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PENNSYLVANIA’S PRIVATE FOREST LANDOWNERS:
EXPLORING MOTIVATIONS, MANAGEMENT ACTIVITIES AND SOURCES
OF INFORMATION

A Dissertation in
Rural Sociology and Human Dimensions of Natural Resources and the Environment

by

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ABSTRACT

Nearly three-quarters of Eastern forests are owned by private forest landowners (PFLs); the combined decisions made by PFLs have important implications on forest resources. We all benefit from the economic, aesthetic, recreational, and ecological services private forests provide. However, America’s forested landscape is changing. Forests are becoming more physically disconnected as their surrounding land uses become increasingly urban in nature. In addition, the number of forest owners is increasing, while average forest parcel size is decreasing. The movement from large ownerships toward a more diverse range of owners has resulted in a multiplicity of management approaches, land tenure, and landowner characteristics. Each of these shifts can potentially lead to a diverse pattern of forest uses and conversion rates across the nation’s landscape. If functional forest landscapes are to be maintained, efforts must be made to engage PFLs in forest management. This dissertation addresses the question of who Pennsylvania’s PFLs are, and informs efforts to engage them in discussions and efforts to improve forest management. The research presented here focuses on where PFLs get their information, the type of management practices they engage, why they own their forestland, and how these motivations and intentions change over time. The PFL typologies presented here provide an important foundation for continuing to create alternative outreach approaches, reflective of PFLs’ interests and goals in Pennsylvania. Implications of results are discussed and avenues for future research noted.
# TABLE OF CONTENTS

LIST OF TABLES ........................................................................................................ vi
LIST OF FIGURES ...................................................................................................... vii
ACKNOWLEDGEMENTS .......................................................................................... xiii
DEDICATION ............................................................................................................... xv

Chapter 1 Introduction ............................................................................................. 1
  PFL – What’s in a Name? ........................................................... 4
  PFL Research ........................................................................... 6
  Pennsylvania’s PFLs ................................................................. 12
  Dissertation Outline ................................................................. 15
  Conclusion ............................................................................. 18
  Literature Cited: Chapter 1 ...................................................... 19

Chapter 2 Mind the Gap: Information Sources Used by PFLs When Making Decisions Regarding Their Forestland .......................................................... 27
  Review of PFLs and Information Sources Used ......................... 28
  Adult Learning Theory .............................................................. 33
  Methods .................................................................................. 37
    Data Analysis ......................................................................... 38
  Results ...................................................................................... 51
    Logistic Regression Results .................................................. 57
  Discussion ............................................................................... 60
  Literature Cited: Chapter 2 ...................................................... 64

Chapter 3 Non-Timber Forest Products (NTFPs) and Private Forestlands: Characteristics of Pennsylvania PFLs Who Harvest NTFPs from Their Forests ............................. 69
  What are NTFPs? .................................................................... 73
  Why NTFPs? .......................................................................... 76
  Methods .................................................................................. 84
    Mail Survey ........................................................................... 84
  Results ...................................................................................... 86
    Rate of Participation ............................................................ 86
    Sociodemographics ............................................................... 89
    Forestland Ownership ........................................................... 95
    Information Sources ............................................................. 102
    Forestland Activities ........................................................... 107
# LIST OF TABLES

Table 2.1 Summary of significant non-respondent and respondent differences .................. 39

Table 2.2 USDA Economic Research Service rural-urban continuum codes .................. 43

Table 2.3 Component loadings for forestry knowledge.................................................... 48

Table 2.4 Component loadings for information source used............................................. 50

Table 2.5 Logistic regression classification matrix for training and hold-out samples .... 58

Table 2.6 Logistic regression predicting information source used \(^a\)............................... 58

Table 3.1 Percentage of Pennsylvania PFLs who have performed forestland............. 107

Table 4.1 Summary of significant non-respondent and respondent differences .......... 149

Table 4.2 Principal component analysis of cooperative activities................................. 166

Table 4.3 Variable means and std. errors for full sample, cooperators, and non-cooperators .............................................................................................................................................. 167

Table 4.4 Logistic regression classification matrix for training and hold-out samples .. 168

Table 4.5 Logistic regression predicting landowner cooperation\(^a\)................................. 168

Table 5.1 2008 Repeated measures panel responses ..................................................... 194

Table 5.2 Collapsed categories for most important ownership reason ......................... 195
LIST OF FIGURES

Figure 2.1 Age distribution of PFLs by type of information source used .......................... 52

Figure 2.2 Educational attainment of PFLs by type of information source used ........ 53

Figure 2.3 PFLs’ frequency of interaction with neighbors by information source used .. 55

Figure 2.4 Incidence of forestry interactions with neighbors by information source .... 55

Figure 2.5 Number of intended management activities by information source ......... 56

Figure 2.6 Likelihood of commercial timber harvest by information source .............. 56

Figure 2.7 PFLs mean forestry knowledge scores ......................................................... 57

Figure 3.1 Distribution of Pennsylvania PFLs by NTFP management activity .......... 87

Figure 3.2 Distribution of Pennsylvania PFLs by likelihood of engaging in NTFP activity in the future ............................................................................................................................................... 87

Figure 3.3 Distribution of PFLs who have harvested NTFPs on their forestland by Pennsylvania county ................................................................................................................................................. 88

Figure 3.4 Distribution of Pennsylvania PFLs by forestland ownership type ............ 90

Figure 3.5 Distribution of Pennsylvania PFLs by age categories ................................. 90

Figure 3.6 Distribution of Pennsylvania PFL non-timber forest product harvesters and non-harvesters across age categories ............................................................................................................... 91

Figure 3.7 Distribution of Pennsylvania PFLs by employment categories (*contains homemaker, student, and non-employment categories) ................................................................. 92
Figure 3.8 Distribution of Pennsylvania PFL non-timber forest product harvesters and non-harvesters across employment categories (*contains homemaker, student, and non-employment categories) ............................................................................................................................. 92

Figure 3.9 Distribution of Pennsylvania PFLs by highest level of education completed. 93

Figure 3.10 Distribution of Pennsylvania PFLs by household yearly income categories 93

Figure 3.11 Distribution of Pennsylvania PFLs by political affiliation......................... 94

Figure 3.12 Distribution of Pennsylvania PFL non-timber forest product harvesters and non-harvesters by political affiliation .......................................................................................................................... 95

Figure 3.13 Distribution of Pennsylvania PFLs by distance of forestland from primary residence ................................................................................................................................................ 96

Figure 3.14 Distribution of Pennsylvania PFLs by frequency of forestland visitation .... 96

Figure 3.15 Distribution of Pennsylvania PFL non-timber forest product harvesters and non-harvesters by frequency of forestland visitation............................................................................................. 97

Figure 3.16 Distribution of Pennsylvania PFLs by years of forestland ownership ........ 97

Figure 3.17 Distribution of Pennsylvania PFLs by importance of reasons for owning forestland.................................................................................................................................................. 98

Figure 3.18 Importance of reasons for owning forestland by percent of Pennsylvania PFL non-timber forest product harvesters and non-harvesters .............................................................. 100

Figure 3.19 Distribution of Pennsylvania PFLs by most important reason for owning their forestland.......................................................................................................................... 101

Figure 3.20 Most important reason for owning forestland by percent of Pennsylvania PFL non-timber forest product harvesters and non-harvesters ...................................................... 101
Figure 3.21 Distribution of Pennsylvania PFLs by information source used when making decisions about their forestland (note: percentages do not sum to 100 since respondents could choose multiple options) .................................................................................................................................................. 103

Figure 3.22 Distribution of Pennsylvania PFLs by information source likely to use in the future (note: percentages do not sum to 100 since respondents could choose multiple options) .................................................................................................................................................. 103

Figure 3.23 Distribution of Pennsylvania PFL non-timber forest product harvesters and non-harvesters by information source used when making decisions about their forestland (note: percentages do not sum to 100 since respondents could choose multiple options) .................................................................................................................................................. 104

Figure 3.24 Information sources likely to use in the future when making decisions about their forestland by percent of Pennsylvania PFL non-timber forest product harvesters and non-harvesters .................................................................................................................................................. 106

Figure 3.25 Distribution of Pennsylvania PFL non-timber forest product harvesters and non-harvesters by forestland activity engaged in on forestland (note: percentages do not sum to 100 since respondents could select multiple activities) .................................................................................................................................................. 108

Figure 3.26 Distribution of Pennsylvania PFL non-timber forest product harvesters and non-harvesters by tree harvesting activity engaged in on forestland .................................................................................................................................................. 109

Figure 3.27 Timber harvesting activities likely to do in the future by percent of Pennsylvania PFL non-timber forest product harvesters and non-harvesters .................................................................................................................................................. 110

Figure 3.28 Self-rated quality as forestland caretaker by percentage of Pennsylvania PFL non-timber forest product harvesters and non-harvesters .................................................................................................................................................. 111

Figure 3.29 Mean knowledge ratings for Pennsylvania PFLs non-timber forest product harvesters and non-harvesters across forestry topics .................................................................................................................................................. 112

Figure 3.30 Mean agreement score for Pennsylvania PFL non-timber forest product harvesters and non-harvesters across timber harvest statements .................................................................................................................................................. 113

Figure 3.31 Mean agreement score for Pennsylvania PFL non-timber forest product harvesters and non-harvesters across forest statements .................................................................................................................................................. 114
Figure 3.32 Distribution of Pennsylvania PFL non-timber forest product harvesters by type of NTFP harvested (note: percentages do not sum to 100 since respondents could select multiple products) ................................................................. 115

Figure 3.33 Distribution of Pennsylvania PFL non-timber forest product harvesters by NTFP activity ................................................................. 116

Figure 4.1 Pennsylvania population change by county, 2000 to 2010 ...................... 137

Figure 4.2 Pennsylvania land cover change from 1992 to 2005............................ 139

Figure 4.3 Percent of cooperating PFLs who worked with neighboring landowners on past activities (note: percentages do not sum to 100 as respondents could select more than one activity) ................................................................. 157

Figure 4.4 Attitude toward cross-boundary cooperation for cooperating and non-cooperating PFLs ................................................................. 158

Figure 4.5 Interaction rates of cooperators and non-cooperators with neighbors........ 159

Figure 4.6 Distribution of PFLs by past forest management activity (note: percentages do not sum to 100 since respondents could select multiple activities) ...................... 159

Figure 4.7 Distribution of commercial timber harvest by cooperators and non-cooperators ................................................................. 160

Figure 4.8 Distribution of forestland visitation by cooperators and non-cooperators .... 161

Figure 4.9 Cooperative activities likely to do in future by percent of cooperators and non-cooperators (note: percentages do not sum to 100 as respondents could select more than one activity) ................................................................. 162

Figure 4.10 Distribution of cooperators and non-cooperators by gender ............... 164

Figure 4.11 Distribution of cooperators and non-cooperators by age categories ....... 164
Figure 4.12 Distribution of cooperators and non-cooperators by educational attainment
......................................................................................................................................... 165

Figure 5.1 Mean likelihood score for management activity by tract size...................... 197

Figure 5.2 PFL Gender distributions across survey samples................................. 198

Figure 5.3 Distribution of highest level of education completed by survey cross-section
......................................................................................................................................... 200

Figure 5.4 Distribution of highest level of education completed within PFLs in repeated
measures panel.......................................................................................................................... 201

Figure 5.5 PFL income distribution across survey samples (*represents the panel average
across 2006 and 2008 responses)......................................................................................... 202

Figure 5.6 Distribution of employment categories across survey cross-sections........ 203

Figure 5.7 Distribution of employment categories within PFLs in repeated measures
panel......................................................................................................................................... 203

Figure 5.8 PFLs’ political affiliation across survey cross-sections ......................... 204

Figure 5.9 Distribution of PFLs by most important ownership reason for cross-sectional
analysis..................................................................................................................................... 206

Figure 5.10 Distribution of PFLs by most important ownership reason and tract size for
cross-sectional analysis........................................................................................................... 207

Figure 5.11 Distribution of PFLs across most important ownership category for repeated
measures panel.......................................................................................................................... 207

Figure 5.12 Distribution of PFLs by most important ownership reason for repeated
measures panel.......................................................................................................................... 208

Figure 5.13 Commercial timber harvests by ownership reason and tract size for cross-
sectional analysis .................................................................................................................. 210
Figure 5.14 Likelihood of improving wildlife habitat on forestland for cross-sections across ownership categories ........................................................................................................... 211

Figure 5.15 Likelihood of improving wildlife habitat on forestland for repeated measures panel across ownership categories ........................................................................................................... 212

Figure 5.16 Likelihood of improving fish habitat on forestland for cross-sections across ownership categories ........................................................................................................... 213

Figure 5.17 Likelihood of improving fish habitat on forestland for repeated measures panel across ownership categories ........................................................................................................... 214

Figure 5.18 Likelihood of creating a stream-side buffer on forestland for cross-sections across ownership categories ........................................................................................................... 215

Figure 5.19 Likelihood of reducing fire hazards on forestland for cross-sections across ownership categories ........................................................................................................... 216

Figure 5.20 Likelihood of reducing fire hazards on forestland for repeated measures panel across ownership categories ........................................................................................................... 217

Figure 5.21 Likelihood of harvesting NTFPs for personal use on forestland for cross-sections across ownership categories ........................................................................................................... 218

Figure 5.22 Likelihood of harvesting NTFPs for personal use on forestland for repeated measures panel across ownership categories ........................................................................................................... 219

Figure 5.23 Likelihood of harvesting NTFPs for sale on forestland for cross-sections across ownership categories ........................................................................................................... 220

Figure 5.24 Likelihood of leasing forestland for cross-sections across ownership categories ........................................................................................................... 221

Figure 5.25 Likelihood of leasing forestland for repeated measures across ownership categories ........................................................................................................... 221
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DEDICATION

To my mother who taught me no matter how set I may be, no matter how immutable
the path I am on seems, I can always change directions
and choose my own adventure.
Chapter 1

Introduction

America’s private forests and those who own them have received considerable attention in the forestry management and social science literatures. The behavior and characteristics of private forest landowners (PFLs) have been the subject matter in hundreds of articles and many books. This makes sense given the fact the United States contains eight percent of the world’s primary forests, nearly 750 million acres (Alvarez 2007; Smith et al. 2004). Moreover, approximately 56 percent of these forests are privately owned by an estimated 11 million owners (Butler 2008; Smith et al. 2004). The majority of PFLs (about 60%) are estimated to own less than 10 acres of forestland (Butler 2008). On an individual level, these owners have a relatively small impact. However, given their sheer numbers, PFLs have a large collective impact (Butler 2008; Best and Wayburn 2001; Kuhns et al. 1998).

Private forests generate economic value and provide aesthetic, recreational, ecologic, and resource protection benefits (Kline et al. 2004). These forests also have the potential to be converted to other forms of land use. While the forestland base has remained fairly stable, forestland per capita has decreased (Butler 2008; Birch 1996) indicating greater numbers of landowners owning smaller parcels of forest. The steady movement away from concentrated, large ownership patterns toward a more diverse range of owners has resulted in a multiplicity of management approaches, land tenure, and landowner characteristics. Each of these changes can potentially lead to a diverse pattern of forest uses and conversion rates across the nation’s landscape.
Total forestland in the United States has been relatively stable over the last century. The USDA Forest Service (USFS) projected a net loss of 20 million acres (2.7%) over the period 2000 to 2050, most to development (USDA FS 2006). Besides conversion to urban uses, forestland is also projected to be converted to agricultural land uses to replace croplands lost to development (Alig et al. 2002). Between 1982 and 2001, approximately 34 million acres of open space (an area the size of Illinois) were lost to development across the United States. During the same time period, ten million acres of forestland were converted to urban uses; moreover, an additional 23 million acres is projected to be lost to development by 2030 (Nie and Miller 2010; USDA FS 2006).

Conversion is only one aspect of forestland loss. Fragmentation (the division of forests into smaller isolated patches) and parcelization (the subdivision of parcels into smaller ownership parcels) also contribute to the story of forestland loss. With an expected net increase in the national population, USFS projections indicated many private forests were likely to see dramatic increases in housing development by 2030 (Stein et al. 2005). Forests and other natural amenities can be important factors in residential location decisions (Kaplan and Austin 2004; Egan and Luloff 2000; Cromartie and Wardwell 1999; McGranahan 1999; Brown et al. 1997).

Subsequently, forest fragmentation is exacerbated by the concentration of land development in rural areas. Between 1994 and 1997, nearly 80 percent of new housing was constructed outside urban areas. Of this new construction, 94 percent were lots one acre or larger, with 57 percent on lots 10 acres or larger (Heimlich and Anderson 2001). From 1990 to 2001, 60 percent of all new housing units were built at the wildland urban interface (WUI) where development pressures affect forest management and
characteristics (GAO 2007). Maintaining forests and their associated benefits in the face of continuing population growth and development pressures has continued to be an important challenge. Small ownership parcels may prevent commodities from being harvested due to economies of size – higher per acre costs and lower per acre revenues (Alig et al. 2003; Sampson and DeCoster 2000; Row 1978). Increased demands for residential and other forms of development may offer PFLs greater potential for financial returns from forest conversion than traditional forestry practices.

Sustaining the economic and social benefits provided by private forests is dependent upon the maintenance of functional forest landscapes within a context of a PFL population increasing in both numbers and diversity (Stein et al. 2005; Kittredge 2004). To this end, PFLs cannot be treated as a homogenous group who can be effectively served by generalized outreach services (Salmon et al. 2006). Given the variation in forest and landowner characteristics, it is difficult to identify the “average” PFL. Further, it is very difficult indeed to take into consideration the individual circumstances, values, and needs of each forest owner when designing and applying outreach services (Emtage et al. 2007). If functional forest landscapes are to be maintained, efforts must be made to engage PFLs in forest management (Gootee et al. 2010; Emtage et al. 2007; Salmon et al. 2006; Downing and Finley 2005). It is essential to employ outreach efforts that are in line with landowner interests and motivations and are delivered using strategies preferred by PFLs.

This dissertation addressed the question of who are Pennsylvania’s PFLs, and builds upon our knowledge of their ownership motivations, management intentions, and ways to reach them. In 2006, a three panel Pennsylvania Private Forest Landowner Study
was begun. The initial objectives of this five year study were: (1) to identify access barriers to Pennsylvania’s private forest resources; (2) to describe the attitudes, perceptions, issues, and concerns of PFLs; (3) to document the availability of technical assistance; and (4) to determine owners’ future plans for their forestland (Metcalf 2010). This parent study consisted of three mail surveys (2006, 2008, and 2010), semi-structured interviews, cognitive mapping exercises, forest inventories, and spatial analyses (Metcalf 2010; 2006). The focus of this dissertation is on the results of the 2008 mail survey.

In 2008, a twenty-page survey was mailed to 6,600 PFLs (100 per county for all counties but Philadelphia) across the Commonwealth of Pennsylvania. Philadelphia County was excluded since it contained less than one-tenth of one percent of the Commonwealth’s forestland (Metcalf 2010). This survey was administered using a tailored design methodology (Dillman 2007) with four waves of contact: initial survey and letter, a reminder postcard, and a second and third follow-up survey. The total adjusted response rate for the 2008 survey was 49 percent (N=2,713). The remainder of this chapter provides an overall review of private forest landowners to give context for the research presented, and concludes with an outline for the subsequent chapters.

**PFL – What’s in a Name?**

In the U.S., forest ownership types are broadly defined as being public or private. Forests held in public ownership include those owned by federal, state, or local governments. Those forests held in private ownership are traditionally sub-divided into forest industry and non-industrial categories. Forest industry ownerships consist of private entities that own forestland, as well as own and operate wood processing
facilities. The remaining ownership type is the non-industrial private forestland (NIPF) owner. NIPF owners are defined as owning at least one acre of contiguous forestland at least 10 percent stocked, who do not own wood processing facilities (Butler 2008).

The language we employ shapes our reality by forcing us to describe people and objects using a set of specific shared symbols. It is a way of communicating that conveys meaning and influences how readers/listeners view the world (Schraml and Memmler 2005; Fishcer 2003; Shotter 1993; Berger and Luckman 1966). Labeling the latter ownership type as non-industrial does not tell us who these landowners are, but rather who they are not. Furthermore, it treats them as residual private landowners. Defining forest landowners by what they are not, in this case non-industrial, implies that forest industry is the ideal private ownership from the perspectives of both forestry professionals and researchers (Schraml and Memmler 2005; Finley et al. 2001).

In 2001, Finley et al. called for a name change from NIPF to a more positive term. Stating that the term lacked sensitivity to the majority of forest landowners who did not own industrial forests, they proposed the term private forest landowner (PFL).

Recognizing this term may not be considered ideal by all (see “Letters” in May 2001 Journal of Forestry), the authors’ intent was to begin a discussion toward finding a more positive descriptor for this class of forestland owners.

A different and more recent attempt at finding a positive descriptor is associated with the emergence of the term ‘family forest owner’ (FFO). Based on a hierarchy of legally defined ownership categories, FFO included forestlands owned by individuals, married couples, estates and trusts, or other non-incorporated groups of individuals.
(Butler 2008; Butler and Leatherberry 2004). As defined, the term FFO excluded formally associated or incorporated groups, non-profits, associations, as well as non-forest industry businesses (Metcalf 2010). Due to its exclusive nature, FFO further subdivided the traditional moniker of NIPF.

Private forest landowner (PFL) was used throughout this dissertation because it was both an inclusive and positive term for defining forest landowners. Defining landowners in terms of what they were as opposed to what they were not simply made more sense.

**PFL Research**

Given their importance in the management of the nation’s forested landscape, an expansive literature has focused on PFLs. This research has traditionally been contextualized as the role PFLs played in the contribution of timber products to society. The impetus behind such a focus lied not only in PFLs owning the majority of forestland, but also in the decline of commercial harvests on public lands and forest industry lands either producing at capacity or being liquidated (Best and Wayburn 2001; Jones et al. 2001; Bourke and Luloff 1994; Young and Reichenbach 1987; Kurtz and Lewis 1981). During the first half of the 20th century, concern for the nation’s timber supply focused on possible shortfalls caused by exploitative cutting practices (Royer 1987). Following World War II, as timber inventories increased and practices on private lands improved, the concern shifted to one of landowner disinterest and underinvestment in timber production (Royer 1987; Binkley 1981; Sedjo and Ostermeier 1978).
Early research attempts to identify the most important determinants of PFL harvesting were rooted in two basic economic theories: profit and utility maximization (Amacher et al. 2003; Alig et al. 1990). Models based on an assumption of profit maximization treated PFLs similar to forest industry, where landowners were seen as firms and their forests as factors of production (Alig et al. 1990). Under these models, PFLs were treated as rational timber producers with predictable supply behavior (Newman and Wear 1993). However, past research has indicated PFLs responded to economic forces in more complex and less predictable ways than forest industry due to their multiple ownership objectives (Dennis 1989). As a result, models of utility maximization assumed PFLs considered both financial and non-commodity benefits of forest management by balancing timber, non-timber products, and forest amenities to maximize perceived utility (Alig et al. 1990; Dennis 1989).

The preoccupation with timber production facilitated early empirical studies where treatment of timber management and forest management was synonymous (Egan 1997; Sutherland and Tubbs 1958; Mignery 1956). Such a myopic focus on timber and the synonymous treatment of these two terms led to confusion about what it meant to manage a forest. However, more recent empirical studies have differentiated between timber and forest management (Steiner Davis and Fly 2010; Finley and Kittredge 2006; Behan 1990; Haymond 1988; Greene and Blatner 1986; Kingsley and Finley 1975), most of the existing PFL literature has continued to focus on timber supply and PFLs’ inclination to manage, harvest, and regenerate their forests. This fixation with timber has painted a lopsided picture of PFLs, and potentially excluded the majority of owners from
incentive programs and educational outreach. Forestry outreach services which fail to recognize non-commodity forest values are likely to fall short of reaching most PFLs.

More recently, the forestry and social sciences literature expanded its scope to include examination of PFLs’ participation in government programs, attitudes toward forests, non-timber management goals, and future plans. Demographic patterns of landownership, landowner motivations, and forest characteristics have become increasingly recognized as influencing management decisions (Kuuluvainen and Salo 1991; Dennis 1990; Doolittle and Straka 1987; Binkley 1981; Kurtz and Lewis 1981). The volitional nature of private forest management in the U.S. has made knowledge of forest owners’ values, attitudes, and objectives vital to the understanding of PFL management decisions.

Despite supposition that attitudes and values were likely predictors little has been done to link them to PFL management decisions (Metcalf 2010). Research on PFLs’ beliefs, values, and attitudes indicated landowners hold a diverse set of forest values ranging from preservation to utilization (Finley and Kittredge 2006; Bourke and Luloff 1994; Bliss and Martin 1989). Forest landowners and the general public were found to hold similar views regarding environmental issues, forestry practices, and policies (Bliss 1994; Bourke and Luloff 1994). Forestry practices viewed as environmentally beneficial were more likely to receive wide support than those practices believed to damage the environment. Studies also indicated PFLs were generally receptive to multiple uses on their forestland, and owners often hold a variety of forest values making it difficult to identify one that was most important (Bengston et al. 2008). Few of the empirical studies in the literature specifically addressed the link between PFLs’ values and their actual
forestry behavior. Those that did focused on forestry behavior in the context of timber production (Metcalf 2010; Dhubhain et al. 2005 Karppinen 1998; Kuuluvainen et al. 1996; Egan and Jones 1993; Marty et al. 1988).

The general objectives of most ownership studies have been to determine who owned the forestland, how the forestland was managed, and the relationship between management and selected sociodemographic and forestland characteristics. In this respect, a number of efforts have been undertaken in recent years to identify different types of forest owners (e.g., Butler et al. 2007; Salmon 2006; Finley and Kittredge 2006; Boon and Meilby 2004). Some studies of PFL ownership motivations have focused on timber management, harvesting, or stand regeneration (Klunger and Walkingstick 2000; Young and Reichenbach 1987; Greene and Blatner 1986), while others focused on program participation (Kaetzel et al. 2009; Kline et al. 2000; Tyson et al. 1998). For the most part, PFL typologies divided owners into two main groups: (1) landowners whose primary objective for owning forestland was economic activity such as timber production; and (2) those whose primary objective was consumptive (e.g. Mizaraite and Mizaras 2005; Kline et al. 2000; Marty et al. 1988; Kurtz and Lewis 1981). This latter group included PFLs who held non-timber objectives, had multiple objectives, as well as those who had no explicit objectives for their forests. In general, these studies indicated only a minority of PFLs fit the mold of “traditional” forest landowner motivated for timber production.

Many of these typologies have been criticized for not being sufficient for targeting forest management communications and recommendations (Herzele and Van Gossum 2008; Schraml and Memmler 2005). In addition, by the very nature of the
statistical procedures used to create the typologies, the differences between groups were accentuated while issues of common importance were overlooked (Herzele and Van Gossum 2008). Despite such issues, these studies provided insight into the diversity of the PFL population, suggested areas for future growth in the forestry profession (Kendra and Hull 2005), and assisted in tailoring communications to various groups of landowners. Landowner characterizations helped to identify PFLs potentially interested in timber production, and increased the understanding of the diversity of landowner objectives and attitudes regarding economic, amenity, and aesthetic benefits of forestland ownership.

The past thirty years of PFL research provided a fairly consistent description of who these owners were. America’s PFLs were predominantly older, white males, and their average age was increasing. Thirty-four percent of PFLs were 65 years of age or older, compared with 19 percent of the general population, and the number of forest owners 65 years or older increased by one-third between 1993 and 2003 (Butler 2008; Butler and Leatherberry 2004). Given the advancing age of the PFL population, it was not surprising that 49 percent were retirees (Butler 2008). Compared to the general public, PFLs were better educated and had higher levels of income. Nationally, 31 percent of PFLs earned at least a bachelor’s degree compared to 24 percent of the general public, and 18 percent had a household income of at least $100,000 annually compared to 12 percent (Butler 2008).

Tract size has long been considered an important factor in explaining PFLs’ timber and forest management behavior (Cleaves and Bennett 1994; Row 1978; Larsen and Ganser 1972; Webster and Stoltenberg 1959). Typically, owners of larger tracts of
forestland were more likely to have a written management plan, received professional advice, conducted a commercial timber harvest, and owned their forest primarily for timber production. Increasingly, PFLs owned smaller parcels of land and were less likely to engage in forest management practices (Metcalf 2010; Butler and Leatherberry 2004; Mehmood and Zhang 2001; Best and Wayburn 2001; DeCoster 1998; Bliss and Martin 1989).

Most (60%) PFLs have owned their forestland for less than 25 years, and 73 percent lived on or within one mile of their forestland (Butler 2008). PFLs owned their forests for many reasons including: amenities such as solitude, privacy, and enjoyment of wildlife; recreation and hunting; incidental ownership; and financial investments including timber production. Most PFLs ranked timber production as a low priority; however, many landowners still harvested timber from their property (Metcalf 2010; Butler 2008; Birch 1996; Jones et al. 1995; Bliss 1994).

Efforts to translate this expansive body of literature into information and programs to inform and educate PFLs have taken the form of both direct and indirect incentives. Direct incentives included tax benefits and cost-share programs designed to encourage forest management practices by reducing implementation costs. Indirect incentives primarily took the form of technical assistance programs through the USDA Forest Service and university extension services (Keuper 2010; Kilgore et al. 2007; Skok and Gregersen 1975). However, some industry sponsored technical programs have been very successful, notably the American Tree Farm System. Each of these traditional methods was generally considered effective at achieving PFLs’ goals for those landowners who use them.
Nationally, most PFLs have not participated in cost-share programs or forest certification programs. Six percent of PFLs participated in at least one cost share program, and less than one percent was enrolled in a forest certification program (Butler 2008). Just under half of all PFLs (46%) had harvested trees either for personal or commercial purposes, but only 14 percent received professional advice about their forestland, and even less (4%) had a written management plan (Butler 2008). Traditional methods of reaching forest landowners may be considered effective for those PFLs who used them, but the vast majority of PFLs did not participate in these programs and have not sought professional advice.

**Pennsylvania’s PFLs**

As the nation’s largest producer of hardwood lumber, forests cover over 16 million acres (60%) of the Commonwealth of Pennsylvania (PA DCNR 2011). Collectively owning 11.6 million acres, PFLs control the management decisions and ultimately the fate of approximately 70 percent of these forests (PA DCNR 2011; McWilliams et al. 2007). A significant amount of forestland has been both lost (primarily through residential and industrial development) and gained (reversion of agricultural lands). In the future, the latter source of forestland gain will be limited as more agricultural land is converted to urban uses (McWilliams et al. 2007; Alig et al. 2003).

During the past two decades, Pennsylvania’s principal trend was one of rapid land development but slow and uneven population growth. In the 1990s, Pennsylvania was ranked the third slowest among all states with a population growth rate of 3.4 percent; however, during this time Pennsylvania developed the sixth-largest amount of land
(Brookings Institution 2003). Between 1970 and 2000 population shifts out of the commonwealth’s cities, boroughs, and first-class townships signified a long-term trend in rural and suburban population growth and decline of urban cores (GCLGS 2010; Brookings Institution 2003). Since the 1970s more than 1.6 million residents moved to second-class townships, which generally represent outlying areas in the state and are much less-densely populated than first-class townships, boroughs, or cities (Brookings Institution 2003). The total developed area in Pennsylvania increased from 4.1 percent in 1992 to 9.6 percent in 2005. During this same time, approximately 1.5 million acres of land were converted to urban uses resulting in a 131 percent increase in urban acreage (GCLGS 2010). Current indications suggest the pace of new development has slowed, but the spatial pattern of development has not changed.

Similar to national trends, USFS estimates for Pennsylvania’s PFL population in 1980, 1994, and 2007 indicated an increase in landowners: 490,000, 513,900, and 533,000 respectively (Butler 2008; Birch 1996; Birch and Dennis 1980). Average forest parcel size in 1980 was 25 acres (Birch and Dennis 1980) and by 2007 was 22 acres (McWilliams et al. 2007). Estimating the number of PFLs is difficult because USFS’s sampling techniques (USDA Forest Service 2007) tend to select large parcels, inadvertently missing smaller parcels (Metcalf 2010). Taking this selection bias into account, Metcalf (2010) estimated there were more than 600,000 PFLs in Pennsylvania, the majority (63%) of whom owned ten acres or less. Regardless, trends clearly indicated a movement away from concentrated, large ownerships toward multiple smaller ownerships, creating a patchwork pattern of forest use and conversion across the landscape.
It is likely the “average” PFL does not exist; however, estimates of the nominal PFL are intended to present a broad overview of forestland ownership in Pennsylvania. Metcalf (2010) found the majority of Pennsylvania PFLs (63%) owned less than 10 acres of forestland, and the vast majority (92%) owned 50 acres or less. Relative to state residents, Pennsylvania’s PFLs were predominantly older males. PFLs’ median age was 57 years compared to residents’ median age of 38 years. Twenty-eight percent of PFLs were 65 years or older and 35 percent were retirees (Metcalf 2010). The Commonwealth’s PFLs were well educated and had relatively high incomes. The majority (65%) had at least some college education, and 40 percent of PFLs reported an annual household income of at least $75,000 (Metcalf 2010). According to the U.S. Census Bureau’s figures for 2000, approximately 44 percent of Pennsylvania residents had at least some college education and the median household income was $40,106.

Pennsylvania’s PFLs owned their forestland for an average of 18 years, and did so for a variety of reasons (Metcalf 2010). Similar to their national counterparts, amenity and aesthetic values were held as more important than financial objectives; the importance of amenity values did not preclude timber harvesting from occurring on their land (Metcalf 2010; McWilliams et al. 2007). Enjoying wildlife (62%), solitude (59%), and enjoyment of owning forestland (58%) were the objectives most often cited by PFLs as important ownership reasons. Growing timber for sale was considered an important reason for owning forestland by 13 percent of PFLs (Metcalf 2010). When asked to indicate the most important reason for owning, only two percent of PFLs indicated timber production, but nearly half of PFLs (46%) harvested trees from their property for either personal or commercial purposes (Metcalf 2010).
The majority of Pennsylvania’s PFLs had not participated in traditional incentive programs or sought professional advice about their forestland. Only two percent of PFLs in Pennsylvania had participated in cost-share programs (McWilliams et al. 2007). Approximately 20 percent of PFLs had commercially harvested timber from their forestland, and less than four percent of all PFLs in the Commonwealth had a written management plan (Metcalf 2010). In addition, of the PFLs who commercially harvest, only 30 percent received advice from a consulting, state, or extension forester and seven percent received advice from an industry forester (Metcalf 2010).

As development draws near, the urban-forest interface experiences development pressures. Many factors may lead PFLs to sell all or part of their forestland. Twenty-seven percent of Pennsylvania’s PFLs planned to sell their forestland as is, and approximately nine percent planned to subdivide or subdivide and then sell their forestland (Metcalf 2010). In a recent study which examined Pennsylvania PFLs’ experiences planning for the future of their forestlands, Gruver (2010) indicated PFLs struggled with coming to a decision about their forests’ future. The findings indicated PFLs who had subdivided and sold forestland felt circumstances left them no other choice – that they were forced to do it. In addition, the author concluded each PFL’s decision making process was both unique and multidimensional, including a mixture of economic, social, biophysical, and cultural factors (Gruver 2010).

**Dissertation Outline**

In 2008, a 20-page mail survey covering various aspects of forestland ownership was mailed to 6,600 PFLs across all counties but Philadelphia in Pennsylvania. Broadly,
this dissertation explored who Pennsylvania’s PFLs were and how we could best reach them. Chapter Two examined the sources of help and information PFLs used when making decisions about their forestland. The subsequent analyses determined the information sources used and logistic regression was used to classify Pennsylvania’s PFLs by these sources. Relationships between information sources used and landowner characteristics, forestland characteristics, and management practices were explored. Further, this chapter examined information sources used by PFLs within the context of the principles of andragogy.

Knowing where PFLs looked for information was only one part of the equation for providing relevant and targeted services to forest landowners. Understanding the management practices and motivations of PFLs was equally important. As briefly discussed, owning forestland meant more than timber production for most PFLs. For some it provided an opportunity to gather a variety of products such as perennials, fruits, fungi, and nuts for consumptive purposes. These forest products were collectively referred to as non-timber forest products (NTFP). People from all walks of life gathered NTFPs and their importance included environmental, economic, and cultural impacts. A growing concern over NTFPs has emerged in recent years (McLain 2005; Ticktin 2004).

Harvesting NTFPs has a long tradition in the United States. Much of the literature focused on the who, what, and why of product gathering on public lands; recent PFL studies indicated a substantial amount of PFLs harvested NTFPs on their own land. USFS estimates indicated that nationally 23 percent of PFLs harvested NTFPs on their land (Butler 2008). In Pennsylvania, 30 percent of PFLs harvested NTFPs from their forestland for personal use and five percent harvested for commercial purposes (Metcalf
A baseline description of PFLs who harvested NTFPs on their forestland is presented in Chapter Three, where harvesters’ attitudes, knowledge, forestland activities, and characteristics were highlighted. In addition, this chapter explores the potential of increasing PFL engagement with their forestland through NTFP management on private forests.

Pennsylvania’s PFL population is growing, resulting in more PFLs owning smaller tracts of forestland. Division of forestland ownership often leads to disjointed management, loss of forestland, and reduction in ecological integrity of private forests. Diverse values and management objectives of multiple forest landowners contribute to complex landscape conditions and made landscape-level discussions and management difficult. Cooperation across ownership boundaries has the potential to decrease the economic strain PFLs experience when managing their forests while reducing the negative effects of parcelization on ecological services and forest product supply. Chapter Four explores forestland and landowner characteristics that indicated a likelihood of cooperating with neighboring landowners on forest management activities.

Landowner profiles are valuable tools in the understanding of PFLs and play an important role in outreach initiatives. The development of such typologies over time is critical to a proper assessment of trends in PFL motivations and management practices. The longitudinal nature of the Pennsylvania Private Forest Landowner Study afforded us the opportunity to examine the effects of change over time. Chapter Five used data from both the 2006 and 2008 mail surveys to analyze data from three distinct groups of respondents: (1) PFLs who responded only in 2006; (2) PFLs who responded only in 2008; and (3) PFLs who responded to both surveys.
2008; and (3) PFLs who responded in both 2006 and 2008. This analysis explored PFLs’ change in ownership motivations and management intentions from 2006 to 2008.

Conclusion

The context in which private forestland is situated is changing. The amount of and sustainability of forestland is significantly affected by urbanization. Research about the rate of growth of urban areas projects counties on the East Coast, including Pennsylvania counties, to have some of the highest urbanization rates over the next fifty years (McWilliams et al. 2007; Nowak and Walton 2005). Up to 20 million acres of forestland is projected to be lost to urban development, as the nation’s growing population continues to be a driving force in the parcelization and fragmentation of forestland.

Ultimately, the collective decisions made by Pennsylvania’s PFLs have significant implications for the long-term sustainability of the Commonwealth’s forest resources. If private forests are to provide both private and public benefits, the challenge of providing relevant information and services where it is needed and in the preferred format must be met. However, to do so we must have a clearer understanding of PFLs characteristics, interests, and motivations. This study seeks to inform future efforts in fostering information exchange with PFLs. Continuing to improve upon our knowledge of who our forest landowners are and how to inform this vast population is crucial if private forestlands are to continue to be a functional component in the nation’s forested landscape.


Chapter 2

Mind the Gap: Information Sources Used by PFLs When Making Decisions Regarding Their Forestland

The combined decisions made by private forest landowners (PFLs) have important effects on the United States’ total forest resource. Approximately 11 million private owners are responsible for the decisions impacting 423 million acres (56 percent) of the nation’s forests. The majority of PFLs (60 percent) own 10 acres or less (Butler 2008; Alvarez 2007; Smith et al. 2004). Despite their relatively small individual impact, the sheer numbers of PFLs indicate their collective decisions will have significant implications for the long-term sustainability of the nation’s forest resources. Indeed, their ability to implement sustainable practices goes hand-in-hand with the ability to access and understand accurate information about forest management (Gootee et al. 2010).

Forests provide market and non-market benefits for both PFLs and the general public, and are expected to do so in an increasingly complex, global environment. The need for updated information on forest and natural resource management has continued to increase. However, knowledge and information collected in response to this ever growing need would be of little utility if it was not applied. It is essential to develop tailored and targeted outreach services which are of interest to PFLs and delivered to them using communication strategies they favor. Without an understanding of the owners, as well as their forests, the development of tailored outreach messages is not possible (Gootee et al. 2010; Cartmell et al. 2006; Measells et al. 2006; Downing and Finley 2005).
In an effort to broaden our understanding of owners and their forests, this paper examines the sources of help and information PFLs used when making decisions about their forestland. Analyses determined the information sources used and classified Pennsylvania’s PFLs by these sources. Logistic regression techniques were employed to analyze survey responses for 2,713 PFLs across the Commonwealth of Pennsylvania. Relationships between information sources used and landowner characteristics, forestland characteristics, and management practices were explored. The results of this analysis are presented within the context of adult learning theory. Possible communication strategies are advanced and discussed.

Review of PFLs and Information Sources Used

It is widely assumed PFLs lack information and knowledge about forest management practices and markets, and that enhancing their knowledge would increase the likelihood of active management on private forestlands. State and Extension agencies have developed educational and technical programs designed to facilitate information exchange and active forest management on private lands. However, few PFLs participated in these programs (Metcalf 2010; Butler 2008; Rosen and Kaiser 1988), and often cited a lack of awareness as reason for not participating (Measells et al. 2006; Measells et al. 2005). McWilliams et al. (2007) reported less than two percent of Pennsylvania’s family forest owners\(^1\) participated in a cost-share assistance program. Nationally, only 14 percent of family forest owners received advice about their forestland (Butler 2008).

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\(^1\) Family forest owners are a subset of NIPF owners, and are defined as families, individuals, trusts, estates, family partnerships, and other unincorporated groups who own forestland (Butler 2008). As a subset, the figures reported for family forest owners are expected to be slightly lower than those for PFLs.
Studies examining commercial timber harvests on private lands found technical assistance was effective at helping PFLs manage timber resources more sustainably and profitably (Cubbage et al. 1996). In research exploring information search habits of PFLs in timber markets, Rosen et al. (1989) found PFLs performed limited information searches. In Pennsylvania, for example, Metcalf (2010) reported 20 percent of PFLs had commercially harvested timber, and of these PFLs, only 37 percent had received technical assistance from consulting, state, extension, or industry foresters.

Despite the availability of credible sources, information searches were generally limited to only a few sources (Rosen et al. 1989; Beatty and Smith 1987; Beales et al. 1981). Moreover, a gap often existed between available information and its use. Choice of strategies for information delivery plays an important role in promoting sustainable forest management. People used different sources depending on the kind of information they sought (Pounds 1985). If information was to be applied in practice, it needed to be disseminated in a way which facilitated its use by PFLs. Research suggested using a diversity of dissemination strategies to reach various clientele, but at the same time cautioned that specific delivery methods needed to be matched with target groups to ensure their efficacy (Bardon et al. 2007; Cartmell et al. 2006; Radhakrishna et al. 2003; Londo and Gaddis 2003; Rodewald 2001). Given the variety of extant delivery methods available, forestry professionals are routinely challenged to choose the most appropriate one for reaching a targeted audience.

Knowing your audience is key to effectively making such a determination. Past research identified associations between information source preferences and sociodemographics, land ownership, and PFL management experiences (Kaetzel et al.
Rodewald (2001) surveyed Extension agents and natural resource professionals in Ohio about their perceptions of the preferred delivery method for wildlife management information; printed media was found to be preferred over web-based technology. Similarly, Cartmell et al. (2006) found direct mail was the most preferred method among agricultural landowners with 50 acres or less in Oklahoma. In a study of Utah and Indiana PFLs, Kuhns et al. (1998) found newspapers and magazines were the most-used sources of information about forest management. Thirty-three percent of PFLs on the Northern Cumberland Plateau in Tennessee received information about managing their forestland from books and magazines, compared to 13 percent from the Internet (Kaetzel et al. 2010). In a survey of West Virginia landowners, Steele et al. (2008) found the majority (70 percent) received information about invasive vegetation from friends, while 50 percent received information from agency personnel and/or media. A study by West et al. (1988) also indicated landowners preferred to receive information from peers (Sagor 2006).

In some studies, landowner characteristics were found to be associated with preferred information sources. Older landowners were more likely to prefer printed materials while, younger landowners showed greater preference for web-based technologies (Bardon et al. 2007). Retired PFLs were less likely to use government agencies as information sources (Kaetzel et al. 2010) and more likely to have used no sources or direct mail sources (Bardon et al. 2007). PFLs who preferred web-based sources were more likely to be white-collar employees, earn higher incomes, and have
higher levels of education (Bardon et al. 2007; Radhakrishna et al. 2003). In Utah and Indiana, larger landowners were more likely to use Extension publications and state and university resources. In addition, PFLs in those states who reported a higher level of forestry education were more likely to use multiple sources than those with lower levels of forestry education (Kuhns et al. 1998). However, in their West Virginia study, Steele et al. (2008) found landowner characteristics were unassociated with source of information on invasive vegetation. In an Oklahoma study, direct mail was most preferred regardless of age or education levels; however, younger landowners were more likely to also have used other media sources, such as television (Cartmell et al. 2006).

Much research regarding landowners and information used tended to focus on landowner characteristics and potential associations with preferred source. Little mention was made of management activities as they related to preferred information sources. In instances where this relationship was discussed, management activities were typically limited to agriculture and/or timber harvesting (i.e., Kaetzel et al. 2010; Rosen et al. 1989). For example, Northern Cumberland Plateau PFLs in Tennessee who harvested timber were more likely to have received information from media sources and friends (Kaetzel et al. 2010). In most cases, the information received was limited to specific management activities which were not examined in conjunction with other management activities (see Steele et al. 2008; Cartwell et al. 2006; Rodewald 2001; Creighton et al. 2002). There is a lack of studies that simultaneously explored the associations of landowner characteristics, forestland characteristics, and various management activities with preferred information sources about forestland management.
Reported preferences for printed materials appeared to contradict research regarding hands-on experiences gained through workshops and personal contact. West et al. (1988) indicated personal contact had greater effect than targeted mailings or mass media in delivering specific PFL management advice. Downing and Finley (2005) indicated PFLs in Pennsylvania preferred active delivery systems such as workshops, field trips, and demonstration areas over more passive strategies, such as slideshows, videos, and newsletters. In addition, they noted PFLs valued opportunities to network with other forest landowners.

A recent finding indicated landowners were more likely to have received information from friends or family in specific instances (Kaetzel et al. 2010; Steele et al. 2008; Shandas 2007). Rodewald (2001) addressed this apparent paradox by providing two possible explanations regarding the speed of delivery and the broad range of topics covered by most state and Extension agencies. Generally speaking, printed materials provided easily understood information on a variety of topics and could be delivered to clients within a quicker time frame in response to requests than most workshops or programs (Rodewald 2001).

Another possible explanation for the gap between preferences for hands-on experiences and personal contact and limited participation in such programs is the traditional format of forestry outreach efforts. Such efforts tend to be one-way information exchanges within a hierarchical expert-student setting; however, adult learning theory suggests adults prefer informal, flexible learning environments where they could draw upon personal experiences. It was believed that grounding outreach services in adult learning theory could help ensure positive engagement of landowners
Adult Learning Theory

One common theme running through the adult learning literature is the basic argument that educators and educational programs needed to reflect the needs, interests, and real-life issues of adult learners. Simply said, if educational materials and programs did not satisfy the needs of the adult learner, they would not be used (Dollisso and Martin 1999). Gootee et al. (2010) demonstrated the natural resource professionals most effective in communicating with landowners were those who adhered to the basic elements of adult learning theory.

How adults learn has been a perennial theme within the adult education literature since its establishment as a professional field in the 1920s. Some ninety years later, the absence of a unifying theory that explains all that is known about adult learners or the process of learning remains a major hindrance, especially in the context of the wide range of theories, principles, and explanations lying at the core of adult learning (Merriam 2001). Perhaps the most widely recognized piece in this mosaic is Malcolm Knowles’ concept of andragogy, which he defined as the “art and science of helping adults learn” (Knowles 1980, p.43).

Andragogy is premised on six principles: need to know; self-concept; experience; readiness to learn; learning orientation; and motivation to learn (Knowles et al. 2005). Adults want to know new information is practical, relevant, and capable of leading to tangible outcomes (Gootee et al. 2010; Daniels and Walker 2001; Vella 1994; Knowles
Adult learners believed they were responsible for themselves (Knowles et al. 2005); therefore, educators needed to engage adults in non-hierarchal, two-way exchanges of ideas as opposed to one-way transmittal of information (Gootee et al. 2010; Ota et al. 2006; Brookfield 1986; Knowles 1978). Adult learners differed from children in the amount of experience they brought to the table. Not surprisingly, a core principle of andragogy is the need to utilize this experience as a resource during instruction. Adults are life-centered; their orientation to learning was positively influenced when learning was task-centered and not subject-centered (Strong et al. 2010; Mezirow 1985). They wanted to learn what would have practical application within the context of their lives. An adult’s motivation to learn was predominantly fueled by internal motivations and could either be immediate or long-term – it is purpose centered.

Research indicated adult learners disliked teaching strategies that involved lectures and preferred more active learning strategies (Strong et al. 2010; Johnson et al. 2008; Downing and Finley 2005; Grudens-Schuck et al. 2003; Dollisso and Martin 1999; Creswell and Martin 1993). Integrating practical hands-on strategies in educational programming was found to be an effective strategy for actively engaging learners in the process (Strong et al. 2010; Downing and Finley 2005; Dollisso and Martin 1999; Creswell and Martin 1993). In a study of the Master Beef Producer program, Strong et al. (2010) found differentiating teaching strategies that encouraged extension agents to focus instruction on problems faced by cattlemen, not just the intended subject matter. The researchers also showed hands-on instruction was the most effective teaching strategy for cattlemen. Lectures, however, remained useful strategies for presenting information from
various sources and highlighting key concepts or ideas, but needed to be short and punctuated with active learning activities (Ota et al. 2006).

Participants’ learning was enhanced by combining adult learning strategies with creative and positive learning experiences (Ota et al. 2006). Participants were more likely to take what they had learned and applied it, bridging the gap between available information and its use. In a recent study of the information exchange process between natural resource management professionals and forestland owners, Gootee et al. (2010) sought to determine how professionals could improve their ability to influence stewardship practices. The authors found natural resource professionals who failed to provide a learning environment reflective of the principles of andragogy were less effective in convincing PFLs to adopt the information they presented. On the other hand, professionals who incorporated empathy, respect, and openness in two-way exchanges of ideas found forest owners more readily accepted forest management recommendations (Gootee et al. 2010).

A potential tool for fostering non-hierarchical, landowner driven approaches to outreach services for PFLs that employs the principles of andragogy is peer education. Peer education has been defined as networks of relationships among students and significant others, which facilitated two-way information exchange and learning (Kueper 2010; Copenheaver et al. 2004). Its success was attributed to empathetic relationships formed between trusted peers (Kueper 2010; Grudens-Schuck et al. 2003; Tosey and Gregory 1998). Often, peer educators were familiar with learners’ instructional style preferences and knowledge gaps (Grudens-Schuck et al. 2003). As part of the peer
education process, peers were encouraged to contribute to the knowledge of the group, taking them from passive learners to active learners (Copenheaver et al. 2004).

However, peer education can fail. Educators who relied solely on passive modes of instruction that encouraged one-way information exchange and failed to incorporate principles of adult learning were less likely to engage learners in the subject matter. This lack of engagement could lead to diminished information exchange (Grudens-Schuck et al. 2003).

Peer education is not a panacea for the information gap; however, peer learning and private forestland management have the potential to work well together. One goal of peer education is to increase levels of empowerment among the target audience. PFLs often turned to friends, family, and/or other forestland owners when making decisions about their forestland. Through existing social networks and/or facilitated peer learning experiences, relevant information could be delivered to landowners when decisions about their forestland are made (Catanzaro 2008). These PFLs, in turn, spread their experience and knowledge to other forest landowners promoting active engagement in both learning and teaching sustainable forest management. Research found the likelihood of landowners following property management suggestions increased if the landowner trusted the source of information (Shandas 2007; Brook et al. 2003; Grieshop et al. 1990). Part of bridging the gap between availability and use of information is reaching not only PFLs who were looking for information, but also reaching those who were not necessarily looking for such information. Forest management information could be disseminated through peer networks already in existence or those intentionally created to engage and inform PFLs.
Methods

A three panel study of PFLs in Pennsylvania was begun in 2006. The initial objectives of this five-year study were: (1) to identify access barriers to Pennsylvania’s private forest resources; (2) to describe the attitudes, perceptions, issues, and concerns of PFLs; (3) to document the availability of technical assistance; and (4) to determine owners’ future plans for their forestland (Metcalf 2010). As the second panel of the study, a 20-page survey was mailed to 6,600 PFLs (100 per county for all counties but Philadelphia) across the Commonwealth of Pennsylvania in 2008.² The survey sample was identified following the design established during the first panel of the study. PFLs were identified by digitally dropping 400 random points per county over maps of forestland in Pennsylvania using GIS software. Ownership data for the identified land parcels were obtained from county tax records. In counties where ownership data were available in spatial format, this was used to identify PFLs (Metcalf 2010). Spatial data was only available for approximately half of the counties in 2008. For those counties without spatial data, the location of each random point was triangulated using plat books and parcel maps, then identified through tax assessment information at county courthouses. A random sample of 100 PFLs per county was selected from those identified.

The mail survey was conducted using a tailored design methodology (Dillman 2007) with four waves of contact: initial survey and letter, a reminder postcard, and a second and third follow-up survey. Adjusting for undeliverable surveys, deceased

² Philadelphia County was excluded since it contains less than one tenth of one percent of the commonwealth’s forestland (Metcalf 2010).
owners, and non-forestland owners, the total response rate for the survey was 49 percent (N=2,713). Attempts were made to contact non-respondents using follow-up telephone interviews. A random sample of 500 non-respondents was drawn, and phone numbers were established for 339 members of this sample. Over a period of seven weeks, up to three phone call attempts were made to contact the non-respondents. Of the 339 non-respondents, 54 percent were successfully contacted; 46 percent of those contacted were willing to participate in the phone survey. Those willing to participate were asked if they owned forestland, how many forested acres they owned, if they had harvested timber from their property, and several basic demographic questions. Responses were recorded and compared with those from the mail survey respondents using chi-square tests.

The results suggested non-respondents were fairly similar to respondents, although some differences emerged. There were no significant differences in number of forested acres owned, rate of timber harvesting, type of ownership forestland was held in, or landowner age. Table 2.1 provides the characteristics that differed between non-respondents and mail survey respondents. Though the majority of respondents in both cases were male, non-respondents contacted were more likely to have been female. The mail survey respondents tended to have more years of formal education. In both cases the majority of respondents were employed either full or part time; however, mail survey respondents were more likely than non-respondents to have been retired.

Data Analysis

Results reported here were analyzed using PASW 18.0 statistical software package, and present a profile of PFLs based on the information sources they used.
Specifically, this analysis explored how the capability to differentiate among PFLs who used professional information sources and those who used peer sources was affected by knowledge of landowner and forestland characteristics, timber and forest management practices, and various sociodemographic variables.

**Table 2.1 Summary of significant non-respondent and respondent differences**

<table>
<thead>
<tr>
<th></th>
<th>Respondents</th>
<th>Non-Respondents</th>
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<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>83.5%</td>
<td>66.2%</td>
</tr>
<tr>
<td>Female</td>
<td>16.5%</td>
<td>33.8%</td>
</tr>
<tr>
<td>$\chi^2$ 14.17; p &lt; 0.001</td>
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<td></td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School or less</td>
<td>36.6%</td>
<td>52.4%</td>
</tr>
<tr>
<td>Some College/Assoc. Deg.</td>
<td>23.9%</td>
<td>23.8%</td>
</tr>
<tr>
<td>College Degree and beyond</td>
<td>39.5%</td>
<td>23.8%</td>
</tr>
<tr>
<td>$\chi^2$ 8.02; p &lt; 0.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Employment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full/Part-Time</td>
<td>55.5%</td>
<td>62.9%</td>
</tr>
<tr>
<td>Retired</td>
<td>42.1%</td>
<td>29.0%</td>
</tr>
<tr>
<td>Other</td>
<td>2.5%</td>
<td>8.1%</td>
</tr>
<tr>
<td>$\chi^2$ 10.32; p &lt; 0.05</td>
<td></td>
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</tr>
</tbody>
</table>

Binary logistic regression was used to examine differences between two sub-groups of PFLs (N=849): those who used professional information sources (professional) and those who used peer sources (peer). Logistic regression is used when the dependent variable is dichotomous and independent variables are of any type. The nonlinear model assumed by logistic regression required a full set of data (Garson 2011). Therefore, missing values were handled using listwise case deletion; only cases with valid values for the dependent and all predictor variables were included. Variables were considered for inclusion in the logistic model if bivariate tests (Chi-square and ANOVA) indicated a statistically significant difference between responses for the PFL sub-groups.
Split-halves validation was used to test the validity of the logistic model. The sample was randomly split into two groups: a training sample (N=406) and a holdout sample (N=443). The training sample was used to derive the logistic model, and the holdout sample was classified using the coefficients based on the analysis. For logistic regression, a generally agreed upon minimum valid case-to-variable ratio is 10 to 1, with a minimum sample size of 100 (Hosmer and Lemeshow 2000). Using the training sample (the smaller sample size of the two), the logistic regression presented here had a case-to-variable ratio of 67 to 1.

In logistic regression, there is no equivalent to $R^2$ available that corresponds to variance explained or predictive efficiency (Spicer 2005; Chao-Ying et al. 2002; Menard 1995). Various attempts have been made to develop “pseudo” $R^2$ statistics for logistic regression; however, each provides different estimates. With none regarded as superior to the others, interpretation of these statistics should be done with caution (Garson 2011; Spicer 2005). Therefore, a classification matrix was used to assess the predictive accuracy of the logistic model.

Cross-classification of cases is accomplished by using the predicted probabilities to assign cases into categories of the dependent variable and then comparing the results with their actual categories. Results of the classification are presented in a 2 x 2 classification matrix. Entries on the diagonal of the matrix represent the number of individuals correctly assigned to their groups, off-diagonal numbers represent incorrect classifications. The percentage correctly classified for each group is averaged to obtain the overall percentage correctly classified (classification accuracy). Classification matrices were generated for both the training and hold-out samples, and the classification
accuracy for the holdout sample was used to estimate how well the model performed. If the model accurately reflected the conditions being studied, the percentage of correct classifications should be significantly larger than would be expected by chance. Using the hold-out sample’s relative frequencies (44% professional and 56% peer) the classification accuracy due to chance was

\[ C = 100 \times [(0.44)^2 + (0.56)^2] \]

\[ = 51\% \]

Finally, Press’s Q statistic was used to determine if the classification results were significantly better than would be expected by chance (Hair et al. 1992). This measure compares the number of correct classifications with the total sample size and number of groups. The calculated value was then compared to the chi-square value (3.84) with one degree of freedom at 0.05 significance level to determine if the classification matrix was statistically better than chance (Hair et al. 1992). The formula used to determine Press’s Q statistic was:

\[ \text{Press’s } Q = \frac{[N - (n \times K)]^2}{N(K - 1)} \]

where N was the total sample size, n was the number of observations correctly classified, and K was the number of groups.

Multicollinearity in logistic regression models is a result of high correlations among predictor variables. The presence of multicollinearity inflates variances of parameter estimates and may result in individual predictors not being significant while the overall model is highly significant. In addition, multicollinearity may result in incorrect signs and magnitudes of coefficients leading to faulty conclusions about
relationships between predictor variables and dependent variables (Garson 2011). In linear regression models, multicollinearity is examined by computing the variance inflation factor (VIF). The VIF is an index that measures how much the variance of the estimated regression coefficients are increased due to collinearity. Since there is no direct counterpart to $R^2$ in logistic regression, VIF statistics cannot be computed. Therefore, the predictor variables were checked for multicollinearity by running a linear regression on the predictor variables and examining the VIF statistics (Spicer 2005; Menard 1995; Hair et al. 1992). VIF statistics of 10 or above indicate a multicollinearity problem and five or above are often seen as a cause for concern (O’Brien 2007). The VIF statistics for the predictor variables in the model ranged from 1.04 to 2.27.

**Predictor Variables**

Following earlier research, sociodemographic and descriptive variables including gender, age, education, income, and tract size were measured. Respondents were asked to indicate the highest grade of school they had completed: (1) none; (2) grade school; (3) some high school; (4) completed high school or GED; (5) some college; (6) technical school beyond high school/Associates Degree; (7) completed college; and (8) graduate/professional school. Respondents’ total household yearly income was measured with eight categories ranging from less than $15,000 to $150,000 or more. Tract size was measured as the total number of forested acres owned. To be included in the analysis, PFLs’ had to own a minimum of one acre of forestland.

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3 The regression was originally run with income as an independent variable, which led to the exclusion of roughly 15 percent of the cases due to missing values. Income was not a significant predictor in this regression model; therefore, it was removed from the analysis.
Part of reaching PFLs is knowing where to find them. The effect geographic location may have on information source used was explored with an independent variable that distinguished between counties based on degree of urbanization. The USDA Economic Research Service’s rural-urban continuum codes (RUCC) were used to create a classification scheme that distinguished metropolitan counties from nonmetropolitan counties by degree of urbanization and adjacency to a metro area (Table 2.2).

The RUCC codes were collapsed into three categories for the purposes of this analysis. The first category was the smallest, accounting for just over six percent of the respondents (n=160). This category consisted of RUCC codes eight and nine and was coded as non-metro, rural. The second category was the largest with 50 percent of the respondents (n=1,239). This category was comprised of RUCC codes four through seven and was coded as non-metro, urban. The final category (n=1,090; 44%) consisted of RUCC codes one through three and was coded as metro.

Table 2.2 USDA Economic Research Service rural-urban continuum codes

<table>
<thead>
<tr>
<th>RUCC</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metro Counties:</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Counties in metro areas of 1 million population or more</td>
</tr>
<tr>
<td>2</td>
<td>Counties in metro areas of 250,000 to 1 million population</td>
</tr>
<tr>
<td>3</td>
<td>Counties in metro areas of fewer than 250,000 population</td>
</tr>
<tr>
<td>Nonmetro Counties</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Urban population of 20,000 or more, adjacent to a metro area</td>
</tr>
<tr>
<td>5</td>
<td>Urban population of 20,000 or more, not adjacent to a metro area</td>
</tr>
<tr>
<td>6</td>
<td>Urban population of 2,500 to 19,999, adjacent to a metro area</td>
</tr>
<tr>
<td>7</td>
<td>Urban population of 2,500 to 19,999, not adjacent to a metro area</td>
</tr>
<tr>
<td>8</td>
<td>Completely rural or &lt; 2,500 urban population, adjacent to a metro area</td>
</tr>
<tr>
<td>9</td>
<td>Completely rural or &lt; 2,500 urban population, not adjacent to a metro area</td>
</tr>
</tbody>
</table>

Previous research indicated PFLs were more likely to follow management suggestions if they trusted the source of information. In addition, they often turned to
friends, family, and other landowners when making forestland decisions suggesting these folks were trusted. Two variables were used to explore the effect of interacting with ones neighbors on information sources used. The first variable examined the frequency of interactions, interaction w/neighbor, and was measured using a five-point scale that ranged from never (1) to very often (5). The second, forestry interaction, asked whether or not respondents had ever interacted with their neighbors regarding a forestland issue. Responses were coded so a negative response equaled zero and a positive reply equaled one. It was hypothesized PFLs who interacted more frequently with their neighbor and interacted over specific forest issues were more likely to have used peer information sources.

Research on sources of information indicated there was no single source of information used by all landowners. To explore whether or not the source used reflected the type and amount of management activities PFLs intended to accomplish, two variables measuring forest management practices were included in this analysis: intended forest management and commercial harvest.

Respondents were asked to indicate how likely they were to do eight forest management activities on their properties: improve wildlife habitat; improve fish habitat; create a stream-side buffer; reduce fire hazards; apply herbicides; plant trees; erect a deer fence; and control vegetation without herbicides. Likelihood of performing each activity was measured on a five-point Likert scale ranging from very unlikely (1) to very likely (5). The relationship of interest was the type of information sources used by PFLs who were likely to perform the forest management activities. Therefore, PFLs who indicated they were “very unlikely,” “unlikely,” or “neither unlikely nor likely” were coded as
unlikely to perform the activity in the future. Those who were “likely” or “very likely” were coded as likely to perform the activity. The total number of activities PFLs indicated they were likely to do was used to create the intended forest management variable, which ranged from unlikely to do any of the activities (0) to likely to do all of the activities (8).

*Commercial harvest* was defined as PFLs’ likelihood of cutting trees for sale (excluding firewood) in the future. Respondents were asked to indicate on a five-point Likert scale (1 = very unlikely and 5 = very likely) how likely they were to (1) cut sawlogs, (2) cut veneer logs, and (3) cut pulpwood for sale. A two-step cluster analysis was run on these three questions to classify respondents into two mutually exclusive groups: PFLs likely to harvest and PFLs unlikely to harvest.

The goal of cluster analysis was to identify groups of individuals that minimize within group while maximizing between group differences. The two-step cluster analysis was used for its ability to handle large datasets and independently determine the number of clusters. However, this type of cluster analysis is dependent on the order cases are entered into the analysis. To account for this, a random number was generated for each case in the analysis. This number was then used to sort the dataset to ensure a random order of case entry, and the cluster analysis was run. This procedure was repeated ten times to check for stability in the cluster solution. Nine out of ten cluster solutions resulted in two groups: PFLs unlikely to harvest (51%) and PFLs likely to harvest (49%). The single solution that differed produced three groups: PFLs unlikely to harvest (48%), PFLs likely to harvest sawlogs and veneer logs (38%), and PFLs likely to harvest sawlogs, veneer logs, and pulpwood (13%).
The internal cohesion and external separation of the clustering solution were assessed using the silhouette coefficient. A silhouette measure greater than 0.5 was used to indicate acceptable cluster quality, meaning greater similarity within clusters and differences between clusters (Mooi and Sarstedt 2011; Tsiptsis and Chorianopoulos 2009). In each of the nine cluster solutions with two groups, the silhouette measure was 0.7. Therefore, the two group solution was used to create the commercial harvest variable; PFLs likely to harvest were coded as one and PFLs unlikely to harvest were coded as zero.

Based on the findings of earlier research, the final predictor variable included was PFLs’ forestry knowledge. It was hypothesized that PFLs who indicated a higher level of forestry-related knowledge would be more likely to have used professional information sources over peer resources. PFLs’ forestry knowledge was measured on a scale of zero to ten where ten was very knowledgeable. Respondents were asked to indicate how knowledgeable they considered themselves to be about eight forestry related topics: (1) Pennsylvania’s forests; (2) general forest management; (3) forest ecology; (4) tree identification; (5) forestland taxes and incentives; (6) logging; (7) stream ecology; and (8) wildlife ecology. The unidimensionality of the eight knowledge items was assessed using principal components analysis.

Principal components analysis (PCA) is an appropriate method for reducing a large number of survey items to a smaller set of composite variables with a minimal loss of information (Spicer 2005; Hair et al. 1992; Dunteman 1989). Partial and simple correlations for each variable were compared using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy to ensure the eight knowledge items were sufficiently
interconnected to warrant data reduction (Spicer 2005). The KMO statistic is expressed as an index with values between zero and one. A value less than 0.5 was regarded as indicative of a structure unsuitable for data reduction (Spicer 2005). The minimum threshold used for extracting components were eigenvalues greater than or equal to one, ensuring a factor accounted for a least as much variance as a single variable.

Contribution of individual variables to a component was determined by examining the component loadings (correlation between variable and a component). The higher the loading, the more the variable contributes to the component. The squared component loading is the percent of variance shared between the variable and component. The minimum threshold to interpret loadings was 0.4, ensuring variables accounted for at least 15 percent of the variance in a component (Spicer 2005; Stevens 2002). Results of the PCA indicated a single component. The internal consistency of the component was tested with Cronbach’s alpha reliability coefficient using 0.60 as a threshold (Vaske 2008). As a result of this examination, it was determined removing the item “forestland taxes/incentives” improved the reliability for the scale. The results of the PCA for the seven remaining and included items indicated a single component which accounted for 74 percent of the total variance, and confirmed the scale’s unidimensionality (Table 2.3). As well, a Cronbach’s alpha score of 0.94 indicated an acceptable internal consistency for the forestry knowledge scale. A single composite variable (forestry knowledge) was created by calculating the mean of the seven knowledge items for each respondent.
Table 2.3 Component loadings for forestry knowledge

<table>
<thead>
<tr>
<th>Items</th>
<th>Component 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA Forests</td>
<td>0.88</td>
</tr>
<tr>
<td>General Forest Mgmt</td>
<td>0.91</td>
</tr>
<tr>
<td>Forest ecology</td>
<td>0.89</td>
</tr>
<tr>
<td>Tree ID</td>
<td>0.79</td>
</tr>
<tr>
<td>Logging</td>
<td>0.81</td>
</tr>
<tr>
<td>Stream Ecology</td>
<td>0.86</td>
</tr>
<tr>
<td>Wildlife Ecology</td>
<td>0.88</td>
</tr>
<tr>
<td>Eigenvalue</td>
<td>5.20</td>
</tr>
<tr>
<td>% Cumulative variance</td>
<td>74.21</td>
</tr>
<tr>
<td>Cronbach's alpha</td>
<td>0.94</td>
</tr>
</tbody>
</table>

**Dependent Variable**

The dependent variable in this analysis was information sources used by PFLs. It was measured by responses to questions about the use of 11 sources of information. Respondents were asked to indicate whether or not they had used any of the following sources of information or help when making decisions about their forestland: written materials, the Internet, foresters, loggers, PA Bureau of Forestry, other government agency, Penn State Extension, TV/video/radio programs, friends or family members, other forest landowners, and woodland owners association. Three variables with low variance were dropped from the analysis: other government agency (12% of respondents used this source), TV/video/radio programs (12% used this source), and woodland owners association (9% used this source).

PCA was used to reduce the eight information sources to two composite variables. Similar to the forestry knowledge items, a component loading of 0.4 was used as the minimum threshold for interpretation. Components were rotated to simplify structure and
to facilitate interpretation of components. Simple component structure was obtained by ensuring each variable loaded on only one factor. The analysis was initially run using a varimax rotation maintaining uncorrelated factors. However, individual variables were found to load on more than one component. Oblique rotations relax the constraint of factors being uncorrelated to gain simplicity in interpretation; therefore, the analysis was re-run using an oblique rotation. This resulted in two components which accounted for 52 percent of the total variance among the eight items. Component one consisted of five items which reflected professional sources of information, while component two consisted of three items and reflected peer sources of information (Table 2.4).

Cronbach’s reliability coefficient for the professional sources component was 0.72 and 0.62 for the peer sources component, indicating an acceptable internal consistency for both scales. Two composite variables (professional sources and peer sources) were created by calculating the mean of items comprising both components for each respondent.

Using the professional and peer source composite variables, a two-step cluster analysis was used to establish groups of PFLs based on information source used. Similar to the previously discussed cluster analysis, the dataset was randomly sorted prior to running the analysis. The stability of the cluster solution was checked by repeating this process multiple times. Four groups of PFLs were identified. Group one, the largest of the four, contained 39 percent (n=755) of the cases; its members used neither professional nor peer information sources. The second group’s members used professional information sources only and accounted for 20 percent (n=391) of the cases. Members of group three used only peer information sources and contained 23 percent (n=458) of the
respondents. Group four, the smallest cluster, contained 18 percent (n=351) of the cases; its members used both professional and peer sources of information. The silhouette measure for this cluster analysis was 0.7 which indicated good internal cohesion and external separation for the four groups.

Given the stated purpose of this analysis, PFLs who had used neither professional nor peer sources and PFLs who used both professional and peer sources were excluded. Therefore, the logistic model presented here classified PFLs by their odds of having used professional information sources and set peer sources as the reference group.

<table>
<thead>
<tr>
<th>Information Source Used</th>
<th>Component Loading&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Professional Sources&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Peer Sources&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bureau of Forestry</td>
<td>*0.84</td>
<td>-0.15</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>*0.64</td>
<td>0.18</td>
<td></td>
</tr>
<tr>
<td>Penn State Extension</td>
<td>*0.85</td>
<td>-0.24</td>
<td></td>
</tr>
<tr>
<td>Internet</td>
<td>*0.58</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>Forester</td>
<td>*0.44</td>
<td>0.29</td>
<td></td>
</tr>
<tr>
<td>Family or Friends</td>
<td>-0.05</td>
<td>*0.80</td>
<td></td>
</tr>
<tr>
<td>Other PFLs</td>
<td>0.15</td>
<td>*0.70</td>
<td></td>
</tr>
<tr>
<td>Logger</td>
<td>-0.21</td>
<td>*0.77</td>
<td></td>
</tr>
</tbody>
</table>

Eigenvalues 3.03 1.61

% Variation explained 37.90 14.51

a. Rotation method: Oblimin (Δ=.5); N=1955
b. Chronbach's alpha = 0.72
c. Chronbach's alpha = 0.62
Results

Reflective of national trends, Pennsylvania private forestland ownership was heavily skewed toward males (Metcalf 2010; Butler 2008). In this study, 84 percent of all respondents were male. A portion of this gender bias may reflect methods for obtaining landowner information from tax records, which tend to list males first. It was likely that for many PFLs the responsibility for making decisions regarding their forestland was shared. Forty-eight percent of PFLs in the Commonwealth jointly owned their forestland with their spouses, and another 22 percent of PFLs held forestland in other forms of joint ownership. Comparison of PFLs who used professional information sources and PFLs who used peer sources indicated there was no significant difference in gender.

Pennsylvania’s private forests were predominantly owned by older PFLs. Most PFLs (91%) were 45 years or older with a mean age of 61 years. Figure 2.1 compares the age distribution of PFLs who used peer sources and those who used professional information sources. The mean age of PFLs who used professional sources was 62 years versus 58 years for those who used peer sources (F(1, 809) 25.21; p<0.001). 4 Forty-three percent of PFLs who use professional sources were 65 years or older compared to 27 percent of those who used peer sources.

4 (F(df between groups, df within groups) statistic; p-value)
Pennsylvania’s PFLs, as a whole, have relatively high educational attainment and income. Two of every five (40%) of Pennsylvania’s PFLs had completed at least a four-year degree, compared to the 26 percent of all Pennsylvanians reported by the U.S. Census. On average, PFLs who used professional sources of information had more formal education than PFLs who used peer sources ($F(1, 823) = 4.48; p<0.05$). Figure 2.2 compares the educational attainment of PFLs who used professional sources and those who used peer sources. Twenty-five percent of PFLs who used professional sources had a graduate degree compared to 18 percent of PFLs who used peer sources. Sixty-eight percent of PFLs reported a household income of $50,000 or more, and 33 percent reported an income of $100,000 or more. The estimated 2008 median income for Pennsylvania was just under $51,000. There were no significant differences between PFLs who used professional information sources and those who used peer sources in terms of household yearly income.
Seventy percent of respondents owned less than 100 acres of forestland, and 15 percent owned less than 10 acres. The mean tract size was 165 acres. Tract size was not related to information source used. There was also no significant relationship between information source used and location as measured by degree of urbanization and adjacency to a metro area.

Overall, most PFLs interacted infrequently with their neighbors. When asked how often they interacted with neighboring landowners, regardless of the context, 46 percent of PFLs indicated “sometimes” and one-third indicated “rarely” or “never.” When compared to PFLs who used professional sources, PFLs who used peer information sources interacted more frequently with their neighbors ($\chi^2 9.90 (4); p<0.05$). Thirty-six percent of PFLs who used professional sources rarely or never interacted with their neighbors (Figure 2.3). However, three-quarters of PFLs who received information from

---

5 (chi-square statistic (df N); p-value)
their peers interacted with neighbors at least sometimes. Similarly, only one-third of PFLs had ever interacted with their neighbors regarding forestland issues (Figure 2.4). Compared to those who used professional sources, PFLs who used peer sources of information were more likely to have interacted with their neighbors regarding forestry issues ($\chi^2 \ 16.99 \ (1); \ p<0.001$).

PFLs most commonly indicated they were likely to improve wildlife habitat (66%), plant trees (60%), and control vegetation without herbicides (40%). Of the eight intended management activities, the average PFL planned on performing 2.5 activities. Figure 2.5 compares PFLs who used peer sources or professional information sources by the number of management activities likely to complete. PFLs who indicated a likelihood of completing four or more management activities were more likely to have used professional information sources. On average, PFLs who used peer sources were likely to complete 2.5 activities compared with 3 activities for PFLs who used professional sources ($F(1 \ 828) \ 6.63; \ p<0.01$).

Overall, 48 percent of PFLs indicated they were likely to have a commercial timber harvest in the future. Forty-four percent were likely to cut sawlogs, 34 percent veneer logs, and 16 percent were likely to cut pulpwood. PFLs who used peer sources were more likely to have a commercial harvest than PFLs who used professional sources ($\chi^2 \ 25.92 \ (1); \ p<0.001$). Just over half (53%) of PFLs who used professional sources indicated they were unlikely to harvest timber for sale (Figure 2.6).
Figure 2.3 PFLs’ frequency of interaction with neighbors by information source used

Figure 2.4 Incidence of forestry interactions with neighbors by information source
Figure 2.5 Number of intended management activities by information source

Figure 2.6 Likelihood of commercial timber harvest by information source

On the forestry-related knowledge scale (0 to 10, where 10 was very knowledgeable) PFLs averaged a self-rating of 5 (Figure 2.7). PFLs indicated they felt most knowledgeable about tree identification (6), followed by wildlife ecology (5), and Pennsylvania’s forests (5). There was no significant difference in knowledge ratings.
between PFLs who used professional sources and those who use peer sources of information.

Figure 2.7 PFLs mean forestry knowledge scores

Logistic Regression Results

The classification accuracy of the logistic model was significantly better than what would be expected by chance alone (Press’s Q = 15.93; p<0.001). The logistic model correctly classified 61 percent of PFLs who used peer sources and 59 percent of PFLs who use professional sources, for an overall classification accuracy of 60 percent (Table 2.5). The increased number of cases correctly classified, when compared to chance, represented an approximately 20 percent improvement in classification accuracy (1.20 X 0.51).
Table 2.5 Logistic regression classification matrix for training and hold-out samples

<table>
<thead>
<tr>
<th>Observed</th>
<th>Predictedabc</th>
<th>Training Sample</th>
<th>Hold-Out Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Peer</td>
<td>Professional</td>
<td>% Correct</td>
</tr>
<tr>
<td>Peer</td>
<td>115</td>
<td>64</td>
<td>64.2</td>
</tr>
<tr>
<td>Professional</td>
<td>69</td>
<td>102</td>
<td>59.6</td>
</tr>
<tr>
<td>Overall %</td>
<td>62.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Chance accuracy criterion rate = 51%
b. Model classification accuracy = 60.2 %
c. Press’s Q statistic = 15.93 p<0.001

The ability to classify PFLs by information source used was improved with knowledge of PFLs’ interaction with neighboring landowners, forest management activities, and demographic characteristics. Four of the six predictor variables included in the logistic model significantly improved classification of PFLs who used peer sources and those who used professional information sources (Table 2.6).

Table 2.6 Logistic regression predicting information source used a

<table>
<thead>
<tr>
<th>Professionalb</th>
<th>b</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-1.50</td>
<td>0.92</td>
<td>2.64</td>
<td>1</td>
<td>0.104</td>
<td>0.22</td>
</tr>
<tr>
<td>Interaction with Neighbors</td>
<td>-0.34</td>
<td>0.14</td>
<td>5.52</td>
<td>1</td>
<td>0.019</td>
<td>0.71</td>
</tr>
<tr>
<td>Forestry Interaction</td>
<td>-0.08</td>
<td>0.24</td>
<td>0.12</td>
<td>1</td>
<td>0.733</td>
<td>0.92</td>
</tr>
<tr>
<td>Intended Forest Management</td>
<td>0.18</td>
<td>0.06</td>
<td>8.54</td>
<td>1</td>
<td>0.003</td>
<td>1.20</td>
</tr>
<tr>
<td>Commercial Harvest</td>
<td>-0.85</td>
<td>0.23</td>
<td>13.62</td>
<td>1</td>
<td>0.000</td>
<td>0.43</td>
</tr>
<tr>
<td>Age</td>
<td>0.03</td>
<td>0.01</td>
<td>7.55</td>
<td>1</td>
<td>0.006</td>
<td>1.03</td>
</tr>
<tr>
<td>Education</td>
<td>0.11</td>
<td>0.07</td>
<td>2.33</td>
<td>1</td>
<td>0.127</td>
<td>1.11</td>
</tr>
</tbody>
</table>

a. Nagelkerke psuedo $R^2 = .133$
b. Reference category is peer sources

The more frequently PFLs interacted with their neighbors, the more likely they used peer information sources. The odds of having used peer sources increased by 40 percent for PFLs who interacted with their neighbor sometimes compared with PFLs who interacted rarely. These results are not surprising as such landowners already exhibited a tendency to turn to peers for information and advice. Nearly three-quarters of PFLs who
used peer sources indicated they interacted with their neighbors sometimes or more often. This result supported past research that indicated PFLs often turned to friends, family, and other landowners as trusted sources of information. There was no significant relationship between types of information source used and interaction with neighbors on specific forestland issues.

PFLs who intended to commercially harvest timber in the future were more likely to have used peer information sources compared to PFLs who did not intend to harvest timber. The odds of using professional information sources decreased by more than half (57%) for PFLs who intended to commercially harvest timber; however, the opposite relationship held for those PFLs who intended to perform any of the eight forest management activities. As PFLs’ intended management activity increased, their odds of using professional sources increased. On average, PFLs indicated they were likely to perform three of the listed management activities on their forestland. PFLs who planned to do three activities were nearly twice as likely to have used professional sources than PFLs who did not plan to do any of the activities.

These results on harvesting and management activities supported past research indicating there is no single source of information used by all PFLs. The different types of information used when harvesting compared to other forest management activities may be a reflection of the varying degrees of technical information often required when implementing specific management activities. A PFL may sell their timber with relative ease with or without knowledge of silvicultural practices or timber markets. However, practices such as improving wildlife habitat or reducing fire hazards often require a greater baseline of technical knowledge to implement. While PFLs may seek out the
advice of trusted peers when selling timber, they may find it necessary to turn to professional outlets for technical information.

Older PFLs were more likely to have used professional sources of information than peer sources. One additional year of age increased the odds of having used professional sources by three percent. This result was similar to past research, which found older PFLs preferred printed materials or direct mail sources; however, it was contrary to research which indicated old PFLs were less likely to use government agencies. There was no significant relationship between types of information source used and educational attainment.

**Discussion**

Regardless of the source (professional or peer), the majority of the Commonwealth’s PFLs (61%) sought information regarding the management of their forestland. The identification of the best methods for delivering information to PFLs is a necessary component for foresters, agencies, and Extension agents providing landowners with accurate and pertinent information. Results of the model presented here indicate several factors affected the probability landowners used professional sources of information compared to peer sources.

The model supported findings in the literature that PFLs used different sources based on their informational needs. PFLs who planned to actively manage their forest (excluding commercial timber harvests) were more likely to have sought information from professional sources. PFLs who intended to commercially harvest timber from their forest were more likely to have sought information from peers. The results also indicated
PFLs who had pre-established relationships with their neighbors were more likely to have used peer sources compared to professional sources.

Peers play an important role in informing PFL management decisions. The low percentage of PFLs who participated in assistance programs or who received advice from natural resource professionals regarding timber harvests does not necessarily indicate they have not received information. Tapping into peer networks through the use of peer learning may be one viable solution to providing PFLs with accurate and relevant information regarding their forestland decisions.

Peer learning is a tool which can effectively encompass the six principles of anadragogy and allow for information to be delivered by the people PFLs already turned to for advice. Since it is participant driven, peer learning can provide relevant information, which has practical implications for PFLs. In addition, it is premised on a two-way exchange of ideas, which is a significant departure from the more traditional hierarchical approach to information dissemination. This two-way communication can more readily incorporate PFLs’ experiences regarding forestland management into the information exchange. Therefore, peers can more readily provide first-hand knowledge of what may or may not have worked on their forestland, or provide information regarding local resources for assistance.

Peer learning can occur formally through organizations and programs, such as Pennsylvania’s Forest Steward volunteer program, or informally through interactions between neighbors. It provides an alternative to more traditional methods of providing accurate information for the sustainable management of private forests. It is not a cure-
all, and should not be viewed as a replacement for traditional approaches. However, it appears to be one possible alternative. Over a third of the PFL population in Pennsylvania used professional sources of information, indicating traditional methods of disseminating information were an effective way of reaching some PFLs. Peer learning provides another tool in the forestry professional’s toolbox.

Tailoring outreach efforts may result in more effective information exchange with PFLs. Understanding where they find their information is a key to bridging the gap between availability and use. This paper examined the differences between those who used professional sources and PFLs who used peer sources. The relationship between information sources used and landowner characteristics, forestland characteristics, and management practices were explored using multivariate analysis. In addition, the model distinguished between timber management and general forest management.

Quality and relevance of information received was likely to vary regardless of source. A limitation of the model presented here was the inability to determine the specific nature of information received from sources, and PFLs’ satisfaction level with the information. Future research could examine the effects these two aspects of information exchange have on management practices. In addition, future analyses should examine the difference between PFLs who did not use any information source compared with PFLs who did. It would be useful to explore how these predictor variables work at differentiating between use of information sources and lack of use, especially those predictor variables which were not significant here (i.e., forestry related knowledge, education, forestry interactions). Nevertheless, this analysis will help natural resource professionals better understand where PFLs find their information. In light of these
results, this study offers one alternative method for disseminating information. Given the limited number of sources often utilized in information searches, tailoring information delivery is essential. If we only have a limited number of chances to reach landowners, we need to make sure we make the most of that opportunity.
Literature Cited: Chapter 2


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Chapter 3

Non-Timber Forest Products (NTFPs) and Private Forestlands: Characteristics of Pennsylvania PFLs Who Harvest NTFPs from Their Forests

Forests yield a diverse array of products harvested for consumptive purposes. Timber has long held a position of prominence in the management of U.S. forests; however, many non-timber forest products (NTFPs) are harvested for both commercial and non-market purposes. NTFPs, including herbaceous forest perennials, fruits, nuts, fungi, lichen, and chemical extracts, are gathered across the United States (Jones and Lynch 2007; Alexander and Fight 2003; Chamberlain et al. 1998; Pierce 1999). As a result of the effort expended in their gathering and increased awareness of the importance they play in local and individual livelihoods, a heightened need for forest management to incorporate these products for commercial, subsistence, and cultural uses has arisen (Gobster 2001).

Resource management philosophies, such as ecosystem management and forest sustainability, have become a template for how the nation’s forests, both public and private, are managed. Forests managed for single uses, such as timber, produce a different array of forest products and services than those managed within the frame of ecosystem management (Antypas et al. 2002). Ecosystem management, as defined by the USDA Forest Service (USFS), is a means to incorporate the needs of people and environmental values in a manner that fosters diverse, healthy, productive, and sustainable forests and grasslands (Carr 1995; Robertson 1992). Consequently, the effects of management activities on a wider variety of species and forest uses must be
considered. Ideally, doing this result in a socially acceptable management scheme designed to address multiple products and values without degrading any.

Both public and private forestlands are under mounting pressure to produce multiple goods and services. Increasingly, these forestlands are expected to produce timber products while providing for wildlife, protecting water quality, enhancing biodiversity, meeting aesthetic and recreational values, and contributing to forest structural complexity (Hummel 2003; Franklin et al. 2002; Loehle et al. 2002; Muir et al. 2002). The majority of the NTFP literature focuses on activities on public lands; this paper extends this material by examining NTFP harvesting on private forest lands in Pennsylvania.

Private forests account for a significant portion of the forestland in Pennsylvania. Approximately 11.6 million acres (70%) of the Commonwealth’s forests are owned and managed by private individuals (Metcalf 2010; Butler 2008; McWilliams et al. 2007). These forests are important for providing economic, amenity, and ecologic benefits to both landowners and the public. Ownership trends indicated an increasing number of private forest landowners (PFLs) owning smaller tracts of forestland. USDA Forest Service (USFS) estimates for Pennsylvania’s PFL population between 1980 and 2007 indicated an increase in landowners from 490,000 to 533,000 (Butler 2008; Birch 1996; Birch and Dennis 1980). Average forest parcel size in 1980 was 25 acres (Birch and Dennis 1980) and by 2007 was 22 acres (McWilliams et al. 2007). However, the tendency for sampling techniques to select large parcels, inadvertently missing smaller parcels, makes estimating the number of PFLs difficult (Metcalf 2010). Taking this selection bias into account, Metcalf (2010) estimated there were more than 600,000 PFLs
in Pennsylvania, the majority (63%) of whom owned ten acres or less. Regardless, trends clearly indicated movement toward more heterogeneous ownership patterns, which result in a multiplicity of management approaches, land tenure, and landowner characteristics.

While managing for NTFPs on public lands in the United States has increased in the last decade, formal management for these products on private lands has lagged (Chamberlain et al. 2001). Compared to public forest management agencies and forest industry, PFLs typically own smaller tracts of forest and very few have written management plans (Metcalf 2010; Butler 2008; McWilliams et al. 2007), decreasing the likelihood of their managing for NTFPs. Coupling management of NTFPs with objectives such as timber or wildlife management may serve to increase forest structure complexity and biodiversity, as well as provide PFLs with alternative income opportunities.

Understanding the motivations and needs of PFLs is a necessary precondition for achieving sustainable forest management on private forestlands. It has, increasingly, recognized that demographic patterns of landownership, PFL motivations and attitudes, as well as forestland characteristics, are influential in PFL management decision making (Metcalf 2010; Finley et al. 2006; Rosen 1995; Bourke and Luloff 1994; Kuuluvainen and Salo 1991; Binkley 1981; Kurtz and Lewis 1981). Studies aimed at better understanding PFLs have highlighted a diversity of ownership motivations, timber management objectives, and landowner attitudes and characteristics (e.g., Metcalf 2010; Gruver 2010; Kaetzel et al. 2009; Butler et al. 2007; Kluender and Walkingstick 2000; Bliss et al. 1997; Greene and Blatner 1986). Little is known, however, about the characteristics, attitudes, knowledge, and management activities of PFLs who harvested NTFPs on their forestland.
Prior studies suggested PFLs were attracted to programs that helped them achieve their ownership goals and reflected their values regarding forest management (Kline et al. 2000; Koontz 2001). An understanding of the differences between various types of PFLs will better equip forestry professionals to provide services tailored to PFL motivations and needs while promoting sustainable forest management practices across Pennsylvania’s private forestland. Studies within the PFL literature have predominantly focused on timber and wildlife management practices. Studies regarding the sociocultural dimension of NTFP harvesting have increased over the past decade, but have typically focused on public lands and were conducted predominantly in the Pacific Northwest. Little is known about NTFP harvests on private forests, especially those in the Northeast. The results presented here serve to inform both the NTFP and PFL literatures.

Access to a database that included detailed information on a large sample of PFLs provided insights into baseline measures of PFL population characteristics and management activities by which trends and changes over time could be observed. In 2006, a five year study of Pennsylvania’s PFLs was begun. As part of this study, mail surveys covering various aspects of forestland ownership were mailed to PFLs across the Commonwealth in 2006, 2008, and 2010. Results presented here focus on responses to the 2008 mail survey, and the sociodemographics, attitudes, management behaviors, and forestry knowledge of Pennsylvania PFLs who harvested NTFPs on their forestland. Following an overview of the NTFP literature and survey methods employed, relevant results from the 2008 panel are presented for the state as a whole and for PFLs who harvested NTFPs compared to those who had not. A discussion of results and implications follow.
What are NTFPs?

Any discussion of NTFPs is best served by clarifying what is meant by the term. As is often the case with disciplinary jargon, many terms have been used interchangeably to describe such products including non-wood forest resources, non-wood forest products, special forest products, minor forest products, forest botanical products, alternative forest products, and non-timber forest products. While similar in concept, these terms vary in their definitions of what resources are included. No clear consensus exists as to whether such products should be narrowly or broadly defined (Davidson-Hunt et al. 2001).

Given the variety of products derived from forests, it is not surprising there is no universally accepted term or definition for them. Historically, these products have been referred to as minor forest products due to their lower revenue earning relative to timber, and their fairly localized pockets of economic influence (Delang 2006; Arnold and Ruiz-Perez 2001; Chopra 1993). These products, however, are not minor in their contribution to the livelihoods of those who gather them, and many have a longer tradition of use than timber (Delang 2006; Chamberlain et al. 1998). The term special forest product is commonly used by the USFS (Chamberlain et al. 2000), but this term has a different meaning in Canada where it is tied to forest management policies (Mitchell 1998). The USFS also uses the term forest botanical products, which is a subset of special forest products and does not include Christmas trees, firewood, and fence materials (USDA Forest Service 2009). Others have used definitions that included all biological materials, with the exception of timber, from forests (i.e., edible plants, honey, wildlife products, fuelwood, resins, and woody plants such as rattan; Delang 2006; Davidson-Hunt et al.
In some cases, researchers have argued the definition of these resources should also include the provision of services (i.e., watershed protection, soil conservation, nutrient cycling, and biodiversity) and not only be limited to products (Lund et al. 1998; Chopra 1993; Wickens 1991).

This variety of definitions reflects the difficulty of fixing on any one term capable of representing the full range of ideas covered by the NTFP concept (Belcher 2003). Given the collective nature of the NTFP concept and terminology, it is important to be specific about the definition implied and care should be taken when generalizing across various NTFP studies. The term NTFP is used throughout this chapter. The reasons for this are twofold: (1) NTFP has become a well-established and recognized term in the vernacular; and (2) it is commonly used in the domestic literature. As originally defined by de Beer and McDermott (1989), NTFPs include all biological material, except timber-based products, that may be harvested from the forest.

Not surprisingly, given the broad nature of its definition, there are numerous species and products which comprise NTFPs. In attempts to simplify the concept, NTFPs are often classified into four categories: edibles, floral greenery, artisanry, and medicinal or dietary supplements (Chamberlain et al. 1998). Edible forest products include but are not limited to mushrooms, fiddlehead ferns, wild ramps, berries, saps and resins, and nuts. Studies in the Pacific Northwest have documented the impact of various species of mushrooms and huckleberries on local and regional economies (Burkhart 2011; Pilz and Molina 2002; Alexander et al. 2001; Pilz et al. 1999; Chamberlain et al. 1998; Schlosser and Blatner 1995). In Northeastern and Midwestern states, studies have reported on the
impacts of maple syrup production on rural livelihoods (Alexander and McLain 2001; Chamberlain et al. 1998; Hinrichs 1998).

A multitude of products are harvested as floral greenery. Perhaps the most widely sold floral product in the U.S. is evergreen boughs used to make wreaths and roping (Thomas and Schumann 1993). Various deciduous species are also used in making wreaths; twig-like wreaths are often made from birch trees, grapevines, and oriental bittersweet vines. Various ferns, grasses, mosses, and galax are also harvested and sold for use in floral arrangements (Alexander and McLain 2001; Savage 1995). Artisanry products are handmade items with both decorative and utilitarian purposes. Many of these products, now marketed as handicrafts, have traditionally played an important role in community culture (Arts 2008). NTFPs such as burls, twigs, branches, and cypress knees are often used in crafting wood carvings and turnings, utensils, containers, furniture, and musical instruments (Chamberlain et al. 1998).

NTFPs used for medicinal purposes or dietary supplements may constitute the highest economic valued segment (Alexander and McLain 2001; Chamberlain et al. 1998). In the United States, plants labeled and marketed as having medicinal value must meet strict Food and Drug Administration standards. Those that do not meet these standards are marketed as dietary supplements (Chamberlain et al. 1998). Two examples of the later widely marketed in the U.S. as dietary supplements are American ginseng and *Gingko biloba*, both of which have significant economic value. Two well-known medicinal NTFPs with substantial economic value are the Pacific yew from which taxol (used in cancer research) is derived and common foxglove from which digitalis (used as a cardiotonic agent) is derived.
Why NTFPs?

If timber has long been considered the ‘major’ product and economic value of forests and is still a needed good, why the seemingly sudden increase of research and management interest in NTFPs? The interest in NTFPs has covered a broad range of ideas, assumptions, and motivations. NTFPs have played important roles in ecological, cultural, and economic systems in countries around the world (Thadani 2001). In the closing decades of the 20th century, an increased recognition in forests’ values for providing a variety of products and services, coupled with the growing concern over deforestation, fueled the increase in NTFP research (Belcher 2003; Thadani 2001).

Three seminal studies emerged in the late 1980s, which highlighted the need to manage and study NTFPs. In 1988, Panayotou and Ashton called for the design of policies that encouraged the production of NTFPs and not just timber, thereby increasing the economic value of forests. De Beer and McDermott (1989) argued harvesting and marketing NTFPs could increase rural income, while Peters et al. (1989) emphasized the higher net revenues of NTFPs per hectare1 than timber. Studies into the early 1990s (e.g., Balick and Mendelson 1992; Grimes et al 1994) continued to evaluate the potential economic contributions of NTFPs; however, the assumptions and methods of evaluation used in these early studies have recently been criticized (Delang 2006). Nevertheless, these early studies increased interest in the potential contributions of NTFPs to rural development and conservation.

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1 1 hectare is equivalent to 2.471 acres.
The potential of NTFPs to improve rural livelihoods, and the general assumption that harvesting NTFPs was less destructive than timber harvesting, positioned NTFP production at the center of conservation and rural development conversations (Belcher 2003). The conservation through commercialization thesis (Evans 1993) hypothesized that forests could be conserved while simultaneously providing livelihoods for rural people through the commercialization of NTFPs. An underlying supposition here was economic benefits of NTFP harvest would surpass the benefits derived from alternative forest uses, such as timber harvesting or land use conversion. Therefore, if the value of NTFPs could be increased, incentives for keeping forests as forests could also be increased. Enthusiasm for the ability of NTFPs to simultaneously promote both of these objectives has waned as the validity of the hypothesis has been severely questioned (Lybbert et al. 2011; Leek 2007; Arnold and Ruiz-Perez 2001; Browder 1992).

Unlike timber, NTFPs are sold mainly in local markets through decentralized trade networks involving large numbers of harvesters, middlemen, and shop-owners (Burkart 2011; Thadani 2001). There are exceptions, however, as some products/species (e.g., American ginseng and Brazil nuts) have established, large, international markets. The predominantly cottage industry nature of most NTFP production, coupled to the sheer numbers of harvesters and intermediaries, makes monitoring and valuation of such products difficult. The lack of systems for tracking the combined value of hundreds of products also makes estimating the contribution of NTFPs to national or regional economies difficult (Gale 2008). While the U.S. Census Bureau indicated a NAICS (North American Industry Classification System) code for the forest nurseries and gathering of forest products industry, this industry is not included in the economic
census. Collecting comprehensive statistics on NTFP markets, which are predominately made up of individuals and cottage industries, is difficult and has resulted in poorly understood market channels (Greenfield and Davis 2003).

The commercialization of NTFPs as a means of potentially improving the livelihoods of rural populations has led to questions of social welfare and justice, land and resource tenure, and poverty alleviation. NTFPs play significant roles in subsistence and incomes, and it is often the poorest households who are most directly dependent on them (Neumann and Hirsch 2000; Amaranthus et al. 1998). Studies suggested that as incomes rose, the importance of harvesting NTFPs decreased (Schreckenberg 1999; Gunatilake et al. 1993; Godoy et al. 1993; Browder 1992); in some cases, NTFP harvesting was found to be associated with the perpetuation of poverty (Pandey 1996; Fearnside 1989). In other examples, where harvesters were close to markets and the NTFP harvested was highly valued, significant rural incomes were documented (Muniz-Miret et al. 1996; Schreckenberg 1996; Terry and Cunningham 1993).

In addition, NTFP commercialization also led to increased concerns for species conservation. Over-exploitation of high value NTFP species or destructive harvesting techniques may alter ecological processes at multiple levels leading to biological degradation – not conservation. The growing commercial trade in some NTFPs has resulted in increasingly higher volumes of harvesting and has generated concern regarding overexploitation (Rock et al. 2004; Ticktin 2004; Pandit and Thapa 2003; Robbins 1999; Chamberlain et al. 1998; Kuipers 1997; Mackinson et al. 1997). Research findings have documented attributes of many NTFP species (i.e., high degrees of variability and unpredictable productivity), which posed critical limitations to
commercial exploitation (La Frankie 1994; Phillips 1992). When a plant part is harvested, its potential for survival depends on the type of material harvested (Sinha and Bawa 2002; Vasquez and Gentry 1989). Species’ life histories also impact harvest tolerance levels. For example, perennial herbs are more likely to tolerate higher rates of harvest compared to trees (Ticktin 2004).

Unfortunately, there is a general lack of information regarding the sustainable harvesting of NTFPs (Chamberlain and Predny 2003). A database of NTFP species known to have commercial value in the U.S. is maintained by the Institute for Culture and Ecology (IFCAE). Currently, there are over 1,300 species listed in this database (IFCAE 2011). This list, however is not fully comprehensive, and species harvested solely for noncommercial purposes are not included. A history of de facto NTFP management in the U.S. has not only left resource managers wanting more information about NTFPs, but has also created situations where harvesting could lead to biological degradation. Studies have shown many NTFP gatherers are conservation minded in their practice (e.g. Emery et al. 2002); however, the increased numbers of harvesters raised concerns regarding potential over-exploitation of species. American ginseng and goldenseal are two examples of commercially traded NTFPs in the U.S. that have experienced population decline (Burkhart 2011). The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is aimed at ensuring international trade in specimens of wild animals or flora does not threaten their survival (CITES 2011). CITES list species in three appendices according to the level or types of protection from over-exploitation, with species in Appendix I being the most endangered.
and species in Appendix III the least. Both American ginseng and goldenseal are listed in Appendix II of CITES (CITES 2011).

While NTFP commercialization holds both promises and concerns for rural development and conservation, it is important to keep in mind that not all NTFPs are valued for commercial uses. Non-market uses of NTFPs have received far less attention in the literature (Delang 2006). While the extant literature references the importance of NTFPs for subsistence and cultural purposes, their non-market values are routinely excluded from economic analyses (e.g., Senaratne et al. 2003; Hedge et al. 1996; Shackleton et al. 2002). On the other hand, since the majority of NTFPs are not marketed, they are not as likely to be plagued with the same potential problems of exploitation as commercial products (Delang 2006).

The bulk of NTFP literature has been internationally focused; however, a series of events in the 1990s fueled increased interest in NTFP management and research in the United States. Increased environmental opposition to clearcutting, road construction, and loss of wildlife habitat resulted in decreased timber harvesting on national forests in the Pacific Northwest (Robbins et al. 2008; Love and Jones 2001; Chamberlain et al. 1998). Whether directly related or simply a proximate cause, the declining employment in logging and mills in this region accompanied an increase in NTFP harvesting. It is important to note that NTFP harvesting had occurred for generations in the area prior to the decline in the logging industry and upswing in public awareness (Pilz and Molina 2002; Love and Jones 2001). Changes in forest management on federal lands and the subsequent decrease in logging highlighted the need to find alternative means for
securing rural livelihoods in timber dependent communities; NTFPs seemed to be a viable option (Thomas and Schumann 1993).

Also occurring at this time, a plant-derived anti-cancer drug, taxol, was discovered and subsequently approved by the FDA for use in the treatment of ovarian cancer (Chamberlain et al. 1998). Derived from the Pacific yew, environmental concerns over potentially adverse impacts of increased yew harvests brought sustained attention to NTFPs on a national level in the United States (Alexander and McLain 2001; Wolf and Wortman 1992). While changes in management on public forests and increased interest in plant-derived medicines may not have directly led to increased NTFP research and management interests in the U.S., they certainly set the context within which this increase occurred. It placed a spotlight on NTFP issues and management concerns, and landed these long-time “minor” forest products squarely in the court of public opinion (e.g. Crosson 1991; Durbin 1991; Francis 1991; Nadler 1991; Ulrich 1991; Ervin 1990). From within this context emerged a U.S. NTFP literature that has been predominantly focused on public lands in the West and high-valued commercial NTFP species.

A variety of high-valued commercial NTFP species have been the focus of several studies: for example, huckleberries (Keefer 2008; Carroll et al. 2003), edible mushrooms (Amaranthus et al. 1998; McLain et al. 1998; Molina et al. 1993; Pilz and Molina 2002; Schlosser and Blatner 1995), American ginseng (Burkhart 2011; Burkhart and Jacobson 2009), floral greens (Wilsey and Nelson 2008; Schlosser et al. 1991), moss (Peck and Christy 2006), ferns (Anderson et al. 2000), and salal (Bennett et al. 2004; Ballard and Huntsinger 2006). This research has explored tensions created by NTFP harvesting both among harvester groups and between harvesters and resource managers. As interest in
and markets for NTFPs increased, the number of harvesters and the different groups of harvesters also increased. This in turn created pressures in some areas due to increased access demands. As a result, policies were created which limited/restricted access; imposed/raised harvest fees, and which controlled harvest practices and types of NTFPs removed (Alexander and McLain 2001; Richard and Creasy 1996; Wang et al. 1996).

Studies have also worked to determine methods for creating programs to address a variety of user needs and to promote the integration of harvester input and knowledge of various NTFP species into management policies (Alexander et al. 2001). Despite the focal emphasis of much of the NTFP literature, the value of NTFPs is more than simply their potential for commercial utilization. When nonmarket values are acknowledged, they are often understood in relation to harvesters’ economic activity and livelihood (Anderson et al. 2000; Richards and Creasy 1996; Falconer 1990).

NTFPs attract harvesters with various use interests, which often overlap: recreational harvesters, subsistence use harvesters, cultural use harvesters, as well as commercial harvesters. Research indicated there was no simple way to type harvesters by sociodemographics or economic status (Robbins et al. 2008; Emery et al. 2002). Studies which explored the sociocultural and economic contexts for NTFP harvest practices found them to be conditioned by the larger framework of household and family activities. Harvesters could be linked to formal or informal markets, and participate in NTFP harvesting practices as a part of a diversified livelihood strategy, to maintain cultural and family values through the generations, or for the pleasure received from participating in the activity (Robbins et al. 2008; Carroll et al. 2003; Doble and Emery 2001; Hinrichs 1998). While potential for economic gain often motivated NTFP harvesting practices,
sociocultural attributes frequently defined the context for harvesting, and even overrode economic considerations (Bailey 1999).

In a collection of case studies, Emery et al. (2002) concluded personal use probably accounted for the greatest number of NTFP uses in the eastern U.S. One important characteristic of forests in the eastern U.S. is the mixed ownerships across the landscape. While the majority of forests in the West fall under public ownership, the vast majority of Eastern forests are privately held. Relative to harvest practices on public lands, little is known about NTFP harvesting on private forestlands.

Potential for forestland conversion or ownership turnover in the private land dominated landscape of the East is likely to lead to harvesting activities displaced to other locations or stopped entirely (Emery et al. 2002). In addition, increased numbers of PFLs and smaller tract sizes indicate a need to find ways to help them actively manage small forested properties well. The array of management activities available to PFLs is limited on smaller forest tracts. In instances where PFLs are interested in managing their timber, timber harvesting may not be cost effective (Ashton 2009; Row 1978). Anecdotal evidence also indicated PFLs who owned small parcels may not see their property as “forest,” and therefore were less likely to actively manage their forestland. Facilitating PFL interest in NTFP management is one potentially viable alternative which could lead to increased interest in active forest management, maintaining both the forested landscape and pre-existing NTFP harvesting practices.

2 During the administration of the 2008 mail survey several PFLs called to say that they did not qualify as forest landowners, indicating they owned only a couple of acres with trees on it, not a “forest.” While the exact number of PFLs who called to say this was not recorded, it does raise the question at what point do landowners consider their property to be “forest.”
Methods

Exploring the differences between PFLs who harvested NTFPs and those who did not is an important component to not only our understanding of the individuals who manage the Commonwealth’s private forests, but also to broadening our conceptualization of NTFP harvesters. The remainder of this chapter reports results from the 2008 statewide survey for the full sample, as well as for PFLs who harvested NTFPs compared to those who did not.

Mail Survey

A three panel study of PFLs in Pennsylvania began in 2006. The initial objectives of this five-year study were: (1) to identify access barriers to Pennsylvania’s private forest resources; (2) to describe the attitudes, perceptions, issues, and concerns of PFLs; (3) to document the availability of technical assistance; and (4) to determine owners’ future plans for their forestland (Metcalf 2010). As the second panel of the study, a twenty-page survey was mailed to 6,600 PFLs (100 per county for all counties but Philadelphia) across the Commonwealth of Pennsylvania in 2008. The survey sample was identified following the design established during the first panel of the study. PFLs were identified by digitally dropping 400 random points per county over maps of forestland in Pennsylvania using GIS software. Ownership data for the identified land parcels were obtained from county tax records. In counties where ownership data were available in spatial format, this was used to identify PFLs (Metcalf 2010). Spatial data was only available for approximately half of the counties in 2008. For those counties without spatial data, the location of each random point was triangulated using plat books and
parcel maps, then identified through tax assessment information at county courthouses. A random sample of 100 PFLs per county was selected from those identified.  

The mail survey was conducted using a tailored design methodology (Dillman 2007) with four waves of contact: initial survey and letter, a reminder postcard, and a second and third follow-up survey. Adjusting for undeliverable surveys, deceased owners, and non-forestland owners, the total response rate for the survey was 49 percent (N=2,713). Attempts were made to contact non-respondents using follow-up telephone interviews. A random sample of 500 non-respondents was drawn, and phone numbers were established for 339 members of this sample. Over a period of seven weeks, up to three phone call attempts were made to contact the non-respondents. Of the 339 non-respondents, 54 percent were successfully contacted; 46 percent of those contacted were willing to participate in the phone survey. Those willing to participate were asked if they owned forestland, how many forested acres they owned, if they had harvested timber from their property, and several basic demographic questions. Responses were recorded and compared with those from the mail survey respondents using chi-square tests.

The results suggested non-respondents were fairly similar to respondents although some differences were found. There were no significant differences in number of forested acres owned, rate of timber harvesting, type of ownership forestland was held in, or landowner age. Although the majority of respondents in both cases were male, non-respondents contacted were more likely to have been female ($\chi^2$ 14.17 (1); p<0.001). The 2008 mail survey respondents tended to have more years of formal education ($\chi^2$ 8.02 (2);

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3 Philadelphia County was excluded since it contains less than one tenth of one percent of the commonwealth’s forestland (Metcalf 2010).
p<0.05). In both cases the majority of respondents were employed either full or part-time; however, mail survey respondents were more likely than non-respondents to have been retired (χ² 10.32 (2); p<0.01).

Results

Rate of Participation

Respondents were asked whether or not they had ever done the following activities relating to NTFPs on their forestland: harvest non-timber products for personal use; harvest non-timber products to give as gifts; harvest non-timber products for sale; let others harvest non-timber products on their property; and plant non-timber product species on their property (Figure 3.1). In addition, they were asked how likely they were to do each of these five activities in the future even if they had not done them in the past (Figure 3.2). Approximately 31 percent of PFLs had planted NTFP species on their forestland, and 30 percent of PFLs had harvested them from their property for personal use. Sixteen percent indicated they had allowed others to harvest NTFPs on their property and 11 percent had harvested them to give as gifts. Only five percent of PFLs harvested NTFPs from their forestland for commercial purposes; however, when PFLs who also harvested for personal use are excluded, only one percent of PFLs harvested exclusively for commercial purposes.
Figure 3.1 Distribution of Pennsylvania PFLs by NTFP management activity

Figure 3.2 Distribution of Pennsylvania PFLs by likelihood of engaging in NTFP activity in the future
Future intentions in these NTFP management activities closely mirrored PFLs’ past behaviors. The percent of PFLs who indicated a likelihood of harvesting NTFPs for sale in the future; however, increased 2.5 percent over those who had previously done so (to eight percent). This result would seem to indicate a potentially growing interest, albeit a small one, in commercial NTFP harvests on private forestlands in Pennsylvania. Figure 3.3 illustrates the statewide distribution by county of PFLs who had harvested NTFPs on their forestland. The trend reflects the highest frequency occurring in counties within the ridge and valley and northern tier regions of the state, areas where forest cover is densest.

Figure 3.3 Distribution of PFLs who have harvested NTFPs on their forestland by Pennsylvania county
Sociodemographics

Private forestland ownership within the United States is heavily skewed toward males, and Pennsylvania’s PFLs are no exception (Metcalf 2010; Butler 2008). In this study, 84 percent of all respondents were male. The gender breakdown of NTFP harvesters was similar to the full sample (85% male), and there was no significant difference in gender between harvesters and non-harvesters. A portion of this gender bias may reflect our having collected landowner information from tax records which tended to list males first. However, 48 percent of PFLs in the Commonwealth jointly owned their forestland with their spouse (Figure 3.4). Another 22 percent of PFLs held forestland in other forms of joint or group ownership. These facts suggest it is likely a greater percentage of females than reflected here share in ownership and decision-making responsibilities. There was no significant difference between harvesters and non-harvesters in ownership type.

Similar to the national population of PFLs, Pennsylvania’s private forests are predominantly owned by older PFLs (Figure 3.5). Most PFLs (91 percent) were 45 years or older; the mean age was 61 years. Less than 10 percent of the PFL population was under the age of 45 while a majority of PFLs were of or near retirement age. The plurality of PFLs (39 percent) was 65 years and older, while the mean age category, 55 to 64, accounted for 30 percent of the PFLs. Figure 3.6 compares the age distribution of PFLs who harvested NTFPs on their forestland with PFLs who had not.
PFLs who harvested NTFPs tended to be younger than non-harvesters ($\chi^2 = 24.229$ (4); $p < 0.01$). The mean age for harvesters was 59 years and for non-harvesters it was 62 years. Over one-third (36 percent) of the harvesters were between the ages of 35 and 64 years compared to 27 percent of non-harvesters. Conversely, nearly three-quarters (72 percent) of non-harvesters were 55 years or older compared to 62 percent of harvesters.
Similar trends were reflected in PFL employment figures (Figure 3.7). The high percentage of retired PFLs (42 percent) corresponded with the aging PFL population.

Figure 3.8 illustrates the distribution of PFLs who harvested NTFPs compared to non-harvesters across employment categories. In line with harvesters’ tendency toward younger ages, harvesters were more likely to be employed full or part-time compared to non-harvesters who were more likely retired ($\chi^2 = 9.151 (3); p < 0.05$). To avoid a problem with empty cells during the chi-square analysis of differences between harvesters and non-harvesters, the employment categories homemaker, non-employed, and student were collapsed and labeled as other.

Compared to the general population in Pennsylvania, PFLs’ education and income was relatively high. The 2009 U.S. census population estimates indicated 26 percent of Pennsylvanians 25 years and older had completed at least a four-year college degree, compared to 40 percent of Pennsylvania PFLs (Figure 3.9). Approximately 11 percent of
PFLs had completed technical school or earned an Associate degree, and another 12 percent had completed at least some college. Just under one-third of PFLs (31 percent) completed high school or their GED, and only six percent held less than a high school education. Sixty-eight percent of PFLs reported a household income of $50,000 or more, and 33 percent reported an income of $100,000 or more (Figure 3.10). According to the
U.S. Census, the estimated median household income for Pennsylvania in 2008 was just under $51,000. There were no significant differences between PFLs who harvested NTFPs and those who did not in terms of level of educational attainment or household yearly income.

Figure 3.9 Distribution of Pennsylvania PFLs by highest level of education completed

Figure 3.10 Distribution of Pennsylvania PFLs by household yearly income categories
The majority of Pennsylvania’s PFLs described themselves as having politically conservative leanings (Figure 3.11). Twenty-seven percent of PFLs described themselves as conservative, and another 33 percent as moderate conservative. Four percent of PFLs described themselves as liberal and another eight percent indicated they were moderately liberal. Finally, 28 percent indicated moderate political views. Figure 3.12 shows the distribution across political affiliation categories for PFLs who harvested NTFPs and those who did not. Harvesters, compared to non-harvesters, were more likely (11 percent vs. 6 percent) to describe themselves politically as being moderately liberal ($\chi^2 16.046 (4); p < 0.01$). Conversely, a greater percentage (35 percent) of non-harvesters described themselves as moderately conservative. Despite these differences, the overwhelming majority of both harvesters and non-harvesters described themselves as being either moderately conservative or conservative.

![Figure 3.11 Distribution of Pennsylvania PFLs by political affiliation](image)
Figure 3.12 Distribution of Pennsylvania PFL non-timber forest product harvesters and non-harvesters by political affiliation

Forestland Ownership

Absentee forestland ownership is often a variable of interest for forestry professionals because it is often assumed PFLs who do not live on or near their forestland are difficult to reach with traditional educational and technical assistance outreach services. In addition, the level of absentee ownership can provide insight into PFLs’ involvement with managing their forestland and with the community where the property is located. Approximately 56 percent of Pennsylvania PFLs lived within one mile of their forestland and an additional 23 percent lived within 30 miles (Figure 3.13). Only eight percent of PFLs lived between 30 and 100 miles away, nine percent between 100 and 250 miles, and four percent lived 250 miles or further from their forestland. The frequency with which PFLs visited their forestland also provided insight into their level of involvement in managing their forestland. Forty-seven percent of Pennsylvania’s PFLs indicated they lived on their forestland, and another 17 percent indicated they visited at
least once a week (Figure 3.14). Thirteen percent visited monthly, 17 percent several times a year, and the remaining six percent visited, at the most, once annually.

Not surprisingly, there was a significant difference between NTFP harvesters and non-harvesters ($\chi^2 64.674 (6); p < 0.01$) in frequency of visitation (Figure 3.15). Harvesters were more likely to live on their forestland and non-harvesters tended to visit less frequently.

Figure 3.13 Distribution of Pennsylvania PFLs by distance of forestland from primary residence

Figure 3.14 Distribution of Pennsylvania PFLs by frequency of forestland visitation
Most PFLs owned their forestland for ten years or longer (Figure 3.16). Mean land tenure was 25 years; however, 20 percent of the PFLs owned their forestland for less than ten years. There was no significant difference in land tenure between PFLs who had harvested NTFPs and those who had not.
The reasons PFLs owned their forestland were as diverse as they were and many PFLs had multiple objectives. When asked to rate the importance of twelve reasons for owning forestland, at least half of the PFLs indicated to enjoy wildlife; solitude; enjoyment of owning forestland; camping, walking, or other recreation; estate to pass on to children; and hunting opportunities as important or very important reasons for owning this land (Figure 3.17). Of the three financial objectives respondents were asked to rate, growing timber for sale was rated highest with more than two in five (44 percent) indicating it was an important or very important reason for owning. Land investment was second with 25 percent, followed by income other than from selling timber (17 percent). In addition, 26 percent of PFLs rated NTFPs as important or very important reasons for owning forestland.

Figure 3.17 Distribution of Pennsylvania PFLs by importance of reasons for owning forestland
Figure 3.18 shows the percent of NTFP harvesters and non-harvesters who rated these same twelve reasons for owning forestland as important or very important. While there were significant differences between these two groups on the importance for nine of these reasons, they did not differ in the importance placed on owning forestland for hunting opportunities, because it came with the property, or for land investment. NTFP harvesters were more likely than non-harvesters to rate as important or very important the following reasons: to enjoy wildlife ($\chi^2 = 24.383$ (4); $p < 0.01$); solitude ($\chi^2 = 35.497$ (4); $p < 0.01$); enjoyment of owning forestland ($\chi^2 = 36.896$ (46); $p < 0.01$); camping, walking, or other recreation ($\chi^2 = 44.316$ (4); $p < 0.01$); estate to pass on to my children ($\chi^2 = 17.011$ (4); $p < 0.01$); personal uses of wood ($\chi^2 = 72.910$ (4); $p < 0.01$); growing timber for sale ($\chi^2 = 15.466$ (4); $p < 0.01$); non-timber forest products ($\chi^2 = 165.289$ (4); $p < 0.01$); and income other than from selling timber ($\chi^2 = 36.480$ (4); $p < 0.01$).

All survey respondents were asked to select from the list of twelve reasons the most important reason for why they owned their forestland. The most common reason selected (20 percent) was enjoyment of owning forestland (Figure 3.19). The second most common response was hunting opportunities (19 percent), followed by solitude (16 percent). Growing timber for sale and land investment were both rated as the most important reason by five percent of PFLs, and income other than from timber was considered the most important reasons by only one percent of PFLs. Less than one percent of PFLs ranked NTFPs as the most important reason. Comparing NTFP harvesters with non-harvesters revealed a similar overall trend (Figure 3.20). Enjoyment of owning forestland was rated the most important reason by both groups; however,
Figure 3.18 Importance of reasons for owning forestland by percent of Pennsylvania PFL non-timber forest product harvesters and non-harvesters
Figure 3.19 Distribution of Pennsylvania PFLs by most important reason for owning their forestland

Figure 3.20 Most important reason for owning forestland by percent of Pennsylvania PFL non-timber forest product harvesters and non-harvesters
harvesters were more likely to rate this as most important ($\chi^2 = 36.896$ (4); $p < 0.01$). Non-harvesters were slightly more likely to rate the three financial reasons as most important.

**Information Sources**

Written materials were the most common information source used by PFLs when making decisions about their forestland (53 percent), followed by: foresters (47 percent); friends or family members (43 percent); loggers (39 percent); other forest landowners (37 percent); and 32 percent used the Internet (Figure 3.21). Less than one-third of PFLs had used Penn State Extension, the PA Bureau of Forestry, other government agency, mass media programs, or woodland associations. When asked to indicate how likely they were to use each source in the future, the top two sources remained the same (Figure 3.22). Fifty-six percent of PFLs indicated they were likely or very likely to use written materials in the future, and 51 percent were likely or very likely to use foresters. Forty-two percent indicated they were likely or very likely to use the Internet, followed by: friends or family (38 percent); Penn State Extension (38 percent); other forest landowners (37 percent), and PA Bureau of Forestry (34 percent). Less than one-third of PFLs were likely or very likely to use loggers, other government agencies, woodland owners associations, or mass media programs in the future.
Figure 3.21 Distribution of Pennsylvania PFLs by information source used when making decisions about their forestland (note: percentages do not sum to 100 since respondents could choose multiple options)

Figure 3.22 Distribution of Pennsylvania PFLs by information source likely to use in the future (note: percentages do not sum to 100 since respondents could choose multiple options)
When compared to non-harvesters, PFLs who had harvested NTFPs were more likely to have used information sources when making decisions about their forestland (Figure 3.23). Similar to the full sample, the most common source of information used by both harvesters (70 percent) and non-harvesters (46 percent) was written materials. The second most common source used by NTFP harvesters was friends or family members (59 percent), followed by foresters with 51 percent. The second most common source used by non-harvesters was foresters (45 percent), and the third most common was friends or family members with 36 percent. The two sources least likely to have been used by harvesters were woodland owners association (11 percent) and other government agency (18 percent). The two sources used the least by non-harvesters were woodland owners associations (8 percent) and television/video/radio programs (8 percent).

![Figure 3.23 Distribution of Pennsylvania PFL non-timber forest product harvesters and non-harvesters by information source used when making decisions about their forestland (note: percentages do not sum to 100 since respondents could choose multiple options)]
When asked to indicate how likely they were to use each source in the future, harvesters were more likely to than non-harvesters to indicate they were likely or very likely to use each of the sources (Figure 3.24). For both harvesters (43 percent likely; 29 percent very likely) and non-harvesters (32 percent likely; 17 percent very likely) the source with the greatest likelihood of use in the future was written materials. Fifty-four percent of harvesters were likely or very likely to use foresters as an information source in the future, and 53 percent were likely to use the Internet. Forty-eight percent of non-harvesters were likely to use foresters, and 37 percent were likely to use the Internet. The two sources least likely to be used in the future by harvesters were television/video/radio programs (18 percent likely; 5 percent very likely) and woodland owners associations (14 percent likely; 7 percent very likely). For non-harvesters, the two sources least likely to be used in the future were woodland owners association (11 percent likely; 4 percent very likely) and television/video/radio programs (9 percent likely; 2 percent very likely).
Figure 3.24 Information sources likely to use in the future when making decisions about their forestland by percent of Pennsylvania PFL non-timber forest product harvesters and non-harvesters
Forestland Activities

Just as landowners own their forests for a multitude of reasons, PFLs engaged in a variety of activities on their forestland. Landowners most commonly engaged in hunting or other types of recreation (Table 3.2). A majority of landowners also had improved wildlife habitat and planted trees. Compared to other common forestland activities, planting NTFP species and harvesting them for personal use ranked toward the middle of the list. These results suggested planting and harvesting NTFPs for personal use was a more common forestland activity than several other listed activities.

<table>
<thead>
<tr>
<th>Activity</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hunt (by me or family)</td>
<td>78.3</td>
</tr>
<tr>
<td>Recreate, besides hunting (by me or family)</td>
<td>77.0</td>
</tr>
<tr>
<td>Improve wildlife habitat</td>
<td>68.2</td>
</tr>
<tr>
<td>Plant trees</td>
<td>63.8</td>
</tr>
<tr>
<td>Control vegetation w/o herbicides</td>
<td>46.4</td>
</tr>
<tr>
<td>Reduce fire hazards</td>
<td>34.4</td>
</tr>
<tr>
<td>Plant NTFPs on my property</td>
<td>30.5</td>
</tr>
<tr>
<td>Harvest NTFPs for personal use</td>
<td>30.2</td>
</tr>
<tr>
<td>Apply herbicides</td>
<td>24.0</td>
</tr>
<tr>
<td>Clear land for a road</td>
<td>21.9</td>
</tr>
<tr>
<td>Clear land for buildings</td>
<td>18.1</td>
</tr>
<tr>
<td>Create a stream-side buffer</td>
<td>16.7</td>
</tr>
<tr>
<td>Erect a deer fence</td>
<td>7.8</td>
</tr>
<tr>
<td>Lease to a club or organization</td>
<td>5.3</td>
</tr>
</tbody>
</table>
A comparison of forestland activities by non-harvesters and harvesters indicated the latter tended to be more actively engaged with their forestland (Figure 3.25). A majority of harvesters indicated having acted on six of the forestland activities compared with four activities for non-harvesters. For both harvesters and non-harvesters the most common activities were recreation, hunting, improving wildlife habitat, and planting trees. The least common activities for both groups were erecting a deer fence and leasing to a club or organization. Harvesters were much more likely to have allowed others to harvest NTFPs on their property ($\chi^2$ 360.263 (1); p <0.01) and to have planted NTFP species on their property ($\chi^2$ 361.927 (1); p <0.01).

![Figure 3.25 Distribution of Pennsylvania PFL non-timber forest product harvesters and non-harvesters by forestland activity engaged in on forestland (note: percentages do not sum to 100 since respondents could select multiple activities)]
Fifty-one percent of PFLs indicated they had harvested trees for sale from their forestland in the past (Figure 3.26); and 67 percent of PFLs had harvested firewood from their properties previously. There were no significant differences in commercial timber harvests between PFLs who harvested NTFPs and those who did not. PFLs who harvested NTFPs were much more likely to have also harvested firewood from their property ($\chi^2 = 87.086 (1); p <0.01$).

Respondents were asked to indicate the likelihood of engaging in seven activities related to harvesting trees on their forestland (Figure 3.27). PFLs who harvested NTFPs were more likely to do each of the seven activities in the future; however, the rank order of the activities for NTFP harvesters and non-harvesters was similar. Cutting firewood for personal use was the activity NTFP harvesters and non-harvester were most
Figure 3.27 Timber harvesting activities likely to do in the future by percent of Pennsylvania PFL non-timber forest product harvesters and non-harvesters

likely to do (80 percent and 60 percent, respectively). Fifty percent of NTFP harvesters indicated a likelihood of harvesting sawlogs for sale and 40 percent indicated they were likely to harvest veneer logs for sale in the future. The activity least likely to occur in both groups was cutting firewood for sale.

In addition to management activities, respondents were asked to indicate on a four point scale how good of a caretaker of their forestland they considered themselves to be (Figure 3.28). For the full sample, the modal response (48 percent) was ‘good.’ A combined 60 percent of PFLs believed themselves to be either a good or excellent caretaker of their forest. Nearly one-third of all PFLs believed they were fair and seven percent indicated they were poor caretakers of their forests. PFLs who harvested NTFPs were more likely to indicate they were either good (46 percent) or excellent (11 percent)
caretakers. Conversely, non-harvesters were more likely to indicate they were fair (35 percent) or poor (8 percent) caretakers of their forests ($\chi^2$ 24.879 (3); $p < 0.01$).

![Bar chart](image)

**Figure 3.28** Self-rated quality as forestland caretaker by percentage of Pennsylvania PFL non-timber forest product harvesters and non-harvesters

**Forestry-Related Knowledge**

Pennsylvania’s PFLs indicated they were somewhat knowledgeable about eight forest-related topics. Knowledge scores were measured on a ten-point scale where 10 is very knowledgeable and 0 is very unknowledgeable. The topic where PFLs were most knowledgeable was tree identification, followed by wildlife ecology, and Pennsylvania forests in general (Figure 3.29). Overall, PFLs were least knowledgeable about forestland taxes and incentives. A comparison between PFLs who harvested NTFPs and non-harvesters showed a similar rank order of forest topics. NTFP harvesters indicated a higher level of knowledge across all eight topics compared to non-harvesters. On average, NTFP harvesters indicated a knowledge rating of five or better on all of the
topics except for forestland taxes and incentives. Non-harvesters had an average knowledge rating of five or better on three of the topics: tree identification, wildlife ecology, and Pennsylvania forests.

Figure 3.29 Mean knowledge ratings for Pennsylvania PFLs non-timber forest product harvesters and non-harvesters across forestry topics
Attitudes

Pennsylvania PFLs held a generally favorable attitude toward harvesting trees (Figure 3.30). NTFP harvesters were more likely than non-harvesters to agree that harvesting trees improved the health of the forest (F 11.897; df 14; p <0.01). Harvesters were also more likely to agree that healthy forests were important (F 17.625; df 1; p <0.01).

NTFP harvesters were also less likely (F 9.799; df 1; p <0.01) to agree with the statement that humans should not interfere with nature (Figure 3.31). As well, NTFP harvesters were more likely to agree that humans should have more love, respect, and admiration for forests (F 3.349; df 1; p <0.01). There were no differences between harvesters and non-harvesters regarding forest owners having the right to use their forests as they see fit or with forests having a right to exist for their own sake regardless of human concerns or use.

Figure 3.30 Mean agreement score for Pennsylvania PFL non-timber forest product harvesters and non-harvesters across timber harvest statements
Figure 3.31 Mean agreement score for Pennsylvania PFL non-timber forest product harvesters and non-harvesters across forest statements

In addition to exploring the characteristics of PFLs who gathered NTFPs, this study also examined the types of NTFPs harvested. Sixty-nine percent of PFLs who harvested NTFPs collected berries (Figure 3.32); followed by cones, seeds, and nuts (38 percent). The least harvested product was bracken fungi (3 percent). One-third of NTFP harvesters collected mushrooms; ferns and boughs were harvested by 22 percent. Medicinal NTFPs, such as ginseng and goldenseal, were harvested by seven percent of NTFP harvesters; however, this percentage doubled when specifically looking at commercial NTFP harvesting. Fifteen percent of respondents indicated they harvested NTFPs other than what was listed. When asked to specify, 29 percent indicated they harvested stone; 28 percent harvested forbs and shrubs; 24 percent harvested fruits; 6
percent harvested craft products; 5 percent harvested seedlings; 4 percent harvested wildlife products; 2 percent harvested minerals; and 2 percent harvested Christmas trees.

NTFP harvesting was often an important sociocultural activity for harvesters. Ninety-three percent of PFLs who harvested did so either alone or with family members (Figure 3.33). Of this 93 percent, roughly half, 49 percent, harvested with their family. Only seven percent of PFLs who harvested NTFPs did so with friends. NTFP harvesters who harvested with their family had an average of three people, including themselves, currently living in their household, and an average of 2.5 children. These averages were higher than harvesters who went alone (2.4 people and 2.2 children). There was no difference in number of people in household between harvesters who went with family and those who went with friends. However, harvesters who went with family, on average, had more children than those who harvested with friends (2 children).

Figure 3.32 Distribution of Pennsylvania PFL non-timber forest product harvesters by type of NTFP harvested (note: percentages do not sum to 100 since respondents could select multiple products)
Implications

The results presented here begin to paint a picture of PFLs who harvested NTFPs on their forestland and highlighted harvesters’ attitudes, knowledge, forestland activities, and characteristics. Harvesting NTFPs is an integrated part of many PFLs’ forest activity in Pennsylvania. PFLs from a range of socioeconomic circumstances harvest NTFPs. These harvesters tended to be younger than non-harvesters, with an average age of 59 years, but the range of ages for harvesters spans from 25 to 97 years old. Though more likely to be employed, harvesters as a group, were predominantly composed of PFLs who were either employed or retired. Politically, NTFP harvesters were predominantly moderate to conservative, but they were more likely than non-harvesters to lean toward liberal.

PFLs who harvested NTFPs tended to be more actively engaged in forest management than non-harvesters. They were more likely to live on their forestland, to engage in activities on their land, harvest firewood, harvest timber in the future, and
access information sources when making decisions about their forestland. In addition, harvesters were just as likely to have commercially harvested timber from their land as non-harvesters. NTFP harvesting by Pennsylvania PFLs was predominantly for personal use and only a small percentage sell or give NTFPs as gifts. Edible NTFPs were the most commonly collected, however, PFLs also harvested floral greenery, materials for handicrafts, and medicinal plants and fungi.

NTFP harvesters tended to see themselves as good or excellent caretakers of their forests, owned their forests for multiple reasons, and indicated higher forest-related knowledge than non-harvesters. There was little variation in responses to attitudinal forest statements, which suggests a need for refining the statements so they better reflect PFLs’ attitudes toward forests. Harvesters, however, tended to hold favorable attitudes toward cutting trees and forest use in general. As well, harvesters were more likely to agree that healthy forests were important and people should have more love and respect for forests.

This diverse range of characteristics and practices suggests that like the broader PFL population, those who harvested NTFPs were not a homogenous group. Similar to the findings of Robbins et al. (2008), these results suggest socioeconomic characteristics were potentially poor predictors for PFLs who harvested NTFPs on their forests. These results add to both the NTFP and the PFL literatures. No studies were found in the literatures which examined, on a broad, statewide scale, the characteristics, attitudes, forestry knowledge, and/or forestland activities of private, non-industrial landowners who harvested NTFPs. In addition, this study offered evidence contrary to the prevalent theme
that NTFP harvesters are a culturally and economically distinct group solely engaged in harvesting activities on lands owned by a third party.

Further, these results suggest NTFP harvesting and management practices could be compatible with other forestland activities in which PFLs commonly engage. Facilitating PFL interest in NTFPs could potentially increase active forest management through increased contact with and improved knowledge of their forestland. The mosaic of characteristics, motivations, and needs of PFLs across Pennsylvania make the policy mantra of ‘no one size fits all’ ring true. Outreach and assistance efforts must take advantage of PFL diversity and employ a variety of methods for increasing forest stewardship on private forests. Harvesters’ past use of and their likelihood of continuing to use written materials make this one viable venue for reaching landowners. Given the younger age of NTFP harvesters, and the high degree of their stated likelihood for using the Internet to gather information, suggests the potential for using social networking resources such as woodland owners’ networks for facilitating interest in NTFP management.

The information presented here provides a baseline description of NTFP harvesting by PFLs. Further research is needed to gain a deeper understanding of motivations behind harvesting activities, management techniques used to sustain availability of products, and PFLs’ interest in intensive management practices such as forest cultivation. One potentially interesting avenue for exploration is that of harvesters’ willingness to allow others to harvest NTFPs on their property. Understanding the conditions under which this would be acceptable could be insightful for issues of access.
for harvesters who do not own forestland or have access rights; particularly in the eastern United States where the vast majority of forests are privately owned.
Literature Cited: Chapter 3


Chapter 4

Hanging Together: Cross-Boundary Cooperation among Pennsylvania’s Private Forest Landowners

The face of America’s forests is changing. The number of forest owners is increasing, while average forest parcel size is decreasing. Forests are more physically disconnected as their surrounding land uses become increasingly urban in nature. In addition to such physical fragmentation, the increasing number of forest parcels creates arbitrary management boundaries along ownership lines. During the past 20 years, private forest landowners (PFLs) have trended towards owning smaller parcels and have become less likely to actively manage for traditional forest practices such as timber harvesting (Metcalf 2010; Butler and Leatherberry 2004; Davis 2003; Mehmood and Zhang 2001; Best and Wayburn 2001; Egan and Luloff 2000; DeCoster 1998; Campbell and Kittredge 1996; Bliss and Martin 1989).

Reflecting national trends, USDA Forest Service (FS) estimates for Pennsylvania’s PFL population in 1980, 1994, and 2007 indicated an increase in landowners: 490,000, 513,900, and 533,000 respectively (Butler 2008; Birch 1996; Birch and Dennis 1980). Average forest parcel size in 1980 was 25 acres (Birch and Dennis 1980) and by 2007 was 22 acres (McWilliams et al. 2007). Estimating the number of PFLs, however, is more difficult because the sampling techniques used by the FS (USDA Forest Service 2007) select larger parcels, inadvertently missing smaller parcels (Metcalf 2010). Taking this selection bias into account, Metcalf (2010) estimated there were more than 600,000 PFLs in Pennsylvania, the majority (63%) of whom owned ten acres or less.
Regardless, the trends are clear. Movement away from concentrated, large ownership patterns toward more heterogeneous ownership results in a multiplicity of management approaches, land tenure, and landowner characteristics. While many owners express interest in the economic benefits of forest ownership and harvest timber, PFLs primarily indicate aesthetic, recreational, and/or preservation as the most important reasons for owning their forestland (Metcalf 2010; Butler 2008; McWilliams et al. 2007; Butler and Leatherberry 2004; Birch 1996; Bourke and Luloff 1994; Bliss 1989). The multiple and diverse reasons PFLs express for owning their forests leads to a kaleidoscope of forest use and conversion patterns across the nation’s landscapes.

Maintaining our forests and their associated benefits in the face of continuing population growth and development pressures is and will continue to be an important challenge. In many regions of the United States, forest landscapes are becoming increasingly fragmented and transformed by development (Haines et al. 2011; Gobster et al. 2000). Fragmentation, parcelization, and land-use conversion all affect a forest’s ability to provide economic benefits, ecological services, and products to society. Smaller ownership parcels often create diminished economies of scale (Munn et al. 2002; Mehmood and Zhang 2001; Egan and Luloff 2000; Gobster et al. 2000; Greene and Blatner 1986; Row 1978), and new ownership motivations are less likely to be driven by traditional forest uses, especially timber production, as being either economically important or ecologically necessary (Butler and Leatherberry 2004; Rickenbach, and Gobster 2003; Munn et al. 2002; Sampson and DeCoster 2000). Further, multiple forest owners with diverse management objectives lead to a higher likelihood of conflict over forest use and management (Edwards and Bliss 2003). Ecological composition and forest
structure can also be altered as a result of parcelization (Ward et al. 2005; Gobster et al. 2000; Turner et al. 1996; Wear et al. 1996). Sustaining the benefits and services provided by private forests is dependent upon the maintenance of functional forest landscapes within this context of PFL population diversity and growth (Stein et al. 2005; Kittredge 2004).

The very real possibility of disjointed management objectives running counter to the goal of long-term sustainable forest management is a significant concern among forest professionals. Researchers have explored several options, including tax incentives and government cost-share programs, as a means of addressing the effects of population trends on forest functionality (Megalos 2000; Sampson and DeCoster 2000). Beyond public policy incentives, researchers have also explored the potential for large-scale management of multiple properties (Finley et al. 2006; Sinclair and Knuth 2000; Rickenbach et al. 1998; Brunson et al. 1996). In general, these results were favorable, with PFLs indicating positive reception of cross-boundary management.

Parcelization – division of larger, single-owner tracts into smaller parcels with multiple owners – often occurs when landowners divide their forestland among multiple heirs or owners. The latter often occurs as a result of high inheritance taxes which regularly lead heirs to sell all or part of their forestlands. In addition, increased migration into forested areas for their natural amenities contributes to parcelization of private forests (Haines et al. 2011; Kruger et al. 2009; Radeloff et al. 2005; Garber-Yonts 2004; Krannich and Petzelka 2003; McGranahan 1999). As development encroaches upon private forests, the urban-forest interface experiences development pressures, affecting forest attributes and management (Stein et al. 2005; Gobster and Rickenbach 2004;
Sampson and DeCoster 2000). However, complete land-use conversion notwithstanding, the loss of forest functionality does not have to be a foregone conclusion of parcelization. Cooperation among neighboring landowners in managing their forestlands may help offset some effects of parcelization.

This chapter explores questions of cooperation using data from a 2008 mail survey of Pennsylvania’s private forest landowners. Cooperation across ownership boundaries has the potential to decrease the economic strain PFLs experience when managing their forests and reduce the negative effects of parcelization on ecological services and forest product supply. Survey data was analyzed to assess PFLs’ levels of interest in nine cooperative activities. Finally, sub-groups based on cooperation behavior were profiled, and implications of these findings are discussed.

Urban Development

Land use changes are embedded within the context of choices made by individuals. Urban development is principally driven by population growth and household formation. When combined with growth in income and wealth, residential preferences, and transportation and communication technologies, these forces drive consumption of land for new housing developments (Heimlich and Anderson 2001). The population of the United States increased 9.7 percent, from 281 million in 2000 to 308 million in 2010 (Mackun and Wilson 2011). Based on U.S. Census Bureau projections and present trends, the population is projected to increase to 392 million by 2050; the highest estimates project the population at mid-century to be 519 million (Day 1996). Despite the large increases in absolute numbers, the rate of population growth is
projected to decrease during this time, from approximately one percent to 0.5 percent, predominantly due to the aging population (Day 1996). Population growth, however, is not likely to cease in the near future.

Over the past 200 years, numerous sociocultural, economic, and political incentives have encouraged urban expansion. Although predominantly rural for much of the nation’s history, the United States’ urban population has steadily grown. Facilitated by advances in transportation and communication technologies, growth of the nation’s population accelerated in the second-half of the 1800s and steadily began shifting westward. As the population spread across the country, so too did the nation’s urban areas, changing both where they were located and the amount of land dedicated to urban uses. In 1920, for the first time, more Americans lived in urban than rural areas (U.S. Census Bureau). The economic growth and population boom following World War II, coupled with federally backed home loans, tax mechanisms for new development, and development of the federal interstate highway system, spurred increased suburbanization. By 1970, the U.S. census revealed more of the nation’s urban population lived in suburbs than in central cities. As rapid population growth fueled the expansion of suburbs into bordering nonmetropolitan counties, the lines between rural and urban become blurred areas (Johnson and Cromartie 2006).

The amount of land used for urban development continues to expand today. Significant natural amenities, recreational opportunities, and quality of life advantages increase an area’s potential for growth and development. Not surprisingly, forests and open space attract employment and in-migration, and tend to increase nearby property values (Kaplan and Austin 2004). While most people prefer their current residence type,
those who do not are twice as likely to prefer lower density settings (Domina 2006; Brown et al. 1997; Fannie Mae 1996). Most newly urbanized areas are less densely populated and less intensively developed than earlier in the nation’s history (Auch et al. 2006; Lopez and Hynes 2003; Heimlich and Anderson 2001). Generally, these areas are characterized by large lot sizes, involving far fewer people but greater amounts of land (McDonell et al. 2008; Jackson-Smith 2003; Heimlich and Anderson 2001). Typically, such development does not strictly follow patterns of ever-widening concentric circles around a central city. It is not uncommon to see increased development along major traffic arteries, or to see leapfrog patterns of residential development.

Associated with an expanding population is an increased amount of land dedicated to urban uses (Auch et al. 2006). Urban land area quadrupled from 15 million acres in 1945 to an estimated 60 million acres in 2002, increasing at about twice the rate of population growth (Lubowski et al. 2006). The burgeoning urban population drives new development constantly expanding the urban fringe. Outward expansion of populations from urban areas accelerates demands for new schools, roads, sewers, emergency services, and other infrastructure needed to support it. Low-density development is typically accompanied by increased property taxes, as it costs more to provide infrastructure and services to outlying areas where greater distances separate houses and businesses (McDonell et al. 2008; Brookings Institution 2003). As populations in newly developed areas grow, there are increased pressures for upgraded infrastructure and, eventually, new low-density developments, furthering the expansion of the urban fringe (Heimlich and Anderson 2001).
Despite these costs, the perceived benefits of low-density development at the urban fringe continue to win out. Perhaps the most attractive benefit is the affordability of land at the fringe, allowing more people to realize home ownership (Heimlich and Anderson 2001). Access to employment is facilitated by proximity to urban areas, as well as advances in information and communication technologies. Other benefits of low-density developments are access to open space amenities, lower crime rate, improved air quality, and more flexible transportation by automobile (Heimlich and Anderson 2001). Unfortunately, the millions of choices made by businesses and individuals aimed at realizing these benefits result in development patterns with negative consequences in the form of loss of rural amenities, traffic congestion, and environmental degradation.

**Pennsylvania Trends**

During the past two decades, Pennsylvania’s principal trend was one of rapid land development but slow and uneven population growth. In the 1990s, Pennsylvania was ranked the third slowest among all states with a population growth rate of 3.4 percent; however, during this time Pennsylvania developed the sixth-largest amount of land (Brookings Institution 2003). From 2000 to 2010, the population growth rate remained unchanged (GCLGS 2010). Most of Pennsylvania’s growth occurred in the eastern part of the state, with 35 of the 38 counties located in this area experiencing growth (Figure 4.1). During this time, Pennsylvania’s total population increased by 421,325 residents (U.S. Census Bureau). The bulk of this growth (72%) occurred in nine counties along the southeastern and eastern borders of the state: Adams, Lancaster, and York Counties close to Maryland; Bucks, Chester, and Montgomery Counties in the greater Philadelphia area; and Monroe, Pike, and Wayne Counties close to New York and New Jersey. Across the
entire Commonwealth, Forest County experienced the greatest percent change in growth (56%; 2,770 residents), followed by Pike County with 23.9 percent and 11,067 residents.

Figure 4.1 Pennsylvania population change by county, 2000 to 2010

Chester County had the greatest increase in absolute numbers of residents (65,385), followed closely by York County with an increase of 53,221 residents (U.S. Census Bureau). Between 2010 and 2030, Pennsylvania’s total population is projected to remain stable with little or no growth (Tucker 2012).

Similar to population growth, aging is a major component of social change in Pennsylvania, and the United States as a whole. The population of Pennsylvanians 65 years and older is projected to increase by 64 percent during the next 20 years (Tucker
2012). This aging population is likely to have significant impacts on future development, recreation, and economic demands placed on forests and other rural lands (Cordell and Macie 2002). Increased numbers of retirees often means development of retirement communities, second homes, and recreational facilities, all of which can create new interface areas for potential conflicts between residents and forest management practices (Marcin 1993).

As a state, Pennsylvania is blessed with numerous natural resources. The Commonwealth ranks second only to Alaska in the miles of streams within its borders, and the picturesque farmlands, rolling hills, and forests are important components of the state’s identity. Slightly less than one-quarter (23%) of the land area in Pennsylvania is classed as agricultural lands (GCLGS 2010). Forests are the dominant land use classification in the Commonwealth, accounting for nearly 60 percent of the land area (GCLGS 2010; McWilliams et al. 2007). The majority (70%) of Pennsylvania’s forests are held in private ownership. Total acreage of forestland has remained relatively stable, as forest-to-urban land conversions are counterbalanced by afforestation of agricultural lands. The forest-to-urban land conversion has primarily occurred near urban centers and along major connecting highways, leaving small patches of fragmented forests.
Figure 4.2 Pennsylvania land cover change from 1992 to 2005
Decentralizing patterns of land development have impacted the Commonwealth’s natural resources. The total developed area in Pennsylvania increased from 4.1 percent in 1992 to 9.6 percent in 2005 (Figure 4.2). During this same time, approximately 1.5 million acres of land were converted to urban uses resulting in a 131 percent increase in urban acreage (GCLGS 2010). The southeastern and south-central areas of the Commonwealth experienced the most significant amount of land developed. Urban development, which either replaces or comes into increasing proximity to forestland, affects not only the amount of forestland but also species composition, health, and overall sustainability (McWilliams et al. 2007). Between 1992 and 2005, approximately 825,000 acres of forests were converted to urban uses. Regionally, counties in the southeastern part of the state experienced the most significant amount of forest-to-urban land conversion, along with counties surrounding Pittsburgh, and counties in the Poconos area or the northeast (GCLGS 2010).

Between 1970 and 2000, population shifts out of the Commonwealth’s cities, boroughs, and first-class townships denoted a long-term trend in rural and suburban population growth and decline of the state’s urban cores (GCLGS 2010; Brookings Institution 2003). Since the 1970s, more than 1.6 million residents have moved to second-class townships, which generally represent outlying areas and are much less densely populated than first-class townships, boroughs, or cities (Brookings Institution 2003).

Current indications suggest the pace of new development has slowed, but the spatial pattern of development has not changed. Pennsylvania’s population and development continues to disperse across the landscape. Residential development has decreased since 2005, and 83 percent of county planning agencies reported decreased
subdivision and land development activity (GCLGS 2010). However, between 2000 and 2005, cities and boroughs lost 3.3 percent and 1.9 percent of their population, respectively, while second class townships grew by 5.9 percent (Brookings Institution 2007). Population in Pennsylvania townships continued to grow by 1.9 percent from 2005 to 2008 (GCLGS 2010). While the pace of new development has slowed, what has occurred continues to expand the state’s urbanized footprint.

**Forest Parcelization and Fragmentation**

Many private forests exist at the interface where development pressures are increasing. Land in close proximity to urban areas generally has greater value in residential or commercial use than in forestry. Although forestland parcelization has occurred in the United States since the 1900s, recently its rate and extent have increased and is likely to continue (Stein et al. 2005; Munn et al. 2002; Sampson and DeCoster 2000). PFLs are free to take advantage of their property’s non-forest market values. The reasons PFLs parcelize their forestland are numerous and include the perception of no alternative, the role of important others, and attending to life events (Gruver 2010). Patterns of land use reflect complex interactions of landowner values, beliefs, and attitudes across economic, social, and environmental conditions (Gruver 2010; Kittredge 2004; Best 2002; Mehmood and Zhang 2001; Crow et al. 1999).

Researchers generally considered parcelization a precursor to development (Gobster and Rickenbach 2004; Hoch et al. 2000). Urban development is accompanied by many land cover, use, and configuration changes, all of which fragment the landscape. This parcelization-induced fragmentation has the potential to significantly alter forested
A large proportion of Pennsylvania PFLs own small, forested parcels of ten acres or less; in fact, one in four privately owned forested acres in Pennsylvania is in this ownership class (Metcalf 2010). A significantly higher percentage of these PFLs own parcels in the more developed southeast, southwest, and northeast regions of Pennsylvania (Metcalf 2010). Such small forests, which retain some forest characteristics, are typically dominated by residential uses (Best and Wayburn 2001).

The consequences of forest parcelization are extensive and impact not only people, but wildlife and ecosystems across the landscape. Increased housing density and associated infrastructure can be linked to fewer recreational opportunities, changes in traditional forest uses, altered hydrologic functions, decreased habitat, and increased risk of wildfire damage. Conflicts over the types of recreation and access to lands traditionally used for recreation are potentially increased as population density increases (Rickenbach and Gobster 2003; Egan and Luloff 2000; Smith and Krannich 2000). In addition to conflict potential, traditional uses of forests are impacted. Fee structures associated with the value of timber and the availability of equipment suitable for small tracts create constraints and often make consulting and harvesting on small tracts unprofitable (Hull et al. 2004; Best and Wayburn 2001; Egan and Luloff 2000; DeCoster 1998).

Forested riparian zones provide diverse food sources and habitat, moderate temperature and water flows, and serve as filters for sediment, nutrients, and contaminants in the stream (Sweeney and Blaine 2007). Stream health is negatively affected by increased impervious surfaces nearby, forest fragmentation, and replacement of tree cover with grass (Riva-Murray et al. 2010). Urban-stressors disrupt spatial patterns of habitats, and subsequent habitat loss and fragmentation are widely believed to
be the most important drivers of extinction and biodiversity loss (Cushman et al. 2010; Fahrig 2003; Haila 2002; Flather and Bevers 2002; Leakey and Lewin 1995). In addition, fire is not constrained by property boundaries. The management practices of landowners affect the connectivity of fuels across ownership boundaries. As the interface between populated areas and wildland increases, reducing the risk of wildfire spread depends on the coordination of treatments across ownership boundaries (Fischer 2011).

**Cross-Boundary Cooperation**

There are few places where the delineation of forest ecosystems does not include a patchwork of ownerships. When the effects of parcelization and subsequent fragmentation are taken into account, the amount of functional forest can be significantly diminished creating a need for coordination of forest management among landowners. However, multiple ownership boundaries complicate efforts to manage resources at scales larger than individual ownerships. The fundamental nature of patterns and processes indicative of a healthy forest do not start or stop at individual property or administrative boundaries.

In the 1990s, ecosystem management characterized natural resource management philosophy and consequently became more widely incorporated into sustainable forest management (Daniels and Walker 1996). Ecosystem management is an attempt to manage at the larger scale of the ecological system as opposed to the smaller scale of individual and fragmented components (McCormick 1999). The goals of ecosystem management are directed at maintaining ecosystem processes over time and across ownership boundaries (Bergmann and Bliss 2004; Yaffee 1996). The diverse values and
management objectives of multiple forest landowners that accompany parcelization contribute to complex landscape conditions that make ecosystem management difficult.

When private forests are managed in a piecemeal fashion, as is often the case, actions are ineffective at an ecosystem level. In addition, expensive lawsuits and stalemates have become common fixtures in resource conflicts and triggered an increasing interest in collaborative management of natural resources. As a result, resource professionals have worked to build mechanisms to implement ecosystem management goals relying on cross-boundary cooperation (Bergmann and Bliss 2004). To resolve potential conflicts between self-interests and group cooperation the permeability of ownership boundaries must be enhanced to allow free passage of information, management, and ecosystem components (Brunson 1998).

Several studies have examined the feasibility of landowner cooperation, focusing of understanding the characteristics of PFLs willing to cooperate, their management objectives, and their perceived barriers to cooperation. A common finding across these studies was the need for PFLs to see examples of cooperative programs before committing, as well as a need for a better understanding of the impacts individual activities have at the larger ecosystem level (Finley et al. 2006; Klosowski et al. 2001; Raedeke et al. 2001; Sinclair and Knuth 2000; Stevens et al. 1999). In addition, strong concerns regarding private property rights may make PFLs less receptive to programs which call for power sharing among landowners (Finley et al. 2006; Rickenbach et al. 1998; Brunson et al. 1996). Promotion of forms of cooperation based on the sharing of equipment and information, as opposed to integrated management plans, may serve to protect functional forests and alleviate concerns about property rights (Kittredge 2005);
on the other hand, PFLs favorably viewed working with neighboring landowners to manage forests in concert with broader ecosystem scales.

Metcalf (2010) found nearly 60 percent of Pennsylvania’s PFLs believed neighboring landowners should cooperate to manage their forests. When reporting how often they interacted with their neighbors, nearly three-quarters of these PFLs indicated limited interaction; however, they were familiar with their neighbors, as PFLs were on a first name basis with an average of two-thirds of them. Overall, PFLs indicated a willingness to cooperate on recreation-based activities, but were unlikely to cooperate on major activities (i.e., building access roads or trails) and financial activities, such as selling timber or hiring a forester (Metcalf 2010).

Incidental ownership, perception of unimportance, very few formal management agendas, and lack of harvesting intentions have been cited as obstacles to cross-boundary cooperation (Finley et al. 2006; Kendra 2003; DeCoster 1998; Birch 1997). Lack of time, satisfaction with the way things are, avoidance of neighbors (Finley et al. 2006; Williams and Ellefson 1997), a need for flexibility of management, and assurances that timber and land values would be preserved (Jacobson et al. 2000) also affected PFLs’ willingness to participate in cooperation programs. In addition to gauging interest in and obstacles to cross-boundary cooperation, studies have identified some steps necessary for encouraging PFLs to cooperate. Resolving potential conflicts between self-interests and cooperative interests is important. Establishing a decision process by which PFLs can clarify and secure interests would be a necessary component in successful cooperation programs (Brunson 1998). Studies identified the need for a catalyst to jumpstart interest and a need for the cooperative program to be relevant (Kittredge 2005; Campbell and Kittredge
1996). Programs that helped make cooperation feasible and provided information about the benefits of cooperation could help overcome some barriers (Finley et al. 2006). As well, Finley et al. (2006) found that spatial information might allow PFLs to see how their individual parcel fits into the landscape mosaic, and help emphasize how their individual management objectives affected the larger landscape.

The diverse values and management objectives of multiple forest landowners contribute to complex landscape conditions and make landscape-level management difficult. Whether through the whims of human nature, the diversity of attitudes, or the independent spirit of PFLs, it is virtually guaranteed any program will see less than 100 percent participation. Conflicting management objectives pose a serious barrier to cross-boundary cooperation; however, common ground among PFLs provides a basis for cooperation. As forest parcelization increases and private forestlands are expected to provide increasing amounts of social and environmental goods and services, recognition and promotion of the common ground is vital.

The analysis reported here presents a profile of PFLs who have cooperated with neighboring landowners on forestland activities. Specifically this analysis examines the ability to differentiate among cooperators and non-cooperators based on their knowledge level, management activity, familiarity of neighbors, and various sociodemographic variables.

Methods

In response to the demographic and land use trends reviewed above, studies have begun to explore the potential role cross-boundary cooperation can play in sustaining
ecological, social, and economically viable forests. Promotion of cross-boundary management in a way relevant to PFLs is critical to creating and sustaining interest in cooperation. Understanding the differences between PFLs who cooperate and those who do not is an important step in developing working relationships among PFLs. The remainder of this chapter uses data from a 2008 statewide survey to profile Pennsylvania PFLs who cooperated with neighbors, and to identify the type of management and cooperative activities performed, as well as their future intentions for cooperation.

Mail Survey

A three panel study of PFLs in Pennsylvania was begun in 2006. The initial objectives of this five-year study were: (1) to identify access barriers to Pennsylvania’s private forest resources; (2) to describe the attitudes, perceptions, issues, and concerns of PFLs; (3) to document the availability of technical assistance; and (4) to determine owners’ future plans for their forestland (Metcalf 2010). As the second panel of the study, a twenty-page survey was mailed to 6,600 PFLs (100 per county for all counties but Philadelphia) across the Commonwealth of Pennsylvania in 2008. The survey sample was identified following the design established during the first panel of the study. PFLs were identified by digitally dropping 400 random points per county over maps of forestland in Pennsylvania using GIS software. Ownership data for the identified land parcels were obtained from county tax records. In counties where ownership data were available in spatial format, this was used to identify PFLs (Metcalf 2010). Spatial data was only available for approximately half of the counties in 2008. For those counties without spatial data, the location of each random point was triangulated using plat books and
parcel maps, then identified through tax assessment information at county courthouses. A random sample of 100 PFLs per county was selected from those identified.\footnote{Philadelphia County was excluded since it contains less than one tenth of one percent of the commonwealth’s forestland (Metcalf 2010).}

The mail survey was conducted using a tailored design methodology (Dillman 2007) with four waves of contact: initial survey and letter, a reminder postcard, and a second and third follow-up survey. Adjusting for undeliverable surveys, deceased owners, and non-forested owners, the total response rate for the survey was 49 percent (N=2,713). Attempts were made to contact non-respondents using follow-up telephone interviews. A random sample of 500 non-respondents was drawn, and phone numbers were established for 339 members of this sample. Over a period of seven weeks, up to three phone call attempts were made to contact the non-respondents. Of the 339 non-respondents, 54 percent were successfully contacted; 46 percent of those contacted were willing to participate in the phone survey. Those willing to participate were asked if they owned forestland, how many forested acres they owned, if they had harvested timber from their property, and several basic demographic questions. Responses were recorded and compared with those from the mail survey respondents using chi-square tests.

The results suggested non-respondents were fairly similar to respondents, although some differences were found. There were no significant differences in number of forested acres owned, rate of timber harvesting, type of ownership forestland was held in, or landowner age. Table 4.1 provides the characteristics which differed between non-respondents and mail survey respondents. Though the majority of respondents in both cases were male, non-respondents contacted were more likely to have been female. The
mail survey respondents tended to have more years of formal education. In both cases the majority of respondents were employed either full or part time; however, mail survey respondents were more likely than non-respondents to have been retired.

Table 4.1 Summary of significant non-respondent and respondent differences

<table>
<thead>
<tr>
<th></th>
<th>Mail Survey Respondents</th>
<th>Non-Respondents</th>
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</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>83.5%</td>
<td>66.2%</td>
</tr>
<tr>
<td>Female</td>
<td>16.5%</td>
<td>33.8%</td>
</tr>
<tr>
<td>$\chi^2$ 14.17; $p &lt; 0.001$</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School or less</td>
<td>36.6%</td>
<td>52.4%</td>
</tr>
<tr>
<td>Some College/Assoc. Deg.</td>
<td>23.9%</td>
<td>23.8%</td>
</tr>
<tr>
<td>College Degree and beyond</td>
<td>39.5%</td>
<td>23.8%</td>
</tr>
<tr>
<td>$\chi^2$ 8.02; $p &lt; 0.05$</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Employment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full/Part-Time</td>
<td>55.5%</td>
<td>62.9%</td>
</tr>
<tr>
<td>Retired</td>
<td>42.1%</td>
<td>29.0%</td>
</tr>
<tr>
<td>Other</td>
<td>2.5%</td>
<td>8.1%</td>
</tr>
<tr>
<td>$\chi^2$ 10.32; $p &lt; 0.05$</td>
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**Data Analysis**

Results reported here were analyzed using PASW 18.0 statistical software package, and present a profile of PFLs who have cooperated with neighboring landowners on forestland activities. Specifically, this analysis explored how the capability to differentiate among cooperating PFLs and non-cooperating PFLs was affected by knowledge of management activities, familiarity with neighbors, cooperative activities and various sociodemographic variables.
Binary logistic regression was used to examine differences between two subgroups of PFLs: those who had cooperated with neighbors on forestland activities (cooperators) and those who had not (non-cooperators). Logistic regression is used when the dependent variable is dichotomous and independent variables are of any type. The nonlinear model assumed by logistic regression required a full set of data (Garson 2011). Therefore, missing values were handled using listwise case deletion; only cases with valid values for the dependent and all predictor variables were included. Variables were considered for inclusion in the logistic model if bivariate tests (Chi-square and ANOVA) indicated a statistically significant difference between responses for cooperators and non-cooperators.

Split-halves validation was used to test validity of the logistic model. The sample was randomly split into two groups: a training sample (N=810) and a holdout sample (N=756). The training sample was used to derive the logistic model; in turn, the holdout sample was classified using the coefficients based on the training sample. In logistic regression, there is no equivalent to $R^2$ that corresponds to variance explained or predictive efficiency (Spicer 2005; Chao-Ying et al. 2002; Menard 1995). Various attempts have been made to develop “pseudo” $R^2$ statistics for logistic regression; however, each provides different estimates. With none regarded as superior to the others, interpretation of these statistics should be done with caution (Garson 2011; Spicer 2005). Therefore, a classification matrix (based on cross-classification) was used to assess the predictive accuracy of the logistic model.

Cross-classification of cases is accomplished by using the predicted probabilities to assign cases into categories of the dependent variable and then comparing the results.
with their actual categories. Results of the classification are presented in a 2 x 2 matrix. Entries on the matrix diagonal represent the number of individuals correctly assigned to their groups, while entries off the diagonal represent the incorrect classifications. The percentage correctly classified for each group is averaged to obtain the overall percentage correctly classified (classification accuracy). Classification matrices were generated for both the training and hold-out samples, and the classification accuracy for the holdout sample was used to estimate how well the model performed. If the model accurately reflected the conditions being studied, the percentage of correct classifications should be significantly larger than would be expected by chance. Using the hold-out sample’s relative frequencies (56% cooperators and 44% non-cooperators) the classification accuracy due to chance was

\[ C = 100 \times \left[ (0.56)^2 + (0.44)^2 \right] \]

\[ = 51\% \]

Finally, Press’s Q statistic (Hair et al. 1992) was used to determine if the classification results were significantly better than would be expected by chance. This measure compares the number of correct classifications with the total sample size and number of groups. The calculated value was then compared to the chi-square value (3.84) with one degree of freedom, at the 0.05 significance level, to determine if the classification matrix was statistically better than chance (Hair et al. 1992). The formula used to determine Press’s Q statistic was:

\[ \text{Press’s Q} = \frac{[N - (n \times K)]^2}{N(K - 1)} \]

where N was the total sample size, n was the number of observations correctly classified, and K was the number of groups.
Multicollinearity in logistic regression models is a result of strong correlations between predictor variables. The presence of multicollinearity inflates variances of parameter estimates and may result in individual predictors not being significant while the overall model is highly significant. In addition, multicollinearity may result in incorrect signs and magnitudes of coefficients leading to faulty conclusions about relationships between predictor variables and dependent variables (Garson 2011). In linear regression models, multicollinearity is examined by computing the variance inflation factor (VIF). The VIF is an index which measures how much the variance of the estimated regression coefficients are increased due to collinearity. Since there is no direct counterpart to $R^2$ in logistic regression, VIF statistics cannot be computed. Therefore, the predictor variables were checked for multicollinearity by running a linear regression on the predictor variables and examining the VIF statistics (Spicer 2005; Menard 1995; hair et al. 1992). VIF statistics of 10 or above indicate a multicollinearity problem and five or above are often seen as a cause for concern (O’Brien 2007). The VIF statistics for the predictor variables in the model ranged from 1.10 to 1.75.

**Predictor Variables**

Following earlier related work (e.g., Metcalf 2010; Finley et al. 2006; Kittredge 2005; Kendra 2003; Williams and Ellefson 1997), predictor variables included questions measuring how actively involved PFLs were in managing their forests, how familiar they were with their neighbors, level of interaction with these neighbors, their attitude toward cooperation, and various sociodemographic variables. The general attitude toward cooperation was assessed by asking respondents to indicate their level of agreement with the following statement: neighboring landowners should work together to manage their
forests. Level of agreement was measured using a five-point Likert scale that ranged from strongly disagree (1) to strongly agree (5). In addition, sociodemographics and descriptive variables including age, gender, education, income, tract size, tenure, and frequency of forestland visitation were measured.

PFLs’ level of forest management activity was measured with two variables: past forest management and past commercial timber harvest. Past forest management was defined as having carried out the following activities: (1) improved wildlife habitat; (2) improved fish habitat; (3) created a stream-side buffer; (4) reduced fire hazards; (5) applied herbicides; (6) planted trees; (7) erected a deer fence; and (8) controlled vegetation without herbicides. Responses ranged from zero (did no activities) to eight (did all of the activities). Past commercial timber harvest was measured by asking respondents to indicate whether or not they had ever harvested trees, excluding firewood, for sale from their property. Responses were dummy coded, so that harvesters equaled one and non-harvesters equaled zero. These variables were measured separately from the cooperative activities, and reflect management activities done on their individual properties.

Respondents were asked questions regarding their neighbors, including: how many neighbors share a property boundary; how many neighbors they knew on a first-name basis; and how frequently they interacted (regardless of the topic of interaction) with their neighbor. Frequency of interaction was measured on a five-point scale ranging from never (1) to very often (5). In addition, respondents were asked about their intentions to cooperate in the future.
Future intentions to cooperate were measured by asking respondents how likely they were to cooperate with neighbors on the following nine activities: (1) coordinate trail building across properties; (2) share tools to reduce cost; (3) share large equipment to reduce cost; (4) improve wildlife habitat across properties; (5) coordinate spraying herbicides to reduce cost; (6) share the cost of hiring labor; (7) sell timber together to get a better price; (8) hire a forester together to reduce cost; and (9) spray for forest insects. Each of these items was measured using a five-point Likert scale that ranged from very unlikely (1) to very likely (5).

To reduce the overall number of variables in the model and eliminate measurement redundancies associated with asking respondents to indicate their willingness to cooperate on several types of activities, the use of data reduction techniques was explored. The presence of several high, simple correlations among intended cooperative activities led to the use of data reduction techniques to create two composite variables: wildlife/recreation cooperation and timber cooperation.

Principal components analysis is an appropriate method for reducing a large number of survey items to a smaller set of composite variables with a minimal loss of information (Spicer 2005; Hair et al. 1992; Dunteman 1989). Partial and simple correlations for each variable were compared using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy to ensure intended cooperative activity variables were sufficiently interconnected to warrant data reduction (Spicer 2005). The KMO statistic is expressed as an index with values between zero and one. A value less than 0.5 was regarded as indicative of a structure unsuitable for data reduction (Spicer 2005). The
minimum threshold used for extracting components were eigenvalues greater than or equal to one, ensuring a factor accounted for a least as much variance as a single variable.

Contribution of individual variables to a component was determined by examining the component loadings (correlation between variable and a component). The higher the loading, the more the variable contributed to the component. The squared component loading is the percent of variance shared between the variable and component. The minimum threshold to interpret loadings was 0.4, ensuring variables accounted for at least 15 percent of the variance in a component (Spicer 2005; Stevens 2002). Components were rotated to simplify structure and to facilitate interpretation of components. Simple component structure was obtained by ensuring each variable loaded on only one factor. The analysis was initially run using a varimax rotation maintaining uncorrelated factors; however, individual variables were found to load on more than one component. Oblique rotations relax the constraint of factors being uncorrelated in order to gain simplicity in interpretation; therefore, the analysis was re-run using an oblique rotation. This resulted in two components with no cross-loading. The internal consistencies of each component were tested with Cronbach’s alpha reliability coefficients using 0.60 as a threshold (Vaske 2008). Two composite variables (wildlife/recreation cooperation and timber cooperation) were created by calculating the mean of items comprising both components for each respondent.

**Dependent Variable**

The cooperative behavior dependent variable was measured by asking respondents if they had ever cooperated with neighbors on any of the nine activities.
PFLs responding positively to one or more of these activities were considered cooperators, and those responding negatively to all activities were considered non-cooperators. In this sample 53 percent of PFLs had cooperated with their neighbors.

Results

PFLs indicated that in the past they had cooperated with their neighbors on a variety of activities. On average, they had cooperated with neighboring landowners on three activities. The most common activity was improving wildlife habitat across properties, cited by 62 percent of cooperators (Figure 4.3). Sharing tools was the second most common activity among cooperators (46%) and 40 percent of cooperators reported having shared large equipment with neighboring landowners. Few cooperating PFLs indicated they had ever cooperated with neighbors on activities concerning finances such as selling timber together (18%), hiring a forester together (17%), or sharing labor costs (13%).

Respondents generally held favorable attitudes toward cooperating with their neighbors. The majority (58%) of PFLs believed neighboring landowners should work together to manage their forests; only seven percent of respondents disagreed or strongly disagreed with this statement. On average, PFLs were familiar with their neighbors and were on first-name basis with nearly 60 percent of them. Most PFLs, however, interacted infrequently with their neighbors. When asked how often they interacted with these neighbors, regardless of the context, 46 percent of PFLs reported “sometimes” and only 21 percent reported “often” or “very often.” One-third of PFLs indicated they “rarely” or “never” interacted with their neighbors.
Figure 4.3 Percent of cooperating PFLs who worked with neighboring landowners on past activities (note: percentages do not sum to 100 as respondents could select more than one activity)

Compared to non-cooperators, PFLs who cooperated with neighboring landowners tended to have more favorable attitude toward cross-boundary cooperation ($\chi^2 = 59.89$ (4); $p<0.001$), greater familiarity with their neighbors ($F = 53.46; p<0.001$), and interacted more frequently with neighbors ($\chi^2 = 202.82$ (4); $p<0.001$). Sixty-five percent of cooperators believed neighboring landowners should work together to manage their forests compared with 49 percent of non-cooperators (Figure 4.4). On average, cooperators were on first-name basis with 68 percent of neighbors compared to non-cooperators’ (56%). Non-cooperators interacted less frequently with neighbors; 48 percent indicated interacting “rarely” or “never” with their neighbors (Figure 4.5).

PFLs perform a variety of management activities on their forestland (Figure 4.6). Landowners most commonly improved wildlife habitat (68%), planted trees (64%), and
controlled vegetation without herbicides (46%). A comparison of forestland activities by cooperators and non-cooperators indicated cooperating PFLs tended to be more actively engaged on their forestland apart from the management activities they engaged in with neighbors. Cooperators reported having accomplished (on their own forests without working with neighbors to do so) an average of three management activities on their forestland compared with two activities for non-cooperators (F 146.16; p<0.001).

Fifty-one percent of respondents indicated they had harvested trees (other than firewood) for sale from their forestland in the past. Cooperators and non-cooperators did not differ in incidence of commercial harvests ($\chi^2$ 3.63 (1); p=0.06). Fifty-two percent of cooperators and 48 percent of non-cooperators had harvested timber for sale from their properties in the past (Figure 4.7).

![Figure 4.4 Attitude toward cross-boundary cooperation for cooperating and non-cooperating PFLs](image)
Figure 4.5 Interaction rates of cooperators and non-cooperators with neighbors

Figure 4.6 Distribution of PFLs by past forest management activity (note: percentages do not sum to 100 since respondents could select multiple activities)
In addition to differences in levels of active forest management, PFLs’ level of engagement with their forest was measured by asking how frequently respondents visited their forest. Forty-seven percent of PFLs lived on their forestland while 17 percent visited at least one a week, and 13 percent at least once a month. Another 17 percent visited several times a year, and the remaining six percent visited once a year or less.

Cooperators reported greater levels of engagement with their forestland (Figure 4.8). Nearly one-third of non-cooperators reported visiting their forestland several times a year or less, while nearly a third of cooperators reported visiting monthly or at least once a week ($\chi^2 = 61.86$ (6); $p<0.001$).
Figure 4.8 Distribution of forestland visitation by cooperators and non-cooperators

Landowners’ future intentions to cooperate with neighbors closely mirrored past cooperative activities. Overall, 38 percent of PFLs indicated a likelihood of cooperating with neighbors to improve wildlife habitat. The second most likely activity across all PFLs was sharing tools (26%), followed by sharing large equipment (23%). Most PFLs were unlikely to cooperate on financial activities such as selling timber together (15%), hiring a forester together (15%), or sharing labor costs (11%). Comparisons of cooperators and non-cooperators indicated cooperators were significantly (all $\chi^2$ values $p<0.001$) more likely to engage in each of the activities than non-cooperators (Figure 4.9).
Figure 4.9 Cooperative activities likely to do in future by percent of cooperators and non-cooperators (note: percentages do not sum to 100 as respondents could select more than one activity)

Most PFLs who had not cooperated in the past indicated they were not likely to do so in the future. Only 26 percent of non-cooperators indicated a likelihood of working with neighbors on at least one of the nine cooperative activities. However, 62 percent of the non-cooperators who intended to work with neighbors in the future were likely to improve wildlife habitat. Willingness of PFLs to work together on improving wildlife habitat may provide common ground among neighbors for building future collaborations. Lack of intentions to cooperate with neighbors on certain activities may be a reflection of PFL management activities in general more than opposition toward cooperation. For example, 14 percent of PFLs indicated a likelihood of coordinating herbicide spraying with neighbors; however, only 22 percent of PFLs indicated they were likely to apply herbicides on their forestland.
Sociodemographics

Pennsylvania PFLs reflected national trends in that private forestland ownership was heavily skewed toward males (Metcalf 2010; Butler 2008). In this study, 84 percent of all respondents were male. A portion of this gender bias may reflect methods for obtaining landowner information from tax records, which tend to list males first. It is likely that for many PFLs the responsibility for making decisions regarding their forestland was shared. Forty-eight percent of PFLs in the Commonwealth jointly owned their forestland with their spouses, and another 22 percent of PFLs held forestland in other forms of joint ownership. Comparison of cooperators and non-cooperators (Figure 4.10) indicated non-cooperators were more likely than cooperators to be female ($\chi^2 = 15.15$; p<0.001).

Pennsylvania’s private forests were predominantly owned by older PFLs. Most PFLs (91%) were 45 years or older with a mean age of 61 years. Figure 4.11 compares the age distribution of cooperators and non-cooperators. Non-cooperators tended to be older than cooperators ($\chi^2 = 17.05$ (4); p <0.001). The mean age of non-cooperators was 62 years versus 60 years for cooperators Forty-three percent of non-cooperators were 65 years or older compared to 36 percent of cooperators.

Pennsylvania’s PFLs, as a whole, had relatively high educational attainment and income. Two of every five (40%) of Pennsylvania’s PFLs had completed at least a four-year degree, compared to the 26 percent of all Pennsylvanians reported by the U.S. Census. Comparison of cooperators and non-cooperators (Figure 4.12) indicated non-cooperators were more likely to have more formal education ($\chi^2 = 27.05$ (5); p<0.001).
Forty-six percent of non-cooperators had at least a four-year degree compared to 36 percent of cooperators.

Figure 4.10 Distribution of cooperators and non-cooperators by gender

Figure 4.11 Distribution of cooperators and non-cooperators by age categories
Sixty-eight percent of PFLs reported a household income of $50,000 or more, and 33 percent reported an income of $100,000 or more. The estimated 2008 median income for Pennsylvania was just under $51,000. There were no significant differences between cooperators and non-cooperators in terms of household yearly income.

Most PFLs owned their forestland for ten or more years. The mean land tenure was 25 years; however, 20 percent of the PFLs owned their forestland for less than 10 years. There was no significant difference in land tenure between PFLs who cooperated with neighbors and non-cooperators. Seventy percent of respondents owned less than 100 acres of forestland, and 15 percent owned less than 10 acres. The mean tract size was 165 acres. Tract size was not related to cooperation.
Logistic Regression Results

The principal component analysis extracted two components from the set of nine intended cooperative activities, and explained 69 percent of the variance. Table 4.2 shows the loadings, eigenvalues, and explanatory contribution of each component. The five variables associated with the first component (loadings ranged from 0.66 to 0.90) included items about cooperation on timber management activities. The four variables associated with the second component (loadings ranged from 0.64 to 0.91) included items regarding cooperation on wildlife and recreation management. Cronbach’s reliability coefficient for the timber management component was 0.88 and 0.84 for the wildlife/recreation component, indicating acceptable internal consistency for both scales. The mean and standard errors for all variables included in the logistic model are

Table 4.2 Principal component analysis of cooperative activities

<table>
<thead>
<tr>
<th>Cooperative Activity</th>
<th>1. Timber Mgmt</th>
<th>2. Wildlife/Rec. Mgmt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build Trails</td>
<td>-0.07</td>
<td>0.79</td>
</tr>
<tr>
<td>Share Tools</td>
<td>-0.01</td>
<td>0.91</td>
</tr>
<tr>
<td>Share Equipment</td>
<td>0.04</td>
<td>0.89</td>
</tr>
<tr>
<td>Improve Habitat</td>
<td>0.14</td>
<td>0.64</td>
</tr>
<tr>
<td>Spray Herbicides</td>
<td>0.77</td>
<td>0.06</td>
</tr>
<tr>
<td>Share Labor Costs</td>
<td>0.66</td>
<td>0.28</td>
</tr>
<tr>
<td>Sell Timber</td>
<td>0.81</td>
<td>0.04</td>
</tr>
<tr>
<td>Hire Forester</td>
<td>0.86</td>
<td>0.01</td>
</tr>
<tr>
<td>Spray Insects</td>
<td>0.90</td>
<td>-0.13</td>
</tr>
<tr>
<td>Eigenvalues</td>
<td>5.00</td>
<td>1.23</td>
</tr>
<tr>
<td>Variation explained</td>
<td>0.55</td>
<td>0.14</td>
</tr>
<tr>
<td>Cronbach's alpha</td>
<td>0.88</td>
<td>0.84</td>
</tr>
</tbody>
</table>
shown in Table 4.3. Values are provided for the full sample, cooperators, and non-cooperators.

The classification accuracy of the logistic model was significantly better than what would be expected by chance alone (Press’s Q = 142.31; p<0.001). The logistic model correctly classified 69 percent of non-cooperators and 74 percent of cooperators, for an overall classification accuracy of 72 percent (Table 4.4). The increased number of cases correctly classified, when compared to chance, represented a 40 percent improvement in classification accuracy (1.40 X 0.51).

The ability to classify PFLs as cooperators or non-cooperators was improved with knowledge of PFLs’ forest management activities, familiarity with neighboring landowners, intentions for cooperative activities, and demographic characteristics. Six of

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>Full Sample</th>
<th>Cooperators</th>
<th>Non-Cooperators</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of neighbors</td>
<td>5.47 (0.14)</td>
<td>5.72 (0.21)</td>
<td>5.18 (0.19)</td>
</tr>
<tr>
<td>No. on 1st name basis</td>
<td>3.45 (0.07)</td>
<td>3.95 (0.12)</td>
<td>2.88 (0.08)</td>
</tr>
<tr>
<td>Interaction Frequency</td>
<td>2.86 (0.02)</td>
<td>3.11 (0.03)</td>
<td>2.57 (0.03)</td>
</tr>
<tr>
<td>Attitude twd cooperation</td>
<td>3.62 (0.02)</td>
<td>3.75 (0.03)</td>
<td>3.47 (0.03)</td>
</tr>
<tr>
<td>Past Forest Mgmt</td>
<td>2.76 (0.04)</td>
<td>3.24 (0.06)</td>
<td>2.23 (0.06)</td>
</tr>
<tr>
<td>Timber Cooperation</td>
<td>2.15 (0.02)</td>
<td>2.39 (0.03)</td>
<td>1.86 (0.03)</td>
</tr>
<tr>
<td>Wildlife/Rec Cooperation</td>
<td>2.48 (0.02)</td>
<td>2.94 (0.03)</td>
<td>1.92 (0.03)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>60.93 (0.27)</td>
<td>60.10 (0.37)</td>
<td>61.88 (0.40)</td>
</tr>
<tr>
<td>Education**</td>
<td>4.16 (0.03)</td>
<td>4.04 (0.04)</td>
<td>4.29 (0.04)</td>
</tr>
<tr>
<td>Visitation**</td>
<td>4.81 (0.03)</td>
<td>5.02 (0.04)</td>
<td>4.57 (0.05)</td>
</tr>
<tr>
<td>Gender (% female)</td>
<td>17%</td>
<td>14%</td>
<td>21%</td>
</tr>
</tbody>
</table>

a. Std error in parentheses
b. Highest level of school completed (1 to 6)
c. Range 0 (never) to 6 (live on property)
Table 4.4 Logistic regression classification matrix for training and hold-out samples

<table>
<thead>
<tr>
<th>Observed</th>
<th>Training Sample</th>
<th>Hold-Out Sample</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-Coop.</td>
<td>Coop.</td>
<td>% Correct</td>
</tr>
<tr>
<td>Non-Cooperators</td>
<td>238</td>
<td>123</td>
<td>65.9</td>
</tr>
<tr>
<td>Cooperators</td>
<td>102</td>
<td>347</td>
<td>77.3</td>
</tr>
<tr>
<td>Overall %</td>
<td>74.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Chance accuracy criterion rate = 51%
b. Model classification accuracy = 71.7 %
c. Press's Q statistic = 142.31 p<0.001

The eleven predictor variables included in the logistic model significantly improved classification of cooperators and non-cooperators (Table 4.5). The more neighbors PFLs knew by first-name and the more frequently they interacted with neighbors, the more likely PFLs cooperated with neighbors. As expected, a favorable attitude toward cooperating with neighbors on forest management increased the likelihood that a landowner had cooperated with their neighbors. The odds of having cooperated increased by 69 percent for landowners who agreed with the statement that neighboring landowners should work together to manage their forests compared with PFLs who disagreed. These results suggested lack of familiarity with neighbors and opposition toward working with neighbors to manage forests were serious potential barriers to cooperation.

Table 4.5 Logistic regression predicting landowner cooperation

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooperator b</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-4.33</td>
<td>0.85</td>
<td>25.79</td>
<td>1</td>
<td>0.000</td>
<td>0.01</td>
</tr>
<tr>
<td>No. of neighbors</td>
<td>-0.03</td>
<td>0.02</td>
<td>2.90</td>
<td>1</td>
<td>0.089</td>
<td>0.97</td>
</tr>
<tr>
<td>No. on 1st name basis</td>
<td>0.10</td>
<td>0.04</td>
<td>6.41</td>
<td>1</td>
<td>0.011</td>
<td>1.11</td>
</tr>
<tr>
<td>Interaction Frequency</td>
<td>0.45</td>
<td>0.11</td>
<td>15.66</td>
<td>1</td>
<td>0.000</td>
<td>1.56</td>
</tr>
<tr>
<td>Attitude twd cooperation</td>
<td>0.26</td>
<td>0.11</td>
<td>5.67</td>
<td>1</td>
<td>0.017</td>
<td>1.30</td>
</tr>
<tr>
<td>Past Forest Management</td>
<td>0.16</td>
<td>0.05</td>
<td>10.39</td>
<td>1</td>
<td>0.001</td>
<td>1.18</td>
</tr>
<tr>
<td>Timber Cooperation</td>
<td>-0.19</td>
<td>0.11</td>
<td>2.82</td>
<td>1</td>
<td>0.093</td>
<td>0.83</td>
</tr>
<tr>
<td>Wildlife/Rec Coop.</td>
<td>0.98</td>
<td>0.12</td>
<td>70.46</td>
<td>1</td>
<td>0.000</td>
<td>2.67</td>
</tr>
<tr>
<td>Age</td>
<td>0.01</td>
<td>0.01</td>
<td>3.12</td>
<td>1</td>
<td>0.077</td>
<td>1.01</td>
</tr>
<tr>
<td>Education</td>
<td>-0.20</td>
<td>0.05</td>
<td>15.06</td>
<td>1</td>
<td>0.000</td>
<td>0.82</td>
</tr>
<tr>
<td>Visitation</td>
<td>0.03</td>
<td>0.07</td>
<td>0.23</td>
<td>1</td>
<td>0.629</td>
<td>1.03</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.35</td>
<td>0.24</td>
<td>2.21</td>
<td>1</td>
<td>0.137</td>
<td>0.71</td>
</tr>
</tbody>
</table>

a. Nagelkerke psuedo R^2 = .362
b. Reference category is Non-Cooperator
Opposition to cooperation may not be a barrier for all non-cooperators; however, level of management may. Some PFLs simply may not actively manage their land, and therefore, do not see the benefit of cooperating with neighbors. Results indicated the number of management activities completed was positively related to likelihood of cooperating. On average, PFLs reported having completed three of the listed management activities. These PFLs were nearly twice as likely to cooperate with their neighbors as PFLs who reported doing none of the activities. PFLs completing no management activities, however, were not necessarily opposed to cooperating with neighbors; only 12 percent indicated disagreement with the idea of neighbors working together to manage their forests.

Cooperators were nearly three times more likely than non-cooperators to indicate intentions to work with neighbors regarding wildlife and recreation management activities. Future intentions to cooperate on timber management activities were not significant in the logistic model. Based on past behaviors and future intentions for cooperation, PFLs indicated more of an interest in cooperative activities related to wildlife habitat and recreation management. Both of the latter activities are benefited by managing on scales larger than small, individual properties. No data were collected on the quality of past cooperative experiences. However, 78 percent of PFLs who had cooperated on wildlife management in the past indicated they were likely to do so again in the future. These past experiences and interest in future cooperation may provide the common ground needed to promote programs to encourage neighboring landowners to work together, and to demonstrate the benefits of managing on scales larger than individual properties.
The association of several sociodemographic and descriptive variables with landowner cooperation was also explored. Results indicated many of these variables were incapable of statistically differentiating between cooperators and non-cooperators. Only education was statistically unique among cooperators and non-cooperators. These results suggested landowner cooperation may be more a reflection of the type of cooperative practice rather than type of PFL.

Conclusions

We must all hang together, or assuredly we shall all hang separately.
Benjamin Franklin. 1776

While Benjamin Franklin was speaking literally of the danger of being hanged if the populace of the American colonies failed to work together, the basic sentiment toward the importance of cooperation still rings true today. We all benefit from the social, economic, and ecological services our forests provide. Demographic changes help create the long-term social and economic tapestry upon which forest management is woven. Trends identified in the literature indicate a significant portion of forestland will change ownership in the near future, and it is anticipated many of these properties will be subdivided and sold. As forestland ownership is transferred and developed, and land uses continue to spread outward from urban cores, Pennsylvania’s private forestland will be managed by an increasing number of PFLs owning smaller tracts of land. Collectively, the management decisions of these landowners will have a significant impact on the sustainability of the forested landscape. Forest tracts less than 10 acres are often more residential in nature and lose much of their ability to function as a working forest.
However, if managed in concert, smaller tracts of forestland may be better able to retain the necessary forest characteristics which ensure continued flow of both public and private benefits.

Successful promotion of cooperation among neighboring landowners necessitates understanding the characteristics of cooperators and non-cooperators. The results presented here begin to paint a picture of Pennsylvania PFLs who cooperated with their neighbors on forest management. Cooperators tended to more actively manage their own forestlands and were more familiar with their neighbors than non-cooperators. Data regarding PFLs’ perceived barriers were not collected as part of this study; however, the results indicated lack of active management and lack of familiarity with neighbors were potential barriers to cooperation. PFLs’ reasons for not managing their forestland or interacting with neighbors were not provided. Regardless, it is plausible that the lack of management was a result of an absence of interest, time, or knowledge about managing their forestland. Lack of familiarity with neighbors could have been a result of avoiding neighbors or the type of ownership in which neighboring forestlands were held (i.e., absentee, corporate, public).

Cross-boundary cooperation is often promoted as a way of creating economies of scale to make timber harvesting logistically and economically feasible for smaller landowners. The results presented here indicated PFLs were unlikely to cooperate with neighbors on selling timber together or hiring a forester together. No matter how promising, if PFLs are not interested in working with one another to this end, such promotions are not likely to be successful. Cooperators, as well as some non-cooperators, indicated the most interest in working with neighbors was to improve wildlife habitat.
The willingness of PFLs to work together in this manner may provide the common
ground needed for emphasizing collaboration among neighboring landowners. In some
cases, it may be more useful to approach the task from a different perspective. Instead of
managing forests to improve wildlife habitat, it may be more relevant to PFL interests to
promote cooperation on managing wildlife habitat to improve forests.

Pennsylvania’s forests are changing. As Pennsylvania’s population continues to
spread outward settling in suburban and rural areas, developed land use will continue to
alter the landscape. Increased forestland parcelization and numbers of PFLs make the
development of tools to engage landowners in managing their forests vital to sustaining
the public and private benefits of private forestlands. Successful promotion of cross-
boundary cooperation hinges on understanding PFLs’ level of interest in cooperating, the
types of activities they are willing to work together on, and the barriers which prevent
them from doing this.

The results presented here indicated knowledge of PFLs’ level of forest
management, familiarity with neighbors, and cooperative intentions improved the ability
to classify cooperators and non-cooperators. In addition to informing current efforts to
engage PFLs in cooperative activity, these results will help future studies identify trends
in cooperation and forestland management. To facilitate a greater understanding of PFLs
cooperative behavior, future studies should explore perceived barriers to managing their
forests, working with neighbors, and engaging in various types of activities. In addition,
understanding the barriers for those non-cooperators who expressed an interest in
working with neighbors will facilitate outreach efforts to engage more PFLs in
cooperative activities.
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Natural resource professionals have long worked to piece together the private forest land owners (PFLs) management puzzle. PFLs bring to the table a variety of backgrounds, management goals, and forestland characteristics. Precisely because of this variance, it is difficult to identify the “average” PFL, and nearly impossible to take into consideration the unique situations of each PFL when creating tailored outreach programs and targeted communication strategies. The sheer numbers of PFLs and diversity of management priorities underscore the importance of understanding their motivations and management practices. Such an understanding allows forestry professionals to envision how over 600,000 puzzle pieces have contributed to the 12 million acre mosaic of Pennsylvania’s private forestlands.¹

It is generally accepted that achieving sustainable forest management depends on understanding the PFLs who manage these resources. To this end, the use of typologies to characterize PFLs, their motivations, and management goals has increased (e.g., Butler et al. 2007; Salmon et al. 2006; Finley et al. 2006; Kendra and Hull 2005; Kluender and Walkingstick 2000; Tyson et al 1998). Typologies segment PFLs into subgroups that minimize within group while maximizing between group differences. Doing this enables forestry professionals to develop outreach services reflective of the diverse nature of PFLs (Emtage et al. 2007; Salmon et al. 2006; Finley et al. 2006; Kendra and Hull 2005).

¹ Metcalf (2010) estimated the number of Pennsylvania’s PFL population to exceed 600,000.
Such typologies depict PFLs and their forestland at a single point in time; however, PFL populations are both diverse and dynamic. Most telling is the fact the number of PFLs has increased while the size of average forestland holdings has decreased (Metcalf 2010; Butler 2008; Birch 1996; Birch and Dennis 1980). Further, studies have indicated PFLs are not uniform in terms of their ownership motivations, attitudes toward forest management, or forest management behaviors (Metcalf 2010; Butler et al. 2007; Ross-Davis and Broussard 2007; Bourke and Luloff 2004; Bengston 1994). The multiplicity of management approaches, land tenure, and landowner characteristics coupled with market and industry fluctuations over time, make forestland ownership and management anything but static.

Despite this, longitudinal studies are largely absent from the PFL literature. Such studies are critical to a proper assessment of trends in PFL motivations and management practices (Rosen 1995). Despite their lack of prevalence in the literature, however, there is some evidence to support the occurrence of shifts in PFLs’ management intentions. Turner et al. (1977) documented inconsistency in PFLs’ harvesting intentions across a four-year period. Over a nine-year period, Rosen (1995) documented deterioration in landowners’ attitudes toward timber harvesting and its compatibility with other forestland uses. Inconsistencies in landowner responses to questions regarding timber harvesting occurrences were documented among Pennsylvania PFLs over an eight month period in 1992 (Egan and Jones 1995). Such findings do not imply that results of PFL cross-sectional surveys and subsequent typologies are unreliable. Rather, the development and use of a longitudinal study design provides critical opportunities to explore both differences between sub-groups, as well as variation among PFLs. Doing this provides a
more robust assessment of PFL motivations and management intentions from which outreach services and communication strategies may be developed.

Following a review of PFL typologies, this chapter presents an analysis of Pennsylvania PFLs’ ownership motivations and management intentions using data from the first two panels of a three panel study. In 2006 and again in 2008, a 20-page survey was mailed to 6,600 PFLs (100 per county for all counties but Philadelphia) across the Commonwealth of Pennsylvania. Responses for three distinct groups of PFLs are presented: (1) respondents who only received a survey in 2006; (2) respondents who only received a survey in 2008; and (3) respondents who received both the 2006 and 2008 surveys. Analyses explored if survey responses changed between survey years, and how ownership motivations affected likelihood of management. Implications of these findings, as well as directions for future research are discussed.

**PFL Typologies**

Forest ownership has undergone significant changes over the past two decades. Industrial forestland owners have liquidated forest holdings, the number of PFLs has increased, and the size of forest holdings has decreased (Bengston et al. 2011; Metcalf 2010; Best and Wayburn 2001; Kurtz and Lewis 1981). PFL surveys have traditionally focused on landowners’ commercial harvesting intentions and practices. Potential timber supply shortfalls due to exploitative practices (Royer 1987) or landowner disinterest or underinvestment (Royer 1987; Binkley 1981; Sedjo and Ostermeier 1978) provided the rationale for much of this research. More recently, the forestry and social science
literature has expanded its scope to include examination of PFLs’ ownership motivations, attitudes regarding forests, and forest management intentions.

Increasingly, it is recognized that demographic patterns of landownership, PFL motivations and attitudes, as well as forestland characteristics are influential in PFL management decisions (Metcalf 2010; Finley et al. 2006; Rosen 1995; Bourke and Luloff 1994; Kuuluvainen and Salo 1991; Binkley 1981; Kurtz and Lewis 1981). Studies have indicated PFLs hold a diverse set of forest values ranging from anthropocentric to biocentric perspectives (Metcalf 2010; Finley and Kittredge 2006; Bourke and Luloff 1994; Bliss and Martin 1989). In addition, studies have reported findings that indicated PFLs hold similar views on environmental issues, forestry practices, and policies as the general public (Bliss 1994; Bourke and Luloff 1994). Clearly, the multiple and diverse forest values held by individual PFLs makes it difficult to identify the single most important value (Bengston et al. 2008).

Various outreach services and forest policies are used to motivate PFLs to manage their forestland for both private benefits and public benefits provided by them (Boon et al. 2004). The effectiveness of such programs is linked to our ability to understand PFLs’ motivations and intentions for their forests. As a result, in recent years the number of studies that have identified various types of PFLs based on their ownership motivations has increased (e.g., Butler et al. 2007; Salmon et al. 2006; Finley and Kittredge 2006; Kendra and Hull 2005; Kline et al. 2000). The nomenclature of PFL types has varied across studies; however, typologies have been fairly consistent in characterizing PFLs based on ownership motivations. Typically these have included: (1) financially motivated; (2) multi-objective; (3) non-financially motivated; (4) and passive PFLs.
Financially motivated PFLs typically indicated greater importance of owning their forests for timber, land investment, or other forms of economic security (Majumdar et al. 2008; Herzele and VanGossum 2008; Butler et al. 2007; Ross-Davis and Broussard 2007; Boon et al. 2004; Kline et al. 2000; Kluender and Walkingstick 2000; Marty et al. 1988; Kurtz and Lewis 1981). This classification of PFLs fit the mold of “traditional” or “classic” forest landowners primarily motivated by timber production. Such PFLs tended to own the largest tract sizes, were older, and had longer durations of ownership tenure. Financially motivated PFLs were more likely to harvest timber. While landowners among the other sub-groups may have harvested timber, a greater proportion of financially motivated PFLs did so.

Multi-objective owners indicated the importance of both monetary and amenity benefits of their forests as reasons for owning their forestland (Majumdar et al. 2008; Butler et al. 2007; Salmon et al. 2006; Kline et al. 2000; Kuuluvainen et al. 1996; Marty et al. 1988; Kurtz and Lewis 1981). Similar to financially motivated PFLs, multi-objective owners tended to own larger tracts of forestland. Kline et al. (2000) found these landowners were more likely to accept incentives to forego timber harvesting in favor of wildlife habitat improvement; although, across the various studies, PFLs in this sub-group had harvested timber.

Non-financially motivated PFLs primarily valued their forests for personal benefits received, including recreation, solitude, enjoyment of wildlife, pleasure in owning the forests, personal wood supply, or as an estate to pass on (Majumdar et al. 2008; Herzele and VanGossum 2008; Butler et al. 2007; Ross-Davis and Broussard 2007; Salmon et al. 2006; Kline et al. 2000; Kluender and Walkingstick 2000; Kuuluvainen et
Typically they owned smaller tracts of forests and along with passive owners controlled the least amount of forest area. These landowners were less likely to harvest timber and tended to place greater importance on producing aesthetic and recreation benefits.

The multi-objective and non-financially motivated owners comprised the largest proportion of PFLs in these studies. It should be noted that some studies separated the multi-objective and non-financially motivated PFLs into different sub-groups, while others grouped them together (Finley and Kittredge 2006; Boon et al. 2004). Regardless, in these studies the combined PFL type was separated from financially motivated and passive forest landowners. Salmon et al. (2006) established a three group classification, which did not include a financially motivated segment. The three segments were multi-objective, non-financially motivated, and passive PFLs. In this instance, the multi-objective owners were more likely to own larger tracts of land, to have had longer ownership tenures, and to harvest timber.

Passive owners are PFLs who have not indicated any ownership reason as being explicitly important. For many of these PFLs, forestland ownership was incidental as it simply came with the property (Butler et al. 2007; Ross-Davis and Broussard 2007; Salmon et al. 2006; Finley and Kittredge 2006; Boon et al. 2004; Kline et al. 2000). Typically, this sub-group was the smallest in size across the studies, and accounted for the smallest amount of forest area. This sub-group was the least likely to actively manage their forestland regardless of management type. For these PFLs, forest ownership was either unimportant or survey metrics failed to capture the motivations passive owners felt were important.
Demographic variables such as education, income, and age were not included in all of the typology descriptions; however, where they were included the results were inconsistent. Salmon et al. (2006) found no significant differences in education level or age across their PFL segments (multi-objective, non-financially motivated, and passive owners); while, Majumdar et al. (2008) found financially motivated PFLs to be better educated and have higher incomes than multi-objective and non-financially motivated PFLs. Kline et al. (2000) found a tendency for non-financially motivated PFLs to be distributed among higher education and income categories while passive owners tended to be among lower income categories.

Consistent across the typologies was the positive relationship between tract size, tenure, and financially motivated and multi-objective PFLs. This is most likely reflective of the economic feasibility of harvesting larger tracts as opposed to smaller tracts. The importance of tract size in explaining PFLs’ timber and forest management behavior has long been established (Cleaves and Bennett 1994; Row 1978; Larsen and Ganser 1972; Webster and Stoltenberg 1959). Owners of larger tracts of forestland are more likely to have developed written management plans, received professional advice, and harvested timber. PFLs who owned smaller tracts of land were less likely to engage in forest management practices (Metcalf 2010; Butler and Leatherberry 2004; Mehmood and Zhang 2001; Best and Wayburn 2001; DeCoster 1998).

Such typologies have provided insight into the diversity of the PFL population, and fairly consistent sub-groupings across multiple geographic locations spanning several years. These typologies have informed various policies and landowner incentive and education programs aimed at improving private forestlands management (Egan and Jones
A primary concern with the increasing numbers of PFLs is the supposition they have different motivations towards and knowledge about forest management. This makes understanding how ownership motivations and management intentions change over time all the more important.

The remainder of this chapter focuses on the results of the 2006 and 2008 Pennsylvania Private Forest Landowner surveys. Changes in PFL ownership motivations and management intentions are explored across two cross-sections and within a repeated measures panel.

**Methods**

In 2006, a three panel Pennsylvania Private Forest Landowner Study was begun. The initial objectives of this five year study were: (1) to identify access barriers to Pennsylvania’s private forest resources; (2) to describe the attitudes, perceptions, issues, and concerns of PFLs; (3) to document the availability of technical assistance; and (4) to determine owners’ future plans for their forestland (Metcalf 2010). The mail surveys reported on here represent two components of the larger PFL study. In addition to the mail surveys, the larger study included semi-structured and structured interviews, cognitive mapping exercises, forest inventories, and spatial analysis (Metcalf 2010; 2006). In 2006 and again in 2008, a twenty-page survey was mailed to 6,600 PFLs (100 per county for all counties but Philadelphia) across the Commonwealth of Pennsylvania.3

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2 For a detailed account of the larger Pennsylvania Private Forest Landowner study design see Metcalf 2006.
3 Philadelphia County was excluded since it contained less than one-tenth of one percent of the Commonwealth’s forestland (Metcalf 2010).
In 2006, the survey sample was identified by digitally dropping 400 random points per county over maps of forestland in Pennsylvania. Ownership data for the identified land parcels were obtained from county tax records. In counties where ownership data were available in spatial format, this was used to identify PFLs (Metcalf 2010). For those counties without spatial data, the location of each random point was triangulated using plat books and parcel maps, then identified through tax assessment information at county courthouses. A random sample of 100 PFLs per county was selected from those identified (Metcalf 2010). The 2008 survey sample was identified following the design established in 2006 with the addition of a repeated measures component. From the 2006 respondents, a maximum of 50 PFLs per county were included in the 2008 panel. In counties where more than 50 PFLs responded to the 2006 survey, PFLs were randomly selected for inclusion in the 2008 survey. In the case of a county having fewer than 50 respondents in 2006, all respondents were selected for inclusion in 2008. To bring the number of PFLs in each county to 100, the remaining participants were randomly selected following the same digital point drop procedure used in 2006.

Both mail surveys were conducted using a tailored design methodology (Dillman 2007) with four waves of contact: initial survey and letter, a reminder postcard, and a second and third follow-up survey. Adjusting for undeliverable, deceased, and non-forestland owners, the 2006 survey response rate was 54 percent, N=3,174 (Metcalf 2010). The total adjusted response rate for the 2008 survey was 49 percent (N=2,713). Attempts were made to contact 2008 non-respondents using follow-up telephone

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interviews. A random sample of 500 non-respondents was drawn, and phone numbers were established for 339 members of this sample. Over a period of seven weeks, up to three phone call attempts were made to contact the non-respondents. Of the 339 non-respondents 54 percent were successfully contacted; 46 percent of those contacted were willing to participate in the phone survey. Those willing to participate were asked if they owned forestland, how many forested acres they owned, if they had harvested timber from their property, and several basic demographic questions. Responses were recorded and compared with those from the 2008 mail survey respondents.

The results suggested non-respondents were fairly similar to respondents although some differences were found. There were no significant differences in number of forested acres owned, rate of timber harvesting, type of ownership forestland was held in, or landowner age. Although the majority of respondents in both cases were male, non-respondents contacted were more likely to have been female ($\chi^2 14.17$ (1 N=2,462); $p<0.001$). The 2008 mail survey respondents tended to have more years of formal education ($\chi^2 8.02$ (2 N=2,450); $p<0.05$). In both cases the majority of respondents were employed either full or part-time; however, mail survey respondents were more likely than non-respondents to have been retired ($\chi^2 10.32$ (2 N=2,453); $p<0.01$).

The 2008 total adjusted response rate for PFLs in the repeated measures panel was 58 percent (N=1,359). Often, decisions regarding private forests are made jointly by spouses or by two or more people in the case of joint ownerships. To evaluate variation in survey responses within PFLs, it was necessary to ensure, as much as possible, the same PFL completed both surveys. Therefore, time invariant variables (i.e., gender and birth year) were examined to ensure a match across both years. This resulted in 1,086 paired
responses. By 2008, 44 of the 2006 PFLs were deceased and 29 had sold their forestland. Of those PFLs who sold their land, 14 percent owned ten acres or less, 57 percent owned between 10 and 50 acres, and 29 percent owned more than 50 acres. Forty-three percent of those who sold had owned their forestland for less than ten years.\(^5\) It is not possible to discern from this data whether or not these properties were subdivided prior to selling.

The repeated measures non-responsive PFLs were compared with the repeated measures respondents. Results indicated the non-respondents and respondents were similar across most demographic and forestland characteristic variables. There were no significant differences in forested acres owned, incidence of commercial harvests, ownership tenure, income, political affiliation, educational levels, or employment. However, there were significant differences found in frequency of forestland visitation ($\chi^2 18.93$ (3 N=1,700); $p<0.001$), gender ($\chi^2 4.61$ (1 N=1,645); $p<0.05$), and age ($F (1, 1,656) 7.95; p<0.01$)\(^6\). Based on their 2006 responses, panel non-respondents were more likely to have visited their forestland several times a year or less, while respondents were more likely to live on their forestland. Panel non-respondents were also more likely than respondents to have been female. The majority of both non-respondents and respondents were male (83% vs. 87%). Finally, non-respondents tended to be older with a mean age of 60 years compared to respondents’ average age of 58 years.

**Data Analysis**

Results reported here were analyzed using PASW 18.0 statistical software package. In all analyses, a $p$-value $\leq 0.05$ was used to establish statistical significance.

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\(^5\) Tract size and tenure based on figures reported in 2006.

\(^6\) ANOVA statistical significance reported as ($F$(df between groups, df within groups) statistic; $p$-value)
For the sake of clarity, the results are reported by variable group, i.e., sociodemographics, ownership reasons, commercial harvesting, and management intentions. For each variable, the results for the cross-sectional analysis (PFLs who responded only in 2006 or 2008) are presented first followed by the results for the repeated measures panel (PFLs who responded in both 2006 and 2008).

This analysis explored three questions: (1) Do PFL responses differ across survey year; (2) does ownership reason influence PFLs likelihood of performing specific management activities; and (3) does the influence of ownership reason on likelihood of management change across survey years (two-way interaction). There were no significant two-way interactions found; therefore, in these data, the influence of ownership reason on likelihood of management did not significantly change across survey years.

Analysis of variance (ANOVA) and chi-square tests were used to explore these questions in both the cross-sectional analysis and the repeated measures analysis. Importantly, there were slight variations in the type of ANOVAs and chi-square tests used to analyze the repeated measures panel. In situations where cases were being compared with themselves at two or more time points, ANOVAs are not appropriate for comparing differences in means (Spicer 2005). An ANOVA essentially compares group differences (between groups) with individual differences (within-groups). The individual differences are calculated by determining how much individuals differ from their group mean, and then summing these differences across the groups. When the data analyzed represents independent cases this does not pose a problem; however, when the groups contain the same individuals this sum is artificially inflated since results at time two are not independent of those at time one (Spicer 2005; Hair et al. 1992). To remove the
inflationary bias introduced by comparing cases with themselves, repeated measures ANOVA (rmANOVA) was used. The rmANOVA adjusts the within-group differences so that any variability due to individuals’ consistency across time is removed, and calculates the F statistic using the residual variability (Spicer 2005). For both the cross-sectional and repeated measures analyses, when examining the influence of ownership reason on likelihood of management, significant differences among ownership reasons were assessed using Tukey’s HSD post-hoc test.

When analyzing nominal variables, Pearson’s chi-square assumes cases are independent of each other. As with ANOVAs, failure to account for dependence leads to the introduction of an inflationary bias in total sample size (Spicer 2005). To account for this, McNemar’s chi-square test (2x2 classification tables) and McNemar-Bowker test of symmetry (PxP classification tables) were used (Ryan 2004). Since the interest was in whether or not the relationship had changed, these tests focused on the discordant cases (off-diagonal), and assumed the off-diagonal cell proportions were symmetric. The concordant cases (on-diagonal) do not contribute information about a difference over time; therefore, only the observed and expected values for the off-diagonal cells were used to calculate the test statistic (Ryan 2004).

Variable Selection

Over the course of the PFL study, feedback among methods allowed modification and improvement of each component. As a result of this feedback, some changes were made in question format on the 2008 mail survey. Only variables measured in a consistent manner in 2006 and 2008 were used in this analysis. In some instances,
variables on the 2008 survey could be collapsed to reflect how they were measured in 2006. When this was the case, these variables were included in this analysis. For the repeated measures analyses it was necessary to ensure PFLs had responses for the variables of interest in both 2006 and 2008; therefore, matched pairs with missing data were removed from the analysis. This resulted in 345 usable, paired responses for the present analysis (Table 5.1). The loss of cases is not a concern in this instance as the remaining cases represent the most appropriate sample of PFLs who participated in the repeated measures panel (Willer 1967).

Table 5.1 2008 Repeated measures panel responses

<table>
<thead>
<tr>
<th>Missing Cases Actions</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Responses</td>
<td>1,359</td>
</tr>
<tr>
<td>Paired Responses from 2006 to 2008</td>
<td>1,086</td>
</tr>
<tr>
<td>Responses remaining after listwise deletion due to missing cases on variables of interest</td>
<td>345</td>
</tr>
</tbody>
</table>

PFLs were given the following list of eleven reasons for owning their forestland: (1) land investment; (2) hunting opportunities; (3) camping, walking, or other recreation; (4) growing timber for sale; (5) personal uses of wood, such as firewood; (6) enjoyment of owning forestland; (7) an estate to pass on to my children; (8) income other than from selling timber; (9) to enjoy wildlife; (10) solitude; and (11) it came with the property. In both years, respondents were asked to pick the most important reason they owned their forestland from the eleven categories provided. Empty cells in the chi-square tests necessitated collapsing ownership reasons. Table 5.2 shows the break down for the collapsed categories. To maintain consistency, the collapsed ownership reasons were used for analyzing influence of ownership reason on likelihood of management in both the cross-sectional and repeated measures panel analyses.
PFLs were asked to indicate how likely they were to do the following management activities on their forestland in the future: (1) improve wildlife habitat; (2) improve fish habitat; (3) create a stream-side buffer; (4) reduce fire hazards; (5) harvest non-timber products for my own use; (6) harvest non-timber forest products for commercial sale; and (7) lease to a club or organization. Each item was measured using a five-point Likert scale that ranged from very unlikely (1) to very likely (5).

In addition to the seven management activities, respondents were also asked if they had commercially harvested timber from their properties. For the 2006 survey, determining commercial harvesting behavior involved multiple questions. The decision process used to establish incidence of harvesting followed that established by Metcalf (2010). First, respondents were asked if they had cut trees from their property in the last ten years. Those who answered yes were then asked about the type of harvest. If respondents described the cuts as “sawlogs for personal use” or “firewood for personal use” they were considered to not have conducted a commercial harvest. Respondents who had cut “sawlogs for sale,” “veneer logs for sale,” “pulpwood,” or “firewood for sale” were considered to have conducted a commercial harvest (Metcalf 2010). The 2008

Table 5.2 Collapsed categories for most important ownership reason

<table>
<thead>
<tr>
<th>Non-Financial</th>
<th>Financial</th>
<th>Incidental</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hunting opportunities; Camping, walking, or other recreation; Personal uses of wood; Enjoyment of owning forestland; Estate to pass on; To enjoy wildlife; Solitude</td>
<td>Land investment; Growing timber for sale; Income other than from selling timber</td>
<td>It came with the property</td>
</tr>
</tbody>
</table>
survey asked if respondents had ever cut trees for sale from their property, excluding firewood. In this case there was no time parameter included in the question and firewood cuts were specifically separated out. Separate questions were asked regarding the year of their last harvest and if they had ever cut firewood for sale. Respondents who indicated they had cut trees from their property for sale and whose most recent harvest was within ten years were considered to have commercially harvested trees. In addition, respondents who answered no to having cut trees for sale, but responded positively to harvesting firewood for sale were also considered to have conducted a commercial harvest. For the analyses reported here, timber harvesting was defined as having cut trees for sale from their property in the past ten years, including firewood.

Tract size was related to likelihood of management activities (Figure 5.1); as forested acres owned increased, PFLs’ likelihood of management increased. In addition, tract size was positively related to incidence of commercial harvest ($F(1, 4,695) = 139.99; p<0.001$). On average, non-harvesters reported owning 87 acres while harvesters owned 314 acres. To control for this relationship in the cross-section and repeated measures analyses, tract size was entered into the ANOVAs as a covariate (Spicer 2005). By doing this, the dependent variable means were adjusted to what would be expected if all respondents had equal tract sizes (mean tract size). Differences between tract sizes were therefore removed so, presumably, the only differences remaining were attributable to the effect of ownership reason and survey year.

Finally, sociodemographics and descriptive variables including, gender, age, education, employment, political affiliation, income, and tract size were examined. To avoid problems with empty cells in chi-square tests, subcategories for education and
employment were collapsed. As a result, education consisted of three categories: (1) high school diploma/GED or less; (2) some college; and (3) college degree and beyond. Employment categories consisted of three categories: (1) full/part-time; (2) retired; and (3) other. The other employment category included students, homemakers, and the non-employed.

Figure 5.1 Mean likelihood score for management activity by tract size

Discussion of Results

Sociodemographics

There was no significant difference in gender distribution across the 2006 and 2008 cross-sections (Figure 5.2). Both samples were predominantly male, with an average distribution of 83 percent male and 17 percent female. The gender distribution
for the repeated measures panel was similar, although it included a higher percentage of males (89% M, 11% F).

![Figure 5.2 PFL Gender distributions across survey samples](image)

While there was a significant difference in age across the two cross-sections, this was not unexpected (F (1, 2,529) 12.57; p<0.001). Given the time lapse between the two surveys, it was expected the average age of PFLs would increase by two years. The average age of PFLs in 2006 was 59 years and in 2008 it was 61 years. At the time of the 2008 survey, the average age of PFLs in the repeated measures panel was 59 years.

Educational attainment (Figure 5.3) differed across the two cross-sections ($\chi^2$ 7.10 (2, N=2,534); p<0.05). The percentage of PFLs with a high school diploma/GED or less remained the same at 36 percent. However, the percent of PFLs with some college increased in 2008 (21% to 25%), and the percentage who had completed college or a graduate degree decreased in 2008 (43% to 39%). Two potential explanations for this
difference are: (1) PFLs sampled in 2008 were slightly less educated than those sampled in 2006; or (2) it is a reflection of differences in educational categories across the two surveys and how they were subsequently collapsed. On the 2006 survey, the education levels were: (1) none; (2) grade school; (3) some high school; (4) completed high school or GED; (5) some college/technical school beyond high school; (6) completed college; (7) graduate/professional school. In 2008, the first four levels remained the same. However, technical school was removed from the some college category to form its own. Starting with some college, the remaining categories were technical school beyond high school/Associates Degree, completed college, and graduate/professional school. Subsequently when the categories were collapsed for comparison, the technical school/Associates Degree was placed into the some college category. It is possible PFLs with Associate Degrees in 2006 indicated they had completed college (instead of some college), and collapsing this 2008 category down into some college may have confounded results.
Similar to results in the cross-section, there were significant differences ($\chi^2 13.72$ (3, $N=328$); $p<0.003$) in education within the repeated measures sample (Figure 5.4).

While one might gain education levels as time passed, it is less easy to comprehend how an individual might become less educated. This result coupled with the similar trend found in the cross-sections made the second explanation discussed above more plausible. This inconsistency within individuals across the two survey years was most likely a result of differing survey metrics and subsequent decisions made in collapsing categories.
There was no significant difference in total household income between the 2006 and 2008 cross-sections or within individual PFLs in the repeated measures panel. In all three instances, the median household income category was $50,000 to $74,999 (Figure 5.5). Approximately 67 percent of PFLs in the cross-sections reported total household incomes of $50,000 or more. PFLs in the repeated measures reported slightly higher incomes; 75 percent indicated an income of $50,000 or more.
Figure 5.5 PFL income distribution across survey samples (*represents the panel average across 2006 and 2008 responses)

The majority of PFLs were employed in 2006 and 2008 (61% and 58% respectively). However, PFLs in 2008 were more likely ($\chi^2 7.08 \ (2, \ N=2,552); \ p<.029$) to be retired than their 2006 counterparts (Figure 5.6). It is not surprising that there was an increase in percentage of PFLs retired given the high percentage of PFLs at or near retirement age. A similar trend was present in the repeated measures panel (Figure 5.7). An additional six percent of PFLs had a change in employment from full or part-time to retired ($\chi^2 14.40 \ (3, \ N=329); \ p<.002$).
Figure 5.6 Distribution of employment categories across survey cross-sections

Figure 5.7 Distribution of employment categories within PFLs in repeated measures panel
Pennsylvania’s PFLs predominantly identified themselves politically as being moderate to conservative. This trend was present in both cross-sections, as well as the repeated measures panel. Differences existed across the two cross-sections ($\chi^2 = 10.47$ (4, N=2,371); p<.05). PFLs in the 2008 sample were less likely than their 2006 counterparts to have identified politically as moderate and more likely to have identified as moderate liberal (Figure 5.8). There were no significant differences within PFLs’ responses in the repeated measures panel.

![Figure 5.8 PFLs’ political affiliation across survey cross-sections](chart)

Figure 5.8 PFLs’ political affiliation across survey cross-sections

PFLs in 2006 reported owning an average of 200 acres of forestland, and PFLs in 2008 reported an average of 156 acres; however no statistically significant difference was found (F (1, 2,722) 3.551; p=0.06). Half of the PFLs in the 2006 and 2008 cross-sections (50% and 51% respectively) owned 50 acres or less. Likewise, there were no significant
differences found within PFLs in the repeated measures panel who reported an average tract size of 117 acres.

Ownership Motivations

PFLs owned their forestland for many reasons and individuals often had multiple reasons for owning their forests. Respondents were asked to indicate the most important reason they owned their forestland (Figure 5.9). Pennsylvania PFLs predominantly indicated non-financial ownership reasons were the most important. There were significant differences in the cross-sectional analysis. PFLs in 2006 were more likely than PFLs in 2008 to indicate incidental ownership as the most important reason they owned their forestland ($\chi^2 = 12.06$ (1, N=2,325); $p<.001$). The 2006 PFLs were also more likely to indicate financial reasons as most important ($\chi^2 = 14.28$ (1, N=2,325); $p<.001$). Specifically, this was seen in the significant difference between PFLs in 2006 who indicated owning as a land investment was most important compared to PFLs in 2008 ($\chi^2 = 18.93$ (1, N=2,325); $p<.001$). PFLs in the 2008 cross-section were more likely to indicate non-financial reasons as being the most important ($\chi^2 = 30.34$ (1, N=2,325); $p<.001$). There were significant differences between cross-sections on owning forestland for general recreation ($\chi^2 = 13.16$ (1, N=2,325); $p<.001$), with PFLs in 2008 more likely to have indicated this as the most important reasons for owning.

Tract size was significantly related to ownership reason ($F(2, 2,322) = 29.78; p<0.001$). PFLs who owned their properties for financial reasons were more likely to have larger forested tracts (Figure 5.10). PFLs who owned their forestland simply
because it came with the property were more likely to own smaller tracts (50 acres or less) of forest land. There was no difference in this relationship across the survey years.

Overall, 184 PFLs in the repeated measures panel (53%) changed the ownership reason they considered most important ($\chi^2$ 16.17 (3 N=345); p<.001). In 2006, 20 PFLs indicated some form of financial reason (Figure 5.11). In 2008, 18 of these PFLs switched to non-financial reasons for owning and two PFLs changed to different financial reasons (i.e., land investment to timber). In 2006, 27 PFLs indicated the most important reason they owned their forestland was because it came with the property; however, in 2008, 24 of these PFLs indicated a non-financial reason and three PFLs identified financial reasons as most important. The remaining 137 PFLs who switched indicated various non-financial reasons as most important in 2006. In 2008, eight changed to

**Figure 5.9** Distribution of PFLs by most important ownership reason for cross-sectional analysis
financial, seven switched to incidental, and 122 changed to different types of non-financial reasons for owning their forestland.

Figure 5.10 Distribution of PFLs by most important ownership reason and tract size for cross-sectional analysis

Figure 5.11 Distribution of PFLs across most important ownership category for repeated measures panel
A review of changes across individual ownership reasons showed incidental ownership changed significantly between 2006 and 2008 ($\chi^2$ 11.76 (1 N=345; p<.01)). Thirty-five PFLs in 2006 indicated the most important reason they owned forestland was it came with the property (Figure 5.12). In 2008, 77 percent of these PFLs (N=27) changed what they indicated as their most important reason for owning. Three of these PFLs indicated timber was the most important reason in 2008. The remaining 24 PFLs indicated a variety of non-financial reasons for owning their forestland in 2008. Seven PFLs who indicated various non-financial ownership reasons in 2006 indicated it came with the property was most important in 2008.

Figure 5.12 Distribution of PFLs by most important ownership reason for repeated measures panel
The number of PFLs who indicated land investment was the most important ownership reason also changed significantly ($\chi^2 9.00$ (1 N=345; p<.01). In 2006, 52 percent (N=14) of PFLs who indicated land investment was most important in 2006 changed their reason in 2008. Two of these PFLs indicated timber was the most important ownership reason, and 12 indicated various non-financial reasons for owning their forestland. Two PFLs who indicated non-financial ownership reasons in 2006 indicated land investment as the most important reason in 2006.

Sixty-seven percent (N=6) of PFLs who indicated general recreation as the most important reason in 2006 reported a different reason in 2008 ($\chi^2 8.33$ (1 N=345); p<.01). All of these PFLs indicated some other form of non-financial ownership as the most important reason in 2008. Nineteen PFLs who indicated various non-financial reasons, one PFL who indicated financial reasons, and one PFL who indicated incidental ownership in 2006 all indicated general recreation as the most important ownership reason in 2008.

There was a significant change in ownership reason for PFLs’ owning 10 acres or less ($\chi^2 9.40$ (3 N=60); p<.05). In 2006, 27 percent of PFLs owning 10 acres or less indicated incidental ownership and 68 percent indicated non-financial reasons; however, in 2008 12 percent indicated incidental ownership and 85 percent reported non-financial reasons. There was no significant change in PFLs’ ownership reasons from 2006 to 2008 for PFLs with more than 10 acres of forestland.
Commercial Harvesting

Thirty-seven percent of PFLs in the 2006 and 2008 cross-sections had conducted a commercial timber harvest on their forestland in the past 10 years. There were no significant differences between the cross-sections in incidence of commercial harvests. Controlling for tract size (Figure 5.13), PFLs who owned 100 acres or more and indicated financial reasons as being the most important reason for owning their forest were more likely to harvest timber than those who owned for incidental or non-financial reasons ($\chi^2$ 12.52 (2); p<.01). PFLs who owned 11 to 50 acres and owned their forestland for financial reasons were more likely to harvest timber than incidental and non-financial owners ($\chi^2$ 6.28 (2); p<.05). In the repeated measures panel, there was no significant change within PFLs’ reported incidence of commercial harvests. In addition, there was no significant relationship between ownership reason and incidence of commercial harvest.

![Figure 5.13 Commercial timber harvests by ownership reason and tract size for cross-sectional analysis](image-url)
Management Activities

Improving Wildlife Habitat

Respondents were asked to indicate how likely they were to improve wildlife habitat on their property in both 2006 and 2008. Respondents in 2006 (Figure 5.14) indicated a greater likelihood of improving wildlife habitat on their properties (F (1, 2,053) 5.59; p<.05); however, the average likelihood scores indicated PFLs from both survey years were likely to improve wildlife habitat. PFLs’ reasons for owning their forestland were also related to the likelihood of performing this management activity (F (2, 2,053) 85.93; p<0.001). Post-hoc test results indicated non-financial owners were more likely than financial or incidental owners to improve wildlife habitat on their properties in the future (p<0.001).

Figure 5.14 Likelihood of improving wildlife habitat on forestland for cross-sections across ownership categories
In the repeated measures panel, there was no significant change in individual PFLs’ likelihood of performing this activity across the two surveys. Ownership reason was related to likelihood of improving wildlife habitat (F (2, 319) 9.29; p<0.01). Non-financial owners were more likely than financial owners to perform this activity (p<0.001); however, incidental owners did not differ significantly from financial or non-financial owners in their likelihood of improving wildlife habitat (Figure 5.15).

![Figure 5.15 Likelihood of improving wildlife habitat on forestland for repeated measures panel across ownership categories](image)

#### Improve Fish Habitat

Respondents were also asked to indicate how likely they were to improve fish habitat on their property in both 2006 and 2008. There was no difference in response between the cross-sections. PFLs indicated they were unlikely to improve fish habitat on

---

7 rmANOVA statistical significance reported as (F(df within group, df error) statistic; p-value)
their property (Figure 5.16). PFLs’ reasons for owning forestland were related to their likelihood of improving fish habitat (F (2, 1,934) 23.54; p<0.001). Incidental and financial owners were less likely than non-financial owners to improve fish habitat on their properties in the future (p<0.001). For the repeated measures panel, there was no significant change in individual PFLs’ likelihood of performing this activity (Figure 5.17). Overall, PFLs indicated they were unlikely to improve fish habitat. Ownership reason was related to likelihood of improving fish habitat (F (2, 288) 4.02; p<0.05). Financial and incidental owners were less likely than non-financial owners to perform this activity (p<0.01).

![Figure 5.16 Likelihood of improving fish habitat on forestland for cross-sections across ownership categories](image)

**Figure 5.16** Likelihood of improving fish habitat on forestland for cross-sections across ownership categories
When asked to indicate how likely they were to create a stream-side buffer on their property in both 2006 and 2008, no difference in response between the cross-sections was found. PFLs from both survey years indicated they were unlikely to create a stream-side buffer on their property (Figure 5.18). PFLs’ reasons for owning forestland were related to their likelihood of improving fish habitat ($F(2, 1,903) = 23.54; p<0.05$). Post-hoc test results indicated the only significant difference among ownership categories was incidental owners tended to be less likely than non-financial owners to perform this activity ($p<0.05$).

For the repeated measures panel, there was no significant change in individual PFLs’ likelihood of performing this activity across the two surveys. In addition, there was
no significant relationship between ownership reason and likelihood of creating a stream-side buffer.

*Reduce Fire Hazards*

Respondents were asked to indicate how likely they were to reduce fire hazards on their property in both 2006 and 2008. There was no difference in response between the cross-sections. PFLs from both survey years indicated they were unlikely to reduce fire hazards on their property (Figure 5.19). PFLs’ reasons for owning forestland were related to their likelihood of performing this activity (F (2, 1,941) 27.92; p<0.001). Post-hoc test results indicated non-financial owners were more likely to reduce fire hazards than incidental or financial owners (p<0.001).

![Figure 5.18 Likelihood of creating a stream-side buffer on forestland for cross-sections across ownership categories](image)

<table>
<thead>
<tr>
<th>Ownership Reason</th>
<th>2006 x-sec</th>
<th>2008 x-sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidental Ownership</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial Ownership</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Financial Ownership</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
For the repeated measures panel, there was no significant change in individual PFLs’ likelihood of performing this activity across the two surveys (Figure 5.20). On average, PFLs in the repeated measures panel indicated they were unlikely to reduce fire hazards on their property. Ownership reason was related to likelihood of reducing fire hazards ($F(2, 298) = 3.08; p<0.05$). Financial and incidental owners were less likely than non-financial owners to perform this activity ($p<0.05$).
Fig 5.20 Likelihood of reducing fire hazards on forestland for repeated measures panel across ownership categories

Harvest Non-Timber Forest Products (NTFPs) for Personal Use

When asked to indicate how likely they were to harvest NTFPs for personal use from their property, the cross-sectional analysis indicated respondents in 2006 were more likely to harvest NTFPs for personal use than respondents in 2008 (F (1, 2,000) 15.53; p<0.001). However, on average, PFLs indicated they were unlikely to perform this activity (Figure 5.21). PFLs’ reasons for owning their forestland were also related to the likelihood of performing this management activity (F (2, 2,000) 10.37; p<0.001). Post-hoc test results indicated non-financial owners were more likely than financial or incidental owners to harvest NTFPs for personal use (p<0.001).
For the repeated measures panel, there was a significant difference within individual PFLs’ likelihood of harvesting NTFPs for personal use ($F(1, 310) = 5.92; p<0.05$). In 2006, PFLs were neutral in their intentions to perform this activity (Figure 5.22); however, in 2008 PFLs indicated they were unlikely to harvest NTFPs for personal use. Forty-four percent (N=139) of the PFLs in 2006 indicated they were likely or very likely to perform this activity. In 2008, 31 percent (N=43) of these PFLs indicated they were neutral, unlikely, or very unlikely to harvest NTFPs for personal use. Ownership reason was not significantly related to performing this activity in the repeated measures panel.
Figure 5.22 Likelihood of harvesting NTFPs for personal use on forestland for repeated measures panel across ownership categories

*Harvesting NTFPs for Sale*

When asked to indicate how likely they were to harvest NTFPs for sale on their property in both 2006 and 2008, no difference in response between the cross-sections was uncovered. PFLs from both survey years indicated they were unlikely to harvest NTFPs for sale (Figure 5.23). PFLs’ reasons for owning forestland were related to their likelihood of performing this activity (F (2, 1,968) 3.68; p<0.05). Post-hoc test results indicated financial owners were more likely to harvest NTFPs for sale than incidental or financial owners (p<0.001).

For the repeated measures panel, there was no significant difference within individual PFLs’ likelihood to harvest NTFPs for sale. On average, PFLs in the panel were unlikely to harvest NTFPs for sale. Ownership reason was not related to performing this activity.
The final management activity PFLs were asked about on both surveys was leasing forestland to a club or organization. There was no significant difference in respondents’ likelihood of leasing forestland between cross-sections. On average, PFLs were very unlikely to do this activity (Figure 5.24). There was a significant relationship between likelihood of leasing land and ownership reason ($F (2, 1,970) 22.05; p<0.001$). PFLs who owned their forestland for financial reasons had a higher mean likelihood score than incidental and non-financial owners ($p<0.001$); however, financial owners, on average, indicated they were unlikely to lease their forestland.

In the repeated measures panel, there was no significant difference within individual PFLs’ likelihood of leasing their forestland. On average, PFLs were unlikely to lease land. Ownership reason was significantly related likelihood of doing this activity ($F$
PFLs who owned their forestland for financial reasons indicated a higher likelihood of leasing land than non-financial owners (p<.01). However, on average, they were unlikely to lease forestland (Figure 5.25).

Figure 5.24 Likelihood of leasing forestland for cross-sections across ownership categories

Figure 5.25 Likelihood of leasing forestland for repeated measures across ownership categories
Conclusions

Many researchers have reported on the need to segment PFLs and target outreach and communication strategies toward these segments. Typologies are valuable in our understanding of PFLs and have played an important role in policy and outreach initiatives geared toward engaging PFLs in managing their land for both private and public benefits. The importance of understanding Pennsylvania’s PFLs cannot be overstated. PFLs make decisions which directly affect the health and sustainability of nearly 70 percent of the Commonwealth’s forests. The effectiveness of programs and policies is predicated on understanding the characteristics, ownership motivations, and management intentions of Pennsylvania’s nearly 600,000 PFLs.

Most typologies are static images of an extremely diverse and dynamic population. Not only do new landowners enter the population while others leave, but changes within individual PFLs’ motivations make this population a moving target. The results reported here indicate that PFLs’ responses to survey questions regarding ownership motivation change over time, both between cross-sections and within individual PFLs. The inconsistency from 2006 to 2008 in the identification of the most important ownership reason reflects the diversity of ownership motivations PFLs hold and the difficulty of selecting just one that defines their forestland ownership.

Despite differences between the cross-sections and the inconsistency of responses from 53 percent of the repeated measures panel, Pennsylvania PFLs still predominantly own their forestland for non-financial reasons. The net decrease in PFLs who owned their forestland simply because it came with their property may indicate these landowners are
not as passive as they are often characterized to be. While non-financial owners were the most likely to do all but two of the management activities, incidental owners were very similar to financial owners in their management intentions. Where they differed was on the two commercial activities. In these cases, they were similar to the non-financial owners in their intentions. Writing this group off as disinterested in their forests may be a disservice to many of the Commonwealth’s PFLs. It may be interesting for future research to explore these PFLs ownership motivations more in depth. Are they truly disinterested in owning forestland, or are they simply not intentional forestland owners? Does their incidental ownership provide an avenue for them to become engaged in forestry and forest ownership when they otherwise would not?

Future research should continue to explore the dynamic nature of PFLs’ responses across time with the inclusion of the 2010 survey cross-section (the third and final panel) and the continuation of the repeated measures panel. Data from all three panels should be used to establish whether or not overall ownership and management trends remained constant across the four year study period. In addition, the question format of the 2010 survey should allow for comparison with the 2008 data of the relative rankings of the various ownership reasons, in addition to the most important reason. The data from the 2010 and 2008 surveys should also allow for comparison of future timber harvest intentions, not simply the rate of incidence.

This study builds upon the typological foundation of private forestland ownership, and creates a more robust base from which outreach programs and services can be developed. Fitting the pieces of an ever evolving puzzle together can be a daunting task. However, better understanding change within PFLs, as well as among PFLs, will provide
forestry professionals with a clearer assessment of how these pieces fit within Pennsylvania’s forestland mosaic.
Literature Cited: Chapter 5


Chapter 6

Summary

We all benefit from the social, economic, and ecological services forests provide. Sustaining these depends upon the maintenance of functional forested landscapes within a context of a dynamic and diverse PFL population. The combined decisions made by PFLs have important implications for the Commonwealth’s forest resources. In the near future, given the age structure of the PFL population and continued trends favoring home development in amenity-rich areas, it is likely a significant portion of forestland will change ownership. Further, given current trends, it is likely many of the largest properties will be subdivided and sold. As forestland ownership is transferred, Pennsylvania’s private forestland will be managed by an increasing number of PFLs owning smaller tracts of land. Collectively, the management decisions of these landowners will have a significant impact on sustainability of the Commonwealth’s forested landscape.

The sheer numbers of PFLs and diversity of management priorities underscore the importance of understanding their motivations and practices. It is difficult to identify the “average” PFL, and impossible to consider the unique situation of each landowner when creating tailored outreach programs and targeted communication strategies. Nonetheless, attaining sustainable forest management is contingent both upon understanding the PFLs who manage these resources and the provision of relevant information and services to them. Typologies, like the ones presented in this dissertation, enable forestry professionals to develop and direct outreach services reflective of the diverse nature of PFLs.
PFLs’ connections with their forestland are developed within dynamic and overlapping economic, social, and ecological contexts. It is vital research continues to inform outreach efforts so programs are both relevant and effectively targeted to meet the diverse needs of the Commonwealth’s PFLs. Whether their interest is timber production, improving wildlife habitat, harvesting non-timber forest products (NTFPs), or encouraging cross-boundary management, we ignore without impunity the people who collectively decide the fate of nearly 70 percent of the state’s forestland.

This dissertation informs efforts to engage Pennsylvania PFLs in discussions and efforts to improve forest management. In 2006, a three panel study focused on Pennsylvania’s private forest landowners began. This five year study included three mail surveys (2006, 2008, and 2010), semi-structured interviews, cognitive mapping exercises, forest inventories, and spatial analyses. The dissertation focused on the results of the 2008 mail survey. Continuing the exploration of Pennsylvania PFLs begun in 2006 (cf., Metcalf 2006; Metcalf 2010; Gruver 2010), the previous chapters explored PFL characteristics, preferences, management practices, and ownership motivations.

Overall, the results presented in this dissertation build upon our knowledge of who Pennsylvania’s forest landowners are and ways to reach this vast population. The effectiveness of programs and policies is predicated on understanding the characteristics, ownership motivations, and management practices of Pennsylvania’s PFLs. Typologies are valuable tools for helping us understand PFLs and have played an important role in outreach initiatives. To this end, profiles of different segments of Pennsylvania PFLs were presented in Chapters Two, Three, and Four. In addition, the longitudinal nature of
the larger study afforded the opportunity to explore in Chapter Five how PFLs’ ownership motivations and management intentions had changed.

Identifying the best methods for delivering information to PFLs is necessary if foresters, agencies, and Extension agents are to provide landowners with accurate and pertinent forest management information. The need for updated information on forest management has continued to increase; however, collected knowledge and information is of limited utility if it is not applied. Chapter Two explored the sources of help and information PFLs used when making decisions about their forestland. Differences between PFLs who received information from professional sources and those who received information from peer sources were explored. Results supported findings in the literature that PFLs used different information sources based on their informational needs.

A key finding of Chapter Two was the need to recognize the role peers played in informing PFL management decisions. The low percentage of PFLs who participated in assistance programs or who received advice from forestry professionals regarding timber harvests does not necessarily indicate they had not received information. Tapping into peer networks through the use of peer learning may be a viable solution for providing PFLs with accurate and relevant information regarding their forestland decisions. This alternative can provide relevant information via the people PFLs already turn to for advice, and can occur both formally through organizations and programs or informally through interactions between neighbors. Premised on two-way exchange of ideas, peer learning can more readily incorporate PFLs’ experiences and knowledge of what may or
may not have worked on their forestland, and provide information regarding local resources for assistance.

Knowing where PFLs look for information is only one part of the equation for providing relevant and targeted services to forest landowners. Understanding the management practices and motivations of PFLs is equally important. Movement away from concentrated, large ownership patterns toward more heterogeneous ownership results in a multiplicity of management approaches, land tenure, and landowner characteristics. Chapters Three, Four, and Five explored the diverse characteristics, management practices, and ownership motivations of Pennsylvania’s PFLs.

Pennsylvania’s forests yield a diverse array of products; owning forestland means more than timber production for most of the Commonwealth’s PFLs. Many owners expressed interest in the economic benefits of forest ownership and harvested timber. However, PFLs primarily indicated aesthetic, recreational, and preservation as the most important reasons for owning their forestland. For some, forestland ownership provided an opportunity to gather a variety of NTFPs. The results presented in Chapter Three provided a baseline description of Pennsylvania PFLs who harvested NTFPs on their forestland and highlighted harvesters’ attitudes, knowledge, forestland activities, and characteristics. This chapter offered evidence contrary to the theme prevalent in the NTFP literature of harvesters as a culturally and economically distinct group solely engaged in harvesting activities on lands owned by third parties. An important implication of the chapter’s results was the compatibility of NTFP harvesting with other forestland activities PFLs commonly perform. PFL engagement in active forest management could potentially be increased by facilitating PFL interest in NTFPs.
Reflective of national trends, Pennsylvania’s PFL population is growing, resulting in more PFLs owning smaller tracts of forestland. The possibility of disjointed management objectives running counter to the goal of long-term forest management is a significant concern of forestry professionals. One potential tool for promoting sustainable forest management available to forestry professionals is cross-boundary management. Successful promotion of cross-boundary cooperation is dependent upon an understanding of PFLs’ level of interest, the types of cooperative activities they are willing to engage, and the barriers which prevent such cooperation. Chapter Four presented a typology of PFLs who cooperated with neighboring landowners to manage their forestland, and identified management practices where PFLs were likely to cooperate with one another. Cross-boundary cooperation is often promoted as a way to encourage timber harvesting on smaller forest tracts; however, results indicated PFLs were unlikely to cooperate with neighbors when it came to selling timber. Rather, PFLs indicated the most interest in cooperation around wildlife habitat improvement across properties. Thus, cross-boundary cooperation promoted as a tool for improving wildlife across properties may prove to be a more effective approach to encouraging PFLs to use this forest management tool.

Development of typologies over time is critical to a proper assessment of trends in PFL motivations and management practices. Chapter Five examined changes in ownership motivations and management intentions of Pennsylvania PFLs from 2006 to 2008, and provided a clearer understanding of differences within this population. The results indicated PFLs’ responses to survey questions regarding ownership motivation had changed over time. Understanding the diversity of PFLs’ ownership motivations and the difficulty in selecting the one or main reason defining why they owned their
Forestland could enable forestry professionals to form a clearer assessment of the state’s forested landscape. This examination of ownership motivations, over time, builds upon the typological foundation of private forestland ownership, and creates a more robust base from which outreach programs and services could be developed.

Increased forestland parcelization and numbers of PFLs make the development of tools to engage landowners in managing their forests vital to sustaining the public and private benefits of private forestlands. Results from the 2008 survey panel built upon the data collected in 2006 regarding Pennsylvania’s PFLs. Results from this second panel provided a more in-depth exploration of Pennsylvania’s PFLs’ sources of information, NTFP harvesting activities, cross-boundary cooperation, and changes in ownership motivations. These results reinforced the need for outreach and assistance efforts to take advantage of PFL diversity and employ a variety of methods for increasing forest stewardship on private forests. The typologies presented here provided an important foundation for creating alternative approaches, reflective of PFL ownership goals and management practices, and which encouraged sustainable management on private forestlands.

No matter how promising, if outreach efforts are not relevant to PFLs’ ownership and management goals, such programs are not likely to be successful. The historic focus on timber production, while important, fails to capture the non-timber motivations held by most PFLs. Results presented here highlighted the common ground of PFLs’ interests in wildlife and recreation. Such commonality lays an important foundation for encouraging sustainable forest management on private forestlands.
Future research should continue to explore the dynamic nature of Pennsylvania’s PFLs. The incorporation of the third and final survey panel from 2010 affords the opportunity to refine PFL typologies by continuing the examination of changes over time within this population. In addition to the ability to refine these typologies, inclusion of the 2010 survey will allow for the characterization of additional population segments, including, for example, those PFLs who develop alternative energy sources on their forestland.

In addition, the results presented here provide a foundation to build more in-depth analyses of PFLs’ use of information sources, NTFP harvesting practices, and cooperative intentions. Future analyses should explore the differences between and among PFLs who did not use any information sources compared to those who did. Future studies into information sources used should also examine the type of information received from the various sources and PFLs’ satisfaction level with this information. Gaining a deeper understanding of NTFP harvesting activities on private lands, the techniques employed to sustain the availability of products, and landowner interest in intensive management practices is a key step in developing the potential of NTFP management as an alternative approach to encouraging active forest management on private forestlands. Finally, to facilitate a greater understanding of PFLs’ cooperative behavior, future studies should explore perceived barriers to managing their forests, working with neighbors, and engaging in various types of activities. Understanding the barriers for those non-cooperators who expressed an interest in working with neighbors would facilitate outreach efforts designed to engage more PFLs in cooperative activities.
If private forests are to continue providing economic, social, and ecological benefits, the challenge of providing relevant information and services where it is needed and in the preferred format must be met. In order to do this, we must continue to improve our knowledge of who our forest landowners are. Partnering with these landowners is vital to ensuring the sustainability of the Commonwealth’s forests. The research presented here provides preliminary comparisons between the first two survey panels; data from this project will continue to allow comparisons in coming years, and continues the commitment to ongoing efforts to better understand our state’s PFLs.
APPENDIX

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EXPLORING THE PRIVATE FORESTLANDS OF PENNSYLVANIA
A study by the Human Dimensions Unit at Penn State

Please read each question and indicate your answer in the space provided. Your responses will be most useful if you read each question and follow directions carefully. All information you provide will be treated confidentially and will never be linked with your name.

We have identified you as a private forest landowner in

Q1. Do you own at least one (1) acre of forestland in this county?

___ No If NO, please STOP here and return this survey to us in the postage-paid envelope enclosed. Thank you!

___ Yes If YES, this is “your county” for this survey. Please continue with Q2a.

Q2a. How many total acres do you own in “your county” (all properties)?

__________ number of acres

Q2b. About how many total forested acres do you own in “your county” (all properties)?

__________ number of forested acres

Q2c. How many separate forested properties do you own in “your county?”

__________ number of separate forested properties

Q3. What do you enjoy most about your forestland?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Q4. How often do you or members of your household visit your forestland?

Please CHECK one:

___ I (or members of my family) live on my forestland ___ Several times a year

___ At least once a week ___ Once a year

___ Monthly ___ Less than once a year

___ Never

Please remember: Throughout this survey we are only asking about your forestland in “your county.”
Q5a. The following are reasons landowners own forestland. Please indicate how important each of the following is for owning your forestland.

1 = Very Unimportant (VU)
2 = Unimportant (U)
3 = Neither Unimportant nor Important (N)
4 = Important (I)
5 = Very Important (VI)

Please CIRCLE a number for each reason:

<table>
<thead>
<tr>
<th>REASON FOR OWNING</th>
<th>IMPORTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VU</td>
</tr>
<tr>
<td>A. Land investment (I hope to sell all or part of my forestland at a profit)</td>
<td></td>
</tr>
<tr>
<td>B. Hunting opportunities</td>
<td></td>
</tr>
<tr>
<td>C. Camping, walking, or other recreation</td>
<td></td>
</tr>
<tr>
<td>D. Growing timber for sale</td>
<td></td>
</tr>
<tr>
<td>E. Personal uses of wood, such as firewood</td>
<td></td>
</tr>
<tr>
<td>F. Enjoyment of owning forestland</td>
<td></td>
</tr>
<tr>
<td>G. As an estate to pass on to my children</td>
<td></td>
</tr>
<tr>
<td>H. Income other than from selling timber</td>
<td></td>
</tr>
<tr>
<td>I. To enjoy wildlife</td>
<td></td>
</tr>
<tr>
<td>J. Solitude</td>
<td></td>
</tr>
<tr>
<td>K. It came with the property</td>
<td></td>
</tr>
<tr>
<td>L. Non-timber products (natural products such as mushrooms, berries, nuts, vines, plants, etc.)</td>
<td></td>
</tr>
</tbody>
</table>

Q5b. From the above list, please pick the most important reason you own forestland?

Please WRITE IN the letter of the most important reason: ______________
Q6. Could any of the following statements be used to describe your property?

Please CIRCLE “Yes” or “No” for each statement:

<table>
<thead>
<tr>
<th>STATEMENT</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. There are drivable roads on my property</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>B. I can access my property directly from a road</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>C. There are beautiful views on my property</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>D. There is a spring, creek, or river on my property</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>E. There are wetlands on my property</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>F. There are important wildlife on my property</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>G. There are important plants on my property</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>

Q7. The following are activities landowners do on their forestland. Please indicate if you have done any of these on your forestland. ALSO, please indicate how likely you are to do each activity in the future, even if you haven’t in the past.

1 = Very Unlikely (VU)
2 = Unlikely (U)
3 = Neither Unlikely nor Likely (N)
4 = Likely (L)
5 = Very Likely (VL)

Please CIRCLE “Yes” or “No” AND please CIRCLE a number for each activity:

<table>
<thead>
<tr>
<th>FORESTLAND ACTIVITY</th>
<th>HAVE DONE?</th>
<th>VU</th>
<th>U</th>
<th>N</th>
<th>L</th>
<th>VL</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Improve wildlife habitat</td>
<td>Yes No</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>B. Improve fish habitat</td>
<td>Yes No</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>C. Create a stream-side buffer</td>
<td>Yes No</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>D. Reduce fire hazards</td>
<td>Yes No</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>E. Hunt (by me or family)</td>
<td>Yes No</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>F. Recreate, besides hunting (by me or family)</td>
<td>Yes No</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>G. Lease to a club or organization</td>
<td>Yes No</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>H. Clear land for a road</td>
<td>Yes No</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I. Clear land for buildings</td>
<td>Yes No</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>J. Apply herbicides</td>
<td>Yes No</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>K. Plant trees</td>
<td>Yes No</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>L. Erect a deer fence</td>
<td>Yes No</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>M. Control vegetation without herbicides</td>
<td>Yes No</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Q8. Do you have any of the following on your forestland?

*Please CHECK ALL that apply:*

___ Second home
___ Camp
___ Farm
___ Primary home

*The next several questions ask about harvesting activities on your forestland.*

Q9. Was your forestland harvested for timber before you got it (within about 5 years)?

___ No
___ Yes

Q10. Have you harvested trees for firewood from your property?

___ No  [If NO, please SKIP to Q14.]
___ Yes

Q11. How often do you cut firewood from your property?

*Please CHECK one:*

A. ___ I have only cut firewood once since acquiring the land
B. ___ At least once every 5 years or more
C. ___ At least once every 2 to 4 years
D. ___ Every year

Q12. Approximately how much firewood do you harvest from your property in a year?

___ number of cords for personal use
___ number of cords for sale

Q13. How do you decide which trees to cut for firewood?

*Please CHECK ALL that apply:*

A. ___ Trees are on the ground
B. ___ Trees are dead and standing
C. ___ Trees are of low quality
D. ___ Trees are small diameter
E. ___ Trees are large diameter
F. ___ Cut trees which will improve growing conditions
G. ___ Cut trees according to my management plan
Q14. How likely are you to do any of the following activities on your forestland in the future?

1 = Very Unlikely (VU)
2 = Unlikely (U)
3 = Neither Unlikely nor Likely (N)
4 = Likely (L)
5 = Very Likely (VL)

Please CIRCLE a number for each activity:

<table>
<thead>
<tr>
<th>FORESTLAND ACTIVITY</th>
<th>LIKELY TO DO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VU</td>
</tr>
<tr>
<td>A. Cut firewood for personal use</td>
<td>1</td>
</tr>
<tr>
<td>B. Cut sawlogs for personal use</td>
<td>1</td>
</tr>
<tr>
<td>C. Cut posts for personal use</td>
<td>1</td>
</tr>
<tr>
<td>D. Cut firewood for sale</td>
<td>1</td>
</tr>
</tbody>
</table>

Q15a. Have you harvested trees for sale from your property (other than firewood)?

___ No  [If NO, please SKIP to Q24.]

___ Yes

Q15b. IF YES, when did you last harvest trees for sale from your property?

_______ year of last harvest

Q15c. How many times have you harvested trees for sale from your property since you acquired it?

_______ number of times

Q16. How many total acres of your forestland have you harvested?

_______ number of acres

Q17. What type of wood has been harvested from your forestland?

Please CHECK ALL that apply:

A. ___ Sawlogs
B. ___ Veneer logs
C. ___ Pulpwood
D. ___ Other, please specify ___________________
Q18. What factors led you to decide to harvest trees from your forestland?
__________________________________________________________________________

Q19a. Did you receive advice about harvesting trees from anyone before you cut?
____ No
____ Yes

Q19b. IF YES, who gave you advice?

Please CHECK ALL that apply:

A. ___ Forester
B. ___ Penn State Extension
C. ___ Logger
D. ___ Family member
E. ___ Bureau of Forestry
F. ___ Other government agency
G. ___ Neighbor
H. ___ Friend
I. ___ Other forestland owner

Q20. How was the most recent harvest managed?

Please CHECK ALL that apply:

A. ___ Managed the harvest myself
B. ___ Sold the timber directly to a timber company
C. ___ Hired a consulting forester
D. ___ Sold the timber directly to a logger
E. ___ Used a bidding process

Q21. How would you describe the last harvest on your forestland?

Please CHECK one:

A. ___ Clearcut
B. ___ Cut most of the large trees
C. ___ Cut trees of all sizes, but left a lot of trees
D. ___ Cut small trees, but left large trees
E. ___ Only cut a few select, large trees

Q22. How happy are you with the outcome of the harvestings that took place on your forestland?

Please CIRCLE one:

<table>
<thead>
<tr>
<th>Very Unhappy</th>
<th>Unhappy</th>
<th>Neither Unhappy nor Happy</th>
<th>Happy</th>
<th>Very Happy</th>
</tr>
</thead>
</table>

Q23. Which of the following reasons were important factors in your decision to harvest?

Please CHECK ALL that apply:

A. ___ Recommended by a forester
B. ___ Needed the money
C. ___ Selling the land
D. ___ Part of my management plan
E. ___ Improved forest conditions
F. ___ Improved wildlife habitat
Q24a. Has anyone ever approached you about harvesting your trees?

___ No

___ Yes

Q24b. IF YES, how important of an impact did this have on your decision?

Please CIRCLE one:

Q25. How likely are you to do the following on your forestland in the future?

1 = Very Unlikely (VU)
2 = Unlikely (U)
3 = Neither Unlikely nor Likely (N)
4 = Likely (L)
5 = Very Likely (VL)

Please CIRCLE a number for each activity:

<table>
<thead>
<tr>
<th>FORESTLAND ACTIVITY</th>
<th>VU</th>
<th>U</th>
<th>N</th>
<th>L</th>
<th>VL</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Cut sawlogs for sale</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>B. Cut veneer logs for sale</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>C. Cut pulpwood</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>D. Do nothing</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>E. Clearcut</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>F. Cut trees of all sizes, but leave a lot of trees</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>G. Cut large trees</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>H. Cut small trees</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Q26. If there is any part of your forestland that you have not harvested trees from, why haven’t you?

________________________________________________________________________

The next several questions ask about harvesting trees to sell as a renewable energy resource.

Q27. Some landowners in Pennsylvania harvest and sell trees for use in renewable energy production (for example, as wood chips, ethanol, and/or fuelwood). How willing would you be to harvest trees for renewable energy purposes?

Please CIRCLE one:

<table>
<thead>
<tr>
<th>Very Unwilling</th>
<th>Unwilling</th>
<th>Neither Unwilling nor Willing</th>
<th>Willing</th>
<th>Very Willing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q28. What type of harvesting would you accept knowing the trees would be used for renewable energy purposes?

*Please CHECK ALL that apply:*

A. ___ I would not harvest trees
B. ___ Clearcut
C. ___ Cut most of the large trees
D. ___ Cut trees of all sizes, but leave a lot of trees
E. ___ Cut small trees, but leave large trees
F. ___ Only cut a few, select large trees

Q29. Please indicate how important each of the following factors would be in leading you to harvest trees for biomass.

1 = Very Unimportant (VU)
2 = Unimportant (U)
3 = Neither Unimportant nor Important (N)
4 = Important (I)
5 = Very Important (VI)

*Please CIRCLE a number for each reason:*

<table>
<thead>
<tr>
<th>FACTORS LEADING TO BIOMASS HARVEST</th>
<th>IMPORTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VU U N I VI</td>
</tr>
<tr>
<td>A. Harvest dead trees</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>B. Reduce fossil fuel use</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>C. Remove low value trees</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>D. Improve wildlife habitat</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>E. Generate income</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>F. Clean up the forest</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>G. Support local renewable energy</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>H. Aid forest regeneration</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>

*The next several questions ask about neighbors and cooperation.*

Q30. Do you post your forestland?

___ No  ___ Yes

Q31a. How many neighbors share a property boundary with your forestland?

_____ number of neighbors
Q31b. How many of these neighbors do you know on a first name basis?

______ number of neighbors

Q31c. How often do you interact with these neighbors?

Please CIRCLE one:

Never Rarely Sometimes Often Very Often

Q31d. Have you ever interacted with them over forestland issues?

___ No

___ Yes

Q31e. IF YES, what were the forestland issues?

_______________________________________________________________

_______________________________________________________________

Q32. The following are ways neighbors cooperate. Please indicate if you have done any of these activities. ALSO, please indicate how likely you are to do each in the future, even if you haven’t in the past.

1 = Very Unlikely (VU)
2 = Unlikely (U)
3 = Neither Unlikely nor Likely (N)
4 = Likely (L)
5 = Very Likely (VL)

Please CIRCLE “Yes” or “No” AND one number for each activity:

<table>
<thead>
<tr>
<th>COOPERATIVE ACTIVITY</th>
<th>HAVE DONE?</th>
<th>LIKELY TO DO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>circle one</td>
<td>VU U N L VL</td>
</tr>
<tr>
<td></td>
<td>AND</td>
<td></td>
</tr>
<tr>
<td>A. Let my neighbors hunt on my property</td>
<td>Yes No → 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>B. Let my neighbors recreate on my property</td>
<td>Yes No → 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>C. Coordinate trail building across properties</td>
<td>Yes No → 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>D. Share tools to reduce cost</td>
<td>Yes No → 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>E. Share large equipment to reduce cost</td>
<td>Yes No → 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>F. Improve wildlife habitat across properties</td>
<td>Yes No → 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>G. Coordinate spraying herbicides to reduce cost</td>
<td>Yes No → 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>H. Share the cost of hiring labor</td>
<td>Yes No → 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>I. Sell timber together to get a better price</td>
<td>Yes No → 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>J. Hire a forester together to reduce cost</td>
<td>Yes No → 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>K. Spray for forest insects</td>
<td>Yes No → 1 2 3 4 5</td>
<td></td>
</tr>
</tbody>
</table>
The next several questions ask about non-timber forest products.

Q33. The following are activities associated with harvesting non-timber forest products. Please indicate if you have done any of these on your forestland. ALSO, please indicate how likely you are to do each activity in the future, even if you haven’t in the past.

1 = Very Unlikely (VU)
2 = Unlikely (U)
3 = Neither Unlikely nor Likely (N)
4 = Likely (L)
5 = Very Likely (VL)

Please CIRCLE “Yes” or “No” AND please CIRCLE a number for each activity:

<table>
<thead>
<tr>
<th>FORESTLAND ACTIVITY</th>
<th>HAVE DONE?</th>
<th>LIKELY TO DO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>..circle one.. AND ..circle one for each activity..</td>
<td></td>
</tr>
<tr>
<td>A. Harvest non-timber products for personal use</td>
<td>Yes No → 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>B. Harvest non-timber products to give as gifts</td>
<td>Yes No → 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>C. Harvest non-timber products for sale</td>
<td>Yes No → 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>D. Let others harvest non-timber products on my property</td>
<td>Yes No → 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>E. Plant non-timber products on my property</td>
<td>Yes No → 1 2 3 4 5</td>
<td></td>
</tr>
</tbody>
</table>

Q34. When harvesting non-timber products, which of the following are you most likely to do?

Please CHECK one:

A. ___ I don’t harvest non-timber products
B. ___ Harvest by yourself
C. ___ Harvest with family
D. ___ Harvest with friends

If you don’t harvest non-timber products, please SKIP to Q36.

Q35. The following are non-timber products that landowners may harvest from their forestland. Please indicate which products have been harvested on your forestland?

Please CHECK ALL that apply:

A. ___ Berries  H. ___ Medicinal products (ginseng, goldenseal, black cohosh, etc.)
B. ___ Grapevines  I. ___ Cones, seeds, nuts
C. ___ Boughs  J. ___ Ramps/wild leeks
D. ___ Ferns  K. ___ Groundpine
E. ___ Maple Syrup  L. ___ Bracken fungi
F. ___ Moss  M. ___ Other, please specify: ________________
G. ___ Mushrooms
The following are several general questions about your forestland.

Q36. In what type of ownership is your forestland held?

Please CHECK one:

___ Individual  ___ Timber investment management organization
___ Joint ownership with spouse  ___ A non-forestry-related corporation
___ Other joint ownership  ___ Club or association
___ Family partnership  ___ Trust or estate
___ Business partnership  ___ Other, please specify: _________________________
___ A forestry-related corporation
___ Non-profit organization
___ A non-forestry-related corporation
___ Club or association
___ Trust or estate
___ Other, please specify: _________________________

Q37. How many miles is your primary residence from your forestland?

Please ENTER the number of miles (enter “0” if you live on or adjacent to your forestland):

__________ number of miles

Q38. When did you first acquire your forestland?  _________ year

Q39. How did you acquire your forestland?

Please CHECK ALL that apply:

___ Bought it  
___ Inherited it  
___ Got it as a gift

Q40. From whom did you acquire your forestland?

Please CHECK ALL that apply:

___ My parents, a spouse, or another family member  
___ Other individual  
___ Land investor/developer  
___ Corporation or business  
___ Local, state, or federal government  
___ Other, please specify: _________________________

The next several questions ask about management activities on your forestland.

Q41a. Do you have a written management or stewardship plan for any of your forestland?

___ No

___ Yes  Q41b. IF YES, what management activities have you completed in the past ten (10) years?

____________________________________________________________________
____________________________________________________________________

If you have a written management plan, please SKIP to Q43a.
Q42. Why don’t you have a written management plan?

Please CHECK ALL that apply:

A. ___ It would cost too much
B. ___ I don’t have the time
C. ___ I don’t know where to start
D. ___ I don’t want a management plan
E. ___ What is a management plan?
F. ___ I’m not sure how a management plan would help me
G. ___ I would rather just make decisions as I go
H. ___ Other, please specify: _________________________

Q43a. The following are sources of help and information forest landowners use when making decisions about their forestland. Please indicate if you have used any of the following sources. ALSO, please indicate how likely you are to use each source in the future, even if you haven’t in the past.

1 = Very Unlikely (VU)
2 = Unlikely (U)
3 = Neither Unlikely nor Likely (N)
4 = Likely (L)
5 = Very Likely (VL)

Please CIRCLE “Yes” or “No” AND please CIRCLE a number for each source:

<table>
<thead>
<tr>
<th>SOURCE OF INFORMATION/HELP</th>
<th>HAVE USED?</th>
<th>LIKELY TO DO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>circle one</td>
<td>VU  U  N  L  VL</td>
</tr>
<tr>
<td>A. Written materials</td>
<td>Yes No →   1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>B. The Internet</td>
<td>Yes No →   1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>C. Foresters</td>
<td>Yes No →   1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>D. Loggers</td>
<td>Yes No →   1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>E. Bureau of Forestry</td>
<td>Yes No →   1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>F. Other government agency</td>
<td>Yes No →   1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>G. Penn State Extension</td>
<td>Yes No →   1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>H. TV/Video/Radio programs</td>
<td>Yes No →   1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>I. Friends or family members</td>
<td>Yes No →   1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>J. Other forest landowners</td>
<td>Yes No →   1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>K. Woodland owners association</td>
<td>Yes No →   1 2 3 4 5</td>
<td></td>
</tr>
</tbody>
</table>

Q43b. From the above list, which source are you most likely to use in the future?

Please WRITE IN the letter of the source you are most likely to use: ___________
The next several questions ask about your past actions and future plans for your forestland in “your county.”

Q44a. Have you ever sold any of your forestland?

___ No  ➡️  If NO, please SKIP to Q45a.

___ Yes, how many acres did you sell? ________ acres

Q44b. Why did you sell your forestland?

___________________________________________

Q44c. Some landowners divide their forestland into separate properties (subdivisions) before selling. Did you sell your forestland as separate properties?

___ No  ___ Yes, how many properties? ________ number of properties

Q45a. Do you plan to sell any of your forestland?

___ No  ➡️  If NO, please SKIP to Q46a.

___ Yes, how many acres do you plan to sell? ________ number of acres

Q45b. Some landowners divide their forestland into separate properties (subdivisions) before selling. Are you planning to sell your forestland as separate properties?

___ No  ___ Yes, how many properties? ________ number of properties

Q45c. Why do you plan to sell your forestland?

________________________________________________________________________

Q45d. How soon do you plan to sell?

Please CIRCLE one:

<table>
<thead>
<tr>
<th>Less than 1 year</th>
<th>1-3 years</th>
<th>4-6 years</th>
<th>7-10 years</th>
<th>More than 10 years</th>
</tr>
</thead>
</table>

Q45e. Do you plan to retain any portion?

___ No  ___ Yes, how many acres? ________ acres

Q46a. Do you plan to leave any of your forestland to heirs?

___ No  ➡️  If NO, please SKIP to Q47a.

___ Yes, how many heirs? ________ number of heirs
Q46b. Do you plan to divide your forestland into separate properties before leaving it to your heirs?

___ No

___ Yes, how many separate properties? ______ properties

The next several questions ask about conservation easements and estate planning. A conservation easement is a legal agreement a property owner makes to restrict future use and development of the land.

Q47a. Do you currently have a conservation easement on any of your forestland?

___ No  

___ Yes, on how many acres? ______ acres

Q47b. What type(s) of resource protection objectives are part of your conservation easement?

Please CHECK ALL that apply:

___ Water resources
___ Forest and woodland resources
___ Wildlife resources
___ Scenic resources
___ Sustainable land use
___ Compatible land use and development

Q48. Would you consider putting a conservation easement on any portion of your forestland?

___ No

___ Yes  

If YES, please SKIP to Q50.

Q49a. I am not interested in conservation easements because:

Please CHECK ALL that apply:

___ They will cost me money to implement
___ I don’t want the government having anything to do with my forestland
___ I don’t want conservancies having anything to do with my forestland
___ My heirs are not interested
___ I want my heirs to decide what is best for the land once they inherit it
___ I don’t want to lock my heirs into any long-term restrictions
___ I depend on my forestland for income
___ My heir(s) will depend on my forestland for income
___ I still want to maintain control over my property
___ I don’t want the public to have access to my property
___ Other, please specify ___________________________________

Q49b. From the above list, which reason best defines why you’re not interested in conservation easements?

Please WRITE IN the letter of the reason: __________
Q50. In planning for the future of your forestland, have you done any of the following activities?

*Please CHECK ALL that apply:*

A. ___Met with a lawyer
B. ___Met with a tax advisor
C. ___Met with an estate planning professional
D. ___Established a trust
E. ___Created an estate plan
F. ___Created a last will and testament

Q51. Are you part of any of the following programs or organizations?

*Please Check ALL that apply:*

A. ___PA Bureau of Forestry Stewardship Program
B. ___Tree Farm
C. ___County/Regional Woodland Owners Association
D. ___Pennsylvania Forestry Association
E. ___Pennsylvania Forest Stewards Volunteers (formerly VIP—Coverts)
F. ___CREP (Conservation Reserve Enhancement Program)
G. ___Watershed Association
H. ___Environmental/Conservation Group
I. ___Hunting/Sportsmen’s Club

Q52. How good a caretaker are you of your forestland?

*Please CIRCLE one:*

<table>
<thead>
<tr>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Now we would like to ask some general questions about forestry in Pennsylvania. Please think about Pennsylvania forests in general. Do not limit your responses to your forestland in “your county.”

Q53. On a scale of 0 – 10, where 10 is very knowledgeable, how knowledgeable do you consider yourself about the following issues? ALSO, please indicate how knowledgeable you think the general public is about the following issues.

*Please ENTER a number between 0 and 10 next to each issue:*

<table>
<thead>
<tr>
<th>YOUR KNOWLEDGE</th>
<th>PUBLIC’S KNOWLEDGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 10 ISSUE</td>
<td>0 – 10</td>
</tr>
</tbody>
</table>

| ___ | Pennsylvania’s forests   |
| ___ | General forest management|
| ___ | Forest ecology           |
| ___ | Tree identification      |
| ___ | Forestland taxes/incentives|
| ___ | Logging                  |
| ___ | Stream ecology           |
| ___ | Wildlife ecology         |
Q54. How strongly do you agree with each of the following statements about forest ecology?

1 = Strongly Disagree (SD)  
2 = Disagree (D)  
3 = Neither Disagree nor Agree (N)  
4 = Agree (A)  
5 = Strongly Agree (SA)

Please **CIRCLE** a number for each statement:

<table>
<thead>
<tr>
<th>STATEMENT</th>
<th>AGREEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Cutting trees permanently harms the forest</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>B. Harvesting trees can improve the health of the forest</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>C. The size of a tree is a good indicator of age</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>D. Cutting trees can improve the forest</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>E. Any cutting of trees harms the water quality of nearby streams</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>F. Cutting only the large trees from a forest is better than clearcutting</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>G. Forests rarely recover from clearcutting</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>H. Cutting only the large trees from a forest is better than cutting some trees of all sizes</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>I. Forests are healthy when deer populations are high</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>J. Deer are not a threat to forest ecosystems</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>K. Ferns are not a threat to forest ecosystems</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>L. Deer eat ferns</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>M. Cutting trees usually results in soil erosion</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>N. Cutting trees usually destroys wildlife habitat</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>
Q55. How strongly do you agree with each of the following statements about forests?

1 = Strongly Disagree (SD)
2 = Disagree (D)
3 = Neither Disagree nor Agree (N)
4 = Agree (A)
5 = Strongly Agree (SA)

Please CIRCLE a number for each statement:

<table>
<thead>
<tr>
<th>STATEMENT</th>
<th>AGREEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Neighboring landowners should work together to manage their forests</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>B. Humans shouldn’t interfere with nature</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>C. Healthy forests are important to me</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>D. Forests have a right to exist for their own sake regardless of human concerns or use</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>E. The primary use of forests should be for products useful to humans</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>F. Humans should have more love, respect, and admiration for forests</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>G. You don’t have to worry about the forest because mother nature will take care of the trees</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>H. People who own forestland have the right to use that forestland as they see fit</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>I. There is not much we can do to protect the forest</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>
Q56. The following are issues which concern many Americans. On a scale of 0 – 10, where 10 is very concerned, how concerned do you consider yourself with the following issues? ALSO, please indicate how concerned you think the general public is with each issue.

*Please ENTER a number between 0 and 10 next to each issue:*

<table>
<thead>
<tr>
<th>YOUR CONCERN</th>
<th>PUBLIC’S CONCERN</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 10 ISSUE</td>
<td>0 – 10</td>
</tr>
<tr>
<td>Timber production</td>
<td></td>
</tr>
<tr>
<td>Water quality</td>
<td></td>
</tr>
<tr>
<td>Inflation</td>
<td></td>
</tr>
<tr>
<td>Forest health</td>
<td></td>
</tr>
<tr>
<td>Climate change</td>
<td></td>
</tr>
<tr>
<td>Maintaining greenspace</td>
<td></td>
</tr>
<tr>
<td>Wood as a renewable resource</td>
<td></td>
</tr>
<tr>
<td>Health care costs</td>
<td></td>
</tr>
<tr>
<td>Air pollution</td>
<td></td>
</tr>
<tr>
<td>College tuition</td>
<td></td>
</tr>
<tr>
<td>Dependency on oil as form of energy</td>
<td></td>
</tr>
<tr>
<td>Water supply</td>
<td></td>
</tr>
<tr>
<td>Maintaining forested landscape</td>
<td></td>
</tr>
<tr>
<td>Unemployment</td>
<td></td>
</tr>
</tbody>
</table>

*Finally, we’d like to ask you a few questions about yourself and your family. All information will be treated confidentially and will never be linked with your name.*

Q57. What is your gender?

___ Male  ___ Female

Q58. When were you born?

__________ year

Q59. What is your current employment status?

*Please CHECK one:*

___Full-time  ___Student
___Part-time  ___HOMEMAKER
___Retired  ___Non-employed (looking for work or laid off)

Q60. What was the highest grade of school you completed?

*Please CHECK one:*

___None  ___Technical school beyond high school/Associates Degree
___Grade school  ___Completed college
___Some high school  ___Graduate/professional school
___Completed high school/GED
Q61. What is your current marital status?

*Please CHECK one:*

___Never married
___Married/Living with partner
___Divorced/Separated
___Widowed

Q62. How many children do you have?

__________ number of children

Q63a. Currently, how many people, including yourself, live in your household?

__________ number of people

**Q63b** How many are 18 years old or younger? __________

**Q63c** How many are 19-59 years old? __________

**Q63d** How many are 60 years or older? __________

Q64. How do you describe yourself politically?

*Please CIRCLE one:*

Liberal Moderate Liberal Moderate Conservative

Q65. How long have you lived in your present community?

__________ number of years in community

Q66. Which of following are current sources of income in your household?

*Please CHECK ALL that apply:*

___Wages and/or salary
___Income from business
___Interest and/or investments
___Income from rental properties
___Supplemental security income
___Other disability benefits
___Social Security payments
___Retirement pension payments
___Unemployment
___Food stamps
___Public assistance/welfare
___Other, please specify: __________________________
Q67. What was the total income of your household (before taxes) last year?

*Please CHECK one:*

___Less than $15,000
___$15,000 to $24,999
___$25,000 to $34,999
___$35,000 to $49,999
___$50,000 to $74,999
___$75,000 to $99,999
___$100,000 to $149,999
___$150,000 or more

As part of the next phase of the study, Pennsylvania’s Bureau of Forestry is interested in identifying three properties in each county for a personal visit. A Bureau Service Forester will ask a few questions about your land, conduct a short mapping exercise with you, and walk through your property looking at your trees. The Service Forester will also be able to answer any questions you have about forestry or your land.

Q68a. Would you be willing to have your county Service Forester contact you about a visit as part of this study?

___ No
___ Yes

Q68b. IF YES, please provide us with your name, the best phone number to reach you, and the best time of day to call.

Name: _________________________

Phone: _________________________

Time: _________________________

THANK YOU!

Those are all the questions we have.

Thank you very much for your time and cooperation in completing this survey!

Please return this completed questionnaire using the postage-paid envelope enclosed.

If you have any comments that you would like to share with us, please use the space below:
VITA

Cynthia Liane Longmire

EDUCATION

Ph.D., The Pennsylvania State University: Rural Sociology and Human Dimensions of Natural Resources, August 2012
M.S., The University of Tennessee: Forestry, August 2007

RESEARCH

Using a Multi-Method Approach to Better Understand Pennsylvania’s Forest Landowners Study
  PA Department of Conservation and Natural Resources Bureau of Forestry
CSREES/CEAP Water Quality Study
  North Carolina State University
Natural Resources on the Northern Cumberland Plateau, TN
  The Nature Conservancy

PUBLICATIONS


RECENT PROFESSIONAL PRESENTATIONS


PROFESSIONAL AFFILIATIONS

International Association for Society and Natural Resources
Society of American Foresters
Rural Sociological Society