

Factors influencing the use of consulting foresters by non-industrial private forest  
landowners in Mississippi

By

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This study describes landowners' willingness to hire consulting foresters and compares forest management expenses between the 1990s (1995-1997) and 2015. Two thousand and ten Mississippi non-industrial private forest (NIPF) landowners were selected randomly from a tax roll mail list maintained by Mississippi State University. Participants were surveyed to identify the characteristics of those landowners willing to hire consultants and compared the landowners' participation in forestry-related activities during the 1990s and 2015. Results indicated three fourth of the survey participants were not willing to use a consultant to manage their forest land. However, consultant fees have increased from the 1990s to 2015. Landowners with larger forest tracts, higher incomes, and higher education levels were more likely to hire consultants. In contrast, age was negatively correlated with willingness to hire a consultant. These findings would be helpful in designing and implementing more effective policy instruments, and improving landowners' participation in forest management.

## DEDICATION

I would like to dedicate this research to my parents, Mrs. Maiya Devi Godar and late Mr. Hemkul Godar.

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# CHAPTER I

## GENERAL INTRODUCTION

### **1.1 Introduction**

The United States has a large timber resource base with one-third of its land forested (Smith et al. 2004). Most of this timberland is owned by non-industrial private forest (NIPF) landowners (Joshi and Arano 2009). NIPF landowners are defined as private forest owners who do not own or operate wood processing facilities and include families, farmers, and investment and conservation organizations, among others (Butler et al. 2015, Woudenberg et al. 2010). Productivity of NIPF forest land has important implications for the nation's timber supply. In particular, parcel size and application of science-based forest management practices influence short and long-term gains from individual properties. As such, private consulting foresters - trained in scientific forest management - are critical to the maintenance and production of forest resources in the United States.

The Southern U.S., known as the wood basket of the nation, contains 40 percent of the country's timberland (Oswalt 2014). In turn, private forest landowners own 87 percent of the South's 214 million acres of forest land, and their decisions play an important role in timber supply as well as the future of southern forest land (Smith et al. 2009). The South, while often considered a softwood-producing region, has a wide range

of forest types and conditions (Wear 1996). Still, about 23 percent of the country's softwood timber supply is grown in the South (Prestemon and Abt 2002).

Mississippi alone contains 19.3 million acres (65 percent) of forest land and 81 percent of these forest lands are privately owned by NIPF landowners (Oswalt 2015). Many of these landowners use assistance foresters such as government foresters or consulting foresters to manage their forest land. According to Wright (2015), consulting foresters are the most important category of assistance foresters for implementing forestry-related activities on NIPF land. Consulting foresters provide a variety of services so NIPF landowners can optimize their ownership objectives. These services include the preparation of written forest management plans, tree planting, timber harvesting and marketing, timber stand improvement, prescribed burning, and wildlife management (Zhang et al. 1998).

Despite being crucial for maintaining a steady timber supply, studies have suggested NIPF forests are not well managed and are underproductive (Hodges and Cubbage 1986, Wright 2015). NIPF landowners are not aware of available sources of technical and financial assistance, and other benefits they could gain from a consultant. Such lack of knowledge regarding consulting forestry services may prevent landowners from implementing sustainable management activities. As well, consulting fees have been shown to be one of the most important barriers influencing landowner's decision to hire a consultant (Watts 1996). Many landowners, particularly those with small parcels, do not think the benefits of hiring a consultant outweigh the costs (Wright 2015). In addition to consultancy fees, other costs associated with timber management activities influence the decision to hire a consultant. The frequency and magnitude of expenditures

on forestry-related activities indicate the intensity of forest management and, therefore, hint at forest products availability in future markets.

Two nested objectives guided this research, and form the two chapters of this thesis. First, this study explored factors influencing NIPF landowners' decisions to hire consulting forestry services. One important assumption linked to this objective was that landowners seek to maximize the benefits they receive from their property, regardless of their profit- or not-for-profit motivations for owning forest land. In addition, this study assumed that consultants help landowners to effectively reach their objectives through the application of science-based forest management practices. The second objective of this study was to examine how landowners' per acre forest management expenditures changed over two points in time. Several studies (e.g., Moak 1982, Kuhn 1984, Dubois et al. 1997, 1999, 2001, Maggard and Barlow 2017) have reported costs related to forest management practices on NIPF lands. However, there are few comparisons between particular time periods. Each chapter includes a discussion on the application of the findings. Results from this study can be used to develop strategies for effective educational outreach and policies which encourage the utilization of consulting foresters and, consequently, to ensure a reliable supply of quality forest products for current and future generations.

Following this introduction, Chapter II focuses on Mississippi NIPF landowners' willingness to hire a consulting forester. The research question examines the degree to which Mississippi NIPF landowners hire consulting forester based on a number of sociodemographic and forest land characteristics. In addition, these sociodemographic characteristics provide an up-to-date description of Mississippi NIPF landowners. This

chapter reviews previous literature as well as a theoretical framework guiding the analysis. The chapter concludes with policy implications as well as suggestions for future research.

Chapter III compares data regarding expenditures on forest management collected from surveys conducted in 2015 and 1995-1997. Results provide a broad picture of how expenditures have changed over time as related to changing market conditions, landowner characteristics, and other factors. Such an analysis can help to conjecture forest products availability in future markets. As in Chapter I, the paper concludes with research and policy implications. Finally, Chapter IV briefly concludes the thesis with comments tying the chapters together.

## 1.2 Literature cited

- Amacher, G. S., Conway, M. C., & Sullivan, J. (2003). Econometric analyses of non-industrial forest landowners: Is there anything left to study? *Journal of Forest Economics*, 9(2), 137-164.
- Arano, K. G., Cushing, T. L., & Munn, I. A. (2002). Forest Management Expenses of Mississippi's Non-industrial Private Forest Landowners. *Southern Journal of Applied Forestry*, 26(2), 93-98.
- Butler, B. J., Hewes, J. H., Dickinson, B. J., Andrejczyk, K., Butler, S. M., & Markowski-Lindsay, M. (2015). Family forest ownerships of the United States, 2013: Findings from the USDA Forest Service's national woodland owner survey. *Journal of Forestry*, 114(6), 638-647.
- Conner, R. C., & Hartsell, A. J. (2002). *Forest area and conditions*. In Wear, D. N. and Greis, J. G. (Eds.), Southern forest resource assessment. USDA Forest Service, General Technical Report, Southern Research Station-053. Asheville, NC. 635 p.
- Dubois, M. R., McNabb, K., & Straka, T. J. (1999). Costs and cost trends for forestry practices in the South. *Forest Landowner Magazine*, 58(2), 3-8.
- Dubois, M. R., McNabb, K., & Straka, T. J. 1997. Costs and cost trends for forestry practices in the South. *Forest Landowner Magazine*, 56(2), 7-13.
- Hodges, D. G. and Cabbage, F. W. (1986). Private forestry consultants: 1983 status and accomplishments in Georgia. *Southern Journal of Applied Forestry*, 10(4), 225-230.
- Joshi, S., & Arano, K. (2009). Determinants of private forest management decisions: A study on West Virginia NIPF landowners. *Forest Policy and Economics*, 11(2), 118-125.
- Kuhn III, J. F. (1984). *Cost trends of selected forest management activities in the southern United States from 1961 to 1982*. Thesis. Mississippi State University. Mississippi State, MS. 48 p.
- Maggard, A., & Barlow, R. (2017). 2016 costs and trends for southern forestry practices. *Forest Landowner Magazine*, 76(5), 31-39.
- Moak, J. E. (1982). Forest practices cost trends in the South. *Southern Journal of Applied Forestry*, 6(3), 130-132.
- Oswalt, S. N., Smith, W. B., Miles, P. D., & Pugh, S. A. (2014). *Forest resources of the United States, 2012: A technical document supporting the Forest Service 2015 update of the RPA Assessment*. USDA Forest Service, General Technical Report, Washington Office-91. Washington DC. 218 p.

- Oswalt, S. N. (2015). *Mississippi's forests, 2013*. USDA Forest Service, Research Bulletin, Southern Research Station-204. Asheville, NC. 81 p.
- Prestemon, J. P., & Abt, R. C. (2002). *Timber products supply and demand*. In Wear, D. N. and Greis, J. G. (Eds). Southern forest resource assessment. USDA Forest Service, General Technical Report, Southern Research Station-53. Asheville, NC. 635 p.
- Smith, W. B., Miles, P. D., Vissage, J. S., & Pugh, S. A. (2004). Forest resources of the United States, 2002. USDA Forest Service, General Technical Report, North Central Research Station-241. NC. 137 p
- Smith, W. B., Miles, P. D., Perry, C. H., & Pugh, S. A. (2009). *Forest resources of the United States, 2007*. USDA Forest Service, General Technical Report-78. St. Paul, MN. 336 p.
- Watts, L. (1996). Choosing and using consultants. *Management*, 43(4), 58-62.
- Wear, D. N. (1996). *Forest management and timber production in the U.S. South*. Southeastern Center for Forest Economics Research, SCFER Working Paper No. 82, Research Triangle Park, NC. 40 p.
- Wright, W. C. (2015). *2013. Mississippi consulting forester survey*. Thesis, Mississippi State University, Mississippi State, MS. 103 p.
- Woudenberg, S. W. Conkling, B. L., O'Connell, E. B., Lapoint, E. B., Turner, J. A., & Waddell, K. L. (2010). *The Forest Inventory and Analysis database: Database description and user's manual version 4.0 for Phase 2*. USDA Forest Service, General Technical Report, Rocky Mountain Research Station-245. Fort Collins, CO. 344 p.
- Zhang, D., Warren, S., & Bailey, C. (1998). The role of assistance foresters in non-industrial private forest management: Alabama landowners' perspectives. *Southern Journal of Applied Forestry*, 22(2), 101-05.

## CHAPTER II

### FACTORS INFLUENCING THE USE OF CONSULTING FORESTERS BY NON-INDUSTRIAL PRIVATE FOREST LANDOWNERS

#### **2.1 Abstract**

Among other activities, consulting foresters help landowners make critical management decisions and encourage reforestation after final harvest. However, research and anecdotal evidence suggest a large portion of Non-industrial Private Forest (NIPF) landowners do not utilize the services of consulting foresters. This paper describes landowners' willingness to hire a consulting forester. Two thousand and ten Mississippi NIPF landowners were selected randomly from a property tax mailing list maintained by Mississippi State University. Participants were surveyed to determine their attitudes and behaviors regarding consulting foresters, and to identify the characteristics of those landowners willing to hire consultants. A binary probit regression model was used for analysis. Results indicated one fourth of the survey participants were willing to use a consulting forester to manage their forest land. These landowners tended to have larger forest tracts, higher income, and higher education levels than their counterparts. In addition, age was negatively correlated with willingness to hire a consulting forester. The paper concludes by suggesting ways to improve collaboration and communication between consulting foresters and NIPF landowners to increase the quality and quantity of goods and services from NIPF lands.

Key words: Non-industrial private forest, hire, consulting foresters, services.

## **2.2 Introduction**

Timber is one of the most important agricultural crops in the United States. In 2011, eight billion cubic feet of growing-stock was harvested, which accounted for 63 percent of the nation's total growing-stock (Oswalt et al. 2014). The southern U.S., known as the nation's wood basket, makes up 24 percent of the U.S. land area, but contains 40 percent of the nation's timberland (Wear 1996). Further, the majority of timberland in the nation and the South belongs to Non-industrial private forests (NIPF) landowners – 42 percent and 59 percent, respectively (Butler and Leatherberry 2004). This makes NIPF landowners instrumental in determining timber supply for domestic and international forest product manufacturing.

Mississippi's nearly 20 million acres of forest land, comprising more than 65 percent of the state's land area (MFC 2007), tend to be owned by NIPF landowners. As of 2013, eighty-one percent of Mississippi's forest land owned by NIPF landowners, followed by 12 percent owned by public entities (e.g., federal, state and local government), and seven percent by forest industry (Oswalt 2015). The majority (60 percent) of this forest land was comprised of small tracts, i.e., nine acres or less (Hanson et al. 2010). The most common timber species was loblolly pine, comprising 25 percent of Mississippi's forests (Oswalt 2015) with approximately 46 percent of forest land in the saw timber product class, 26 percent in pulpwood and 27 percent in regeneration (MFC 2010). Between 1995 and 2006, Mississippi landowners received more than \$10.8 billion for their standing timber, or nearly \$899 million annually (MFC 2010).

Mississippi NIPF landowners generally receive technical assistance from two sources: (1) state government service foresters and (2) private consulting foresters (Cubbage and Hodges 1986). In the past, landowners may have received assistance from industry foresters; however, this service essentially ended when the forest products industry divested itself of its land holdings in the 1990s. Research has demonstrated that government foresters often assist a high number of clients characterized by small parcel sizes compared with consulting foresters which have more medium and large landowners as their clients (Zhang et al. 1998). While government foresters offer many services free of charge, they tend to be in high demand and are not always available (Wright and Munn 2016, MFC 2017).

Martin (1994) defined a consulting forester as a trained professional forester that works for a private forest owner. A consulting forester helps forest landowners to optimize their objectives and seeks to enhance the future condition and value of the timberland. Also, these foresters' help landowners make more revenue from selling timber, maintain timber quality and health, and manage timber stands efficiently and effectively (Hubbard and Abt 1989). To this end, consultants provide information on financial assistance programs, regeneration, and timber stand improvement, among other activities. Zhang and Mehmood (2001) suggested advice from consultants motivated landowners to actively manage their forest land. As recently as 2013, consulting foresters were reported as the primary resource for professional advice available to landowners (Wright and Munn 2016). However, less than 38 percent of the NIPF landowners in the South use professional forestry assistance (Munn and Rucker 1994). Of those who use

professional forestry assistance, less than 50% hire a consulting forester (Royer and Kaiser 1985, Zhang et al. 1998).

There are many reasons landowners do not hire a consultant, including lack of awareness of benefits consultants provide and expenses associated with investing in a consultant (Measells 2005). Along with low investment in land management activities and low levels of technical knowledge among landowners, failure to hire a consultant often results in (or reflects) passive management which, in turn, can make timberland less economically productive. The primary research objective of this study is to describe forest land characteristics and sociodemographic characteristics of landowners who are willing to use consulting foresters versus those who do not. Following a brief review of the forest landowner literature, a theoretical framework is presented to explain landowners' decisions to hire a consultant. Hypotheses are listed, and then conclusions and implications follow presentation of the study's results.

## **2.3 Background**

### **2.3.1 NIPF landowner characteristics**

There are approximately 386,000 landowners in Mississippi owning, on average 50 acres (Londo 2000). In Mississippi, NIPF landowners are a fairly homogenous group. They tend to be male, college educated, and retired (Birch 1997, Butler and Leatherberry 2004, Measells et al. 2005, Vanderford 2013). More than three-quarters of Mississippi NIPF landowners who had harvested timber in recent years were at least 50 years of age (Gunter et al. 2001). More than half of Mississippi NIPF landowners who had reforested

their land after harvest felt that the advice of a professional forester was highly important (Gunter et al. 2001).

Several decades of research demonstrate that most forest landowners retain their land for timber production, protecting wildlife, passing the land to heirs, and non-timber objectives that include aesthetics, relaxation, and privacy (Frederick and Sedjo 1991, Birch 1996, Amacher et al. 2003, Poudyal and Hodges 2009, Smith et al. 2009). Also, Gunter et al. (2001) found that about two-thirds of Mississippi NIPF landowners who reforested after timber harvest owned at least 100 acres of forest land, and 44 percent of NIPF landowners had used government cost-sharing funds to help cover their reforestation expenses. Southern NIPF landowners were more likely to be involved with timber production than their peers in other regions of the country (Butler and Letherberry 2004).

### **2.3.2 Consulting foresters**

Clark et al. (1992) outlined several benefits of consultants, including increasing landowners' monetary returns; decreasing possible site impacts associated with logging operations; helping landowners realize the value of forest management practices; and increasing their level of satisfaction to pursue future timber operations. A survey carried out by the Association of Consulting Foresters of America, Inc. (1994) found consulting foresters impacted approximately 25 million acres of NIPFs in 1993 at the national level.

In 2013, the Mississippi Board of Registration for Foresters (BORF) licensed approximately 96 percent of consulting foresters who practiced forestry in Mississippi.

Other consultants were licensed to practice in the state through reciprocal agreements. Forty-eight percent of consultants were registered to practice forestry in other states. Two-third of the consultants licensed through BORF dealt with NIPF landowners (Wright 2015). Mississippi forestry consultants offered various primary services such as timber sales operations, inventory cruises, preparation of management plans, boundary line maintenance, site preparation, planting, chemical treatment, and silviculture treatment (Kronrad and Albers 1983). Other services included aerial inspection, wildlife damage appraisal, game management plan, taxation counseling, wetland delineation, use of herbicides, and fertilization (Watkins and Munn 2001). According to Wright and Munn (2016), some consulting foresters also offered various types of mapping services, including, stand mapping, and database management through global positioning system and geographical information systems.

Services may be offered as a one-time activity or on a long-term basis and comprise the full suite of services ranging from regeneration to harvest (known as a turn-key operation) (Martin 1994). Consulting services were provided both in-house, where landowners hired consultants through an individual firm, and sub-contracted, where services involved contracting to an outside entity hired by the consultant. Consultants charged fees based on services provided, property size, travel distance, and time required to provide the service. For many services, “dollar per acre” was the most common fee base and this “dollar per acre” fee decreased as tract size increases, reflecting economies of scale (Wright 2015).

### **2.3.3 Barriers to hiring a consulting forester**

Despite studies suggesting higher income from consultant-led timber sales (one study noted per acre prices were 78 percent greater than non-consultant sales), there are many reasons why NIPF landowners do not hire a consultant (Franklin and Munn 1995). Much of the reticence to hiring a consultant can be traced to a lack of awareness about the technical and financial assistance benefits a consultant can provide. In other words, landowners may not be aware of the services consultant provide (Measells 2005). Further, landowners may not understand or appreciate the benefits of scientific forest management as practiced by a consulting forester. Conversely, some landowners may feel they have no need for assistance because they believe they are already managing their forest land to its highest potential (Davis and Fly 2010).

In addition, many landowners may perceive the benefits of hiring a consultant do not outweigh the fees (Watts 1996). Some may feel they cannot afford consulting services, particularly for activities that cannot be immediately paid for through a timber harvest (Watts 1996, Measells et al. 2005). Further, since 1978, private ownerships of less than ten acres of forest land have been increasing across the Southern U.S. (Birch 1997). However, research suggests more than 100 acres are needed for the highest efficiencies in timber management (Birch 1997). Because most NIPF landowners own relatively small tracts, hiring a consultant can be expensive, even if they are managing for timber.

Urbanization is exacerbating parcelization of forest land into small tracts (Wear and Greis 2002, Butler and Leatherberry 2004). A study carried out by DeCoster (2000) found that about three million acres are being split into pieces smaller than 100 acres

every two years. Besides negatively impacting forest composition and timber production, urbanization will result in a loss of 12 million forest acres between 1992 and 2020, and an additional loss of 19 million before 2040 (Barlow et al. 1998, Mehmood and Zhang 2001, Wear and Greis 2002, Vanderford 2013). In turn, decreased parcel sizes deter landowners from forest management of any kind due to lost economies of scale.

Research has suggested several other factors that influence landowner's decision to hire a consulting forester. The presence of a written forest management plan has been shown to be a key factor (Zhang and Mehmood 2001) and, more generally, a forest management plan is an indicator of active management. However, only five percent of NIPF landowners in the Southern U.S. have a written management plan (Birch 1997, Butler 2008). Besides a written plan, household income has demonstrated a significant effect on hiring a consulting forester (Zhang and Mehmood 2001). Larson and Hardie (1989) found timber seller characteristics such as parcel size, forest type, presence of management plan, and income influenced the decision to hire a consultant to handle timber sales. The same study suggested no significant advantage of assistance for low valued stands; however, active (on site) assistance increased return to landowners with high valued stands (Hubbard and Abt 1989). The research has shown a number of barriers to hiring a consultant even when it may be in the landowner's best interest to do so. This thesis paper aims to contribute to previous research by hiring the theory of utility maximizing behavior to explain the landowner's decision to hire a consultant.

## **2.4 Theoretical framework**

This research is guided by the notion that decisions regarding forest management activities depend on the landowner's utility maximizing behavior (Amacher et al. 2003).

In order to maximize utility, a landowner decides to invest his or her money so that each dollar spent on each product or services purchased yields the equal amount of marginal utility. Individual behavior is driven by behavior intentions, where behavior intentions are a function of an individual's attitude toward an action or activity, subjective norms, and perceived behavioral control (Ajzen 1991). The main idea is that the best predictor of future behavior is the intent to a specific behavior (Ajzen 1991, Tian et al. 2015).

According to the economic theory of utility-maximization, landowners that are considered utility-maximizers take non-monetary benefits such as biodiversity, aesthetics, and recreation into consideration along with timber benefits produced from their forest lands (Finley and Kittredge 2006, Tian et al. 2015). This is important because landowners with multiple objectives have tended to be interested in a wide range of forest related benefits (Kluender and Walkingstick 2000, Butler 2007). In conjunction with sociodemographic and property characteristics, these landowners have also been actively involved with forest management operations and incentive programs (Erickson et al. 2002, Majumdar et al. 2008, Joshi and Arano 2009). In turn, their willingness to participate in management activities makes them more likely to use a consulting forester. Figure 2.1 shows a conceptual model of forest land characteristics, landowner and consulting foresters. Socio-demographic characteristics and parcel size of the landowners are interlinked. Each influences the other. Any expenditure on forest management activities or to obtain benefits from a timber sale could be affected by the forest management plan and membership in a forestry organization. Thus, these landowners execute monetary transactions which would influence them to hire a consultant in order to maximize the utility of their property.

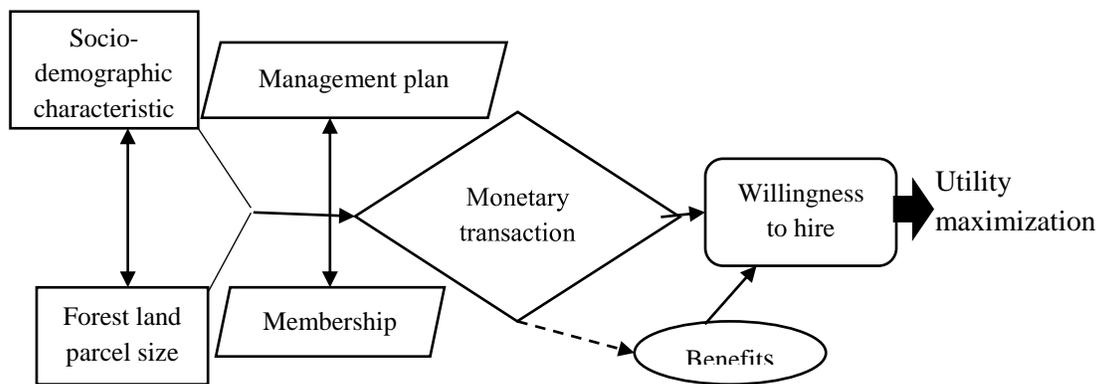


Figure 2.1 Conceptual model of landowner behavior on willingness to hire consultant

The objective of this study was to determine the land and landowner characteristics that are predictors of landowners' willingness to use the services of consulting foresters (based on the assumption that landowners manage forest land to maximize their utility). As part of this objective, and in consideration of Figure 2.1, the following hypotheses were tested: (1) increasing parcel size increases willingness to use consulting foresters; (2) as income increases, willingness to use consulting forester increases; (3) membership in a forestry organization has a positive effect on willingness to hire a consultant; and (4) a written forest management plan will increase the likelihood in hiring a consultant.

## 2.5 Methodology

A random sample of 2,010 NIPF landowners received a mail survey in 2016. The sample frame was generated from a property tax mailing list managed by Mississippi State University, Forestry Department. The seven-page survey instrument included four parts (see Appendix 2). Part I solicited respondents' forest land acreage, willingness to hire a consulting forester, have hired a consultant in the past, possession of a forest management plan, and membership in a landowner organization. Part II comprised

information on forest management activities. Part III asked for information on timber harvests. The last part asked for the respondent's demographic characteristics, including age, gender, household income before taxes, race, and highest educational level. The survey was pre-tested at a local forest landowner association meeting. During the pre-test, participants were asked if the questions were clear and understandable. The survey was mailed to Mississippi landowners using the Total Design Method (Dillman et al. 2009).

### 2.5.1 Data Analysis

To explore the hypothesis of a linear relationship between willingness to use a consulting forester with forest land and NIPF socioeconomic characteristics, a linear regression model was employed and represented as:

$$y = \beta X + u \quad (1)$$

where  $y$  is a binary variable representing whether or not the sample of NIPF landowners used consulting forester services; and  $X$  is the matrix of the variables representing forest landowner socio-economic characteristics (age, gender, income, race, and educational level) and forest land characteristics (parcel size, management plan, membership in landowner association). Finally, the matrix includes any income and expenses related to the participant's forest land management activity.

Next, a binary probit model determined the probability of willingness to use a consultant.

$$P(y_i=1) = \Phi(X\beta) \quad (2)$$

where  $y_i$  is the willingness of NIPF landowner to use consulting foresters' services,  $P(y_i=1)$  is the probability of  $y_i$ ,  $X$  includes the socioeconomic characteristics of NIPF landowners,  $\beta$  is the parameter estimates,  $\Phi$  gives the cumulative distribution function

(cdf) of  $X\beta$ , and  $\varepsilon$  is the error. The set of parameters,  $\beta$ , represent the impact of change in  $X$  on the landowner's probability of willingness to hire a consultant. In a symmetric and normal cumulative distribution, the probit relationship between  $Y$  and  $X$  is:  $\text{Prob}(Y=1|x$

$$\int_{-\infty}^{x'\beta} \Phi(t)dt = \Phi(X'\beta).$$

The probit model has many advantages. The predicted probability is bounded by 0 and 1 and thus it avoids the problem of predicting values outside the probability range. Also, it forces disturbance terms not to be heteroskedastic (Nagubadi et al. 1996). In addition, the marginal effects are computed in the probit model. They can be represented as

Marginal effect =  $\text{prob}[y=1|xd, d=1] - \text{Prob}[y=1|xd, d=0]$ , where  $xd$  indicates means of all other model variables.

The specific model is stated as follows;

$$P(\text{WILLING}=\text{YES}) = f(\text{TACRE}, \text{PLAN}, \text{MEMBER}, \text{MTRANS}, \text{AGE}, \text{GENDER}, \text{INCOME}, \text{RACE}, \text{EDUB})$$

where **WILLING** is willingness of NIPF landowner to use consulting forestry services, **TACRE** is log transformation of total acreage of forest land in Mississippi, natural logs (logarithms base  $e$ ) is preferred because coefficients on the natural-log scale are directly interpretable as approximate proportional differences, **MTRANS** is any monetary transaction for management activities on forested land, **PLAN** is the written management plan, **MEMBER** is the management of forestry organization, **AGE**, **GENDER**, **INCOME**, **RACE**, **EDUB** are age, gender, annual household income, race, and highest educational degree of the landowners, respectively.

Table 2.1 shows the definition and descriptive statistics of the variables selected in the cumulative distribution function of the standard normal distribution

Table 2.1 Definition and descriptive statistics of variable used in the probit model for willingness to hire a consulting forester.

Variable	Type	Definition Units	Mean	Std. Deviation
WILLING	Binary	Interest in using a consulting foresters services, 1 if yes, 0 otherwise	0.38	0.48
TACRE	Continuous	Total forest land in acres, recoded to Natural Logarithm (LN) ACRE	4.29	1.18
MTRANS	Binary	Any monetary transaction for forest management, 1 for yes and 0 for no	0.18	0.39
PLAN	Binary	Written forest management plan, 1 for yes and 0 for no	0.10	0.31
MEMBER	Binary	Membership in a forestry organization, 1 for membership and 0 for none	0.13	0.34
AGE	Continuous	Landowner age in years	66.61	12.42
GENDER	Binary	1 for male and, 0 for female	0.75	0.43
INCOME	Ordered categories	Household income; 11 categories, ranging from 1 (<\$19,999) to 11 (>\$200,000)	4.50	0.43
RACE	Binary	Landowner's race, 1 for white and 0 for all others	0.92	0.27
EDUB	Binary	Landowner's education level, 1 for bachelor degree or more and 0 for all else	0.55	0.49

(N=276)

Variables were compared on the basis of frequency using a chi-square test. An analysis of variance (ANOVA) determined whether willingness to use consulting forester, written forest management plan, member of forestry organization, and education changed significantly over the income class using a =0.05 level of significance.

## 2.6 Results

Landowner characteristics and willingness to hire a consultant are presented as descriptive statistics (frequencies and contingency tables) and a binary probit regression model. In total, 465 surveys were returned for a 23 percent response rate. After omitting the invalid response, only 276 observations were used in the probit regression model. T-tests comparing responses between the first and last 30 respondents did not reveal a non-response bias (Armstrong and Overton 1977). Table 2.2 shows the survey response rate.

Table 2.2 Survey responses rates

Phase I mail out	2,010
Phase I responses	256
Phase II responses	209
Total surveys returned	465
First mailing response rate	12.8%
Second mailing response rate	10.45%
Total response rate	23.25%

### 2.6.1 Respondents' characteristics

Table 2.3 compares the survey sample descriptive statistics to the National Woodland Owner Survey (NWOS). Among five age groups (<40, 41-60, 61-80, 81-100, >100), the largest percentage of the respondents (60 percent) belonged to the 61-80 year age group. The survey mean age of 68 was consistent with NWOS. The majority (71 percent) of respondents were male, while 29 percent were female. Males comprised 71 percent of landowners in both the survey and the NWOS. According to annual household income, 53 percent of respondents had an income less than \$100,000, and 47 percent of respondents had an income more than \$100,000 per annum. The mean income of landowners was between \$60,000 to \$79,999 and \$50,000 to \$99,999 in the survey and

the NWOS, respectively. The majority of respondents (53 percent) held a graduate degree or more, approximately 32 percent of the respondents had less than a high school degree and 15 percent of the respondents had vocational and technical training. For education, 53 percent landowners had at least bachelor degree in the survey whereas 50 percent in NWOS. Ninety percent of landowners were white in the survey while 95 percent of the NWOS were white.

Table 2.3 Comparison of Mississippi’s NIPFs sample estimates obtained via a mail survey with estimates reported in the National Woodland Owners Survey.

Demographic characteristics	Survey sample	National Woodland Owner Survey
Age (mean)	68	65-74 years
Gender	Male (71%)	Male (71%)
Income (mean)	\$60,000-79,999	\$50,000-99,999
Race	White (90%)	White (95%)
Education	At least bachelor’s degree (53%)	At least bachelor’s degree (50%)

(Butler 2008)

The results revealed that only 24 percent of the respondents were willing to hire a consulting forester, whereas 74 percent of the respondents were not and remaining two percent of respondents didn’t know about consulting foresters (Figure 2.2). Similarly, only 10 percent of the respondents had a written forest management plan and the remaining 90 percent did not have a management plan (Figure 2.3). In addition, the majority (87 percent) of the respondents was not involved in any forestry-related association; only 13 percent were members (Figure 2.4).

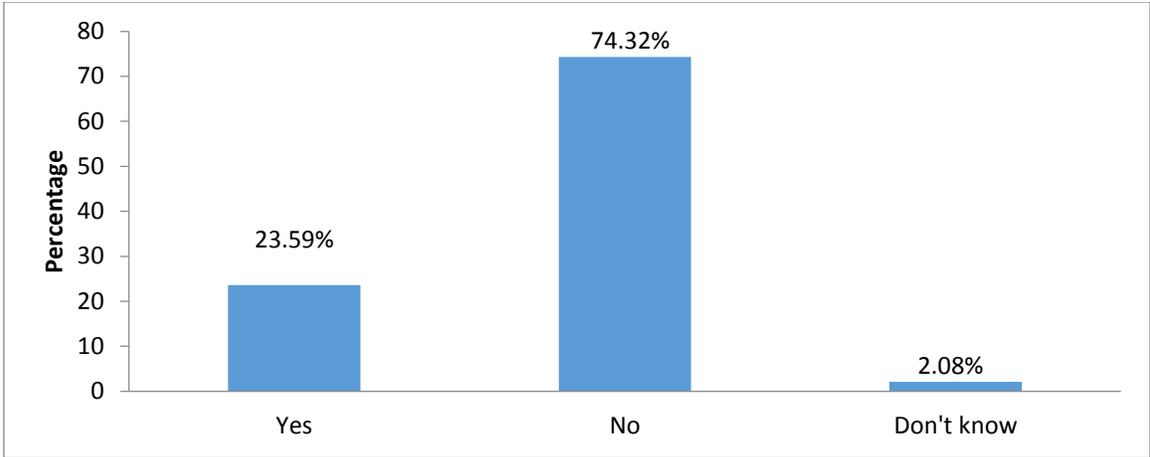


Figure 2.2 Willingness to hire consulting foresters by Mississippi NIPF landowners.

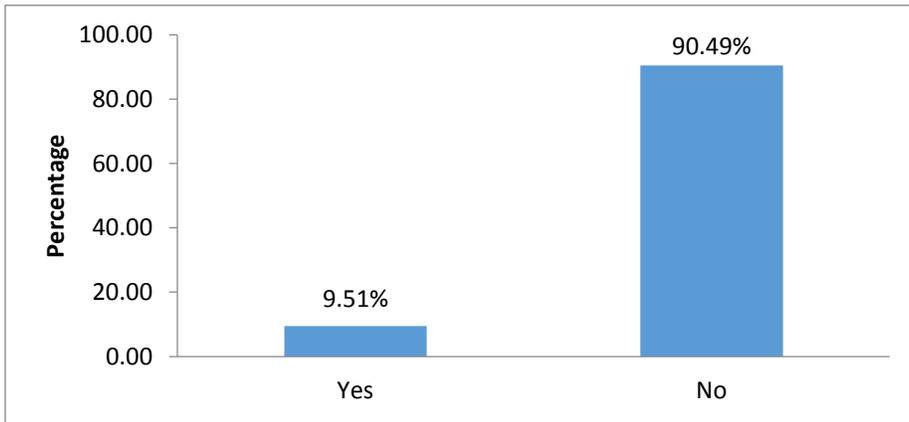


Figure 2.3 Landowners having a management plan

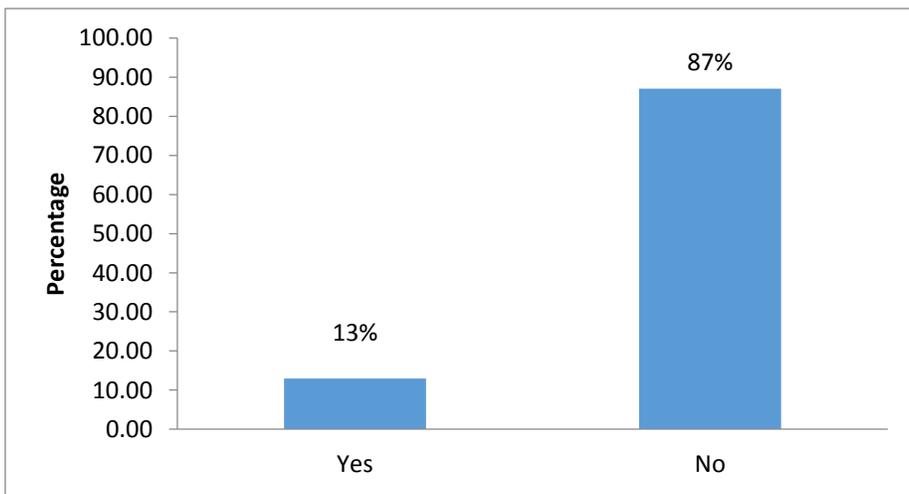


Figure 2.4 Landowners involved in forestry organization

## 2.6.2 Forest land characteristics

The distribution of survey respondents by ownership size is shown in Figure 2.5. Survey participants owned an average of 157 acres of forest land (Table 2.4). Most (66 percent) respondents owned less than 100 acres of forest lands. Similarly, 29 percent of respondents owned between 101 and 500 acres of forest land, whereas the smallest percentage of respondents (5 percent) owned more than 501 acres of forest land. The median ownership size was 75 acres. Parcel size of some respondents in the sample was less than 20 acres. The reason might be explained by an outdated landowner list for that particular county (Arano et al. 2002). Only ten percent of the respondents had a written forest management plan, and less than 13 percent were involved in a forest landowner organization.

Table 2.4 Forest area owned by NIPF respondents in Mississippi, 2015

Statistic	Forest acre
Mean	157
Median	75
Minimum	2
Maximum	2,500

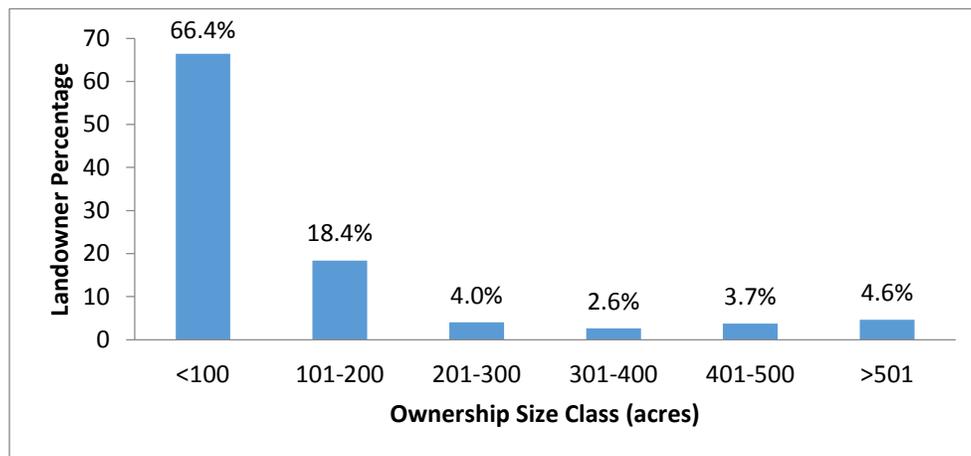


Figure 2.5 Distribution of Mississippi NIPF Landowners by ownership size class.

### 2.6.3 Distribution of respondents by willingness to use a consulting forester

Contingency tables provide a basic picture of the interrelation between two variables and can help find interactions between them. Using Pearson's Chi-square test, if the proportions of individuals in the different columns vary significantly between columns, the two variables are not independent (i.e., there is a contingency). If there is no contingency, the two variables are considered independent. Previous research has found education to be related to hiring a consultant. The Chi-square test therefore was used to determine if there were significant relationships between pairs of categorical variables (Table 2.5). Out of a 122 respondents who did not have a bachelor's degree, 24 were willing to use a consultant. By comparison, out of 154 respondents who had a bachelor's degree or higher, 83 were willing to use a consultant. A Chi-square test revealed a contingency between the two variables ( $p < .0001$ ).

Table 2.5 Association between education level and willingness to use a consultant. (Significance at 0.05 level of significance)

Education level	Willingness to use a consultant		
	Yes	No	Total
Under bachelor degree			
Count	24	98	122
Percent within education	19.67	80.33	100
At least bachelor degree or higher			
Count	83	71	154
Percent within education	38.77	61.23	100
Total	107	169	276

Similarly, Table 2.6 shows the association between membership in a forestry organization and willingness to use a consultant. Out of the 38 respondents who were members of any forestry organization, 25 were willing to use a consultant. By comparison, out of 238 respondents who were not members of a forestry organization, 82

were willing to use a consultant. A Chi-square test revealed a contingency between the two variables ( $p < .0001$ ).

Table 2.6 Association between member of forestry organization and willingness to use a consultant. (Significance at 0.05 significant level)

Member of forestry organization	Willingness to use of a consultant		
	Yes	No	Total
Member			
Count	25	13	38
Percent within member	65.79	34.21	100
Non-member			
Count	82	156	238
Percent within member	34.45	65.55	100
Total	107	169	276

Table 2.7 shows association between forest ownership size and willingness to use a consultant. Out of the 176 respondents who owned less than 100 acres of forest land, only 50 were willing to use a consultant, while 53 percent of respondents owning 101 to 200 acres were willing to use a consultant. Out of the nine respondents who owned between 201 and 300 acres of forest land, three were willing to use a consultant. Similarly, out of 11 respondents who owned 301 to 400 acres, seven were willing to use a consultant. Out of 14 respondents who owned between 401 and 500 acres of forest land, 10 were willing to use a consultant. Finally, among 13 respondents who owned more than 500 acres, nine were willing to use a consultant. This distribution of data shows there is an association between forest ownership size and willingness to use a consultant. A Chi-square test revealed a significant distribution of responses ( $p < .0001$ ).

Table 2.7 Association between forest ownership size and willingness to use a consultant. (Significance at 0.05 significant level)

Forest ownership size	Willingness to use a consultant			
		Yes	No	Total
<=100	Count	50	126	176
	Percent within size	28.40	71.59	100
101-200	Count	28	25	53
	Percent within size	52.83	47.17	100
201-300	Count	3	6	9
	Percent within size	33.33	66.67	100
301-400	Count	7	4	11
	Percent within size	63.63	36.36	100
401-500	Count	10	4	14
	Percent within size	71.43	28.57	100
>500	Count	9	4	13
	Percent within size	69.23	30.77	100
	Total	107	169	276

Respondents' income was linked with willingness to use a consultant (Table 2.8). A total of 28.35 percent of low income respondents (<\$100,000 per annum) were willing to use consulting foresters whereas, 63.41 percent of higher income respondents (>\$100,000 per annum) were willing to use a consultant. A Chi-square test also showed a significant association between income and willing to use a consultant ( $p < .0001$ ).

Table 2.8 Association between annual household income and willingness to use a consultant. (Significance at 0.05 significant level)

Income	Willingness to use a consultant			
		Yes	No	Total
Less than 100,000	Count	55	139	194
	Percent within member	28.35	71.65	100
More than 100,000	Count	52	30	82
	Percent within member	63.41	36.59	100
	Total	107	169	276

Similarly, Table 2.9 shows a significant association between having a written forest management plan and willingness to use a consultant. The majority (77 percent) of respondents with a written management plan was willing to use a consultant; while nearly 34 percent of 246 respondents without a management plan were willing to use a consultant. A Chi-square test revealed a contingency between the two variables ( $p < .0001$ ).

Table 2.9 Association between written forest management plan and willingness to use a consultant. (Significance at 0.05 significant level)

Management plan	Willingness to use a consultant			
		Yes	No	Total
Yes	Count	23	7	30
	Percent within management plan	76.67	23.33	100
No	Count	84	162	246
	Percent within management plan	34.15	65.85	100
	Total	107	169	276

#### 2.6.4 Relationship between socioeconomic variables and willingness to use a consulting forester

Table 2.10 shows a linear probability model indicating that willingness to hire a consultant was related to forest land, age, income and education degree were more likely

to use a consulting forester ( $p < 0.05$ ). Membership in a forestry organization, having a written management plan, gender, monetary transactions, and race were not statistically related to willingness to hire a consulting forester.

As one percent increase in ownership parcels, landowners were 0.07 percent more likely to hire a consultant, holding other factors constant. Landowners with higher annual income were two percent more likely to hire a consultant compared to landowners with lower incomes. Moreover, landowners with a bachelor's degree had a higher probability (17 percent) of hiring a consultant than those with less than a bachelor degree. As age of the respondent increased, the probability of using consulting foresters was diminished by half. Moreover, there was no significant effect of an interaction between age and income, forest acres and income, or education and income. Thus, interaction variables were not used in the final probit model.

Table 2.10 Results of probit model on willingness to hire a consulting forester.

Variables	Parameters	Marginal effect	Standard error	P-value
Intercept	-0.337		0.684	0.621
Forest acre	0.258	0.072	0.100	0.010*
Plan	0.063	0.176	0.339	0.062
Member	0.112	0.031	0.249	0.707
Monetary transaction	0.467	0.130	0.249	0.060
Age	-0.020	-0.005	0.007	0.008*
Race	-0.395	0.110	0.295	0.180
Gender	-0.415	-0.116	0.219	0.057
Income	0.076	0.021	0.035	0.030*
Education Bachelor	0.608	0.170	0.196	0.002*
Likelihood ratio	93.35			
Wald Chi-square	70.89			

(N=276)

\* Significant at level of significance 0.05.

## 2.7 Discussion

This study examined Mississippi NIPF landowners' willingness to use a consulting forester. This study identified a model explaining the relationship between landowners' decision to hire a consulting forester and the landowner's demographic characteristics and forest land characteristics. Forest acreage is positively and statistically significant, suggesting that as the size of forest land increases, the likelihood of hiring a consulting forester increases. Previous studies also found similar behavior among NIPF landowners of Alabama (Mehmood and Zhang 1998, Dyer et al. 2015). This observation is in line with the notion of utilization maximization, which suggests that landowners holding small tracts of forest land are less able than their counterparts to offset the cost of hiring consulting foresters. Such landowners may focus their attention on recreation, aesthetics and biodiversity conservation, whereas larger parcel sizes are more appropriate for income generation. As well, income was positively and significantly related to willingness to hire a consultant, indicating that the likelihood of hiring a consultant increases with income. This might be just a reflection of landowners maximizing their income through harvesting timber and/or leasing hunting rights. On the other hand, forest landowners with a focus on timber production must incorporate forest management activities and potentially use a consulting forester to increase their income, particularly when many mills are limiting their procurement to sustainably managed forests. Similarly, NIPF landowners having higher income are more engaged in forest management decisions and were more willing to hire a consulting forester (Zhang and Mehmood 2001, Joshi and Arano 2009, Knoot et al. 2015).

Education with at least a bachelor's degree was positive and significantly related to willingness to hire a consultant ( $p < 0.01$ ). This means that as education increases, there is an increasing likelihood of hiring a consulting forester. This finding suggests that educated landowners have more awareness and/or knowledge of the benefits of forest management and, potentially, an interest in optimizing utilization of their forest land. As well, the finding reflects previous research which demonstrates that income and education were positively correlated. These landowners may have better understanding of the benefits of hiring a consulting forester in forest management (Munn and Rucker 1994, Zhang and Mehmood 2001). In short, the landowners with higher levels of education, income, and larger forest holdings were most likely to seek assistance from consulting foresters (Bliss et al. 1997, Gunter et al. 2001, Kilgore and Blinn 2004).

By contrast, the age of landowners was negatively significant ( $p < 0.01$ ). This implies that older landowners were less likely to hire consulting foresters. In other words, as age increases, NIPF landowners were less likely to manage forest land, which is in line with the results reported by Becker et al. 2010, Joshi and Mehmood 2011, Aguilar et al. 2014. Thus, hiring a consulting forester may reflect old-aged landowners not willing to manage forest land because of their age and interest to live retired life without the responsibilities connected with management decisions. Several studies also showed rate of harvesting and forest investment decreases as age increases (Romm et al. 1987, Kuuluvainen and Salo 1991). One possible reason for this was older landowners are more likely to delay decisions so that their heirs can make those decisions instead (Kuuluvainen et al. 1996). So the older landowners are more likely to retain the forest land for future generations and participate in little or no harvesting (Joshi and Arano

2009). Moreover, they often want to use forest land for recreation rather than for economic uses. This is in line with the utility maximization theory which states motivations regarding forest management influence landowner's behavioral intentions. Nevertheless, landowners do not seem to make the connection between maximizing non-economic benefits with hiring a consulting forester.

Other factors such as gender, race, member of forestry organization, and a written forest management plan were not significantly related to a willingness to hire a consulting forester in this analysis. This is in contrast with some studies reporting that membership in a forestry organization positively affects willingness to use a consultant (Straka et al. 1984, Nagubadi et al. 1996, Sun et al. 2008). Previous literature has also shown that a written forest management plan was an indication of active forest management, which was positively correlated to the willingness to use a consulting forester (Bettinger 2010).

## **2.8 Implications**

The results help in modeling NIPF landowners' behavior with regards to hiring forestry consultants which may impact participation in forest management and therefore available of forest products to society. Results provide insights on how non-industrial private forest land is managed, actively or otherwise, to provide timber, wildlife habitat, watershed protection, recreational opportunities, and other benefits for landowners and society. Results of this study have implications for policy, education, and future research. Low levels of contracting consulting foresters imply skepticism regarding the benefits consultants provide for financial as well as non-financial objectives. Activities promoting collaboration and communication between consulting foresters and NIPF landowners can

help to clarify the diverse long-term benefits consultants provide. Improved interactions can increase awareness that hiring a consultant, even when timber prices are low, will contribute to a higher future financial return than not having a consultant. Such efforts to improve awareness and knowledge about consulting foresters should reach out to all landowners, but in particular young landowners and those with large parcels, who can in turn influence their counterparts. Extension and outreach programs are well-positioned to contribute to improved interactions and promoting the use of consulting foresters.

Outreach activities, such as workshops and field days, are an excellent vehicle to share ideas and knowledge between landowners and consultants, as well as among landowners. Ideally, this would increase the quality and quantity of forest goods and services from NIPF lands and, as a result, forest landowners would receive higher revenue from their property.

Future studies should consider landowner attitudes in addition to the behavioral factors addressed here. There are several factors such as, ownership objectives, trust in consultants, and environmental concerns, which could influence interest in hiring a consultant. Objectives would clarify financial versus non-financial intentions. Trust in consultants describes the landowner's views on professional knowledge and experience. Environmental concerns may affect willingness to hire a consultant if landowners think consultants only impact financial rather than specific ecological issues. Satisfaction towards previous experiences with a consultant may also have an impact. In addition, such factors should be tested using other conceptual frameworks, such as the Theory of Reasoned Action and the Theory of Planned Behavior (Ajzen 1991).

Some methodological changes could also be considered. The survey could be distributed through a stratified random sample based on forestry activity level in each Mississippi County as recorded by severance taxes. In this way, responses would be more representative of geographies with greater forestry activity than places, such as the Mississippi Delta, with low forestry activity improving the precision of findings. In addition, a telephone interview survey could be considered as an approach to increase the response rate. The challenge in employing a telephone survey would be asking respondents to access forest records that may not be easily available. Regardless of approach, response rate depends on the types and nature of the questions in the survey. The questionnaire could be further improved by incorporating more closed-ended rather than open-ended questions. Respondents may find it easier to complete closed-ended questions (Biemer 1991). It is important to remember that timber prices also likely play an important role in survey response.

Finally, the questionnaire's forest composition question (e.g, hardwood or pine forest) should be clarified so that respondents understand each category is mutually exclusive. A separate question would ask if the forest is planted or natural. It is possible that, in some case, owners of planted stands may be more active than owners of natural stands. Finally, residence status, such as location of primary residence as well as length of residence, and temporary residence, could impact use of a consulting forester (Butler 2008). Any new variables should be tested while controlling for parcel size, income, education, membership in a forestry organization, and presence of a written forest management plan.

## **2.9 Conclusions**

This study identified the characteristics of NIPF landowners and their forest land in relation to willingness to use a consulting forester services. With regard to this study's hypotheses, increasing parcel size, income, and education increased willingness to hire a consultant. Membership in a forestry organization and written forest management plan were not significant factors. In addition to these findings, the study revealed most landowners were not interested in hiring a consultant forester and few landowners took advantage of services provided by consultants. These findings suggest many landowners are not actively managing their forestland. To engage NIPFs landowners for active forest management - which involves the use of consulting forester services - educators and decision makers need to be cognizant of factors affecting landowners' decision to hire a consultant. As in other NIPF studies, landowner's parcel size, education, household income, and age are important factors in NIPF's decisions to hire a consultant. Other characteristics such as gender, race, and monetary transactions were not significant. Knowing the effects of the factors addressed in this research this research will help policy makers, program managers, and others design and implement programs and services to increase NIPFs' use of consultants and, therefore, optimize utilization of forestland.

## 2.10 Literature cited

- Ajzen I. (1991). The theory of planned behavior. *Organizational Behavior and Human decision process*, 50, 179-211.
- Amacher, G. S., Conway, M. C., & Sullivan, J. (2003). Econometric analyses of non-industrial forest landowners: Is there anything left to study? *Journal of Forest Economics*, 9(2), 137-164.
- Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of Marketing Research*, 14(3), 396-402.
- Barlow, S. A., Munn, I. A., Cleaves, D. A., & Evans, D. L. (1998). The effect of urban sprawl on timber harvesting: A look at two southern states. *Journal of Forestry*, 96(12), 10-14.
- Biemer, P. P., Groves, R. M., Lyberg, L. E., Mathiowetz, N. A. & Sudman, S. (1991). *Measurement Errors in Surveys*. Wiley, New York.
- Birch, T. W. (1997). *Private forest-land owners of the southern United States, 1994*. USDA Forest Service, Research Bulletin, Northeastern Forest Experiment Station-138. 195 p.
- Birch, T. W., Hodge, S. S. & Thompson, M. T. (1998). *Characterizing Virginia's private forest owners and their forest lands*. USDA Forest Service, Research Bulletin, Northeastern Forest Experiment Station-707. 10 p.
- Butler, B. J., Leatherberry, E. C., Best, C., Kilgore, M. A., Sampson, R. N., & Larson, K. 2004. America's family forest owners. *Journal of Forestry*, 102(7), 4-14.
- Butler, B. J. (2008). *Family Forest Owners of the United States, 2006*. USDA Forest Service, General Technical Report, Northern Research Station. Newtown Square, PA. 72 p.
- Clark, B. J., Howard, T. E., & Parker, R. G. (1992). Professional forestry assistance in New Hampshire timber sales. *Northern Journal of Applied Forestry*, 9(1), 14-18.
- Davis, M. L. E. S., & Fly, J. M. (2010). Do you hear what I hear: Better understanding how forest management is conceptualized and practiced by private forest landowners? *Journal of Forestry*, 108(7), 321-328.
- DeCoster, L. A. (1998). The boom in forest owners-a bust for forestry? *Journal of Forestry*, 96(5), 25-28.
- Dillman, D. A., Smyth, J. D., & Christian L. M. (2009). *Internet, mail, and mixed-mode surveys: The tailored design method*. New York: Wiley-Interscience.

- Dyer, J. F., Barlow, B., Kush, J., Morse, W., Teeter, L., & Keever, G. (2015). Factors affecting Alabama landowner interest in harvesting pine straw and willingness to accept prices. *Agroforestry System*, 89, 829-839.
- D'Amato, A. W., Catanzaro, P. F., Damery, D. T., Kittredge, D. B., & Ferrare, K. A. (2010). Are family forest owners facing a future in which forest management is not enough? *Journal of Forestry*, 108, 32-38.
- Erickson, D. L., Ryan, R. L., & Deyoung, R. (2002). Woodlots in the rural landscape: Landowner motivations and management attitudes in a Michigan (USA) case study. *Landscape and Urban Planning*, 58, 101-112.
- Finley, A. O., Kittredge Jr, D. B., Stevens, T. H., Schweik, C. M., & Dennis, D. C. (2006). Interest in cross-boundary cooperation: Identification of distinct types of private forest owners. *Forest Science*, 52(1), 10-22.
- Franklin, E. C., & Munn, I. A. (1995). Valuation of consulting foresters' contribution to timber sale prices. *The Consultant*, Winter.
- Gunter, J. E., Bullard, S. H., Doolittle, M. L., & Aranao, K. G. (2001). *Reforestation of harvested timberlands in Mississippi: behavior and attitudes of non-industrial, private forest landowners*. Bulletin FO172, Mississippi State, MS: Mississippi State University, Forest and Wildlife Research Center. 25 p.
- Hanson, C., Yonavjak, L., Clarke, C., Minnemeyer, S., Boisrobert, L., Leach, A., & Schleeweis, K. (2010). *Southern forest for the future*. Retrieved from <http://www.seesouthernforests.org/southern-forests-for-the-future>. Accessed May 6, 2016.
- Hodges, D. G., & Cabbage, F. W. (1986). Private forestry consultants: 1983 status and accomplishments in Georgia. *Southern Journal for Applied Forestry*, 10(4), 225-230.
- Hubbard, W. G., & Abt, R. C. (1989). The effect of timber sale assistance on returns to landowner. *Resource Management and Optimization*, 6(3), 225-234.
- Joshi, S., & Arano, K. G. (2009). Determinants of private forest management decisions: a study on West Virginia NIPF landowners. *Forest Policy and Economics*, 11(2), 118-125.
- Kluender, R. A., & Walkingstick, T. L. (2000). Rethinking how non-industrial landowners view their lands. *Southern Journal for Applied Forestry*, 24(3), 150-158.
- Kronrad, G. D., & Albers, C. A. (1983). Consulting forestry services and fees in North Carolina. *National Wood lands*, 7(1), 9-12.

- Kuuluvainen, J., Karppinen, H., & Ovaskainen, V. (1996). Landowner objectives and non-industrial private timber supply. *Forest science*, 42(3), 300-309.
- Larson, D. M., & Hardie, I. W. (1989). Seller behavior in stumpage markets with imperfect information. *Land Economics*, 65(3), 239-253.
- Majumdar, I., Teeter, L., & Butler, B. (2008). Characterizing family forest owners: A cluster analysis approach. *Forest Science*, 54(2), 176-184.
- Martin, J. (1994). *Hiring a consulting forester*. Department of Forest Ecology and Management, School of Natural Resources, University of Wisconsin-Madison. Forestry Facts, 75, 1-5.
- Measells, M. K., Grado, S. C., Hughes, H. G., Dunn, M. A., Idassi, J., & Zielinske, B. (2005). Non-industrial private forest landowner characteristics and use of forestry services in four southern states: Results from a 2002-2003 mail survey. *Southern Journal for Applied Forestry*, 29(4), 194-199.
- Mehmood, S. R., & Zhang, D. (1998). Determinants of NIPF landowners' choice of assistance foresters. Proceeding of the 1998 Southern. Forest Economics Workshop, Williamsburg, VA.
- Munn, I. A., & Rucker, R. R. (1994). The value of information services in a market for factors of production with multiple attributes: The role of consultants in private timber sales. *Forest Science*, 40(3), 474-496.
- Nagubadi, R. V., McNamara, K. T., Hoover, W. L., & Mills, W. L. 1996. Program participation behavior of non-industrial forest landowner: A probit analysis. *Journal of Agriculture and Applied Economic*, 28(2), 323-336.
- Oswalt, S. N., Smith, W. B., Miles, P. D., & Pugh, S. A. (2014). *Forest resources of the United States, 2012: A technical document supporting the Forest Service 2015 update of the RPA Assessment*. USDA, Forest Services, General Technical Report, Washington Office-91. Washington, DC. 218 p.
- Oswalt, S. N. (2015). *Mississippi's forests, 2013*. USDA, Forest Service, Research Bulletin, Southern Research Station-204. Asheville, NC. 81 p.
- Poudyal, N. C., & Hodges, D. G. (2009). Factors influencing landowners interest in managing wildlife and avian habitat on private forestland. *Human Dimensions of Wildlife*, 14(4), 240-250.
- Romm J., Tuazon R., & Washburn C. (1987). Relating forestry investment to the characteristics of non-industrial private forestland owners in Northern California. *Forest Science*, 33, 197-209.

- Royer, J. P., & Kaiser, H. F. (1985). Influence of professional forester on pine regeneration in the South. *Southern Journal for Applied Forestry*, 9, 48-52.
- Smith, B. W., Miles, P. D., Perry, C. H., & Pugh, S. A. (2009). Forest resources of the United States, 2007. USDA Forest Services, General Technical Report, Washington Office-78. Washington, DC. 336 p.
- Vanderford, E. F. (2013). *Mississippi private forest owner characteristics and future plans: implications for extension forestry*: Thesis. Mississippi State University. Mississippi State, MS. 106 p.
- Watkins, C. C., & Munn, I. A. (2001). Mississippi consultant fees and services: By tract size and professional affiliation. *Southern Journal for Applied Forestry*, 25(4), 178-186.
- Watts, L. (1996). Choosing and using consultants. *Management*, 43(4), 58-62.
- Wear, D. N. (1996). *Forest management and timber production in the U.S South*. SCFER working paper No. 82, 40 p.
- Wear, D. N., & Greis, J. G. (2002). The southern forest resource assessment: Summary report. USDA Forest Service, General Technical Report, Southern Research Station-54. 103 p.
- Wicker, G. (2002). Motivation for private forest landowners. *Southern forest resource assessment*, 225-237.
- Wright, W.C. (2015). *2013 Mississippi consulting forester survey*. Thesis. Mississippi State University, Mississippi State, MS. 103 p.
- Wright, W. C., & Munn, I. A. (2016). *2013 fees and services of Mississippi's consulting foresters*. Forest and Wildlife Research Center, Research Bulletin FO460, Mississippi State University. 35 p.
- Zhang, D., & Mehmood, S. R. (2001). Predicting non-industrial private forest landowners' choices of a forester in harvesting and tree planting assistance in Alabama. *Southern Journal for Applied Forestry*, 25(3), 101-107.
- Zhang, D., Warren, S., & Bailey, C. (1998). The role of assistance forester in non-industrial private forest management: Alabama landowners' perspective. *Southern Journal for Applied Forestry*, 22(2), 101-105.

## CHAPTER III

### COMPARISON OF FOREST MANAGEMENT EXPENSES OF MISSISSIPPI'S NON-INDUSTRIAL PRIVATE FOREST LANDOWNERS: RESULTS FROM 1995-1997 AND

2015

#### **3.1 Abstract**

Non-industrial private forest (NIPF) landowners manage their forest property through a variety of active and passive activities which can change over the lifespan of the forest and ownership cycle. Patterns of change may emerge which suggest the evolving nature of forest landownership and NIPFs' interest in their land. As a basis for better understanding changing management practices, this paper explores changing expenditures in forestry-related activities in the 1990s (1995-1997) and 2015. Although the number of responses differed substantially, the survey periods contained similar questions. In each survey, twelve forestry-related activities were grouped into four major categories: (1) fees for professional services, (2) timber management expenditures, (3) other management expenditures, and (4) property taxes. In both survey cycles, timber management expenditures represented the largest component of annual expenditures with fees for professional services and other management expenditures ranking second and third, respectively. Specifically, planting and site preparation activities accounted for the greatest costs in both the 1990s and 2015. By broadly describing differences in expenditures over time, this study provides insights which landowners can use to make informed management

decisions based on economic as well as biological considerations. As well, it can contribute to information needed by timber supply modelers to predict future timber availability. Finally, results can help policy makers develop appropriate policies, such as cost-share programs with conservation and risk reduction objectives.

Key words: Non-industrial private forest, forest management, expenditures, property taxes.

### **3.2 Introduction**

For the purposes of this study, active forest management is defined as purposive management seeking to develop timber and/or non-timber forest products, including recreation, biodiversity, carbon storage, aesthetics, ecosystem regulation, and other products and services. In the United States, a significant portion of active forest management occurs on private forest land (Bulter and Leatherberry 2004). Since non-industrial private forests (NIPF) comprise 59 percent of the nation's total timberland area, the owners' management decisions and behaviors are particularly important regarding the net benefits provided by the nation's forests (Moffat et al. 1998). In particular, the U.S. South, known as the wood basket of the United States, performs a critical role in satisfying the nation's demand for timber, paper products, and forest-based biofuels.

By percentage of area, Mississippi is one of the most heavily forested states in the nation. Hardwood and mixed stands occupy 10.5 million acres and pine forests cover 6.62 million acres of forested land (MFC 2010). Notably, forested acreage has increased over the past four decades in Mississippi (MFC 2010). While natural stands have decreased since 2006, planted loblolly pine has increased (Oswalt 2015). Regardless of forest type, the U.S. Forest Service's National Woodland Owner Survey (NWOS) notes that the most

important reason for owning forest land is to provide a legacy to heirs, followed by long-term investment, protecting or improving wildlife habitat, and personal recreation (Butler et al. 2016). In a recent study, Mutandwa et al. (2016) found that timber production was only the fourth most important reason for owning forests.

NIPF management activities include site preparation, fertilization, tree planting, and road construction. Routine activities include property line maintenance, protection against fire, insect, animal damage control, and supervision and administration. In addition, NIPFs must prepare for and conduct intermediate and final timber harvests. In some case, NIPFs are involved with hunting/wildlife management activities, prescribed burning, pruning, and pre-commercial thinning. Forest management expenditures can vary greatly depending on the level and nature of the management activity, as well as the size of the property.

Analysis of expenditures associated with timber management activities is important to the individual landowner, the forest products industry, and state and national revenues (Arano and Munn 2004). Besides profit-related goals, expenditure information may be a predictive indicator of landowners' willingness to invest in forest management for timber production. Expenditure analysis requires NIPFs landowners keeping detailed records of their management activities, which they should do anyway for tax considerations, risk mitigation, and for management decisions (Jacobson 2009). Landowners whose primary business is selling forest products will need more detailed records than hobby owners. Detailed information about expenditures demonstrates how investments on private forest lands are distributed among various management or silvicultural activities. Besides landowners, timber supply modelers need information about the type and intensity of management practiced by various landowners in order to improve predictions of future

timber availability (Adams et al. 1982). Policy makers utilize cost and expenditure data to develop appropriate policies and/or legislation (Rogers and Munn 2003).

Activities and costs of landowners published in journals such as *Forest Landowner Magazine* serve as benchmarks for others' management decisions. A well-known report published in *Forest Landowner Magazine* provides bi-annual estimates of the costs of forestry-related activities in the South. For example, in the most recent report, the average cost for mechanical site preparation was \$140.99 per acre; machine planting cost was \$80.30 per acre; prescribed burning was \$26.63; chemical application cost was \$69.53 per acre; and custodial management cost per acre was \$10.15 in 2016 (Maggard and Barlow 2017). Custodial management costs include items such as boundary line maintenance, road construction, and insect and diseases management. Previous reports published in *Forest Landowner Magazine* (2015) reported that prices increased steadily from 2008 to 2012, but dropped in 2014. In addition to the *Forest Landowner Magazine* reports, a number of scholarly articles have addressed management costs (e.g., Moak 1982, Kuhn 1984, Dubois et al. 1991, 1995, and 1997, Belli et al. 1993, and Munn et al. 2002), but detailed comparison between time periods is rare. Moreover, information regarding forest management practices and costs is collected from forest industry, state forestry agencies, and scientists, but is less commonly collected from NIPF landowners (Moffat et al. 1998).

Mississippi NIPF owners have widely diverse values, attitudes, and ownership objectives (Wicker 2002). Several studies have shown NIPF landowners were placing greater emphasis on non-timber benefits than timber production (Haymond 1988, Birch 1996, Erickson et al. 2002, Belin 2005, Joshi and Arano 2009). Specifically, managing land for recreation and gaining income through hunting leases have gained increasing interest

over recent years (Baen 1997). It is also important to note that minerals such as coal, oil and natural gas have been a source of income for some Mississippi forest landowners. Nevertheless, timber sales are normally the primary revenue source of a forestry investment.

The intensity of forest management can be inferred by the extent of expenditures on forestry-related activities. A study by Arano and Munn (2006) reported that NIPF landowners in Mississippi were not managing forest land intensively. Landowners' spending on silvicultural practices was used as a measure of management intensity and increasing levels of expenditures, which in turn suggest increasing management intensity (Arano and Munn 2006). The authors suggested intensity of forest management could be partly attributed to the size of forest holdings (also see Hatcher et al. 2013). Landowners holding larger forest tracts tended to manage more intensively than those with smaller forest tracts (Hatcher et al. 2013). Also, authors have noted landowners with small holdings tend to have limited management options and, therefore, do not participate in what they consider to be activities more appropriate for larger-scale operations (Conner and Hartsell 2002). Underscoring the benefits of economies of scale, Barlow (n.d.) stated that "a good rule of thumb is treating larger areas generally costs slightly less on a per acre basis than the same treatment on smaller acreages." Cost sharing and technical assistance programs, such as the Conservation Reserve Program, were more appealing to those who either owned large forest acreages or were actively managing their lands for timber production (Kingsley and Birch 1977, Thompson 1999).

This study examined the forestry-related activities and expenditures of NIPF landowners of Mississippi in 2015 compared with expenditures averaged from 1995 to

1997 (hereafter referred to as the 1990s). The overall goal of this research was to contribute to building interest among investors in forestry-related activities. This article also contributes to the on-going need for forest management expenditure analysis, which will benefit the decisions of landowners, foresters, policy-makers, and timber supply modelers. The following sections describe the study's methods and present results. The article concludes with a discussion and implications for policy and future research

### **3.3 Methods**

To compare expenditures across two points in time, this study analyzed NIPF landowner data from multiple surveys. For all surveys, the sample frame was generated from a property tax mailing list managed by Mississippi State University. Landowners were selected randomly from approximately 300,000 forest landowners with at least 20 acres of forest land. The 1990s survey was mailed to approximately 5,000 landowners while the 2016 survey was mailed to 2,010 landowners. Survey distributions were based on the Total Design Method<sup>1</sup> (Dillman et al. 2009).

Survey instruments were designed to elicit information from NIPF landowners about the area of forest land they owned in Mississippi and their associated annual forest management expenditures for the previous tax year (i.e., 1995, 1996, 1997, and 2015). The questionnaires were divided into 4 sections. The first section addressed landowners' forest ownership by forest stand type. The second section asked about forest management costs for activities such as site preparation, planting, prescribed burning, fertilization, routine expenses for timber management cost, and fees for professional services. The third section

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<sup>1</sup> Mailings consisted of four contacts: (1) cover letter and questionnaire; (2) reminder post card; (3) replacement survey and cover letter; and (4) reminder postcard or a thank you letter.

asked for timber harvesting information (e.g., timber harvest expenses, expense associate with hunting and wildlife management). The last section solicited respondents' demographic characteristics. All surveys were conducted as part of a long-term project to determine use values for forest land in Mississippi for the Mississippi Department of Revenue.

To illustrate the frequency and distribution of forest management activities, the percentage of respondents who incurred expenditures for each forest management activity was computed. This percentage was compared with the 1990s expenses described by Arano et al. (2002). Average annual, per acre treatment costs for both active and passive landowners were computed for 2015 and compared with average costs from the 1990s data. This study identified active landowners as those participants who incurred expenses towards forest management and/or routine activities during the particular data year of interest. Otherwise, they were considered passive managers for this point in time. Although this is a narrow interpretation of "active", it helps to focus data analysis; further, it is not inconsistent with this article's purpose, which is to provide insights into management activities. To compare per acre cost, each dollar value of the 1990s was compounded to 2015 based on an inflation rate of 2.2 percent determined from the Consumer Price Index 1997 to 2015 (Nagubadi and Zhang 2005). Expenditures were compared on the basis of frequency of occurrence as well as magnitude.

### **3.4 Results**

The 2015 survey had a 23 percent adjusted response rate, while the 1990s surveys averaged 21 percent. Results are organized in three sections: (1) respondent reporting

frequencies; (2) mean expenditures for landowners involved in active and passive management; and (3) mean expenditures for landowners involved in active management.

The average forest parcel size was 231 acres in the 1990s. This compares to an average parcel size of 157 acres reported in the 2015 survey data (Table 3.1), suggesting a trend of parcelization. The median parcel size reported was 75 acres in 2015 and 80 acres in the 1990s. In both survey cycles, some forest land samples was less than 20 acres because of time the interval between time of acquired landowner lists and survey conducted

Table 3.1 Comparison of Mississippi’s NIPF sample estimates obtained via mail surveys, the 1990s and 2015.

<b>Statistic</b>	<b>Forest acres (1990s)</b>	<b>Forest acres (2015)</b>
Mean	231	157
Median	80	75
Minimum	1	2
Maximum	44,617	2,500

### **3.4.2 Respondents’ reporting frequencies**

With the exception of property taxes, fewer than 15 percent of the 1990s respondents and 10 percent of 2015 respondents reported annual expenditures for any specific activity (Table 3.2). This result is indicative of a growing lack of active participation in forest management.

#### **3.4.2.1 Fees for professional services**

In the 1990s survey, 17.4 percent of respondents reported paying fees for some professional services (i.e., consulting foresters, surveyor, attorney, and accountant), whereas 6.3 percent of 2015 respondents reported using professional services. Consulting forester fees were the most common expenditure in both surveys, reported by 6.9 percent of respondents in the 1990s versus 2.5 percent in 2015. In addition to consulting forester fees,

a surveyor fee was reported as common in 2015, reported by 2.5 percent of the respondents. Attorney fees were the least common in both survey periods, reported by 5.7 percent of respondents in the 1990s versus 1.5 percent in 2015.

#### **3.4.2.2 Timber management expenditures**

In the 1990s, 20.3 percent of respondents incurred timber management expenditures, which decreased to 9.4 percent in 2015. The most common timber management expenditure in the 1990s was planting, whereas planting and site preparation costs were highest in 2015. Prescribed burning was least common in both time periods (3.4 percent and 2.8 percent in the 1990s and 2015, respectively).

#### **3.4.2.3 Other management expenditures**

This category included on-going expenses associated only with forested acres as opposed to the property as a whole, which could include forested and non-forested areas. Approximately 27 percent of respondents incurred expenditures in this category in the 1990s, whereas about 8 percent did in 2015. In the 1990s, supervision and administration (12.3 percent), property line maintenance (12.1 percent), and road construction (10.9 percent) were common. This compares with 6.3 percent, 5.4 percent, and 6.6 percent, respectively reporting for each activity in 2015. Forest protection against fire, insects, and diseases were the least common activities in both survey cycles (7.9 percent in the 1990s versus 2.3 percent in 2015).

#### **3.4.2.4 Property taxes**

Unsurprisingly, property tax was the most commonly reported expenditure during both survey cycles. Seventy-three percent of the 1990s respondents reported paying

property taxes on their forest land while approximately 69 percent did in 2015. Because the surveys assessed use values, participants were asked to report taxes paid on forest land versus agriculture land. However, respondents from both survey periods were unlikely to report both categories separately.

Table 3.2 Percentage of respondents who incurred forest management expenses, the 1990s and 2015

Expense category	1990s (N=1,075)	2015 (N=386)
Fees for professional services	17.40	6.30
Consulting forester	6.90	2.50
Attorney	5.70	1.50
Accountant	8.40	1.80
Surveyor	4.90	2.50
Timber management expenditures	20.30	9.40
Timber stand improvement	3.60	1.10
Prescribed burning	3.40	2.80
Site preparation	5.60	6.20
Planting	12.10	4.10
Other	3.70	2.80
Other management expenditures	27.20	8.20
Property line maintenance	12.10	5.40
Protection against fire, insects or disease	7.90	2.30
Road construction and maintenance	10.90	6.60
Supervision and administration	12.30	6.30
Property taxes	73.00	68.90

### 3.4.3 Mean expenditures for landowners engaged in active and passive management

This sub-section describes average expenditures of active and passive landowners within the same survey. In the 1990s, total annual expenditures averaged \$13.92 per acre owned, whereas the comparative relative value in the 2015 was \$9.56 per acre owned (Table 3), a decline of 31 percent. Total annual expenditures for forest management in the 1990s were higher than in 2015.

#### **3.4.3.1 Fees for professional services**

Annual expenditures for professional services for all respondents averaged \$2.89 per acre in the 1990s whereas \$1.53 per acre in 2015. Consulting forester fees accounted for more than half of this total professional fee, \$1.82 in the 1990s and \$0.81 per acre in 2015. By comparison, attorney, accountant, and surveyor fees each averaged \$0.35 per acre and \$0.16 per acre in the 1990s and 2015, respectively.

#### **3.4.3.2 Timber management expenditures**

Expenditures for timber management activities were \$5.17 and \$2.83 per acre in the 1990s and 2015, respectively. Planting and site preparation constituted major expenditures in both time periods. Planting costs were \$0.72 per acre in the 1990s versus \$3.23 per acre in 2015. Similarly, average site preparation cost was \$1.45 per acre in the 1990s, similar to \$1.49 per acre in 2015.

#### **3.4.3.3 Other management expenditures**

As a whole, other management expenditures were \$1.91 per acre in the 1990s and \$1.18 per acre in 2015. Specifically road construction and maintenance represented the major portion of management expenditures - \$0.72 in the 1990s and \$0.65 per acre in 2015. The remaining expenses were roughly divided among property line maintenance, protection against fire, supervision and administration in both year.

#### **3.4.3.4 Property taxes**

NIPF landowners paid annual property taxes of \$3.41 and \$4.02 per acre in the 1990s and 2015, respectively.

Table 3.3 Mean expenditures per acre, the 1990s and 2015

<b>Expense category</b>	<b>Current value of 1990s (\$/ac-owned)</b>	<b>2015 (\$/ac-owned)</b>
Fees for professional services	2.89	1.30
Consulting forester	1.82	0.81
Attorney	0.51	0.08
Accountant	0.27	0.03
Surveyor	0.28	0.38
Timber management expenditures	5.71	2.83
Timber stand improvement	0.84	0.28
Prescribed burning	0.19	0.34
Site preparation	1.45	1.49
Planting	3.23	0.72
Other management expenditures	1.91	1.18
Property line maintenance	0.40	0.34
Protection against fire, insects or disease	0.28	0.10
Road construction and maintenance	0.72	0.65
Supervision and administration	0.51	0.09
Property taxes	3.41	4.02
<b>Total expenditure</b>	<b>13.92</b>	<b>9.56</b>

#### **3.4.4 Mean expenditures for landowners engaged in active management**

In contrast to the previous sub-section, this sub-section describes costs only of active managers (i.e., those who reported costs) while excluding passive managers (i.e., respondents who did not report expenditures). Total annual expenditures for those landowners who incurred any type of expense related for timber management was \$53.41 per acre in the 1990s and increase to \$293.86 per acre in 2015 (Table 4). There have been seen significant differences in expenses among timber management expenditures and other type of expenditures.

##### **3.4.4.1 Fees for professional services**

Landowner spent 50 percent of the total amount of fees for professional services (i.e., forester, attorney, account, and surveyor) on consulting foresters. Consulting

foresters' fees averaged \$8.51 per acre in the 1990s and \$10.30 per acre in 2015 with the remaining 50 percent distributed to attorney, accountant, and surveyor in both the 1990s and 2015.

#### **3.4.4.2 Timber management expenditures**

Expenditures for timber management activities were \$24.11 per acre in the 1990s and increased to \$246.32 per acre in 2015. In this category, planting and site preparation expenditures were major expenses in both survey cycles. Planting cost was \$10.35 in the 1990s and increased to \$100.19 per acre in 2015. Similarly, site preparation cost was \$7.74 in the 1990s and increased to \$72.77 per acre in 2015. The average cost per acre for prescribed burning was \$1.38 in the 1990s versus \$21.05 in 2015.

#### **3.4.4.3 Other management expenditures**

Annual expenditures for property line maintenance and road construction and maintenance for timber managers averaged \$2.58 per acre in the 1990s and \$6.41 per acre in 2015. Except supervision and administration, other activities cost increase significantly from the 1990s to 2015.

#### **3.4.4.4 Property taxes**

The average annual property tax for timber managers was \$3.86 per acre in the 1990s and \$6.49 per acre in 2015, which suggests that property taxes for landowners have increased over a survey cycles.

Table 3.4 Mean expenditures per acre owned for NIPF respondents who incurred the expenses, Mississippi, the 1990s and 2015

<b>Expense category</b>	<b>Current value of 1990s (\$/ac-owned)</b>	<b>2015 (\$/ac-owned)</b>
Fees for professional services	16.05	21.55
Consulting forester	8.51	10.30
Attorney	2.68	2.32
Accountant	0.66	1.67
Surveyor	4.22	7.26
Timber management expenditures	24.11	246.32
Timber stand improvement	4.65	52.31
Prescribed burning	1.38	21.05
Site preparation	7.74	72.77
Planting	10.35	100.19
Other management expenditures	9.39	19.50
Property line maintenance	2.62	5.86
Protection against fire, insects or disease	1.63	4.69
Road construction and maintenance	2.54	6.96
Supervision and administration	2.60	1.99
Property taxes	3.86	6.49
<b>Total expenditures</b>	<b>53.41</b>	<b>293.86</b>

### 3.5 Discussion

Cost is a fundamental consideration in utility maximization of forest management decisions. This study presented Mississippi NIPF landowners' management costs from the 1990s and 2015. The expenditures information presented here suggests the degree to which landowners' were interested and active in managing and generating income from forest land.

A significant portion of sampled landowners were not involved in any forest management activities during either survey cycle, suggesting low levels of active management during the points of time under analysis. Still, other than property taxes, broad categories such as fees for professional services, timber management expenditures, and other management expenditures resulted were less frequently incurred in 2015 than the

1990s (10 percent versus 30 percent, respectively). One possible reason for the low response rate in 2015 may be decreasing parcel size (Arano 2003, Londo and Grebner 2004). Landowners holding smaller and fragmented forest land properties have limited management options (Conner and Hartsell 2002). Still, the data could also suggest preferred management regimes have changed over time among NIPFs. Responses reflected reported costs with an average of \$13.92 per acre in the 1990s versus \$9.56 per acre in 2015. Again, except property taxes, professional services fees, timber management expenditures, and other management expenditures decreased by approximately 40 percent on average for all NIPF landowners. Averaged property taxes increased by nearly 18 percent from the 1990s to 2015.

Another possible reason for the diminishing trend is that landowners may be less interested in managing their forest for monetary benefits. This in turn suggests negative attitudes towards forest investments. Of the four expenditure categories (i.e., fees for professional services, timber management activities, other management activities, and property taxes), results help rank categories to understand how landowners are likely to invest. Timber management expenditures and fees for professional services accounted for more than 91 percent of total average annual expenditures in 2015, or nearly 80 percent during the 1990s. These expenses are directly related to timber production, either through enhancing timber growth or returns on timber sales. The findings suggest that those landowners managing for timber are actively involved in utility maximization during the two time points.

The per acre cost for prescribed burning, site preparation, and planting cost were \$15.79, \$125.52 and \$84.83, respectively in 2015, which were comparable to Maggard and

Barlow's (2017) study where prescribed burning was \$26.63 per acre, site preparation cost was \$140.99, and planting cost was ranged from \$52 to \$89 per acre depending upon type of planting method. These showed that costs of forestry practices have been more variable in recent years due to poor housing markets, decreased demand for timber, and low stumpage prices (Maggard and Barlow 2017). These amounts are substantial and may reduce interest in the supply side of the market.

Moreover, expenditures on forest management have been increasing over time, resulting in decreased participation. One reason for increasing net costs is related to smaller tract size.<sup>2</sup> Per unit costs increased as size decreases. As well, owners of small tracts tend to be less interested in timber management, and more interested in recreation, aesthetics and other non-timber objectives, than owners of large tracts.

The decision by NIPF landowners to engage in forest management is significantly affected by the magnitude of related expenses. Mean expenditures for NIPF landowners provide a better estimate of the actual costs that play a crucial role in decision-making process to landowners. Moreover, this study contributes to previous work (i.e., Dubios et al 1991, 1995, 1997, Maggard and Barlow 2017) which documented costs directly related to silvicultural practices while overlooking other expenses, such as fees for professional services and property taxes.

Future research must address the issue of low response rates. A large number of responses are important for an accurate representation of forest management expenditures. The sample frame must be updated, while at least some of the research could be validated by gathering data at forest landowner meetings. Also, this research does not include a

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<sup>2</sup> See Chapter II of this thesis.

comparison of real price increases. Future studies should consist of a comprehensive comparison of forest management activities' expenditure by accounting real rates of change. Third, future surveys may include questions about forest composition, location of forest land, management objectives, and age class distributions in order to assess potential causes for differences in management intensity and expenditures. Fourth, future research must collect both cost and revenue data. This research was limited to cost per acre of management activities. Fifth, this information would be interesting when compared with NIPF landowner expenditures throughout the Southeast, as well as other parts of United States. With periodic NIPF landowner expenditure surveys across the region or nation, such comparative research would provide timber supply modelers with key information for the prediction of future timber supply. Finally, expenditures suggest an indication of forest management intensity. All else equal, greater expenditures indicate more intensive forest management. Thus, the comparison study of forestry-related activities and expenditures over time could establish a direct relationship between expenditures and forest productivity which, in turn, points to future timber availability.

### **3.6 Conclusions**

Costs for the management practices discussed in this paper increased over approximately twenty years, while the average forest holding size in Mississippi decreased between the 1990s and 2015. A greater percentage of respondents incurred site preparation costs and property tax in 2015 than in the 1990s. Of all activities, active NIPF landowners spent a greater portion of their total expenses on timber management and fees for professional expenses in both the 1990s and 2015. Given that most of Mississippi's forest land was owned by NIPF landowners, changes in parcel size and monetary transaction for

forest land will have a profound effect on markets for management activities and the supply of forest products. Hence, periodically monitoring forest management related expenditures might be a reasonable indicator of future timber supply trends; for example, continuously increasing expenditures suggest a growing timber supply in the future.

### **3.7 Management and policy implications**

This paper contributes to an understanding of NIPF landowners' management behavior, while exploring the intensity of management which may impact future timber supplies. This study identified the most common silvicultural practices among landowners. Results help to identify factors affecting forest products production on NIPF land over time. Repeated studies could provide insights on how forest landscapes are changing over time. Active landowners spent more money on site preparation and planting than other activities indicating that they were more interested in optimizing benefits than their counterparts who did not invest. The study also improves the understanding of the contribution of forest management to the State's economy by providing statistics on annual investments in forestry activities. While this study is not an economic impact analysis per se, it illuminates trends which landowner expenditures contribute directly and indirectly to economic activities and employment in the forestry sector.

In addition, information presented here concerning activeness in forest management, reasons for owning forest land, and investment in forestry enterprise could be useful for policy makers. Policy makers need accurate information concerning the types of practices being implemented on various parcel sizes in order to develop appropriate policies and/or legislation. For instance, government programs that involve cost-sharing and subsidies could be implemented to ensure investment in planting and site preparation.

Since forest management is a long-term investment involving risks and uncertainties, policy makers should formulate policy instruments such as low-interest loans, tax incentives, and forest insurance programs that can mitigate risk, encourage investment, and promote active management.

### 3.8 Literature cited

- Adams, D. M., Haynes, R. W., Dutrow, G. F., Barber, R. L., & Vasievich, J. M. (1982). Private investment in forest management and the long-term supply of timber. *American Journal of Agricultural Economics*, 64(2), 232-241.
- Arano, K. G., & Munn, I. A. (2006). Evaluating forest management intensity: a comparison among forest landowner types. *Forest Policy and Economics*, 9, 237-248.
- Arano, K. G., & Munn, I. A. (2004). *Non-industrial private forest landowners' forest management activities and expenditures in Mississippi, 1998-2000 data*. Forest and Wildlife Research Center, Bulletin FO249 Mississippi State University. 13 p.
- Baen, J. S. (1997). The growing importance and value implications of recreational hunting leases to agricultural land investors. *Journal of Real Estate Research*, 14(3), 399-414.
- Barlow, B. (n.d). Cost for common forestry practices in the South. Retrieved from <http://www.aces.edu/natural-resources/forestry/economics-management/forestrypractice/>. Accessed Aug. 10, 2017.
- Belin, D. L., Kittredge, D. B., Stevens, T. H., Dennis, D. C., Schweick, C. M., & Morzuch, B. J. 2005. Assessing private forest owner attitudes toward ecosystem-based management. *Journal of Forestry*, 103(1), 28-35.
- Belli, M. L., Straka, T. J., Dubois, M. R., & Watson, W. F. (1993). Costs and cost trends for forestry practices in the South. *Forest Landowner Magazine*, 52(3), 25-31.
- Birch, T. W. (1996). *Private forest landowners of the United States, 1994*. USDA Forest Service, Resource Bulletin, Northeastern Forest Experiment Station-134. 183 p.
- Butler, B. J., Leatherberry, E. C., Best, C., Kilgore, M. A., Sampson, R. N., & Larson, K. (2004). America's family forest owners. *Journal of Forestry*, 102(7), 4-14.
- Haymond, J. L. (1988). NIPF opinion leaders: what do they want? *Journal of Forestry*, 86(4), 30-35.
- Conner, R. C., & Hartsell, A. J. (2002). Forest area and conditions. In Wear, D. N. and Greis, J. G. (Eds.), *Southern Forest Resource Assessment*. USDA Forest Service, General Technical Report, Southern Research Station-53. Asheville, NC. 635 p.
- Dillman, D. A., Smyth, J. D., & Christian L. M. (2009). *Internet, mail, and mixed-mode surveys: The Tailored Design Method*. New York: Wiley-Interscience.
- Dubois, M. R., McNabb, K., Straka, T. J., & Watson, W. F. (1999). Costs and cost trends for forestry practices in the South. *Forest Landowner Magazine*, 58(2), 3-8.

- Dubois, M. R., McNabb, K., Straka, T. J., & Watson, W. F. (1995). Costs and cost trends for forestry practices in the South. *Forest Landowner Magazine*, 56(2), 7-13.
- Dubois, M. R., Watson, W. F., Straka, T. J., & Belli, K. L. (1991). Costs and cost trends for forestry practices in the South. *Forest Landowner Magazine*, 50(3), 26-32.
- Erickson, D. L., Ryan, R. L., & Young, R. D. (2002). Woodlots in the rural landscape: landowner motivations and management attitudes in a Michigan case study. *Landscape and Urban Planning*, 58, 101-112.
- Hatcher Jr, J. E., Straka, T. J., & Greene, J. L. (2013). The size of forest holding/parcelization problem in forestry: A literature review. *Resources*, 2, 39-57.
- Jacobson, M. (2009). *Keeping records of forest management activities*. Penn State Cooperative Extension. 10 p.
- Joshi, S., & Arano, K. G. (2009). Determinants of private forest management decisions: a study on West Virginia NIPF landowners. *Forest Policy and Economics*, 11, 118-125.
- Kingsley, N. P., & Birch, T. W. (1977). *The forest-land owners of New Hampshire and Vermont*. USDA Forest Service, Resource Bulletin. Northeastern Forest Experiment Station-51. Upper Darby, PA. 47 p.
- Londo, A. M., & Grebner, D. L. (2004). Economies of scale and forest management in Mississippi. In Connor, K. F. (Eds.), *Proceeding of the 12th biennial southern silvicultural research conference*. USDA Forest Service, General Technical Report, Southern Research Station-71. Asheville, NC. 594 p.
- Maggard, A., & Barlow, R. (2017). 2016 costs and trends for southern forestry practices. *Forest Landowner Magazine*, 76(5), 31-39.
- Mississippi Forestry Commission. (2010). *Mississippi's assessment of forest resources and forest resource strategy*. 10 p.
- Moffat, S. O., Cabbage, F. W., Cascio A. J., & Sheffield, R. M. (1998). The future of forest management on NIPF lands in the South: Results of an expert opinion survey. In Abt, K. and Abt, R.C. (Eds.), *Proceedings of the Conference on Southern Forest Economics Workshop*. Southern Research Station. Research Triangle Park, NC. 17-24 p.
- Mutandwa, E., Grala, R. K., Grado, S. C., & Munn, I. A. (2016). Family forest owners' familiarity with conservation programs in Mississippi, USA. *Small Scale Forestry*, 15(3), 303-319.

- Nagubadi R. V., & Zhang, D. (2005). Determinants of timberland use by ownership and forest type in Alabama and Georgia. *Journal of Agricultural and Applied Economics*, 37(1), 173-186.
- Oswalt, S. N. (2015). *Mississippi's forests, 2013*. USDA Forest Service, Research Bulletin, Southern Research Station-204. Asheville, NC. 81 p.
- Rogers, W. R., & Munn, I. A. (2003). Forest management intensity: a comparison of timber investment management organizations and industrial landowners in Mississippi. *Forest Policy and Economics*, 27(2), 83-91.
- Society of American Foresters. (1979). *Improving outputs from non-industrial private forests*. Study report. Washington, DC: Society of American Foresters. 11 p.
- Thompson, M. T. (1999). *A forested tract-size profile of Florida's NIPF landowners*. USDA Forest Service, Research Paper, Southern Research Station-15. Asheville, NC. 10 p.
- Zhang, D., & Flick, W. (2001). Sticks, carrots, and reforestation investment. *Land Economics*, 77(3), 443-456.

## CHAPTER IV

### OVERALL CONCLUSIONS

Non-industrial private forest landowners' decisions influence the supply of forest products. Management decisions depend on landowner's utility maximizing behavior. Landowners that are considered utility-maximizers focus on non-monetary benefits such as recreation, aesthetics, and wildlife habitat in addition to timber production. Regardless of objective, utility maximizing landowners seek to achieve the most benefit for every dollar spent on their forest land. Arguably, a landowner who hires a consulting forester aims to maximize the utility of his resources, given that consultants implement scientifically sound practices in forest management. Understanding the underlying determinants of using consulting forestry services could form the basis for developing, modifying, and targeting policy and educational instruments to motivate NIPF landowners towards active forest management in order to optimize the utility of their forest land and ensure a sustainable forest products supply for society.

Utility optimization was addressed in both chapters of this thesis. Chapter II identified major factors affecting landowners' decisions to hire a consulting forester. A majority of landowners were not hiring a consultant to conduct forest management activities suggesting underutilization of forest resources.<sup>3</sup> One explanation for this is that, taking inflation into account, consulting fees have been increasing from the 1990s to 2015 (see Chapter III). This is exacerbated by parcelization, which leads to average cost per acre

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<sup>3</sup> As noted in the introduction, this thesis assumes maximized utilization is achieved through active management, including hiring a consultant. While a landowner can utilize his property without active management, this thesis argues the benefits are not enjoyed to the fullest extent because options and practices to improve the property are not implemented in a passive management approach.

rates increasing as parcel size decreases. Age, income, and education, as well as forest parcel size, had significant effects on landowners' willingness to hire consulting foresters. Additionally, many landowners neither had a written forest management plan nor were involved in any forestry-related organizations. These last two characteristics are important because previous research has shown a connection between participation in forest management activities and active management to supply forest products. In short, findings suggest the need for more effective outreach information and/or financial incentives regarding the benefits of hiring consulting foresters.

Chapter III compared major forestry-related activities, and associated costs, performed by Mississippi's NIPF landowners between two points in time, 2015 and averaged data between 1995 and 1997. Reflecting previous studies, expenditures per acre for forestry-related activities have increased over time. A higher proportion of costs associated with timber management activities during both periods were directly related to the timber production. Such comparative analysis provides useful information to landowners and managers considering long-term goals and management activities. In other words, decisions may be delayed or advanced with the recognition that costs change over time. Therefore, to involve landowners in active forest management, policy makers need to develop policy instruments such as forest management incentive programs, low interest rates on forestry business loan, provision of market linkages, and provision of forest land insurance to mitigate the landowner's investment risk.

Conclusions and implications from both studies reflect previous research regarding willingness to hire a consultant and degree of participation in forestry-related activities. Although findings are based on the Mississippi's NIPF landowners, the study could be

scaled up to the Southeast and even nationally. Findings at larger scales would be helpful in designing and implementing more effective policy instruments, and improving landowners' participation in forest management.

Some limitations of this research must be acknowledged. First, the response rate for the 2015 survey was low, making generalization difficult. In particular, a large number of observations were omitted from the analysis because of incomplete response regarding management activity cost questions. However, the lacks of responses to cost questions suggest the general lack of active participation in forest management. Lack of response was not limited to this survey; Maggard and Barlow's (2017) recent cost trends article also noted diminishing response in collecting expenditure information from NIPFs as well as private forestry firms. Finally, further data analysis that integrates additional characteristics such as forest type, location of forest land from residence, reason of owning forest, and year of forest holding could provide a more in-depth understanding of landowner behavior in relation to expenditures such as hiring a consultant.

## APPENDIX A

## A.1 Literature cited

- Ajzen I. (1991). The theory of planned behavior. *Organizational Behavior and Human decision process*, 50, 179-211.
- Adams, D. M., Haynes, R. W., Dutrow, G. F., Barber, R. L., & Vasievich, J. M. (1982). Private investment in forest management and the long-term supply of timber. *American Journal of Agricultural Economics*, 64(2), 232-241.
- Amacher, G. S., Conway, M. C., & Sullivan, J. (2003). Econometric analyses of non-industrial forest landowners: Is there anything left to study? *Journal of Forest Economics*, 9(2), 137-164.
- Arano, K. G. and Munn, I. A. (2006). Evaluating forest management intensity: a comparison among forest landowner types. *Forest Policy and Economics*, 9, 237-248.
- Arano, K. G., & Munn, I. A. (2004). *Non-industrial private forest landowners' forest management activities and expenditures in Mississippi, 1998-2000 data*. Forest and Wildlife Research Center, Bulletin FO249, Mississippi State University. 13 p.
- Arano, K. G., Cushing, T. L., & Munn, I. A. (2002). Forest Management Expenses of Mississippi's Non-industrial Private Forest Landowners. *Southern Journal of Applied Forestry*, 26(2), 93-98.
- Armstrong, J. S. and Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of Marketing Research*, 14(3), 396-402.
- Baen, J. S. (1997). The growing importance and value implications of recreational hunting leases to agricultural land investors. *Journal of Real Estate Research*, 14(3), 399-414.
- Barlow, B. (n.d). Cost for common forestry practices in the South. Retrieved from <http://www.aces.edu/natural-resources/forestry/economics-management/forestrypractice/>. Accessed Aug. 10, 2017.
- Barlow, S. A., Munn, I. A., Cleaves, D. A., & Evans, D. L. (1998). The effect of urban sprawl on timber harvesting: A look at two southern states. *Journal of Forestry*, 96(12), 10-14.

- Belin, D. L., Kittredge, D. B., Stevens, T. H., Dennis, D. C., Schweick, C. M., & Morzuch, B. J. (2005). Assessing private forest owner attitudes toward ecosystem-based management. *Journal of Forestry*, 103(1), 28-35.
- Belli, M. L., Straka, T. J., Dubois, M. R., & Watson, W. F. 1993. Costs and cost trends for forestry practices in the South. *Forest Landowner Magazine*, 52(3), 25-31.
- Biemer, P. P., Groves, R. M., Lyberg, L. E., Mathiowetz, N. A., & Sudman, S. (1991). *Measurement Errors in Surveys*. Wiley, New York.
- Birch, T. W., Hodge, S. S., & Thompson, M. T. (1998). *Characterizing Virginia's private forest owners and their forest lands*. USDA Forest Service, Research Bulletin, Northeastern Forest Experiment Station-707. 10 p.
- Birch, T. W. (1997). *Private forest landowners of the United States, 1994*. USDA Forest Service, Resource Bulletin, Northeastern Forest Experiment Station-134. 183 p.
- Butler, B. J., Hewes, J. H., Dickinson, B. J., Andrejczyk, K., Butler, S. M., & Markowski-Lindsay, M. (2015). Family forest ownerships of the United States, 2013: Findings from the USDA Forest Service's national woodland owner survey. *Journal of Forestry*, 114(6), 638-647.
- Butler, B. J., Leatherberry, E. C., Best, C., Kilgore, M. A., Sampson, R. N., & Larson, K. (2004). America's family forest owners. *Journal of Forestry*, 102(7), 4-14.
- Clark, B.J., Howard, T.E., and Parker, R. G. (1992). Professional forestry assistance in New Hampshire timber sales. *Northern Journal of Applied Forestry*, 9(1), 14-18.
- Conner, R. C., & Hartsell, A. J. (2002). *Forest area and conditions*. In Wear, D. N., & Greis, J. G. (Eds.), Southern forest resource assessment. USDA Forest Service, General Technical Report, Southern Research Station-053. Asheville, NC. 635 p.
- Davis, M. L. E. S., & Fly, J. M. (2010). Do you hear what I hear: Better understanding how forest management is conceptualized and practiced by private forest landowners? *Journal of Forestry*, 108(7), 321-328.
- DeCoster, L. A. (1998). The boom in forest owners-a bust for forestry? *Journal of Forestry*, 96(5), 25-28.
- Dillman, D. A., Smyth, J. D., & Christian L. M. (2009). *Internet, mail, and mixed-mode surveys: The Tailored Design Method*. New York: Wiley-Interscience.

- Dubois, M. R., McNabb, K., & Straka, T. J. (1999). Costs and cost trends for forestry practices in the South. *Forest Landowner Magazine*, 58(2), 3-8.
- Dubois, M. R., McNabb, K., & Straka, T. J. (1997). Costs and cost trends for forestry practices in the South. *Forest Landowner Magazine*, 56(2), 7-13.
- Dubois, M. R., McNabb, K., Straka, T. J., & Watson, W. F. (1995). Costs and cost trends for forestry practices in the South. *Forest Landowner Magazine*, 56(2), 7-13.
- Dubois, M. R., Watson, W. F., Straka, T. J., & Belli, K. L. (1991). Costs and cost trends for forestry practices in the South. *Forest Landowner Magazine*, 50(3), 26-32.
- Dyer, J. F., Barlow, B., Kush, J., Morse, W., Teeter, L., & Keever, G. (2015). Factors affecting Alabama landowner interest in harvesting pine straw and willingness to accept prices. *Agroforestry System*, 89, 829-839.
- D'Amato, A. W., Catanzaro, P. F., Damery, D. T., Kittredge, D. B., & Ferrare, K. A. (2010). Are family forest owners facing a future in which forest management is not enough? *Journal of Forestry*, 108, 32-38.
- Erickson, D. L., Ryan, R. L., & Young, R. D. (2002). Woodlots in the rural landscape: landowner motivations and management attitudes in a Michigan case study. *Landscape and Urban Planning*, 58, 101-112.
- Finley, A. O., Kittredge Jr, D. B., Stevens, T. H., Schweik, C. M., & Dennis, D. C. (2006). Interest in cross-boundary cooperation: Identification of distinct types of private forest owners. *Forest Science*, 52(1), 10-22.
- Franklin, E. C., & Munn, I. A. (1995). Valuation of consulting foresters' contribution to timber sale prices. *The Consultant*. Winter.
- Gunter, J. E., Bullard, S. H., Doolittle, M. L., & Aranao, K. G. (2001). *Reforestation of harvested timberlands in Mississippi: behavior and attitudes of non-industrial, private forest landowners*. Bulletin FO172, Mississippi State, MS: Mississippi State University, Forest and Wildlife Research Center. 25 p.
- Hanson, C., Yonavjak, L., Clarke, C., Minnemeyer, S., Boisrobert, L., Leach, A., & Schleeweis, K. (2010). *Southern forest for the future*. Retrieved from <http://www.seesouthernforests.org/southern-forests-for-the-future>. Accessed May 6, 2016.

- Hatcher Jr, J. E., Straka, T. J., & Greene, J. L. (2013). The size of forest holding/parcelization problem in forestry: A literature review. *Resources*, 2, 39-57.
- Haymond, J. L. (1988). NIPF opinion leaders: what do they want? *Journal of Forestry*, 86(4), 30-35.
- Hodges, D. G., & Cabbage, F. W. (1986). Private forestry consultants: 1983 status and accomplishments in Georgia. *Southern Journal of Applied Forestry*, 10(4), 225-230.
- Hubbard, W. G., & Abt, R. C. (1989). The effect of timber sale assistance on returns to landowner. *Resource Management and Optimization*, 6(3), 225-234.
- Jacobson, M. (2009). *Keeping records of forest management activities*. Penn State Cooperative Extension. 10 p.
- Joshi, S., & Arano, K. (2009). Determinants of private forest management decisions: A study on West Virginia NIPF landowners. *Forest Policy and Economics*, 11(2), 118-125.
- Kingsley, N. P., & Birch, T. W. (1977). *The forest-land owners of New Hampshire and Vermont*. USDA Forest Service, Resource Bulletin, Northeastern Forest Experiment Station-51. Upper Darby, PA. 47 p.
- Kluender, R. A., & Walkingstick, T. L. (2000). Rethinking how non-industrial landowners view their lands. *Southern Journal for Applied Forestry*, 24(3), 150-158.
- Kronrad, G. D., & Albers, C. A. (1983). Consulting forestry services and fees in North Carolina. *National Wood lands*, 7(1), 9-12.
- Kuhn III, J. F. (1984). *Cost trends of selected forest management activities in the southern United States from 1961 to 1982*. Thesis. Mississippi State University. Mississippi State, MS. 48 p.
- Kuuluvainen, J., Karppinen, H., & Ovaskainen, V. (1996). Landowner objectives and non-industrial private timber supply. *Forest science*, 42(3), 300-309.
- Larson, D. M., & Hardie, I. W. (1989). Seller behavior in stumpage markets with imperfect information. *Land Economics*, 65(3), 239-253.

- Londo, A.M., & Grebner, D.L. (2004). Economies of scale and forest management in Mississippi. In Connor, K. F. (Eds.), *Proceeding of the 12th biennial southern silvicultural research conference*. USDA Forest Service, General Technical Report, Southern Research Station-71. Asheville, NC. 594 p.
- Maggard, A., & Barlow, R. (2017). 2016 costs and trends for southern forestry practices. *Forest Landowner Magazine*, 76(5), 31-39.
- Majumdar, I., Teeter, L., & Butler, B. 2008. Characterizing family forest owners: A cluster analysis approach. *Forest Science*, 54(2), 176-184.
- Martin, J. (1994). *Hiring a consulting forester*. Department of Forest Ecology and Management, School of Natural Resources, University of Wisconsin-Madison. *Forestry Facts*, 75, 1-5.
- Measells, M.K., Grado, S.C., Hughes, H.G., Dunn, M.A., Idassi, J., & Zielinske, B. (2005). Non-industrial private forest landowner characteristics and use of forestry services in four southern states: Results from a 2002-2003 mail survey. *Southern Journal for Applied Forestry*, 29(4), 194-199.
- Mehmood, S.R., & Zhang, D. (1998). Determinants of NIPF landowners' choice of assistance foresters. Proceeding of the 1998 Southern. Forest Economics Workshop, Williamsburg, VA.
- Mississippi Forestry Commission. 2010. *Mississippi's assessment of forest resources and forest resource strategy*. 10 p.
- Moak, J. E. (1982). Forest practices cost trends in the South. *Southern Journal of Applied Forestry*, 6(3), 130-132.
- Moffat, S. O., Cabbage, F. W., Cascio A. J., & Sheffield, R. M. (1998). The future of forest management on NIPF lands in the South: Results of an expert opinion survey. In Abt, K., & Abt, R. C. (Eds.), *Proceedings of the Conference on Southern Forest Economics Workshop*. Southern Research Station. Research Triangle Park, NC. 17-24.
- Munn, I. A., & Rucker, R. R. (1994). The value of information services in a market for factors of production with multiple attributes: The role of consultants in private timber sales. *Forest Science*, 40(3), 474-496.

- Mutandwa, E., Grala, R. K., Grado, S. C., & Munn, I. A. (2016). Family forest owners' familiarity with conservation programs in Mississippi, USA. *Small Scale Forestry*, 15(3), 303-319.
- Nagubadi, R. V., McNamara, K. T., Hoover, W. L., & Mills, W. L. (1996). Program participation behavior of non-industrial forest landowner: A probit analysis. *Journal of Agriculture and Applied Economics*, 28(2), 323-336.
- Nagubadi R. V., & Zhang, D. (2005). Determinants of timberland use by ownership and forest type in Alabama and Georgia. *Journal of Agricultural and Applied Economics*, 37(1), 173-186.
- Oswalt, S. N., Smith, W. B., Miles, P. D., & Pugh, S. A. (2014). *Forest resources of the United States, 2012: A technical document supporting the Forest Service 2015 update of the RPA Assessment*. USDA Forest Service, General Technical Report-91. Washington Office, DC. 218 p.
- Oswalt, S.N. (2015). *Mississippi's forests, 2013*. USDA Forest Service, Research Bulletin, Southern Research Station-204. Asheville, NC. 81 p.
- Poudyal, N.C., & Hodges, D. G. (2009). Factors influencing landowners interest in managing wildlife and avian habitat on private forestland. *Human Dimensions of Wildlife*, 14(4), 240-250.
- Prestemon, J. P., & Abt, R. C. (2002). *Timber products supply and demand*. In Wear, D.N. and Greis, J.G. (Eds). Southern forest resource assessment. USDA Forest Service, General Technical Report, Southern Research Station-53. Asheville, NC. 635 p.
- Rogers, W. R., & Munn, I. A. (2003). Forest management intensity: a comparison of timber investment management organizations and industrial landowners in Mississippi. *Forest Policy and Economics*, 27(2), 83-91.
- Romm J., Tuazon R., & Washburn C. (1987). Relating forestry investment to the characteristics of non-industrial private forestland owners in Northern California. *Forest Science*, 3, 197-209.
- Royer, J. P., & Kaiser, H. F. (1985). Influence of professional forester on pine regeneration in the South. *Southern Journal for Applied Forestry*, 9, 48-52.

- Smith, W. B., Miles, P. D., Vissage, J. S., & Pugh, S. A. (2004). Forest resources of the United States, 2002. USDA Forest Service, General Technical Report, North Central Research Station-241. NC. 137 p.
- Smith, W. B., Miles, P. D., Perry, C. H., & Pugh, S. A. (2009). *Forest resources of the United States, 2007*. USDA Forest Service, General Technical Report-78. St. Paul, MN. 336 p.
- Society of American Foresters. (1979). *Improving outputs from non-industrial private forests*. Study report. Washington, DC: Society of American Foresters. 11 p.
- Thompson, M. T. (1999). *A forested tract-size profile of Florida's NIPF landowners*. USDA Forest Service, Resource Paper, Southern Research Station-15. Asheville, NC. 10 p.
- Vanderford, E. F. (2013). *Mississippi private forest owner characteristics and future plans: implications for extension forestry*: Thesis. Mississippi State University. Mississippi State, Mississippi. 106 p.
- Watkins, C. C., & Munn, I. A. (2001). Mississippi consultant fees and services: By tract size and professional affiliation. *Southern Journal for Applied Forestry*, 25(4), 178-186.
- Watt, L. (1996). Choosing and using consultants. *Management*, 43(4), 58-62.
- Wear, D. N. (1996). *Forest management and timber production in the U.S. South*. Southeastern Center for Forest Economics Research, SCFER Working Paper No. 82, Research Triangle Park, NC. 40 p.
- Wear, D. N., & Greis, J. G. (2002). The southern forest resource assessment: Summary report. USDA Forest Service, General Technical Report. Southern Research Station-54, 103 p.
- Wicker, G. (2002). Motivation for private forest landowners. *Southern forest resource assessment*. 225-237.
- Wright, W. C. (2015). *2013 Mississippi consulting forester survey*. Thesis. Mississippi State University, Mississippi State, MS. 103 p.

- Wright, W. C., & Munn, I. A. (2016). *2013 fees and services of Mississippi's consulting foresters*. Forest and Wildlife Research Center, Research Bulletin FO460, Mississippi State University. 36 p.
- Woudenberg, S. W. Conkling, B. L., O'Connell, E. B., Lapoint, E. B., Turner, J. A., & Waddell, K. L. (2010). *The Forest Inventory and Analysis database: Database description and user's manual version 4.0 for Phase 2*. USDA Forest Service, General Technical Report, Rocky Mountain Research Station-245. Fort Collins, CO. 344 p.
- Zhang, D., & Mehmood, S. R. (2001). Predicting non-industrial private forest landowners' choices of a forester in harvesting and tree planting assistance in Alabama. *Southern Journal for Applied Forestry*, 25(3), 101-107.
- Zhang, D., Warren, S., & Bailey, C. (1998). The role of assistance foresters in non-industrial private forest management: Alabama landowners' perspectives. *Southern Journal of Applied Forestry*, 22 (2), 101-105.

**A.2 Survey instrument**

A Non-industrial Private Forest Landowner Forest Management Survey in Mississippi

**Part I: PROPERTY DATA**

1. How many acres of forest land did you own in Mississippi in 2015 (include land that was wooded but currently contains no live trees or seedlings?)

..... Total acres of forest land owned in Mississippi

2. To the best of your ability, divide your total Mississippi forest land (from question 1) into the following categories:

Planted pine: ..... acres

Include all planted or artificially seeded pine plantations.

Natural pine: .....acres

The majority of the trees are pine, but some hardwooded may also be present.

Hardwood/Pine: ..... acres

The majority of the trees are hardwoods, but at least 25% of the trees are pines.

Hardwood: .....acres

The majority of the trees are hardwoods; less than 25% of the trees or seedlings.

Non-typed: .....acres

Land that once was wooded but currently contains no live tress or seedling.  
(for example, very recent clear cut areas)

If you entered “0” or “none” in question 1 and 2, please proceed to Part IV on page &. Otherwise, please continue to question 3. Thank you.

3. Have you ever hireed a consulting forest for any of your forest management activities on your forest land?

YES                      NO                      Don't Know    (Circle one)

4. Would you be willing to hire a consulting forester?

YES                      NO                      Don't Know    (Circle one)

If no, please indicate why:.....

- 5. Do you have a written forest management plan?  
YES                      NO                      (Circle one)
  
- 6. Are you a member of any forestry organization? For example, a County Forestry Association.  
YES                      NO                      (Circle one)
  
- 7. How much were your total 2015 county property taxes (ad valorem taxes) on your forested land? \$.....
  
- 8. Did you harvest timber, lease hunting rights, Or incur any expenses for management activities on your forested land in 2015?  
YES                      NO                      (Circle one)

If you answered YES to question 8, please go to Part II and complete the remainder of the questionnaire. If you answered NO to question 8, please proceed to page 7 and complete Part IV and then return this questionanaire in the envelope provided. Thank you.

**PART II: 2015 FOREST MANAGEMENT ACTIVITIES**

Please itemize your forest management costs and the number of acres treated by completing the items in this section. Some guideline:

- Report only those costs that occurred during 2015.
- Cost figures should include only the actual amount of money spent by you during 2015 for each of the specified management activities. Do not include your time or other costs that are not out-of-pocket expenses.
- Avoid “double-counting” or listing the same cost twice. For example, if you report chemical treatment, burning, or fretilization udner site prepartion on page3, don not report the same treatments under timber managmnet costs on page 4.
- Be as accurate as possible; however, if you are unsure, report your best estimate.

- 1. CAPITAL EXPENDITURES (capitalized expenses for income tax purpose)

A. SITE PREPARATION

Site preparation includes any treatment of the site in preparation for planing. Mechanical site preparation includes all treatments such as chopping, ripping, shearing, piling, disking or any combination of the above that utilize heavy equipment. Chemical site preparation involves the use of herbicides to prepare the site and is usually applied using a tractor, skidder or helicopter. Burning is typically used to remove the wood debris after mechanical or chemical site preparation but may be used alone. Bedding is the process of mounding soil in wet sites to provide a planing spot above the water table.

	Acres Treated	Total Cost
1. Mechanical Site Prep	.....	\$.....
2. Chemical Site Prep	.....	\$.....
3. Site Prep Burning	.....	\$.....
4. Bedding	.....	\$.....

- If no treatment or costs, check here  and go to B.\

B. FERTILIZATION IN ASSOCIATION WITH REGENERATION

Acres Treated	Total Cost
.....	.....

- If no treatment or costs, check here  and go to C.

C. REGENERATION-PLANTING

	Species	Trees per Acre	Acres Planted	Total Cost (Seedlings +labor)
1.	Loblolly Pine	.....	.....	.....
2.	Longleaf Pine	.....	.....	.....
3.	Slash Pine	.....	.....	.....
4.	Hardwoods	.....	.....	.....
5.	Other	.....	.....	.....

If other, please describe:  
.....

- If no treatment or costs, check here  and go to D.

D. NATURAL REGENERATION

	Forest type	Acres naturally Regenerated
1.	Pine type	.....
2.	Hardwood type	.....
3.	Pine/Hardwood	.....

- If no treatment or costs, check here  and go to E.

E. ROAD CONSTRUCTION

Miles Built	Total Cost
.....	\$.....

- If no treatment or costs, check here  and go to F.

F. OTHER CAPITAL EXPENDITURES (please describe)

	Total Cost
i. Description:.....	\$.....
ii. Description: .....	\$.....

- If no treatment or costs, check here  and go to Part 2, A.

2. EXPENSED EXPENDITURES (expenses deducted from ordinary income for tax purposes)

A. TIMBER MANAGEMENT COSTS

	Acres Treated	Total Cost
1 Prescribed burning	.....	\$.....
2 Fertilization	.....	\$.....
3 Pruning	.....	\$.....
4 Chemical release	.....	\$.....
5 Pre-commercial thinning	.....	\$.....
6 Timber stand improvement (Please describe)	.....	\$.....
.....	.....	\$.....

- If no treatment or costs, check here  and go to B

NOTE: For the following expenses, report that portion associated only with the forested acres of your property.

**B. ROUTINE OR ON-GOING EXPENSES**

	Total Cost
1. Property line maintenance	\$.....
2. Protection against fire, insects, or disease	\$.....
3. Road maintenance	\$.....
4. Supervision and administration	\$.....
5. Animal damage control (e.g. beavers)	\$.....
6. Timber Loss/Damage Insurance	\$.....

- If no treatment or costs, check here  and go to C

**C. FEES FOR PROFESSIONAL SERVICES**

	Total Cost
1. Consulting forester fees	\$.....
2. Attorney fees	\$.....
3. Accountant fees	\$.....
4. Surveyor fees	\$.....

- If no treatment or costs, check here  and go to Part II A.

**PART III: TIMBER HARVEST INFORMATION**

**A. FINAL HARVESTS**

Types of Harvest	Acres Harvested
1. Clear-cut	.....
2. Seed tree	.....
3. Shelter wood	.....

- If no treatment or costs, check here  and go to B.

**B. INTERMEDIATE HARVESTS**

Type of Harvest	Acres Harvested
1. First thinning	
1a. Row thinning	.....
1b. Selective thinning:	
1b1. Marked thinning	.....
1b2. Operator select	.....
2. Second Thinning (or later)	
2a. Marked thinning	.....
2b. Operator select	.....

- If no treatment or costs, check here  and go to C.

**C. UNEVEN AGE HARVESTS**

Types of Harvest	Acres Harvested
1. Group selection	.....
2. Single tree selection	.....

- If no treatment or costs, check here  and go to D.

**D. TIMBER HARVEST EXPENSES**

Report the costs incurred for conducting the harvests reported above. These costs include cruising, marking, sale preparation, sale administration and supervision etc.

2015 timber harvest expenses	\$.....
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- If no treatment or costs, check here  and go to E.

**E. HUNTING/WILDLIFE MANAGEMENT**

1. 2015 hunting revenues	\$.....
2. Associated expenses	\$.....

- If no treatment or costs, check here  and go to Part IV.

**PART IV: PERSONAL INFORMATION**

1. What is your age? ..... Years
  
2. Are you: (circle one)
  1. Male
  2. Female
  
3. What is your appropriate total annual household income before taxes? (please circle only one)
  1. Under \$19,999
  2. \$20,000 to \$39,999
  3. \$40,000 to \$59,999
  4. \$60,000 to \$79,999
  5. \$80,000 to \$99,999
  6. \$100,000 to \$119,999
  7. \$120,000 to \$139,999
  8. \$140,000 to \$159,999
  9. \$160,000 to \$179,999
  10. \$180,000 to \$199,999
  11. \$200,000 and above
  
4. Are you:
  1. White
  2. Black
  3. Asian
  4. American Indian
  5. Other (please specify .....)
  
6. Your educational level
  1. Some High School
  2. High School
  3. Vocational/Technical Training
  4. Bachelor Degree
  5. Graduate Degree
  6. Other (please specify :.....)

Your contribution of time to this study is greatly appreciated. Please return your completed questionnaire in the postage paid business reply envelope as soon as possible. Thank you.