's future.

We are conducting a study of the region to assist in finding the appropriate balance between forest use and forest conservation. The survey results will better inform policy makers about the activities and opinions of private forest landowners like you. As part of this study, we are contacting a select group of people who own forest land on the Cumberland Plateau to learn about your forest land activities and related views and objectives. In other words, your input counts.

Completing the survey is voluntary and the information you give us is strictly confidential. The questionnaire has an identification number on it for following up non-response only. Once the survey is returned, your name will be deleted from our contact list, and your responses will not be associated with your name.

We would be most happy to answer any questions you may have regarding the study. Please write or email me at dhodges2@utk.edu. Thanks in advance for your help and assistance in this important study.

Please place the completed survey in the pre-addressed, stamped envelope we have provided. If possible, please return your completed survey within two weeks. Your time and effort are greatly appreciated.

Sincerely,
Donald G. Hodges
Professor

First Postcard Reminder

Dear Forest Landowner:

Last week, a survey was mailed to you seeking information about your activities and interests related to your forest land. You were selected because your land lies in our study area, the Cumberland Plateau in Tennessee.

If you have already completed the questionnaire and returned it to us, please accept our sincere thanks! If you have not completed and returned the survey, we would appreciate you doing so at your earliest convenience. Because you are part of a limited number of forest landowners being surveyed, it is important for us to receive your input. This information will be used to inform policy makers about the role of private forest land on the Cumberland Plateau.

If by some chance you did not receive a questionnaire, please email me at dhodges2@utk.edu and I will send you one today.

Sincerely,

Donald G. Hodges
Professor



Follow-up Survey Package

April 23, 2007

Landowner name
Address
City, St Zip Code

Dear "Landowner name":

I am writing to you about our study of Cumberland Plateau forest landowners. If you have already completed the initial survey and sent it back, please accept our sincere thanks. The large number of surveys already returned to us is very encouraging. However, in order to finish the study, having your completed survey would be very helpful.

Our sample size is very small, and we feel your opinions will add valuable information about forest landowner activities and objectives. This is the first comprehensive survey of the region's forest landowners, and with a higher response rate, the findings will more accurately represent the views of all landowners. The results of the study are timely and will be used to inform policy makers about the role of private forest land on the Cumberland Plateau.

In case you don't have the survey we mailed earlier, we have enclosed an additional survey for you to use. Your contribution to the success of this study will be greatly appreciated.

Completing the survey is voluntary and the information you give us is strictly confidential. Once the survey is returned, your name will be deleted from our contact list. Your responses will not be associated with your name, but grouped with others in the presentation of the results.

If you still have any questions regarding this study, please write or email me at dhodges2@utk.edu. Thanks in advance for your help and assistance with this important study.

Sincerely,

Donald D. Hodges
Professor

Second Postcard Reminder

Dear Forest Landowner:

We recently sent you a questionnaire entitled “Cumberland Plateau Landowner Survey.” If you have already completed the questionnaire and returned it to us, please accept our sincere thanks.

Your input into the study is very important to the success of the project. Because you are part of a limited number of forest landowners being surveyed, it is important we receive your responses concerning your activities and interests related to your forest land. This information will help interest groups and policy makers guide the future of forest land on the Cumberland Plateau.

If by some chance you did not receive a questionnaire, please write or email me at dhodges2@utk.edu and I will send you one today.

Sincerely,



Donald G. Hodges
Professor

VITA

Kevin Patrick Hoyt was born in Doylestown, Pennsylvania on April 12, 1959 to Gerald and Margaret Hoyt. Upon graduating from Edgewater High School on June 9, 1978, he entered the University of Montana in Missoula in 1979 to pursue a B.S. degree Forestry. He later transferred to The University of Tennessee, Knoxville, Tennessee, in September of 1981 and was awarded a B.S. in Forest Resource Management in 1983. During his undergraduate career he worked as summer employee for the US Forest Service in Montana and the Florida Division of Forestry. Upon graduation he accepted a Forester-Ranger trainee position with the Florida Division of Forestry in Ocala, Florida. He later worked as a Surveying Technician in Florida and Tennessee.

In April of 1986 he entered graduate school at The University of Tennessee, Knoxville, to pursue a Master's degree in Forestry on part-time basis. In February of 1987 he was awarded an assistantship with the Department of Forestry, Wildlife and Fisheries under the direction of the late Dr. Ray Wells, to study the TVA-ACF Consulting Forester Assistance Program. He was graduated with an M.S. in Forestry, specializing in Forest Management, in June 1988.

From October 1988 to January 1996 he worked for Federal Paperboard, Inc. as a land management forester, procurement forester and Area Wood Procurement Manager in the North and South Carolina regions where he helped to both manage company fee lands and procure wood from NIPF landowners over his seven year career. In February of 1996 he accepted the position of Wood Procurement Manager for the new green-field Oriented Strand Board being built by JM Huber Corporation near Spring City, Tennessee.

From 1996 to 2005, Hoyt worked as Wood Procurement Manager at the Spring City, Tennessee Engineered Wood facility helping to secure the annual wood requirements of the mill, coordinating landowner and logger outreach and acting as the company's Sector Management Representative for the Sustainable Forestry Initiative (SFI) program. During that time period he also was elected as a Board member on the Tennessee Forestry Association (TFA) and since 2005 acted as the TFA's SFI Committee Chairman. Hoyt was recently appointed as the TFA East Tennessee Vice President and asked to reside on the SFI 2010 – 2014 Standard Review Task Force. Since 2005 he has worked for Huber Engineered Woods, LLC, formally JM Huber Corporation, as the company's Sr. Natural Resources Analyst where he helps to investigate and coordinate continuous process improvement initiatives within the company's wood supply chain. The author is a member of Xi Sigma Pi and Gamma Sigma Delta. He has been a member of the Society of American Foresters since 1984.

Hoyt married Lisa Ann Braxton, from Jefferson City, Tennessee, in 1988. They have two children, Brianna Elisabeth (14) and Olivia Grace (9). Hoyt enjoys fly-fishing, continuing education/learning opportunities, traveling to the western United States, camping, and spending quality time with his family. He initiated a Ph.D. in Natural Resources with the University of Tennessee, Knoxville under the direction of Dr. Don Hodges in 2002 to work on this research project. His intention is to continue serving with Huber Engineered Woods, LLC as the Sr. Natural Resource Analyst upon completion of the Ph.D. degree.