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Landowner Decisions and Motivations on the Tennessee Northern Cumberland Plateau: Willingness to Participate in Government Assistance Programs and Reasons for Owning Woodland

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To the Graduate Council:

I am submitting herewith a thesis written by Brandon Russell Kaetzel entitled "Landowner Decisions and Motivations on the Tennessee Northern Cumberland Plateau: Willingness to Participate in Government Assistance Programs and Reasons for Owning Woodland." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Forestry.

Donald G. Hodges, Major Professor

We have read this thesis and recommend its acceptance:

David M. Ostermeier, David J. Houston

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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Brandon Russell Kaetzel
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ABSTRACT

The Tennessee northern Cumberland Plateau is a region rich in history and biodiversity that is currently being faced with increased immigration of retirees and new landowners. This influx of people will lead to parcelization of large tracts of forestland, decreases in timber and water quality, and loss of wildlife and biodiversity. For these reasons it is important that the practice of Sustainable Forest Management (SFM) be adopted in the region. SFM is a tool that can be used to increase biodiversity, improve timber quality, and help to sustain the regional economy. This thesis provides results from two different models that can be used by resource managers to target forest landowners with appropriate information to assist with enrollment in government assistance programs and/or make forest management decisions that meet landowner objectives for forest ownership while still providing timber harvests. Results in Chapter II reveal that landowners would benefit from personal contact with a resource manager when enrolling in assistance programs. Chapter III results reveal that landowners' motivations for owning woodland can be described as privacy, utility, and heritage – each group correlating with different landowner and land characteristics. To promote SFM it is important that resource managers provide appropriate information and personal contact with landowners to help in assistance program enrollment and achieve landowner objectives in ways that improve biodiversity, improve timber and wildlife health, and yield timber.

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CHAPTER I – INTRODUCTION

Sustainable Forest Management

In recent years, there has been recognition of our short-sightedness with regard to our forests and the need to enhance forest biodiversity, productivity, and community development (McDonald and Lane 2002). This realization has led to the creation of Sustainable Forest Management (SFM). SFM arose out of a need to, "manage forests for a broad set of economic, ecological, and social values" (Cubbage et al. 2007, p. 848). SFM can best be defined by the Ministerial Conference on the Protection of Forests in Europe (MCPFE) as,

> The stewardship and use of forests and forest lands in a way and at a rate that maintains their biodiversity, productivity, regeneration capacity, vitality, and their potential to fulfill, now and in the future, relevant ecological, economic and social functions, at local, national and global levels, and that does not cause damage to other ecosystems (MCPFE 2007).

According to Kant (2004), "[t]he concept of SFM is an outcome of dynamism in the human value system, and a reflection of social, cultural, economic, and environmental conditions which are different from the conditions of the nineteenth and early twentieth century" (p. 197). Over a century ago, the forest was looked at mostly as an inexhaustible source of timber. This soon led to sustained timber yield management (SYTM) as it was realized that timber was an exhaustible resource, as land became a constraint in the United States. Next, in this evolution of sustainability it was realized that SYTM was not the absolute answer, and something more was needed that would encompass sustaining biodiversity as well as local, regional, and global economies (McDonald and Lane 2004; Kant 2004).

SFM has been an ongoing regional issue on the northern Cumberland Plateau region of Tennessee. From the earliest settlers to the region to modern day residents problems have persisted about how to best use the land. Early settlers were perplexed with how to survive on the Plateau, and thus they began to clear the land of timber in favor of agricultural and grazing land. In the early 20th Century, national policy makers determined that the best use of parts of the region was for producing electricity – and so the surrounding valleys were flooded. Toward the late 20th Century until the present there have been the challenges of an ever-growing population. Failure to manage the land for multiple sustainable objectives has led to the issues faced today with burgeoning population and development and the threat of decreases in timber production.

Tennessee Northern Cumberland Plateau

History

The Tennessee Cumberland Plateau was largely left alone by European settlers until the late 19th and early 20th centuries with the advent of railroads. Historically, the area was used largely by farming communities and managed through periodic use of fire (Clatterbuck et al. 2006; Gorenflo 2005, Gardner 2005). This use of fire resulted in a patchwork of fields, flats, and meadows on the Cumberland Plateau (Clatterbuck et al. 2006; Williams 1990; Bullard and Krechniak 1956). These forest openings, as the result of frequent and intense fires, provided agricultural land as well as hunting grounds necessary for native-American tribes and later settlers in the region.

The Plateau "remained a mostly inaccessible wilderness until after the Revolutionary War" which was due to "the rugged topography… [making] migration from the east very difficult and dangerous" (Clatterbuck et al. 2006, p.15). As settlers moved west toward the Cumberland Plateau they usually settled in the valley or chose to go around the Plateau following the Tennessee River. The only access to the Cumberland Plateau was through the Cumberland Gap or by following the Cumberland River. The region, rich in diversity, attracted settlers who would later be disappointed by the harsh living conditions of the Cumberland Plateau. Most settlers, disappointed with the Plateau, moved on to middle Tennessee (Clatterbuck et al. 2006; Bullard and Krechniak 1956). Settlers who remained on the Plateau were largely secluded from external forces and developed their own micro-culture, creating extremely close ties to the land (Gardner 2005).

Plateau forests were devastated leading into the Great Depression as the local population overharvested the forests to survive, providing timber for mills along rivers and their own use. This was mostly a result of northern interests and investments in the Cumberland Plateau from the 19th century. From the end of the Civil War until the turn of the 20th century these interests had used the local population to extract resources from the Plateau at amazing rates. This would be the first major example of land use land change in the region (Clatterbuck et al. 2006; Gardner 2005).

It was not until the 1930s and 40s that population shifted toward urban centers in middle and east Tennessee. According to Strickland (2003) the "rural-to-urban population shift", on the Cumberland Plateau was a direct effect of Roosevelt's New

Deal and later the creation of the Tennessee Valley Authority providing new jobs in urban areas. The Tennessee Valley Authority created dams along the Tennessee River providing more costly electric power and jobs to the Tennessee Valley (Held and Visser 1982; Strickland 2003).

The creation of jobs and the flooding of farmland in effect moved many people away from rural settings to established urban areas for work. This created further increases in the population of local major cities (such as Nashville and Knoxville) and led to the abandonment of land on the Plateau. This influx of population resembles the pattern described by Carrion-Flores and Irwin (2004) in which the population moves toward urban centers and then with time back towards the urban fringes to escape the negative externalities associated with densely populated cities. The flooding of the valley also created a still present distrust of big government in what Gardner (2005) refers to as, “the most dramatic collision between frontier culture and the forces of modernity ever to occur in American history” (p.37), and “a lasting legacy of resentment toward land condemnation which is still actively expressed by landowners in the region today” (p. 38).

More recently, exurban growth, or sprawl, on the Plateau can also be explained by the amenities offered by the region. Retirees and others interested in recreation are attracted to the Cumberland Plateau for the scenery and recreation opportunities that exist in the region (Brockett and Wilkinson 2006; Libby 2003). As these groups move toward the Plateau, local communities are forced to accommodate them creating more

exurban growth. Large tracts of land on the Plateau are being split into smaller lots for retiree and second-home development (Brockett and Wilkinson 2006).[1]

Present Condition

The northern Cumberland Plateau of Tennessee has experienced large population growth and development in the last half century (Strickland 2003). Population increases from 2000 to 2005 averaged 4.6 percent for Bledsoe County, 9.1 percent for Cumberland County, 3.2 percent for Fentress County, 2.0 percent for Morgan County, 6.8 percent for Putnam County, and 3.5 percent for Scott County (U.S. Census Bureau 2007). The regional population growth averaged 5 to 10 percent from 1982 to 1992. Cumberland and Morgan Counties grew by more than 28 percent from 1993 to 2003 (Strickland 2003).

From 1982 to 1992 forest area on the northern Cumberland Plateau decreased by 178,900 acres, a change of -2.09 percent (Wear and Greis 2002). The loss was due primarily to urban sprawl (land use land change) and increases in land prices for development, relative to timber and agricultural production. Sprawl on the northern Cumberland Plateau has led to decreases in timber quality, wildlife habitat, and water quality (Bell et al. 1994; Wear and Greis 2002).

The great majority of the northern Cumberland Plateau in Tennessee is controlled by non-industrial private forestland owners, with approximately 855,000

[1] These large tracts being broken up are a result of the divestiture of land by industry on the plateau to development groups.

acres. Forest industry ranked second with approximately 185,000 acres[2] (Schweitzer 2000). Druckenbrod (2005) also notes "across all land-cover classes 23 percent was in public ownership, 21 percent in large private ownership, and 56 percent in small private ownership" (p.11). This is consistent at the national level where 60 percent of America's forests are private forests (Smith et al. 2004). Stein et al. (2005) note that those private forests "furnish diverse habitats for fish and wildlife, providing the key to the conservation of many species" (p.4).

The Cumberland Plateau "is essentially a tableland bounded on both the east and west by sheer rock cliffs" (Clatterbuck et al. 2006, p.9). The Plateau consists of mostly well-drained shallow soils. Historically, fire played an important role in the construct of the forest types and structures of the region, however with the advent of fire suppression, old-growth and young forest habitats on the northern Cumberland Plateau have declined (Wear and Greis 2002). Decreases in old-growth and young forest habitats have led to decreases in wildlife populations that depend on these forest cover types (examples include certain species of warblers and Berwick's wren).

Projections of the potential forest cover of the Cumberland Plateau indicate that current natural forest conditions occupy only half of their native range. Large forest patches are declining in favor of smaller stands. This is due primarily to privately owned lands that only have a fraction of their potential natural forest cover (Druckenbrod 2005).

[2] This number is expected to have decreased since Schweitzer's publication due to industry divestiture of land on the Tennessee Cumberland Plateau.

Justification of Research

The MCPFE definition, defined earlier, of SFM contains the key elements of SFM. Chapter II provides an analysis that can be used by resource managers to better assist landowners in enrolling in conservation aid programs. These programs are targeted at improving timber quality, wildlife habitat, and water quality associated with the land enrolled as well as adjoining properties (Bell et al. 1994; Nagubadi et al. 1996; Thacher et al. 1996).

Greene et al. (2005) reported that SFM and incentive programs complement one another. Their results reveal that the majority of landowners wanted to practice SFM – the problem that they noted was that these programs only play a small role in landowner's management decisions. This is due to the fact that landowner attitudes and objectives change from region to region, as does the available assistance programs. Greene et al. also reported that the best way to assist landowners, besides providing dynamic and adequately funded programs, is to provide personal contact with a resource manager.

Chapter III of this thesis examines the differing non-industrial private forest landowner motivations for owning woodland and the land and landowner characteristics that correlate with these motivations. It is hoped that by understanding these motivations we can assist landowners in accomplishing their objectives while ensuring a sustainable supply of timber – another aspect of SFM. This necessity of understanding landowner motivations and attitudes is echoed in many papers (Greene et al. 2005;

Majumdar et al. 2008; Schelhas et al. 2003). The importance of a sustainable timber supply in the United States is likewise noted by Arano and Munn (2006) and Zhang and Nagubadi (2005). Finally, Chapter IV summarizes the results of the models and how they can be used to better disseminate information to NIPF landowners to implement SFM – the research objective of this thesis.

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CHAPTER II – PREDICTING THE PROBABILITY OF LANDOWNER ENROLLMENT IN CONSERVATION ASSISTANCE PROGRAMS ON THE TENNESSEE NORTHERN CUMBERLAND PLATEAU

Introduction

The northern Cumberland Plateau of Tennessee (Cumberland, Fentress, Morgan, and Scott counties) has experienced large population growth and development in the last half century (Strickland 2003). Population increases from 2000 to 2005 were 9.1% for Cumberland County, 3.2% for Fentress County, 2.0% for Morgan County, and 3.5% for Scott County (U.S. Census Bureau 2007). From 1982 to 1992 forest area on the northern Cumberland Plateau decreased by 178,900 acres, a change of -2.09 percent (Wear and Greis 2002). The loss was due primarily to secondary and retirement home development and increases in land values for development, relative to timber and agricultural production**.** The development of the northern Cumberland Plateau has led to decreases in timber quality, wildlife habitat, and water quality (Bell et al. 1994; Wear and Greis 2002).

State and local leaders are calling for policies to deter forest loss and the problems associated with the continuing population expansion. Conservation assistance programs that offer land owners benefits such as financial incentives and technical assistance are one policy option to address these concerns. These programs usually require the participant to address certain natural resource issues and/or follow regulatory requirements prohibiting certain practices on enrolled land. For instance, plans may prohibit agricultural practices that increase sedimentation in streams or prohibit use of chemicals for agricultural purposes. Programs are targeted at improving timber quality, wildlife habitat, and water quality associated with the land enrolled as well as adjoining properties (Bell et al. 1994; Nagubadi et al. 1996; Thacher et al. 1996).

Few landowners have participated in conservation assistance programs in Tennessee (Bell et al. 1994), and few studies have assessed participation characteristics (Bell et al. 1994; Nagubadi et al. 1996; Strickland 2003).

The objective of this paper is to develop models that can be used as a policy tool to help the state of Tennessee institute state-level assistance programs by estimating their need and possible participants. Specifically, models were developed to predict the probability of landowners participating in conservation assistance programs using landowner and land characteristics, ownership objectives, past management activities, and information sources. The models outlined can be used to identify private landowners who are likely to enroll in conservation assistance programs.

Literature Review

Landowner demographics such as age, education, and gender have been found to be correlated with the likelihood of participation in conservation assistance programs. Some studies have revealed that participation behavior is not related to landowner demographics unless other variables such as management objectives and information sources are included in the model(Nagubadi et al. 1996). For example, age is a questionable measure of participation since older farmers are physically less able and more risk averse; however they may be interested in lower labor requirements and incentives offered by assistance programs (Thacher et al. 1997).

Education has been positively correlated with participation (Bell et al. 1994). With increased education the landowner will be less daunted by program language and

tasks and more likely to enroll (McLean-Meyinsse et al. 1994). Gender is correlated with participation, since women are more sympathetic to environmental causes and thus more likely to participate in conservation assistance programs (Gan et al. 2005, Lambert et al. 2006).

Land characteristics such as land size and tenure are correlated with the probability of participation in conservation assistance programs as well. Large areas of land are more likely to be enrolled in more diverse conservation assistance programs (Bell et al. 1994; Nagubadi et al. 2005; Thacher et al. 1997). Also, larger tracts of land increase the landowner's possible management options (Gan et al. 2005). The landowner may opt to enroll only part of their land, as opposed to all of it, or enroll multiple tracts into different programs. Tenure, the amount of time that land has been under ownership, has been shown to be negatively correlated with participation by woodland owners (Nagubadi et al. 1996).

Landowners who view their land as a long-term financial investment are more willing to actively manage the land and seek assistance in achieving management objectives. Commercial objectives as a reason for ownership, such as timber production as a means of income, have been positively related to participation (Nagubadi et al. 1996). Also, landowners with timber management and conservation objectives such as water quality and wildlife habitat improvement are more likely to participate in a conservation assistance program than those who do not have those objectives (Bell et al. 1994).

Royer (1987) used logistic regression to model reforestation habits of southern landowners. He reported that landowners who were active managers in the past, i.e., those who engaged in tree harvests and plantings, were more likely to participate in conservation assistance programs than those who had not. Royer also found that landowners under a budget constraint were more likely to invest in reforestation when offered technical or financial assistance. Active managers are believed to be interested in financial and technical assistance to reforest areas that have been harvested.

Low participation may be due to misinformed opinions or a lack of knowledge regarding eligibility (Esseks and Kraft 1988). The most common reason for not participating in conservation assistance programs was unfamiliarity. That is, exposure to information increases the probability of landowners participating (Bell et al. 1994; Esseks and Kraft 1988; Gan et al. 2005; Nagubadi et al. 1996; Thacher et al. 1996). In addition to information sources, participation also increases with exposure to educational meetings/groups and extension assistance (Bell et al. 1994; Nagubadi et al. 1996; Thacher et al. 1996). A lack of financial and technical assistance was believed to hamper conservation practices like reforestation (Royer 1987).

Data and Methods

We tested whether landowner and land characteristics, ownership objectives, past management activities, and information sources influence the probability of landowners participating in conservation assistance programs. Data for the models were obtained from a 2005 survey of landowners in eight northern Cumberland Plateau

counties conducted by the Human Dimensions Lab at The University of Tennessee. The survey was mailed to 1,462 landowners in the area. Of this original number, approximately 450 addresses were determined to be bad addresses, resulting in 1,010 verifiable landowners in the area. The response rate was determined to be 39% based on the original 1,462 landowners, and 55% based on the 1,010 verifiable landowners in the area.

The dependent variable created for this model is *enroll* which is a measure of whether a participant is currently or has been enrolled previously in a conservation assistance program. *Enroll* was created by assigning a value of 1 to any case where a survey participant had indicated current or previous enrollment in any of the following programs: Greenbelt Forest Program, Wildlife Habitat Program, Conservation Reserve Program, Forestry Incentives Program, Stewardship Incentives Program, Wetland Reserve Program, Forest Land Enhancement Program, and/or Wildlife Habitat Incentives Program. If the survey participant did not indicate current or previous enrollment in any of the programs a value of 0 was assigned.

Fourteen independent variables were evaluated by the model: *acre*, *tenure*, *female*, *hsch*, *age*, *impfin*, *imptim*, *impwat*, *harv*, *plant*, *infagy*, *inffor*, *infmed*, *infenv* (Table 2-1)[3]. Ten of the independent variables (*female*, *hsch*, *impfin*, *imptim*, *impwat*, *harv*, *plant*, *infagy*, *inffor*, and *infmed) are* dichotomous; the remaining four (*acre*, *tenure*, and *age)* are continuous. The independent variables are described in Table 2-1 and their expected signs are provided. The *a priori* expectations of the variables are

[3] All tables and figures in this thesis are presented in the appendices after each chapter.

consistent with the literature described previously. Because several prior studies offer conflicting results for age and tenure, we tested these two variables with no *a priori* expectations with regard to the direction of the relationship with the dependent variable.

Logistic regression was selected as the instrument of analysis in this model due to the dichotomous dependent variable. Before the model was estimated different tests were used to assess whether collinearity was a problem between the different independent variables. Correlation matrices of the variables were assessed, as well as the variance inflation factor (VIF), after Ordinary Least Squares (OLS) regression (Menard 2002). STATA[4] was also used to calculate odds ratios for each variable. The theoretical model presented is:

$$LOGIT\ P(enroll = 1 \mid X_i) = \beta_0 + \beta_1 acre_i + \beta_2 tenure_i + \beta_3 female_i + \beta_4 hsch_i + \beta_5 age_i + \beta_6 impfin_i + \beta_7 imptim_i + \beta_8 impwat_i + \beta_9 harv_i + \beta_{10} plant_i + \beta_{11} \inf agy_i + \beta_{12} \inf for_i + \beta_{13} \inf med_i + \beta_{14} \inf env_i + \varepsilon$$

Results

The results of the logistic regression are presented below. Diagnostic tests revealed that collinearity was not a problem. Specifically, the largest correlation value estimated was 0.49 between independent variables *tenure* and *age*. Also, the largest VIF was 1.50 for independent variable *infagy* with a mean VIF of 1.23 for all independent variable. Correlation coefficients of 0.80 or higher and VIF's of 10 or higher are indications of high collinearity between correlates that substantially affects the variance of an estimated regression coefficient (Gujarati 2003).

[4] STATA is a data analysis and statistical software package created by StataCorp LP.

Approximately 20 percent of landowners were enrolled in government assistance programs (n=504). The average age of landowners in the study was 60.1 with an average tenure of 21.2 years. Size of property in the study averaged 68.2 acres (Table 2-2). The most important reasons for owning woodland were as a financial investment (50 percent) and watershed protection (64.0 percent). 49.1 percent of landowners had harvested timber from their property before, and 62.0 percent of landowners reported having planted trees before on their property in the study area.

Five independent variables were significant at the .10 level or higher (Table 2-3: Model 1). *Female* and *infagy* were significant at the .01 level, and *acre* and *inffor* were significant at the .05 level. *Hsch* was significant at the .10 level. The results reveal that the amount of land owned was positively related to the probability of participation. The results also indicate that females were 1/3 as likely, approximately 67 percent less likely, to enroll in conservation assistance programs than men. There was a negative relationship between participation in conservation assistance programs and the variable *hsch* suggesting that with completion of high school or higher, landowners were 1/3 as likely to enroll in assistance programs, or approximately 66 percent less likely, according to the odds ratio.

Both variables *infagy* and *inffor* were positively related to the probability of enrollment. Specifically, those who received information from a government agency were 3.2 times as likely to enroll in conservation assistance programs, and those who received information from a forester were over 2.4 times more likely to enroll in conservation assistance programs than those who did not receive information from

either. Overall, Model 1 correctly classified 83.9 percent of 323 observations opposed to 82.7 percent correctly classified without the model.

A second logistic regression was run on variables whose coefficients exceeded their standard errors and those significant at the .05 level or above in Model 1 to create a more parsimonious model (Table 2-3: Model 2). Six independent variables: *acre*, *tenure, female*, *impfin*, *infagy*, and *inffor* were estimated to be significant at the 0.10 level or better. *Female* and *infagy* were significant at the .01 level; *acre, tenure,* and *inffor* were significant at the .05 level; and *impfin* was significant at the .10 level.

There was no change in the coefficient or odds ratio for the continuous variable *acre* in Model 2. The continuous variable *tenure* was significant, indicating that with increased length of ownership the probability of enrollment in a conservation assistance program increases. There was little change in the coefficient and odds ratio for the variable *female*. Independent variable *impfin* had a positive relationship with the probability of enrollment in conservation assistance programs. The model reveals that those with ownership of woodland for financial reasons were 1.8 times more likely to enroll in conservation assistance programs than those with other reasons for ownership. Finally, variables *infagy* and *inffor* were positively related to the probability of enrollment in conservation assistance programs, as in Model 1. Model 2 reveals that those who receive information from a government agency and those who receive information from a forester were 2.4 times more likely to enroll in conservation assistance programs than those who did not receive information from either. Overall, Model 2 correctly classified

84.29 percent of 382 observations as opposed to 82.9 percent correctly classified without the model.

Discussion

The results of the models indicate that several factors affect the decision of landowners to participate in conservation assistance programs. Increased amounts of land were expected to increase the probability of participation in conservation assistance programs. The models suggest that this relationship is positive, confirming the literature and hypothesis of this paper. Increased length of time of ownership (tenure) was expected to decrease program participation. Tenure was not significant in Model 1, but in Model 2, the results indicate that increased tenure was significantly related to participation. One possible explanation may be that new landowners are purchasing smaller tracts of land, as parcelization is becoming a major concern in the region. As a consequence, landowners who have held their land for a longer period are more likely to own tracts that are large enough for management activities and more likely to have management goals that match current conservation programs.

Both Models 1 and 2 suggest that on the Tennessee northern Cumberland Plateau, females were significantly less likely to enroll than males. This contradicts Gan et al. (2005) and Lambert et al. (2006). Although few studies have examined the role of gender in program participation, the contradictory results of our study to recent work may be attributed to the small percentage of female owners in the study area or simply differences in other owner characteristics. Also, the results of Model 1 suggest that

there is a weak significant negative relationship between formal education and enrolling in conservation assistance programs. The differing results for education may be the result of the average education level on the plateau, relative to those in areas of prior work.

Reasons for ownership of woodland such as long-term financial investment, commercial reasons, and conservation reasons were expected to increase the probability of participation. Ownership as a long-term financial investment was the only variable that had a significant relationship with participation. Timber production and water quality exhibited no significant relationship to the probability of participation. Timber production is a marginal operation in the region for most landowners, as a large portion of the Tennessee northern Cumberland Plateau can be characterized by low site productivity and poor quality timber stands. Moreover, water quality concerns have been somewhat muted by the flat topography of the plateau. As a consequence, many landowners did not acquire their property with these factors in mind.

Finally, it was hypothesized that information from government agencies, foresters, media, and environmental groups would increase the probability of enrollment. Past literature indicated that exposure to information about conservation assistance programs and landowner education would increase enrollment. Both Model 1 and Model 2 show a highly significant and positive relationship between receiving information from government agencies and foresters and enrollment in conservation assistance programs. There was also a non-significant relationship between information from media and environmental groups with enrollment. This may suggest

that previous literature was correct that low participation was due to misinformed opinions, lack of knowledge, and that exposure to information increases probability of enrollment.

Conclusion

The purpose of this paper was to develop a model that could be used to predict the probability of landowners enrolling in conservation assistance programs based on landowner and land characteristics. Two models were calculated that reveal the importance of direct contact between professional resource managers and private landowners. Also, the models suggest that landowners are more likely to enroll as the amount of land they own increases. This is an obvious, but particularly salient issue in a region that is experiencing a significant reduction in the average number of acres owned.

The Governor of Tennessee and several state agencies and conservation organizations have identified the northern Cumberland Plateau as a region of concern due to its importance to the state's forest economy as well as the high level of biodiversity. Both are susceptible to the effects of increasing rates of land development and parcelization. One option identified to alleviate some of the negative aspects of land use change is new or modified assistance programs. It will be important to target landowners with information on conservation assistance programs to protect land from urban sprawl and fragmentation. One limitation of the models in this paper was the lack of measures of landowner demographics and their effects on enrollment. Future

research should examine the effects that demographics such as landowner income and landowner dependence on income from their land have on enrollment in conservation assistance programs so that more accurate models can be developed.

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Appendix - Tables

Table 2-1. Dependent and independent variable list for theoretical logistic model for predicting probability of participation in conservation assistance programs

Dependent Variable:		
enroll		1 = Yes 0 = No
	Yes if:	Greenbelt Forest Program Wildlife Habitat Program Conservation Reserve Program Forestry Incentives Program Stewardship Incentives Program Wetland Reserve Program Forest Land Enhancement Program Wildlife Habitat Incentives Program
Independent Variables (signs are expected correlation):		
acre	+	Amount of land owned in study area (acres)
tenure	+/ -	Amount of time majority of land owned (years)
female	+	1 = Female 0 = Not female
hsch[a]	+	1 = Completed high school or higher 0 = Had not completed high school
age	+/-	Age of landowner (years)
impfin[b]	+	1 = Long-term financial investment important reason for owning 0 = Not important
imptim[b]	+	1 = Timber production important reason for owning 0 = Not important
impwat[b]	+	1 = Protecting watershed important reason for owning 0 = Not important
harv	+	1 = Yes, have harvested or cut trees 0 = No
plant	+	1 = Yes, have planted trees 0 = No
infagy	+	1 = Yes, have used information from a government agency 0 = No (Agency = TDEC, USDA FS, NRCS, Farm Bureau, SWCD, County Ext.)
inffor	+	1 = Yes, have used information from a forester 0 = No
infmed	+	1 = Yes, have used information from the media 0 = No (Media = Internet, Books or Magazines, TV, Radio, Newspaper)
infenv	+	1 = Yes, have used information from environmental groups 0 = No

[a] Although most researchers have evaluated the effect of education with college-level education, the education levels of the respondents (and in the region) were such that using high school as the cut-off level provided a better distribution of the population.

[b] A value for 1 was assigned if the landowner indicated that their woodland was important or very important for a long-term financial investment (impfin), timber production (imptim), or for protecting water quality (impwat).

Table 2-2. Summary statistics of land and landowner characteristics (n=504)

Variable	Mean	Std. Dev.	Min	Max
enroll	.1965443	.3978146	0	1
acre	68.19488	180.5853	1	2212
age	60.05532	12.61827	25	98
female	.3401639	.4742503	0	1
harv	.4909091	.5004231	0	1
hsch	.9038855	.2950501	0	1
impfin	.50	.5005565	0	1
imptim	.2083333	.4065873	0	1
impwat	.6396396	.4806465	0	1
infagy	.3917749	.488676	0	1
inffor	.1425486	.3499901	0	1
infmed	.3931624	.4889751	0	1
infenv	.0779221	.2683395	0	1
plant	.6198347	.4859295	0	1
tenure	21.22458	14.27678	3	73

Table 2-3. Variable coefficients and odds ratios from theoretical logistic model for predicting probability in conservation assistance programs

	Model 1 enroll	Model 2 enroll
acre	0.0018**	0.0018**
	(1.0018)	(1.0018)
tenure	0.0161	0.0202**
	(1.0162)	(1.0204)
female	-1.0962***	-0.9852***
	(0.3441)	(0.3734)
hsch	-1.0841*	
	(0.3381)	
age	-0.0080	
	(0.9921)	
impfin	0.5030	0.5661*
	(1.6536)	(1.7613)
imptim	0.3835	
	(1.4675)	
impwat	-0.1013	
	(0.9036)	
harv	-0.2035	
	(0.8159)	
plant	-0.2250	
	(0.7985)	
infagy	1.1553***	0.8761***
	(3.1570)	(2.4015)
inffor	0.8855**	0.8672**
	(2.4241)	(2.3801)
infmed	-0.3789	
	(0.6846)	
infenv	-0.0571	
	(0.9445)	
constant	-1.0107	-2.8273***
Observations	323	382
Pseudo R-squared	0.1928	0.1625
LR Chi^2	57.45***	56.64***
Correctly Classified	83.9%	84.3%
Correctly Classified w/o Model	82.7%	82.9%

Odds ratios are in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

CHAPTER III – UNDERSTANDING LANDOWNER MOTIVATIONS FOR OWNING WOODLAND AND SUSTAINING TIMBER ON THE TENNESSEE NORTHERN CUMBERLAND PLATEAU

Introduction

Many studies have documented that nonindustrial, private forest (NIPF) landowners are underserved (Arano and Munn 2006; Hughes et al. 2005; Measells et al. 2005). That is, landowners lack the knowledge and training ordinarily provided by resource managers and/or government agencies concerning active and effective management of their forestland. This deficiency is in part due to resource managers' lack of understanding of differing landowner objectives and motivations (Arano and Munn 2006; Kittredge 2004).

It is becoming increasingly important to understand landowner objectives and motivations, as we see increasing numbers of landowners with smaller land holdings. Recent research suggests that the South is becoming increasingly important to ensuring an adequate timber supply for the United States (Arano and Munn 2006; Zhang and Nagubadi 2005). Zhang and Nagubadi (2005) reported that the loss of production forests in the South is due largely to parcelization and lack of management. Therefore, understanding landowner objectives in the southern United States is critical to promoting a sustainable timber supply.

Few researchers have attempted to group NIPF landowners based on ownership objectives. Most researchers have treated landowners as homogenous, and thus analyzing them as such – even though they may have different motivations for ownership and views on stewardship. Basic landowner characteristics have been incorporated into research on ownership goals and perceptions only recently (Majumdar et al. 2008; Schelhas et al. 2003). Schelhas et al. further note that, "[s]tudies of NIPF

landowners have consistently shown that they have diverse reasons for owning forest land, they value many different benefits from their lands…. One clear need is for better understanding of land management styles-clusters of practices and management objectives…" (p. 65). Schelhas's sentiment that a better understanding is needed of landowners so that effective policies can be implemented is echoed in many other recent studies (Arano and Munn 2006; Kuuluvainen et al. 1996; Ross-Davis and Broussard 2007).

The objective of this paper is to categorize NIPF landowners of the Tennessee northern Cumberland Plateau based on motivations for owning woodland, and to assess how land and landowner characteristics are correlated with these motivations. Motivation categories were assigned using principal components analysis (PCA) with varimax, orthogonal, rotation. Multinomial logistic regression was then used to assess these relationships. Land managers should be able to use the results to effectively disseminate appropriate information and develop management plans that accomplish landowner objectives while ensuring a sustainable timber supply.

Literature Review

A very small percentage of NIPF landowners have developed written management plans (Kittredge 2004). This is in part due to the wide array of landowner objectives ranging from intense management to doing nothing (Arano and Munn 2006). Measells et al. (2005) stressed that most forest landowners could benefit from a management plan and management improvements. These can only be accomplished if landowners are notified of available services, but the reality is that most landowners are

underserved and do not benefit from such services. Landowners are underserved according to Arano and Munn (2006) because they are "…outside of the loop on information, communication, and networking that would enable them to take positive steps toward managing their forestland" (p. 247). Hughes et al. (2005) echo Arano and Munn by defining the underserved as those who have not used information that would be to their benefit.

Landowners possessing different characteristics as well as objectives make disseminating information increasingly difficult. In order to better assist landowners, it is first necessary to recognize the different reasons for ownership and the different objectives of landowners. Landowners are a "moving target", and resource managers must be able to cater management to differing landowner needs (Kittredge 2004).

Bliss and Martin (1989) assessed the motivations of NIPF landowners in Wisconsin. They interviewed sixteen NIPF managers to determine recurring attitudes of landowners and to demonstrate how qualitative methods can be used to identify management motivations. They reported several important motivations:

1) the role that forest ownership plays in the identity of the family,
2) the concept of the forest as a family environment where they can enjoy each other's company,
3) the idea of "keeping it in the family" – the forest as something to be passed down,
4) the forest as a legacy – leaving your mark,
5) the forest as a source of personal identity – for those that were raised in rural settings.

Likewise, Measells et al. (2005) identified three main motivations of owning woodland in the southern United States:

1) the idea of having something to pass down to their children,
2) the woodland is part of their farm/residence,

3) having woodland as a place to relax and enjoy privacy.

Measells et al. also noted that the majority of those surveyed in Tennessee believed that owning forestland is a good investment, forest management is a good investment, and they have an obligation to manage forestland responsibly. Similarly, Pan et al. (2007) found that aesthetics, investment, and legacy were the most common motivations for owning forestland in Alabama. Pan et al. also reported that while landowners in Alabama still consider harvesting trees, this objective is not a significant motivation.

Kluender and Walkingstick (2000) used K means cluster analysis to assign different NIPF landowner categories using data from a 1995 mail survey in Arkansas. They reported that NIPF landowners who fell into groups labeled timber managers and affluent weekender possessed higher education levels, larger incomes, and were working full time. Landowners in the timber management group were much more active in managing their forestland, whereas the landowners in the affluent weekender category were more interested in aesthetics and recreation. The affluent weekender landowners owned fewer forested acres on average than those in the timber management category. Kluender and Walkingstick contend that while previous studies have revealed that well educated and higher income landowners are more likely to be forest managers – their results demonstrate that they may be more interested in non-market values of the land (the affluent weekender). They argue that the affluent weekender category will sell little timber unless, “harvesting will augment other non-commodity or amenity ownership objectives like wildlife habitat enhancement and aesthetics, such as opening a spectacular vista” (p.157).

Kuuluvainen et al. (1996) suggest that classification-regression models can be used to evaluate the long-term decisions of NIPF landowners. They further note that agencies can better target landowners with appropriate information as a result of such models.

Data and Methods

Data for this model were collected through a 2005 survey conducted by the Human Dimensions Lab at The University of Tennessee. The survey resulted in a response rate of approximately 55 percent based on the 1,010 verifiable addresses of landowners in the 4 county study area of the Tennessee northern Cumberland Plateau.

Following Kuuluvainen et al. (1996), the study utilized a classification-regression model. The dependent variable for this model, *motivation,* was comprised of three sub-variables *motutil* (utility motivation for owning woodland), *motherit* (heritage motivation for owning woodland), and *motpriv* (privacy motivation for owning woodland) assigned using Principle Components Analysis (PCA)[5]. Questions on the survey pertaining to why people own woodland were analyzed using PCA keeping only those components with a minimum Eigenvalue of 1 (Kaiser's Rule). The components were rotated using varimax (orthogonal) rotation. The new sub-variables were then created using the predict command in STATA. Depending on which motivation category (sub-variables *motutil*, *motherit* and *motpriv*) landowners scored highest, they were assigned a corresponding value of 0-2 for the multinomial logistic (mlogit) regression. If the landowner scored higher on subvariable *motpriv*, for example, they were assigned a

[5] STATA (Intercooled v9) was used for all statistics in this paper – developed by STATA Corp.

value of 1 for the dependent variable *motivation* (see Table 3-1). Individuals with missing data were assigned a value of 3 assuming they were undecided on what their motivations for ownership were.

Independent variables for this model are shown in Table 3-1. Three independent variables *attenjoy, attlegacy*, and *attprofit* were assigned using PCA to group landowners into different component groups based on their responses to a series of statements concerning what their woodland means to them. These three independent variables were created using the same routine that was used to create sub-variables *motutil*, *motpriv* and *motherit*.

Before running mlogit regression in STATA, the variables were assessed for collinearity by analyzing their variance inflation factors (VIFs) after an ordinary least squares (OLS) regression. VIFs less than 10 are generally accepted as having no issues with collinearity (Gujarati 2003). Also, the likelihood-ratio tests and Wald tests for independent variables were examined.

Mlogit regression was estimated without any *a priori* expectations of the independent variables, due to inconsistencies in the literature pertaining to correlations of land and landowner characteristics with motivation categories, using the undecided motivation category as the base outcome so that the independent variables' correlations with heritage, privacy, and utility motivations could be assessed. After running mlogit regression, the summary statistics of the independent variables were rendered. Due to the difficulty of interpreting odds ratios of mlogit regression, an odds ratio plot was created to more easily identify patterns (Long and Freese 2006). Finally, summary

statistics were calculated for landowners who had utilized information sources concerning their woodland.

Results

The average tenure of woodland ownership for landowners in this study area was 18.6 years with an average amount of 63.5 acres (n=504) (Table 3-2a). The summary statistics reveal that roughly one- half of the landowners in the study area have harvested timber in the past. Few landowners in this study area, 3.9 percent, had written management plans for their woodland (Table 3-2b). However, 77.2 percent of the landowners in the study area indicated that they were actively managing their land (Table 3-2b) – these results are similar to those reported by Ross-Davis and Broussard (2007). Approximately 80.1 percent of landowners surveyed reside in the study area.

Factor loadings for the dependent variable's sub-variables utility, privacy, and heritage (motivations for owning woodland) are reported in Table 3-3. Landowners with a utility motivation were interested in owning woodland for timber production, collecting firewood, hunting and fishing, and as a long-term financial investment. Landowners with a privacy motivation were interested in having trees surrounding their property, privacy, and learning more from nature. Finally, landowners with a heritage motivation were interested in owning woodland because it was part of their family heritage and to pass on to their children or other heirs.

Factor loadings for the independent variables enjoy*,* legacy, and profit (agreement with statements regarding what woodland means to landowners) are provided in Table 3-4. The statements most popular among respondents for each

category involved enjoying the outdoors (enjoy), thinking of their woodland as a legacy to pass on (legacy), and thinking of the land as a financial investment (profit). After OLS regression the highest VIF is 1.16 for independent variable *tenure*, and a mean VIF of 1.09 for all independent variables implying that collinearity is not an issue in the mlogit model.

Independent variables *attenjoy* and *attprofit* both were significant at the .01 level, revealing correlations with the heritage motivation of owning woodland (Table 3-5). As landowners' factor scores for *attenjoy* increased, they became less likely to have a heritage motivation for owning woodland. Conversely, as landowners' factor scores for *attprofit* increased, they were more likely to exhibit the heritage motivation.

Independent variables *acre*, *attenjoy*, *attlegacy*, *attprofit*, *employ*, and *harvest* were significantly correlated to the privacy motivation for owning woodland (Table 3-5). As acreage increased, the landowner was more likely to have a privacy motivation. As a landowner's factor scores for *attenjoy* and *attprofit* increased, they were less likely to have a privacy motivation. Similarly, as a landowner's factor score on *attegacy* increased they were more likely to have a privacy motivation. If a landowner was employed, the odds that they are motivated by privacy increased by 2.1 times from those with undecided motivations for ownership, and if a landowner has harvested trees before, his/her odds of having a privacy motivation was approximately 50 percent less than those with undecided motivations (Figure 3-1).

Similar to privacy, the utility motivation was significantly related to *attenjoy*, *attlegacy*, *attprofit*, *harvest*, and *reside* (Table 3-5). As the factor scores for *attenjoy* increased, the likelihood that the landowner possessed a utility motivation for woodland

ownership increased. *Attlegacy* and *attprofit*, however, both decreased the likelihood that a landowner possessed a utility motivation as landowners' factor scores for these two variables increased. Those who have harvested timber from their woodland were 60 percent less likely to have a utility motivation for owning woodland than those with undecided motivations, and landowners who reside on their land were almost 3 times as likely to have utility motivations as those with undecided motivations (Figure 3-1).

Landowners with a utility motivation were more interested in owning their land for enjoyment than landowners in the other categories. Landowners were as likely to have a privacy motivation, rather than a heritage motivation, as their factor scores for *attlegacy* increased. As factor scores for *attprofit* increased, landowners were more likely to have a heritage motivation than privacy or utility. Being employed increased the odds of having a privacy motivation for owning woodland rather than heritage or utility motivations. Finally, residing in the study area increased the likelihood of having a utility motivation rather than a privacy or heritage motivation for owning woodland (Figure 3-1).

As can be seen in Table 3-6, few people surveyed on the Tennessee northern Cumberland Plateau have utilized information sources concerning their woodland and can be labeled underserved coinciding with Arano and Munn's (2006) assertion noted earlier. Only 14.3 percent of landowners had utilized information from a forester and 12.5 percent from the US Forest Service. These results reveal that most landowners in the study area are underserved as denoted by Arano and Munn (2006) and Hughes et al. (2005).

The variables *mgplan* and *tenure* had no significant relationships with any of the motivation categories.

Discussion

The population of the Tennessee northern Cumberland Plateau is increasing, due primarily to an influx of retirees and individuals seeking a more rural setting as can be seen in the results. The increase in these new landowner types may account for the small percentage of landowners in the utility motivation category (20.8 percent of landowners). As Kluender and Walkingstick (2000) note, amenity values of the land may be more important to affluent weekender landowners.

The results reveal that motivations for owning woodland for privacy and heritage are similar to those reported earlier by Bliss and Martin (1989) and Measells et al. (2005). Results for the utility motivation for owning woodland are similar to those of Measells et al. (2005). Their research revealed that Tennessee landowners own woodland as a financial investment and feel they have an obligation to manage it responsibly. Pan et al. (2007) found similar results of a utility motivation in Alabama, noting that residents had waning motivations for harvesting timber.

The results reveal that harvesting timber decreased the likelihood of having either a privacy or utility motivation for owning woodland (harvest was not significant in the heritage motivation category). Also, an interest in profit from the land decreased the likelihood of a landowner being motivated by privacy or utility. Further, these results indicate that landowners are more interested in amenity values of their woodland.

Landowners were less likely to have a heritage motivation as their interest in the land for enjoyment increased. Conversely, landowners interested in their land for profit generation were more likely to hold a heritage motivation. This implies that landowners with a heritage motivation are not concerned primarily with enjoying their property so much as generating money/resources to pass to their heirs.

The privacy motivation was correlated with the amount of acres owned; the importance of woodland for enjoyment, legacy, and profit; employment status; and past timber harvesting. As acreage increased these landowners were more likely to possess a privacy motivation. Timber harvesting was negatively correlated with this motivation category. Landowners would be less likely to have a privacy motivation if they removed trees that would otherwise provide a sense of privacy.

The amount of time that a landowner owned their land was not related to their ownership motivation. That is, long-time owners' motivations did not differ from the motivations of newer landowners. Also, *employ* and *reside* were only significant in one motivation group each. Being employed was only significantly related to the privacy motivation. Owning woodland provides full time employees a place to rest and have a sense of privacy – akin to the affluent weekender category in Kluender and Walkingstick (2000). Also, residing in the study area increased the likelihood that a landowner would have a utility motivation. Having a management plan was not related to any motivation category.

Landowners with a utility motivation loaded high on questions pertaining to owning woodland as a long-term financial investment, for collecting firewood, for timber production, and for hunting and fishing. Even though harvesting timber in the past was

negatively related to this motivation category, this may be due to bad previous experiences or a misunderstanding of what a harvest is (they may have counted a harvest as removing trees from their yard). It is important that information be provided to landowners that fit these criteria, such as landowners that are employed, own an increasing amount of acres of woodland, and have similar motivations for owning woodland.

Landowners with a heritage motivation for owning woodland loaded high on questions pertaining to owning woodland to pass on to my children or other heirs and owning woodland as part of my family heritage. The results of the mlogit regression reveal a correlation between an interest in profit from the forest and a heritage motivation. Conversely, having harvested timber in the past was not correlated with an interest in profit. These landowners could benefit from information and a management plan that allows for profit, stressing silvicultural practices that favor more commercially important species, while leaving behind a landscape that children and heirs will enjoy.

Conclusion

The main focus of this paper has been to explore landowner motivations and objectives that will provide landowners with information to accomplish their ownership and management objectives. As the number of landowners increases and average tract sizes decrease, it will become more difficult to categorize and assist landowners. This is due to more diverse sizes of holdings and objectives of landowners. Future research should continue to examine classifying NIPF ownership motivations, managing NIPF

lands with continually changing land and landowner characteristics, and disseminating information to landowners effectively.

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Appendix A - Tables

Table 3-1. Dependent and independent variables for multinomial logit regression model

Dependent Variable:	
motivation	0 = Heritage motivation for owning woodland 1 = Privacy motivation for owning woodland 2 = Utility motivation for owning woodland 3 = Undecided (Base Outcome)
Independent Variables:	
acre	Continuous – amount of acres in study area
attenjoy	Continuous – based on factor scores
attlegacy	Continuous – based on factor scores
attprofit	Continuous – based on factor scores
employ	0 = Not Employed 1 = Employed
harvest	0 = Has not harvested trees before 1 = Has harvested trees before
mgplan	0 = Does not have a management plan 1 = Does have a management plan
reside	0 = Landowner's primary residence is not in the study area 1 = Landowner's primary residence is in the study area
tenure	Continuous – amount of time landowner has owned the land

Table 3-2a. Summary statistics for independent variables used in multinomial logistic regression (n=504)

Variable	Mean	Std. Dev.	Min	Max
acre	63.5383	177.9732	1	2212
attenjoy	0.0028	1.5285	-8.3800	2.2512
attlegacy	-0.0215	1.3240	-3.9626	2.3269
attmanage	-0.0059	1.1424	-2.7820	3.0830
employ	0.5697	0.4957	0	1
harvest	0.5072	0.5006	0	1
mgplan	0.0409	0.1982	0	1
reside	0.8005	0.4001	0	1
tenure	18.5601	13.9179	1	71

Table 3-2b. Percentage of landowners responding to characteristic questions (n=504)

Response	Question			
	Harvested Timber Before	Have a Written Management Plan	Consider Yourself an Active Manager	Residence in the Study Area
No	50.91	96.10	22.83	19.59
Yes	49.09	03.90	77.17	80.41

Table 3-3. Factor loadings of landowner motivations concerning why they own woodland

	Factor Loadings		
Landowner Motivations	Privacy	Utility	Heritage
To pass on to my children or other heirs	0.0183	0.0012	**0.6856**
As part of my family heritage	-0.0285	0.0012	**0.6928**
As a long-term financial investment	0.1236	**0.3926**	-0.0361
To collect firewood	0.0806	**0.4911**	-0.0827
For privacy	**0.5473**	0.0346	0.0193
For timber production	-0.1230	**0.6249**	0.0085
To have trees surrounding my primary or vacation home	**0.6220**	-0.0253	-0.1040
For hunting and fishing	0.0389	**0.4567**	0.1153
To learn more from nature	**0.5235**	-0.0615	0.1319
Percent Landowners in Category[a]	17.86	20.83	29.96

[a]The undecided category (base) accounted for 31.35 percent of landowners

Table 3-4. Factor loadings of landowner attitudes concerning what their woodland means to them

	Factor Loadings		
Landowner attitudes	Enjoy	Legacy	Profit
I am sometimes in awe of the beauty of my land	**0.5515**	-0.0516	0.0022
My land gives me the opportunity to enjoy the outdoors	**0.5858**	0.0179	0.0018
I think of my land primarily as a financial investment	0.0195	-0.1522	**0.7101**
I like knowing that I can sell trees if I need the money	-0.1059	0.1632	**0.5386**
I enjoy relaxing on my property and taking in the natural surroundings	**0.5750**	0.0362	-0.0053
Owning land means I can do with it what I please	0.0996	0.1306	**0.4504**
I like to think of my land as a legacy that I will pass on to my children	0.0186	**0.6849**	-0.0527
My land is an important part of my family's heritage	-0.0124	**0.6781**	-0.0034

Table 3-5. Results from multinomial logistic regression

	Heritage Motivation	Privacy Motivation	Utility Motivation
acre	0.0011	0.0020*	-0.0021
	(0.0011)	(0.0011)	(0.0023)
attenjoy	-0.2788***	-0.2880**	0.4542***
	(0.0991)	(0.1199)	(0.1222)
attlegacy	0.0140	0.9189***	-0.1890*
	(0.1178)	(0.1769)	(0.1129)
attprofit	0.3355***	-0.3692**	-0.2584*
	(0.1291)	(0.1449)	(0.1438)
employ	0.4254	0.7011**	0.3256
	(0.2783)	(0.3241)	(0.3064)
harvest	0.1253	-0.6296*	-0.7762**
	(0.2877)	(0.3295)	(0.3111)
mgplan	0.3222	-1.2597	-0.5447
	(0.5943)	(1.1704)	(0.8971)
reside	0.3376	0.1329	1.0480**
	(0.3356)	(0.3839)	(0.4198)
tenure	-0.0033	-0.0035	-0.0167
	(0.0102)	(0.0113)	(0.0132)
Constant	-0.5929	-0.9009**	-0.7027
	(0.3931)	(0.4433)	(0.4880)
Observations	416	416	416
Pseudo R^2	0.1478		
LR Chi^2	168.94***		

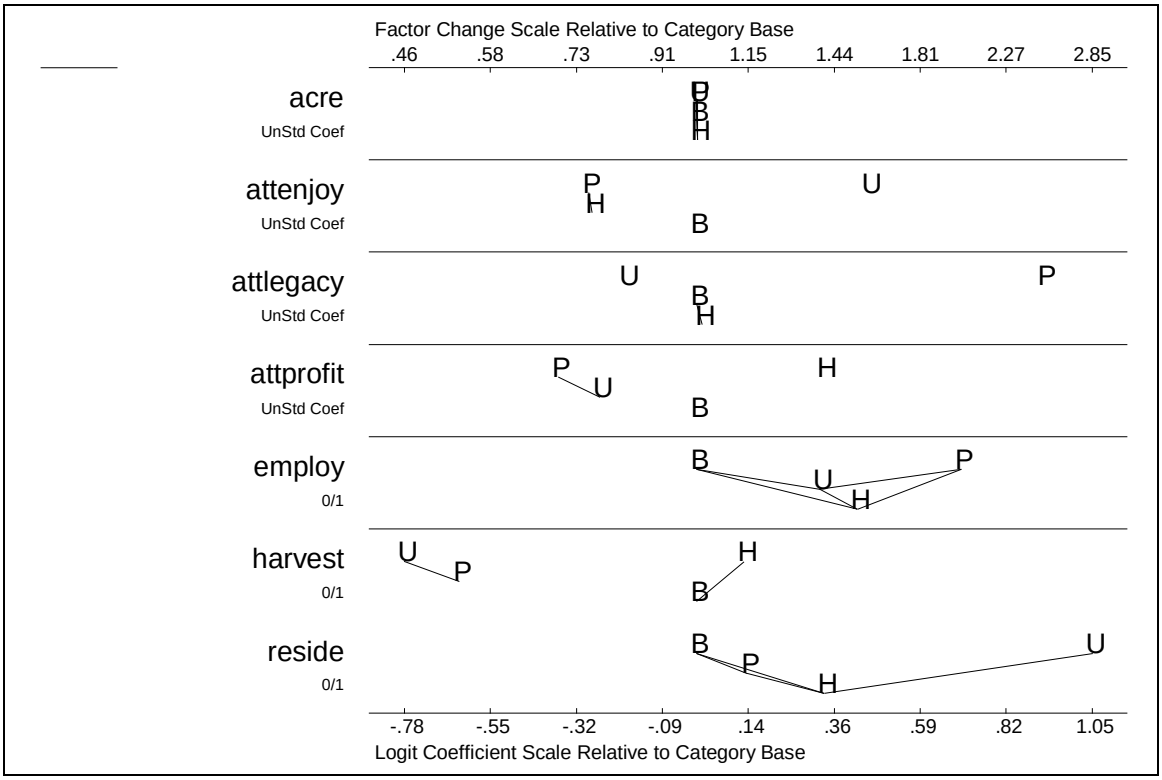
Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3-6. Percentage of landowners in survey who have utilized information sources concerning their woodland (n=504)

	Information Source						
Response	TDEC[a]	USDA[b] FS	NRCS[c]	Farm Bureau	SWCD[d]	Forester	County Extension
No	86.80	87.55	93.29	81.21	86.98	85.75	80.30
Yes	13.20	12.45	06.71	18.79	13.02	14.25	19.70

[a]Tennessee Department of Environment and Conservation
[b]United States Department of Agriculture, Forest Service
[c]Natural Resources Conservation Service
[d]Soil nd Water Conservation District

Appendix B - Figures



(B)ase (undecided); (H)eritage; (P)rivacy; (U)tility

Figure 3-1. Odds ratio plot for mlogit regression of independent variables significant at the .10 level or higher

CHAPTER IV - SUMMARY

The Tennessee northern Cumberland Plateau is a region rich in history and resources, and should receive increased attention to protect the region's natural resources for future generations to enjoy. This can be done by embracing the direction of SFM as pointed out in the first chapter of this thesis. It is important that we seek to protect biodiversity while ensuring a sustainable supply of timber that strengthens the regional economy.

Brockett and Wilkinson (2006) note that the land base in the region is changing as large tracts are disaggregated into smaller units. The previous land holders may have had more homogenous objectives, whereas newer NIPF landowners have many different objectives that we do not necessarily understand (Arano and Munn 2006; Kittredge 2004). Protecting the region's biodiversity may be possible with the use of conservation assistance programs. As noted by Greene et al. (2005) these programs should complement SFM. Greene et al. further contend that the largest hindrance to the relationship between SFM and these assistance programs is the differing objectives of landowners and the many types of available programs. They further stated that the best way to assist landowners is to provide them contact with a resource manager.

The conclusions of Greene et al. (2005) support the results of Chapters II and III. Chapter II reveals that contact with a resource manager increased the probability of landowners enrolling in conservation aid programs that improve timber quality, wildlife habitat, and water quality. These programs complement SFM, as noted by Greene et al. (2005), by protecting biodiversity and promoting a sustainable timber supply via improving timber quality. Enrollment in assistance programs was also positively related

to large acreage and long tenure. One reason for this may be that larger land holders would be those who had owned their land the longest and owned larger tracts – new land owners are buying smaller tracts due to parcelization. The larger land holders with longer tenure have more land to enroll in conservation assistance programs. As parcelization persists, it will become increasingly important to conserve land for SFM to be an option.

Chapter III builds on previous literature addressing landowner objectives for owning woodland. Understanding landowner objectives can be beneficial for ensuring a sustainable timber supply that strengthens the regional economy of the Tennessee northern Cumberland Plateau. This is increasingly important as noted by Arano and Munn (2006) and Zhang and Nagubadi (2005) whose research asserts that the South is becoming increasingly important to ensuring an adequate timber supply for the country.

The results of the multinomial logistic model presented in Chapter III reveal three motivations for owning woodland on the Tennessee northern Cumberland Plateau: privacy, utility, and heritage. Landowners had very different ideas of what their woodland means to them for each motivation. The results of the model presented in Chapter III reveal that landowners may be more interested in non-market values of their woodland (which, may account for the small percentage of landowners with a utility motivation). Approximately 50 percent of landowners had harvested timber from their property. Landowners who had harvested timber in the past were less likely to have a privacy or utility motivation. This negative correlation between harvesting timber and motivations for privacy and utility could be remedied by disseminating appropriate

information to landowners about the importance of timber management and providing contact with a resource manager. This negative correlation need not be the case, as most landowners could benefit from timber harvests that may provide more privacy and utility to the landowner.

One interesting observation is that there was only a correlation between increased acreage and a privacy motivation for woodland ownership. These landowners with larger holdings may also benefit from information about government assistance programs described in Chapter II. Government assistance programs are usually better applied to those with larger land holdings, since they have more land for more options of management. While the annual profit of an assistance program may not pique the landowner's interest in an assistance program, the conservation of the land enrolled will fit their legacy attitude while still providing privacy.

It is worth noting that the heritage motivation did not correlate with harvesting timber. This is interesting when considering that this motivation did, however, have a positive correlation with landowners having an attitude for profit. While it makes sense that a landowner with a heritage motivation would have an attitude toward profit – it is interesting that they do not correlate with having harvested in the past. It is especially important to contact landowners with this heritage motivation to explain that timber harvests can provide profit and still leave behind a healthy forest to pass on to heirs. These same landowners could benefit from information concerning assistance programs, from Chapter II, that would improve timber health for a future harvest, while protecting the land to pass down to heirs, and provide an annual profit.

The overarching theme of this thesis is the need for effectively disseminating information to landowners concerning government assistance programs and the importance of management. Both chapters have stressed that resource managers must provide needed information to landowners that,

1) helps conserve land for biodiversity while promoting timber and water quality,
2) accomplishes landowner objectives,
3) and ensures a sustainable supply of timber that strengthens the regional economy.

While these three things are important, the top-priority should be to gain the trust of NIPF landowners. One example of distrust, as noted by Gardner (2005), was the flooding of the surrounding valley causing distrust among landowners of government agencies. Gardner also identified the micro-culture that has developed on the Plateau.

Resource managers have to find a way to build back public trust that encompasses the culture of the landowners in the region. This will be a complicated task as this culture broadens with the influx of new landowners in the region. Gaining trust can only be done by using a bottom-up strategy that recognizes the diversity of needs for landowners and tries to reach out to them. Resource managers and agencies have to be proactive in providing information instead of expecting landowners to come to them first. Without garnering landowner trust via understanding their goals and reaching out, it will be very difficult to attain SFM in the region that would protect biodiversity while allowing for timber management and yield. Further research should look at how landowners perceive resource managers and government agencies, and how public trust can be built. Also, as noted throughout this thesis, future research

should continue to determine what information landowners need and how to more effectively disseminate information that meets their objectives.

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VITA

Brandon Russell Kaetzel was born in Hopkinsville, Kentucky on September 16, 1982 to Jason Dale and Kelly Anne. He was raised in Murfreesboro, Tennessee where he attended elementary and high school. At the age of sixteen, Brandon earned his Eagle Scout Award from the Boy Scouts of America. He spent five years as a camp counselor and ropes course director for the Boys Scouts of America at Boxwell Reservation in the Middle Tennessee Council. It would be this experience that would influence his decision to study for a degree in forestry.

Brandon received his Bachelor of Science Degree from the University of Tennessee in Forest Resource Management in 2004. He then studied for the Roman Catholic priesthood before returning to UT in 2006 to earn his Master of Science Degree in Forest Economics and Policy. Brandon has been accepted to Auburn University to study toward a PhD in Forest Economics beginning in the fall of 2008.

Brandon is engaged to Jennifer M. Fortuna and has a cat named Buster. He enjoys nature, theology and good food.