ABSTRACT

HENDERSON, JESSE DAVID. Climate Change, Landowner Preferences and the Future of Private Forests. (Under the direction of Dr. Robert C. Abt).

Climate change and landowner preferences will influence the future of forests, particularly in the US South, an important forested area with a high percentage of private forest landowners. This dissertation examines both issues.

We use the SRTS model to examine the consequences of carbon fertilization induced by climate change for pine forests in the US Southeast. We examine this impact in the context of baseline modeling scenarios of increasing sophistication to determine the comparative impact of growth and demand on forest inventory, removals and carbon sequestration. Carbon fertilization estimates come from above-ground biomass data generated by the 3-PG forest growth model based on 20 climate models and Representative Concentration Pathway (RCP) scenarios 4.5 and 8.5, which respectively assume 4.5 W/m^2 and 8.5 W/m^2 of radiative forcing by 2100. We examine forest market and carbon sequestration impacts using SRTS, with and without climate change-related growth, under four scenarios. In the most aggressive demand scenario, demand increases 2% per year until 2035. Results suggest that forest inventory will increase under all climate change scenarios. Results show lower timber prices over the long run under carbon fertilization. Welfare analysis shows that modeling assumptions about demand and harvesting have a greater impact than carbon fertilization.

We examine in detail the empirical relationships between parcel size and landowner preferences using the National Woodland Owner Survey (NWOS) data, consisting of 170 variables and 10,109 observations. The analysis follows three methodological pathways to understand how landowner characteristics relate to the future likelihood of timber harvests: (1) a production possibilities conceptual model with cluster analysis, (2) a probit analysis, and (3) a conditional probability analysis connecting forest landowner attributes to wooded acres (parcel size). Results show a strong empirical linkage between parcel size and a timber management objective, the future likelihood of timber harvests, consultation with experts, seeking costly information, and many additional factors. The results have applications in empirical agent-based models of forest landowners and in the development of similar bottom-up modeling approaches.

Climate Change, Landowner Preferences and the Future of Private Forests

by
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DEDICATION

In memory of

Phillip Henderson Lungren

and

Marlys Nadine Lungren

BIOGRAPHY

Jesse Henderson grew up in West Tennessee. His first introduction to forestry was a leaf collection project in 8th grade in which he topped his class for completion. After graduating valedictorian of his high school, he pursued a degree in physics at The University of Tennessee at Knoxville (UTK) where he graduated with honors. A capstone course on renewable energy at UTK furthered his interest in environmental sustainability.

In the interschool years, Jesse taught mathematics at Father Ryan High School in Nashville, TN. He then taught and managed undergraduate chemistry laboratories at Vanderbilt University. These experiences motivated the choice to enter graduate school.

He earned his Master of Science in natural resource policy at North Carolina State University, taking courses in economics, natural resources, public policy and engineering. Concurrent with his PhD program in Forestry and Environmental Resources, Jesse worked as a full-time Research Associate for the Southern Forest Resource Assessment Consortium.

Jesse lives in Raleigh with his wife Rachel and daughters Matilda and Ramona.

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CHAPTER 1:
Introduction

Models are maps, not the territory. Philosophers have debated about the appropriate measure of a scientific model. Popper (1963) argued that science advances through a process of falsification, where hypotheses or models are disproven rather than proven. Alternatively, Kuhn (1970) suggested that *normal science* operates under a set of accepted theories and norms; researchers will make subtle contributions to the accepted body of knowledge until the rare *paradigm shift* causes an upheaval and restructuring of the scientific field in question. Models in essence are mathematical summaries of the current scientific understanding within a field, and they amend or evolve as the underlying scientific understanding improves.

Forward-looking models are an important component of public policy analysis and planning for private enterprises, particularly in forestry. Since the growth of forests occurs over decades, forest policy and forest markets are particularly susceptible to the passage of time, and a corresponding level of care should underlie forest economic models. Indeed, the earliest models in forestry recognized the importance of time in the calculus of optimal timber rotations (Amacher, Brazee, & Deegen, 2011; Brazee & Mendelsohn, 1988; Faustmann, 1849; Samuelson, 1976). More generally, what an individual forest landowner should do in normative terms differs from a positive description of timber supply in the aggregate (Wear & Parks, 1994).

Over the course of development of forest economics, researchers have merged economic models with biophysical models using a multitude of assumptions. Assumptions made by forest economic models depend on both the readily available data, the accumulation of knowledge, and resulting changes in favored methods over time (D. M. Adams & Haynes, 1980). Models have incorporated different assumptions about expectations for the future (Muth, 1961; Brent Sohngen & Sedjo, 1998; Young & Darity, 2001), covering diverse geographic scales, from individual stands to regional, national or global[1]. Increases in computing power have also opened up possibilities for the

[1] For example, stand level (Mei et al., 2019), regional (R. Abt et al., 2009), national (D. Adams et al., 2005), and global (Buongiorno et al., 2003). For a comparison of attributes of global forest economic models, see Appendix A Table A.1.

construction of new types of models that account for both the forest stand and market scale (Henderson & Abt, 2016).

Structural Change

In addition to evolution of methodologies, models of forest markets have had to contend with structural changes in forest markets over time. The final uses of wood, deriving from technological change and development, drive a portion of this change. Broadly speaking, wood is still primarily a fuel source and a building material, but use in shipbuilding, for example, has declined over the centuries as products using chips and pulp, wood pellets, paper and fiberboard, have increased their share of final use. Since 1980, uneven growth and decline of product demand has occurred. Production of wood-based panels has grown by a factor of 4.1, paper and paperboard by a factor of 2.4, roundwood production by a factor of 1.2 (Food and Agriculture Organization, 2017). In 1980 wood pellets were virtually non-existent, whereas current worldwide production exceeds 33 million metric tons (Food and Agriculture Organization, 2017). New products, such as cross-laminated timber, could further shift demand in the future, depending on adoption rates, which vary by country (Laguarda Mallo & Espinoza, 2015).

Larger firms tend to be first adopters of new technologies, forcing other firms to adopt new technology in order to remain competitive. A three-decade analysis of the

Pacific Northwest showed a trend for sawmills substituting capital for labor (Helvoigt & Adams, 2009). The use of smaller sawlogs has reduced the need for manual labor, making mechanization tenable (Helvoigt & Adams, 2009). Increases in energy efficiency have been observed through the integration of sawmills with pellet and combined heat and power plants (Anderson & Westerlund, 2014).

Technical changes have occurred in timber supply as well. The most apparent structural change in harvesting operations has been the replacement over time of labor with capital. Technological development in timber harvesting technology has progressed from the manual saw and axe, prevalent until the mid-20th century, to chainsaws and other mechanized harvesters. In the most capital-intensive setting, cut-to-length (CTL) operations use a single machine to fell, de-limb and cut trees to the desired length (Forest Resources Association, 2014). CTL methods are limited by high upfront investment costs, terrain limitations, and the possibility of damaging high value timber, making felling by chain saw still prevalent (Ciubotaru, Câmpu, 2018; Forest Resources Association, 2014). However, the expectation for employment in logging in the United States (US) is a decline of 13% over the 2016-2026 time period (U.S. Bureau of Labor Statistics, 2018).

While on the whole forestry has become a more capital intensive sector over time, some forest management practices, such as planting and weed control still rely on intensive labor (Brodbeck, Conner, & Morse, 2018). In the US, *Los pineros*, seasonal and migrant forestry workers under the H-2B program, have come to make up a significant portion of the manual labor force in US forestry, comprising 12.7% of the work force nationwide and 50% to 84% in the US South (Brodbeck et al., 2018; Grzywacz et al., 2013). Future developments in immigration policy could affect these workers and reforestation efforts.

A variety of shocks outside a regional forest sector also matter. The Great Recession caused a decline in sawtimber demand due to a lack of new housing demand. Subsequent analysis of timber markets had to account for this new realization (R. C. Abt, Abt, Cubbage, & Henderson, 2010). Changes in tariffs and legal rulings on forest product dumping can result in volatility in supply and demand (Baschuk, 2019). Other shocks to timber inventory—hurricanes, insects and fires—can create temporary gluts in supply a salvage-grade timber but reductions in inventory that alter equilibrium in the long term (Prestemon & Holmes, 2000).

The Basic Framework

In countries with private forests and forest markets like the United States, the basic accepted model in forest economics simplifies the preceding complexities of timber markets, relying on a supply and demand curve in price (P) and quantity (Q) space. The supply (s) curve gives the relationship between price and quantities for suppliers of the forest product in question—forest landowners. It is typical to include a forest inventory component in the supply model, a supply *shifter*, such that increases in inventory increases the quantity supplied at every price, attenuated by an inventory elasticity (τ). Similarly, we can represent demand (d) as a relationship between prices and quantities, with an exogenous demand-shifting component (G), parameterized by a demand shifter elasticity (∂). Using a constant-elasticity functional form, these curves, parameterized by supply and demand price elasticities (respectively γ and ε), are given by equations 1.1 and 1.2.

$$Q_s = \beta P^{\gamma} I^{\tau} \quad (1.1)$$

$$Q_d = a P^{\varepsilon} G^{\partial} \quad (1.2)$$

Exogenous Change

Assigning parameter values (γ = 0.4, ε = -0.4, β = 15.85, α = 630.96) and taking the demand shifter elasticity (τ) to be 1, we can understand the impact on economic equilibrium from a 10% exogenous increase in demand (Figure 1.1). The curve Demand-1 shifts 10% along the quantity index axis to arrive at Demand-2. A price index of 100 corresponds to a quantity index of 100 on the Demand-1 curve and a quantity index of 110 on the Demand-2 curve. Because the supply curve is the second constraint on economic equilibrium in the model, we observe that moving from Equilibrium-1 to Equilibrium-2 requires both a price and a quantity increase. Similarly, assuming an inventory elasticity (τ) value of 1, a 10% increase in inventory shifts the supply curve along the quantity axis by 10%, resulting in a price decrease and harvest increase (Figure 1.2).

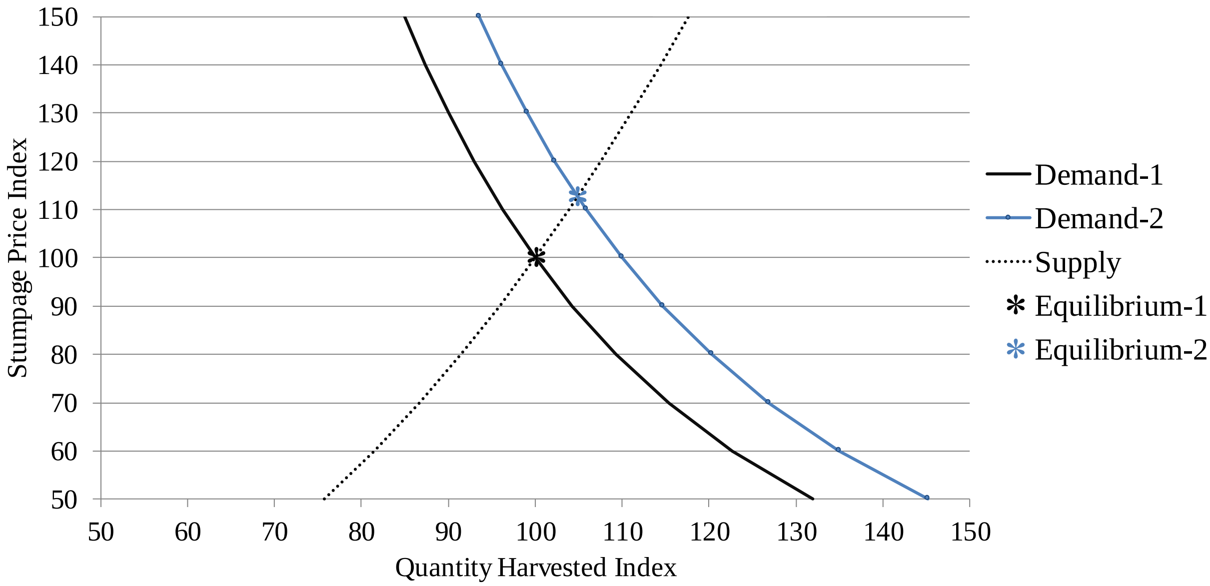

Figure 1.1. Impact of a 10% increase in demand on economic equilibrium.

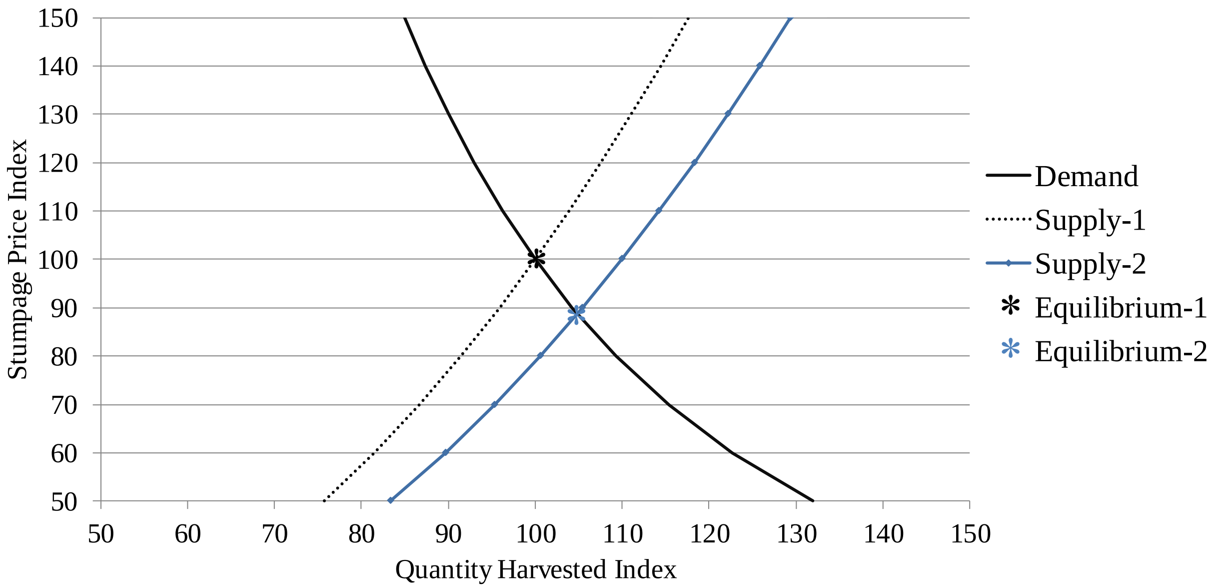

Figure 1.2. Impact on economic equilibrium of a 10% increase in supply due to an inventory increase.

Exogeneous influences on the supply and demand curves could work in concert or disharmony, depending on the elasticity parameter values and the magnitude of changes in the exogenous variables. If the curves shift left or right by the same magnitude, prices would remain unchanged and quantities harvested would decrease or increase, respectively. Conversely, shifts of the supply and demand curves in opposite directions can produce little to no change in quantity harvested while producing increases or decreases in price. Imperfect coordination between exogenous supply and demand shifters is typical, resulting in some movement in both price and quantity over time.

To ground the model in reality, the real phenomena that the inventory variable in Equation 1.1 tries to capture are complex. First, the existing total timber inventory for a product class (e.g. sawtimber) derives from the full history of natural and human intervetions. In the very short term, no action can increase the existing inventory. In the present, passive or active management activities by individual forest landowners, including tree planting, silvicultural practices, neglect, fire prevention, and so on, will influence the age class structure and total timber inventory in the future. However, since the inventory variable is an aggregate measure, no single forest landowner controls the total inventory. This is why we consider the inventory shifter to be an exogenous influence, with the caveat that large landowners may have outsized influence on total inventory at local scales.

On the demand side of the system, consumers in the timber stumpage market include mills, biomass refineries, wood-powered energy plants and other manufacturers. Factors that affect demand outside of the individual firms are exogenous. The entry of a new processing mill in a region can represent an exogenous demand shift. Changes in demand for wood products in export markets can filter down to the stumpage market, causing shifts in demand in the same direction. The creation of new products, as in the recent surge in cross-laminated timber and woody biomass pellets, could spur an increase in demand for related stumpage markets. Additionally, the development of new substitutes for wood, such as in building structures, could cause a decline in demand.

Endogenous Change

In the price-quantity space represented in Figures 1.1. and 1.2, the shape of the curves is governed by the relationship between prices that producers and consumers would collectively accept in exchange for selling or harvesting given amounts of timber products. The supply curve at the industry level stems from the sum of supply curves at the level of the firm, or forest landowner. Changes in the number of forest landowners, the costs structures they face, production technologies, and changes in attitudes has the potential to change the independent relationship between prices and quantities, reflected in the price elasticity of supply. For consumers, technological changes that improve the efficiency of log cutting could contribute to a fundamental change in the relationship between price and quantity demanded as more firms adopt the technology. Crucially, endogenous changes affect supply or demand curve unevenly, causing a change in shape of the curve rather than a shift.

Purpose

This dissertation participates in the long tradition of updating models in forest economics by examining important exogenous and endogenous factors affecting timber supply, respectively: (1) the impact of carbon fertilization on a regional scale forest economic model and (2) the underlying empirical relationships between landowner behavior and preferences at the scale of parcels.

Chapter Descriptions

The two chapters offer insights about the future of forest economic modeling from opposite but complementary modeling paradigms. The Sub-Regional Timber Supply (SRTS) model is a recursive equilibrium model described as an econometric or a top-down model. In contrast, the findings from chapter three are useful in bottom-up models like agent-based models. Taken as a whole, these investigations provide new insights about the biophysical and behavioral assumptions for which future models of timber supply must account.

Chapter 2 uses the SRTS model to examine the consequences of carbon fertilization induced by climate change for pine forests in the US Southeast. Resulting changes in pine (*pinus taeda*, loblolly) growth affect forest markets and regional carbon sequestration. We examine this impact in the context of baseline modeling scenarios of increasing sophistication to determine the comparative impact of growth and demand on forest inventory, removals and carbon sequestration. Carbon fertilization estimates come from above-ground biomass data generated by the 3-PG forest growth model based on 20 climate models and Representative Concentration Pathway (RCP) scenarios 4.5 and 8.5, which respectively assume 4.5 W/m^2 and 8.5 W/m^2 of radiative forcing by 2100. We examine forest market and carbon sequestration impacts using SRTS, with and without climate change-related growth, under four scenarios. In the most aggressive demand scenario, demand increases 2% per year until 2035. Results suggest that forest inventory will increase under all climate change scenarios. Results show lower timber prices over the long run under carbon fertilization.

Chapter 3 employs National Woodland Owner Survey (NWOS) data consisting of 170 variables and 10,109 observations to examine in detail the empirical behavior behind timber supply curves. The analysis follows three methodological pathways to understand how landowner characteristics relate to the future likelihood of timber harvests: (1) a production possibilities conceptual model with cluster analysis, (2) a probit analysis, and (3) a conditional probability analysis connecting forest landowner attributes to wooded acres (parcel size). Results show a strong empirical linkage between parcel size and a timber management objective, the future likelihood of timber harvests, consultation with experts, the probability of seeking costly information, and additional factors. The results have applications in empirical agent-based models of forest landowners.

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CHAPTER 2:
Representative Forest Market Pathways under Climate Change: Pine Forests in the US Southeast

Introduction

Human activities are responsible for global warming. The 40% increase in atmospheric concentration of carbon dioxide derives from fossil fuel emissions and net land use change emissions (IPCC, 2013). Climate change is a serious threat to natural ecosystems and human beings (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), 2018; Thomas, Jersild, Brooks, Thomas, & Wynne, 2018). Under a business as usual (BAU) scenario, climate change will rival land use change as a cause for species population declines (IPBES, 2018). An additional 9% population decline could arise by 2050, 40% below population levels observed during European settlement (IPBES, 2018). In addition to tangible impacts on the biosphere, economic effects will occur. While the initial economic impacts of climate change could be positive at low levels of global warming, studies project increasing declines in economic output and quality of life at warming levels of 2ºC and beyond (Tol, 2018). By 2100, the expectation of global mean surface temperature under various greenhouse gas emission trajectories is an increase of between 0.3 ºC to 4.8 ºC (Intergovernmental Panel on Climate Change (IPCC), 2014). Not accounting for non-market losses, the worst case for economic damages in the US equal 1 to 3% of annual GDP by the end of the century (Hsiang et al., 2017).

Four Representative Concentration Pathway (RCP) scenarios were designed to provide consistency in climate change-related research and assessment and to develop integrated socioeconomic, emissions and climate scenarios—based on total radiative forcing—to represent greenhouse emission trajectories over time (R. Moss et al., 2008; van Vuuren et al., 2011). RCP8.5 is the highest and fastest rising pathway, with greater than 8.5 watt per square meter (W/m^2) of radiative forcing by 2100 and increasing radiative forcing beyond (Riahi, Grübler, & Nakicenovic, 2007). RCP3PD (RCP2.6) is the lowest pathway with a peak at 2.6 W/m^2 of radiative forcing and declines before 2100. The other two, RCP4.5 (Clarke et al., 2007) and RCP6, are intermediate ranges of radiative forcing, which stabilize at approximately 4.5 W/m^2 and 6 W/m^2 by 2100. The RCPs are not particularly policy-prescriptive but provide a reference for time-dependent projections of atmospheric greenhouse gas concentrations (R. H. Moss et al., 2010).

The literature documents potential impacts of climate change on forests, and those effects can be broadly divided into three categories: flow effects and stock effects (B Sohngen & Sedjo, 2005), and additionally range effects (Fei et al., 2017). Flow effects relate to potential future growth of forests due to climate change and carbon fertilization, whereas stock effects include influences on current forests through disturbances. Range effects describe shifts in the geographical distribution of species. Tree species in the southern US have shown a median westward range shift of 24.7 km per decade, with *pinus taeda* (loblolly pine) notably lacking any significant shift (Fei et al., 2017).

The most commonly studied impacts of climate change on forest ecosystems examine the stock effects from increases in the rate and severity of forest disturbance risks, including wildfires, drought, storm, and pest outbreaks (Allen et al., 2010; Ayres & Lambordero, 2000; Emanuel et al., 2008; Liu et al., 2014; Vose, Peterson, & Patel-Weynand, 2012). While climate change could enhance timber growth rates, timber growing opportunities, and positive impacts on forest product markets (B Sohngen & Sedjo, 2005; Wertin, McGuire, & Teskey, 2012), climate-induced changes in forest structure, composition, and functions are estimated to have overall negative economic effects (Holmes, McNulty, Vose, Prestemon, & Li, 2014).

Pine forests in the southeastern US are economically important (Mei, Wear, & Henderson, 2019) and are projected to be affected by climate change in the coming decades (Susaeta, Adams, & Gonzalez-Benecke, 2017; Thomas et al., 2017; Wertin et al., 2012). This problem was a motivation behind the Pine Integrated Network: Education, Mitigation, and Adaptation Project (PINEMAP), an integrated research, extension, and education effort intended to inform landowners managing about 20 million acres of planted pine forests under climate change. PINEMAP's primary goals were increasing forest productivity, carbon sequestration, and forest resilience and sustainability under climate change, focusing on loblolly pine plantation forests in the southeastern states (PINEMAP, 2016). It produced improved forest productivity measures as it relates to climate change (Thomas et al., 2017, 2018). These forest growth data are relevant to looming questions in the forest sector (Buchholz et al., 2014): (1) What impacts will climate change-induced growth have on the forest resource and forest markets, and (2) What are the implications of this new information for the formation of BAU scenarios used for climate policy analysis?

The purpose of this study is to: (1) evaluate the impacts that demand assumptions and growth perturbations have on forest market projections to understand how researchers should amend previous BAU assumptions, and (2) simulate the dynamic interaction of forests and markets in the US Southeast under exogenous climate change-induced changes in forest growth. By integrating a database of growth changes from PINEMAP Physiological Principles Predicting Growth (3-PG) into the Sub-regional Timber Supply (SRTS) model, this study projects southeastern timber markets under two RCPs scenarios and 20 climate models. While most of the previous studies have examined potential climate change impacts on timber markets based on global timber trade models (Kim, Baker, Sohngen, & Shell, 2018; B. Sohngen & Mendelsohn, 1998; B Sohngen, Mendelsohn, & Sedjo, 2001; Brent Sohngen & Tian, 2016), few studies evaluated forest management and timber markets under RCPs and alternative shared socio-economic pathways (SEPs) (Daigneault, 2018; Susaeta et al., 2017). Given that the U.S. South is a major wood producing region in the world and is projected to remain an important source of wood fiber for the foreseeable future (Mei et al., 2019), the findings of this study are important towards understanding the future trends and performance of southern timber markets under climate change.

Literature Review

Dividing the literature according to the two objectives, the first section of reviewed literature discusses the baseline question—what assumptions underlie different kinds of BAU scenarios? Second, we identify previous studies on the impact of carbon fertilization on forest markets.

The Baseline Question

The choice of a baseline is pivotal for policy analysis. Without a reference case, it is impossible to judge the change stemming from a policy. Gustavsson et al. (2000) recommended four guiding principles in formulating a baseline scenario: (1) accuracy, (2) comprehensiveness, (3) conservativeness, and (4) practicability[2]. The requirements for a baseline may depend on context. For policy planning and evaluation, as opposed to a monitoring setting, comprehensiveness and conservativeness are perhaps the two most relevant criteria (Bucholz, et al. 2014).

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[2] Accuracy means that a BAU scenario should reflect a true attempt to model actualities in the "do nothing" case, e.g. incorporating technological change and uncertainty when possible. Comprehensiveness means identifying appropriate temporal and spatial boundaries; addressing potential sources of leakage. Conservativeness means avoiding arbitrarily high or low baselines (in the case of GHG emissions) which would bias the measure of GHG reductions. Practicability means designing measurability into the accounting regime, so actual outcomes are measurable in follow-up analyses and policy monitoring settings. (Gustavsson et al., 2000)

To place the baseline question in a concrete context, consider the case of woody biomass sustainability in the US. Whether or not woody biomass is sustainable is both a scientific and a policy question. As a matter of science, studies have shown varying results depending on varying assumptions, spatial and temporal scales of analysis, and disparate definitions of sustainability. As a policy matter, the Environmental Protection Agency (EPA) must make a determination of woody biomass' carbon neutrality in definitive policy terms. The EPA identified two types of baseline methodologies, a reference point baseline and an anticipated baseline (EPA, 2014). A reference point baseline compares two points in time, whereas an anticipated baseline compares at least two potential future pathways. The anticipated baseline is therefore more applicable to dynamic modeling (Parish, et al. 2017). Still, the assumptions that underlie anticipated baselines can vary in complexity and scientific rigor. The assumptions therefore warrant sensitivity analysis.

Carbon Fertilization and Forest Markets

A number of previous studies have examined the relationship between forests and the carbon cycle under climate change and reported that climate change will have substantial impacts on the structure, composition, function and stresses on forested ecosystems (Allen et al., 2010; Iverson, Prasad, Matthews, & Peters, 2008; Susaeta et al., 2017; Westerling, Turner, Smithwick, Romme, & Ryan, 2011). Under elevated carbon dioxide (CO_2) concentrations, plant species are found to exhibit a higher rate of photosynthesis and plant metabolism, resulting in increased plant growth (Taub, 2010; Way & Oren, 2010). While higher CO_2 concentrations alone can lead to nitrogen depletion and limits to CO_2 fertilization effects, CO_2 increases coupled with warming has a more neutral and variable effect on nutrient availability, with positive impacts on above-ground biomass (Dieleman et al., 2012). Wertin et al., (2012) reported a positive change in growth of loblolly pine seedlings under elevated temperature and atmospheric CO_2 settings.

Based on global forest sector models using integrated economic and ecological settings, several previous studies have examined the probable impacts of climate change on timber markets. The general conclusions of existing studies include that carbon fertilization increases forest stocks, thereby decreasing prices and producer surplus, and increasing the economic welfare of timber consumers (McCarl, Adams, Alig, Burton, & Chen, 2000; Perez-Garcia, Joyce, Binkley, & Mcguire, 1997; B. Sohngen & Mendelsohn, 1998; B Sohngen et al., 2001; B Sohngen & Sedjo, 2005). An assessment using the CINTRAFOR Global Trade Model, Perez-Garcia et al. (1997) estimated that the overall net economic impact of climate change on the forest sector could range from $10.7 billion to $15.9 billion. Based on a dynamic model of ecological change, Sohngen and Mendelsohn (1998) showed that climate change would drive timber prices lower than the baseline case in all biogeographical regions. With increasing global timber production and lower timber prices, a welfare analysis based on the Global Timber Model projected that timber consumers are likely to benefit from climate change (McCarl et al., 2000; B Sohngen et al., 2001). Similarly, based on integrated ecological-economic assessments using a dynamic global vegetation model, Sohngen and Tian (2016) projected that climate change could result in a 44% increase in growing stock volume per hectare globally, mostly due to carbon fertilization and a warmer world. Tian et al., (2018) also projected that US forests would continue to remain a carbon sink through most of the coming century.

Some of the recent studies examined forest management scenarios and carbon sequestration futures under alternative RCPs and SEPs. Susaeta et al., (2017) looked at the implications of carbon fertilization on optimal harvests of slash pine forests at the stand level. Under two alternative climate scenarios (RCP4.5 and 8.5), their model projections suggest weak impacts of climate change on optimal harvest ages of even-aged slash pine stands in the US South. Their results vary by site productivity and location – modest increases in land expectation values (LEV) under climate change for low productivity sites and decreases in LEV for southeastern sites. Similarly, Daigneault (2018) projected the probable future pathways of the global forest sector under five different SEPs. The study projects that industrial roundwood prices will double over the next century under the climate scenario of SEP5, and higher prices would incentivize management that is more intensive, with greater roundwood harvests over the years. Another study shows that climate change-induced forest growth, coupled with climatic risk, only marginally changes the forest investment calculus (Mei et al., 2019).

Recent research has shifted attention to a related question—the carbon consequences of using woody biomass. Based on IPCC projections, a study using the Global Forest Products Model (GFPM) showed that high global demand for fuelwood would result in substitution with roundwood (Raunikar, Buongiorno, Turner, & Zhu, 2010). A recent study used a global forest sector model to examine the impact of additional biomass demand on forest carbon uptake and carbon stored in forest products, accounting for the economic effect of higher prices encouraging an increase in timberland and forest carbon stocks in most of the regions in the world (Kim, et al. 2018). Similarly, positive influences of markets for woody biomass energy on forest carbon sequestration and net forest carbon stock are well documented in recent studies (Favero & Mendelsohn, 2014; Galik, Abt, Latta, & Vegh, 2015; Sedjo & Tian, 2012). Galik et al., (2015) also found that net forest carbon, particularly in the Southeast, is greater in the scenario of renewable portfolio standard (RPS) than in a scenario with no RPS. Similarly, Favero and Mendelsohn, (2014) argued that markets for woody biomass energy would promote forest carbon sequestration, leading to conversion of agricultural land to forestland.

The present study differs from preceding analyses on this topic in a few important ways. First, the better regional precision of climate effects lends to more accurate regional results. Second, the inclusion of empirical baseline growth derived from FIA data provides for additional realism in projections of forest inventory and structure. Finally, the scenario analysis of increasing economic sophistication covers a wide range of anticipated BAU scenarios and serves as a sensitivity analysis that increases our understanding of modeling assumptions on projections of forest markets.

Methods

The methodology that follows first provides some descriptions of the models used in the analysis and the techniques used to summarize data. We then discuss the assumptions that drive model scenarios and demand trends, and the limitations of the analysis.

Spatial Conformity

The Sub-regional Timber Supply Model (SRTS) is a partial-equilibrium economic model that spatially optimizes timber harvests for a market-wide demand, subject to sub-regional supply curves that reflect price and inventory constraints (R. Abt, Cubbage, & Abt, 2009). A typical sub-region consists of multiple adjacent counties, and the default sub-regions are FIA survey units. Since the overlap of counties in the PINEMAP 3-PG database does not completely overlap with FIA survey units (Figure 2.1), this analysis merges outlier counties into custom sub-regions based on proximity to whole FIA survey units. For example, this process merged counties in West Tennessee into the North Mississippi sub-region. Data Appendix Table B.1 provides a full accounting of counties and their custom survey units. This process resulted in 33 sub-regions with most exactly matching FIA survey units. County level FIA inventory and removal data was then extracted and totaled for each survey unit, retaining heterogeneous features of ownership (corporate, non-corporate), management type, species, age class, and diameter-at-breast-height (dbh) distributions by physiographic region.

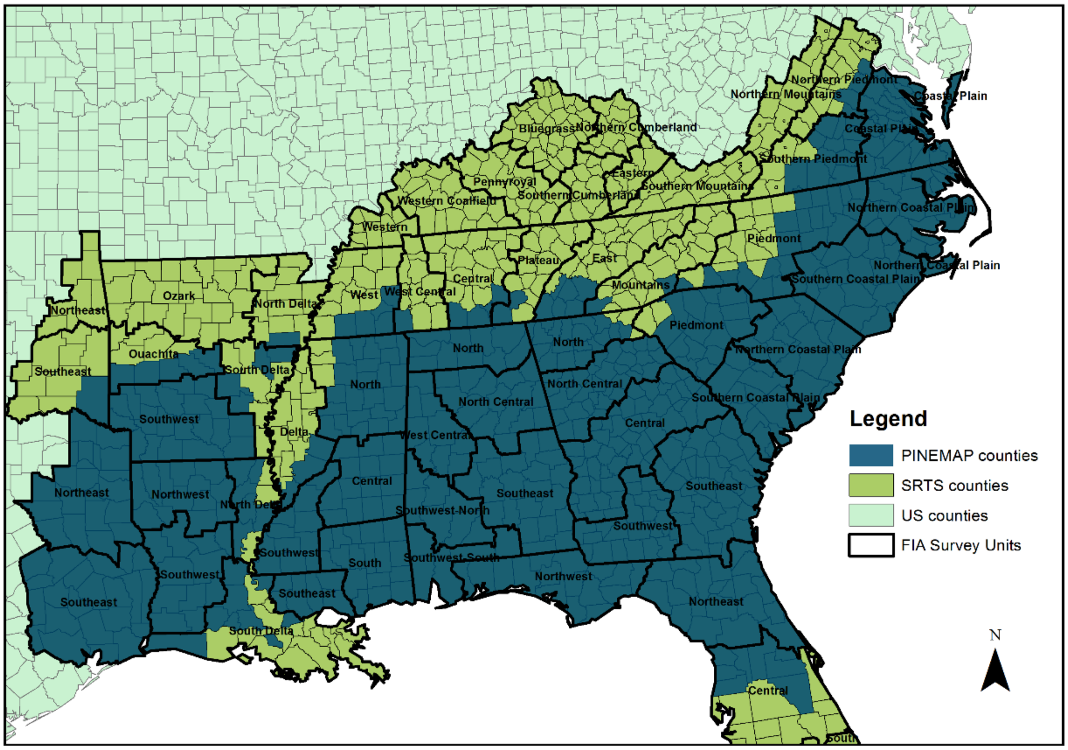

Figure 2.1. Spatial crossover of counties in the PINEMAP 3-PG database (blue), counties in SRTS (green and blue), and default borders of FIA survey units (black lines).

Summarizing 3-PG Data

3-PG is a physiological process model of timber growth in response to environmental inputs (Landsberg & Sands, 2011; Landsberg & Waring, 1997). The model was further developed during the PINEMAP project (Thomas et al., 2017, 2018). County level results from 3-PG covering the historical range of loblolly pine were retrieved (Brooks, 2016) for use with the SRTS model. The data includes simulated projections of above-ground biomass growth by county for 20 climate models and two Representative

Concentration Pathways (RCPs): 4.5 and 8.5[3]. The data used includes above-ground biomass for pine stands grown for 40 years, starting with a planting year of 1971 and ending with a planting year of 2062.

SRTS relies on Forest Inventory Analysis (FIA) data, and aggregation to multi-county scales (custom sub-regions or FIA survey units) ensures adequate sample sizes. Therefore, to conform the 3-PG data for incorporation into SRTS, we perform sub-regional linear regressions of aboveground biomass (WS) on 3-year age class (AC), 3-year age class squared (AC^2), and planting year (PY) by climate model (i), RCP scenario (j), and survey unit[4] (k):

$$(WS_{mean} = \beta_0 + \beta_1 AC + \beta_2 AC^2 + \beta_3 PY)_{ijk} \tag{2.1}$$

Equation 2.1 comprises 1,320 regressions (2 RCP scenarios, 20 climate models, 33 sub-regions). The results produced highly accurate *3-PG summary models* ($R^2 \sim 0.99$) in

[3] Recall that RCP4.5 and 8.5 assume 4.5 W/m^2 and 8.5 W/m^2 of radiative forcing, as noted above. Economic growth rates are approximately 2% per year for both scenarios (as shown in Appendix B Figure B.1) and population growth assumptions are similar over the study period.

[4] Custom sub-regions based on modified FIA survey units as described under "Spatial Conformity"

which every term was significant for 1,319 models[5] (p-value < 2.2e-16). Table A.1 shows a meta-analytical summary of regression results by sub-region. From these regression results it is worth noting that a positive relationship exists between planting year and aboveground biomass. This term captures the increasing effect of CO_2 fertilization over time.

Implementation in SRTS

The introduction of yield curves that change based on the planting year adds a *vintage* beyond just the age class. A given SRTS model run uses a table of regression results by sub-region for a single RCP scenario and a single climate model. These tables did not replace the empirical growth or age class distributions in SRTS, but instead perturbed the empirical growth over the course of the model run by indexing the PINEMAP growth to the SRTS base year. So in the first year of the SRTS run, the age class of existing inventory implies the planting year, and the planting year in part determines how much perturbation above the empirical yield occurs. Simply put, the parameter for the planting year in the regression results shifts the intercept of the yield curve on an annual basis in the model.

[5] The lone exception was Central Florida under RCP 8.5 with climate model MIROC-ESM. This regression showed non-significant effects from the intercept and planting year on aboveground biomass.

Scenario Development: Representative Forest Market Pathways

In contrast to previous work which examined market and inventory impacts on the forest resource with and without biomass, *ceteris paribus*, this study examines the market and inventory impacts in two dimensions: (1) with and without climate change (e.g. how any choice of BAU must change given this new information) under (2) four cases of increasing economic sophistication (Table 2.1).

The SRTS Mode column in Table 2.1 identifies two options in the SRTS model for modeling demand. The *demand* mode treats the demand scenario as an exogenous shifter of the demand curve, much in the same way as Figure 1.1 showed. The *harvest* mode treats the demand scenario as a shifter of the quantity harvested, removing the typical price-constraining features of demand curves. Figure 2.2 illustrates the distinction between these two model options. Moving from Demand-1 to Demand-2 represents a 10% shift in the demand curve. Moving from Demand-1 to the Harvest Mode curve represents the 19.5% shift in the demand curve necessary to produce a 10% increase in harvests. This modeling mechanism is equivalent to assuming a highly inelastic price elasticity of demand (~ 0.01), such that the demand curve is virtually vertical. The implication of the harvest mode assumption is therefore that consumers of timber stumpage will obtain harvests regardless of price.

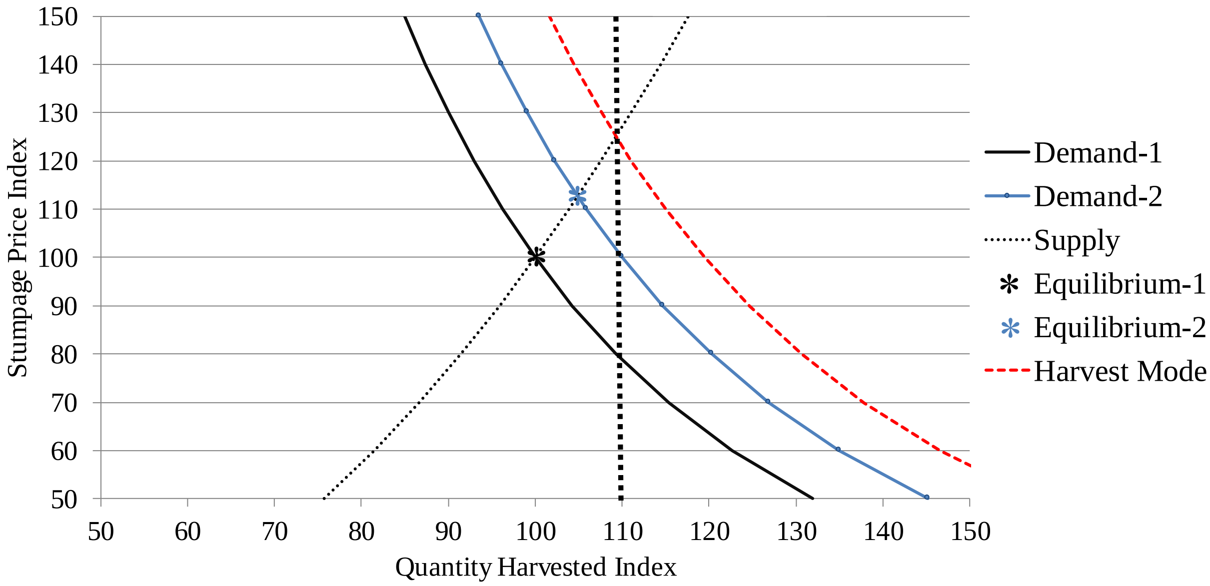

Figure 2.2. Distinction between a 10% shift in the demand curve (Demand-1 to Demand-2) and a 10% shift in harvests (Demand-1 to Harvest Mode), requiring a 19.5% shift in the demand curve.

The *pure biological* case asks what would happen to forests, given current inventory, if we stopped using wood altogether. The purpose of this case is to isolate the biological effects from the human-induced effects. Next, the *constant harvest* case assumes that current harvests in every product category will continue at their baseline levels, and prices will not affect harvests. The *quantity demanded* scenario projects that demand will increase in line with assumed economic growth in the RCP scenarios until 2035[6], when harvests plateau. This scenario simulates a good faith attempt to match the economic assumptions that underly the climate scenarios. However, this scenario again employs the

[6] See: Appendix B, Figure B.1

harvest mode in SRTS, which treats harvest as exogenous. The *fully economic* case—so-called because it uses the full partial equilibrium solution in SRTS—is identical to the *quantity demanded* scenario, with two exceptions: (1) a nonlinear demand curve represents demand, mediating harvest increases with price increases, and (2) land use change occurs endogenously based on relative pine sawtimber and pine pulpwood rents.

Table 2.1. Scenario name, SRTS Mode, and Demand Scenario.

Friendly Scenario Name	**SRTS Mode**	**Demand Scenario**
Pure Biological	Harvest	Fading to zero
Constant Harvest	Harvest	Constant
Quantity Demanded	Harvest	Rising to plateau at 2035
Fully Economic	Demand	Rising to plateau at 2035

Demand Scenarios

The study uses an annually increasing demand scenario to drive demand for timber products, shifting upward by 2% per year and levelling off in 2035 (Figure A.2). Empirically, economic growth and demand see interruptions due to recessions or other economic fluctuations. Particularly with forest products, these interruptions may cause substantial feedbacks on forest inventory stocks, as well as reforestation driven by stumpage price changes. However, this study uses a rate of increase in demand that maintains consistency with the economic growth assumptions associated with RCPs, within the 2035 limit.

Forest Carbon and Soil Carbon

As a post-process of the model results, detailed forest inventory results from the market projections are converted to carbon stocks using Smith et al. (2006). We then make a calculation for changes in soil carbon based on the same source. This calculation approximates that clearing forestland causes a loss of 25% of soil carbon, and new forestland increases soil carbon from the 75% mark to full saturation, as suggested by Smith et al. (2006). We assume that for southern states west of Tennessee and Alabama, inclusive, soil carbon for loblolly stands is 41.9 metric tons of carbon per hectare and 72.9 metric tons per hectare otherwise (Smith et al., 2006). We further assume that approximately half of the study area falls in each of these regions.

Discounted Welfare Comparisons

In order to quantify the extent to which the scenarios and model assumptions could influence policy analysis, we conduct welfare analysis. For each of the 164 model runs, we calculate the consumer and producer surplus using a geometrical approximation of the nonlinear supply and demand curves. We sum across products then discount all measures to the base year to obtain a present value of each run. We take the average of scenarios with climate change within their respective scenario, collapsing these measurements down to four. Combined with the four scenarios without climate change, we thus obtain eight aggregate measures each of consumer and producer surplus.

To compare the welfare measures, we calculate percent error (Equation 2.2) in two ways: (1) within scenarios, comparing the climate change cases to their corresponding case without climate change, and (2) among scenarios, comparing each scenario to the most sophisticated model, the fully economic case with climate change. In Equation 2.2, x_o is the *other* value and x_t is the *true* value. In the within-scenario calculations, we consider the case with climate change to be true. In the among-scenario calculations, we consider the fully economic case with climate change to be true.

$$(x_o - x_t)/x_t \tag{2.2}$$

Results

From the scenario permutations, we have results from 164 runs of the SRTS model. We index removals, prices and inventories to a value of 100 in the 2013 base year such that changes over time are readily comparable to the starting point.

Impacts of Representative Forest Market Pathways

Figure 2.2 shows removals of pine pulpwood and pine sawtimber over time. Harvests drop asymptotically and remain flat at zero for the pure biological case, as designed. The two harvest mode cases proceed in a linear, deterministic fashion because the model acquires the requested harvests regardless of prices in harvest mode. The removals in the constant demand scenario remain constant at the current level, but under the quantity demanded scenario, rise upward until 2035, remaining flat at the 150% level in both sawtimber and pulpwood scenarios. The fully economic case, however, adapts away from the strictly prescribed demand trajectory (as shown in the quantity demanded case) because rising pine pulpwood prices and falling pine sawtimber prices cause opposite shifts in harvests. Furthermore, because pine sawtimber harvests also produce pine pulpwood, the fully economic case produces a greater proportion of pine pulpwood removals from sawtimber harvests, compared to the quantity demanded case. The sawtimber removal trends are quite similar under quantity demanded and fully economic scenarios, but the pulpwood removal projection under the fully economic mode is always lower than under the quantity demanded case.

These varying harvest levels cause corresponding long-term feedbacks in the pine pulpwood and pine sawtimber inventory (Figure 2.3). The pure biological case shows pine pulpwood inventory almost double over the study period, and pine sawtimber triples. In the pure biological case, we see the imprint of the historical forest inventory structure moving forward through time, undulating in the long-term. The constant harvest case produces the second highest inventory, and the quantity demanded case pushes inventory to the lowest point in both pulpwood and sawtimber. Because the fully economic case is responsive to prices, pine pulpwood inventory rebounds in the middle of the study period and pine sawtimber gains inventory later, partially due to pine pulpwood inventory aging into the sawtimber product class. Pine pulpwood inventory in both the fully economic and the quantity demanded scenarios drops back to the original level in the long term, but pine sawtimber inventory in the fully economic case is projected to be approximately 116% higher than that of the quantity demanded scenario in 2060 and beyond.

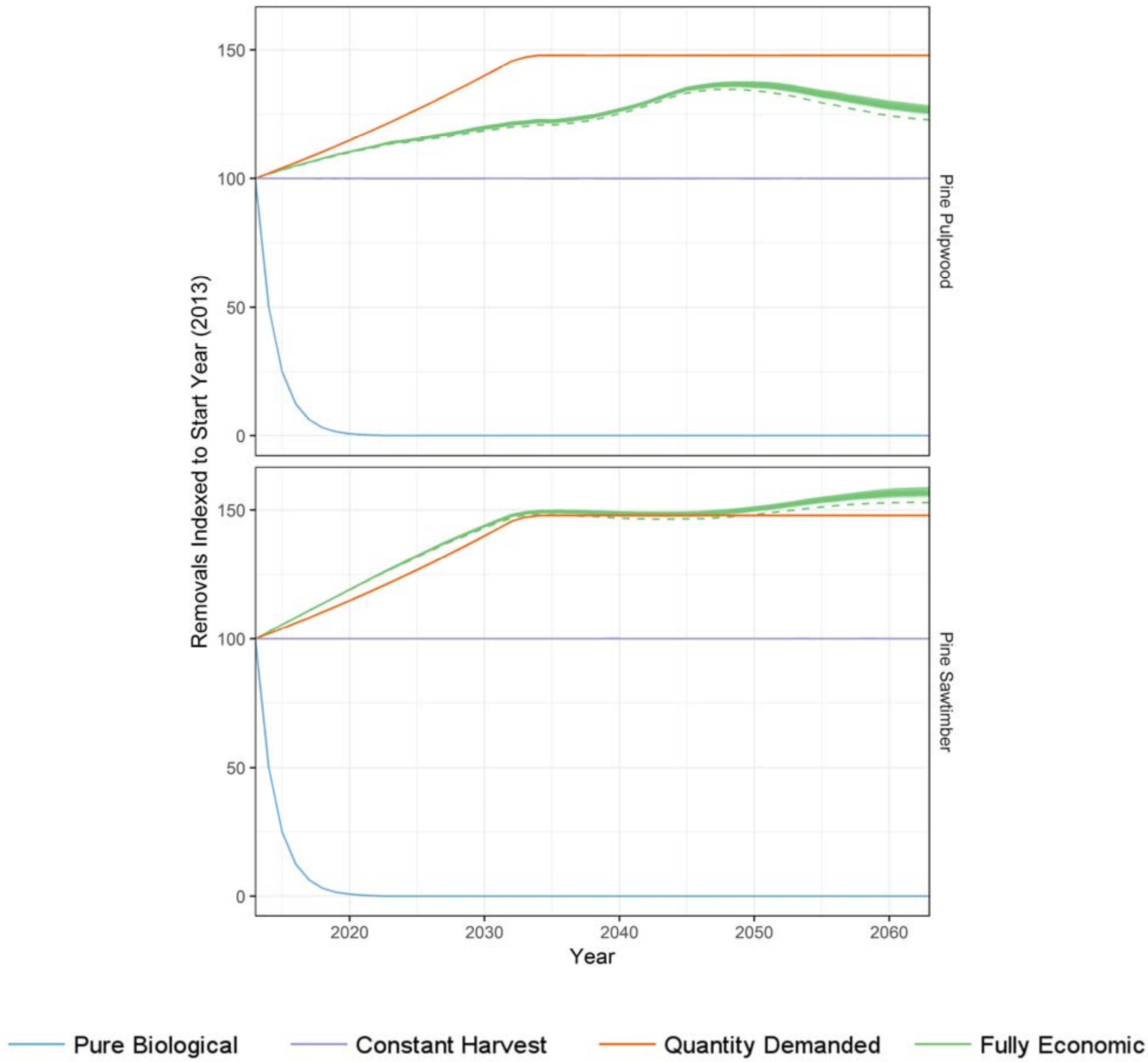

Figure 2.3. Indexed pine pulpwood (top) and pine sawtimber (bottom) removals by representative forest market scenario. Dashed lines indicate the case without climate change. Solid lines are results from 20 climate models each for RCP scenarios 4.5 and 8.5. Only the fully economic case diverges from the case without climate change, among scenarios, since it allows removals to adjust to prices.

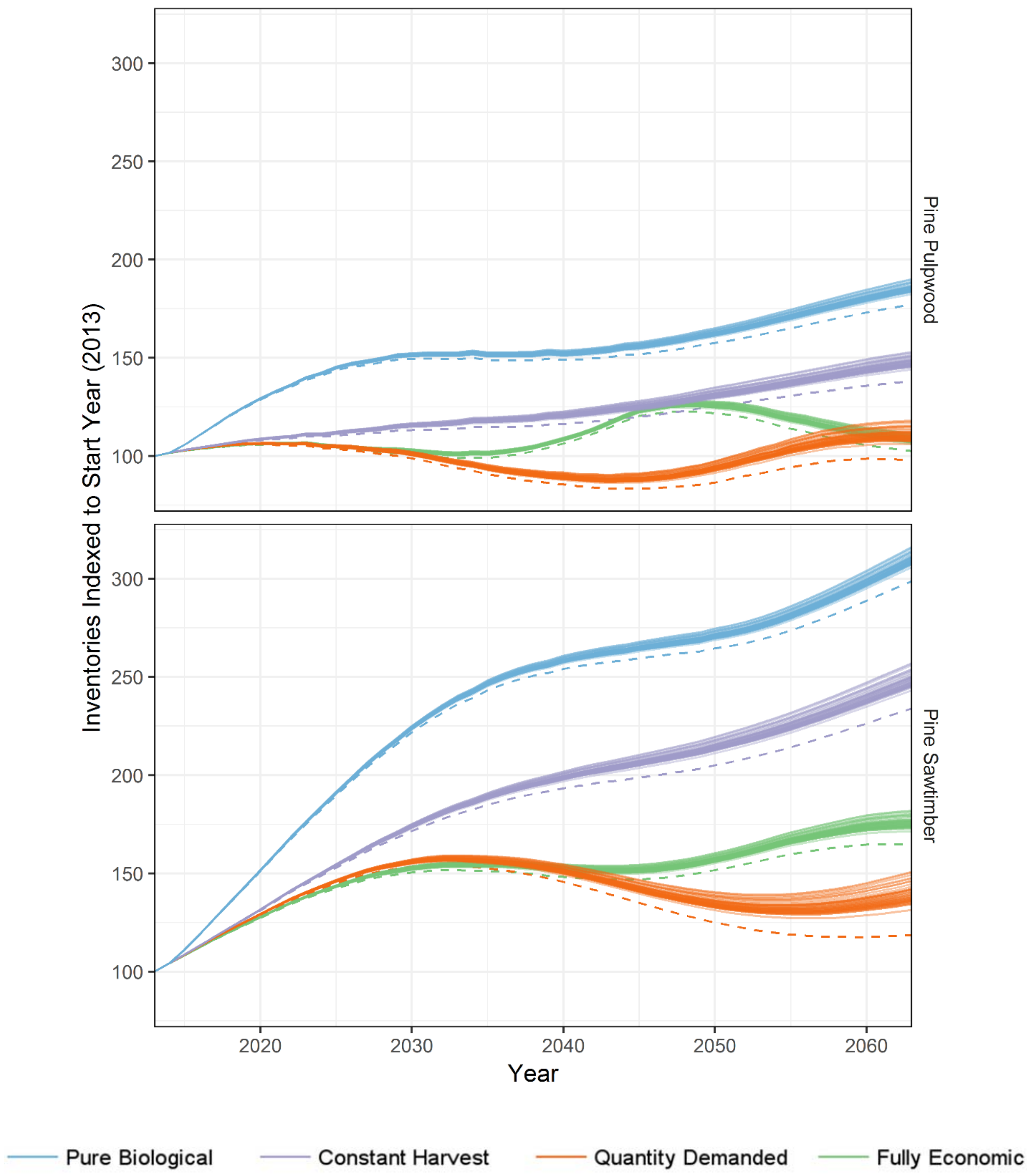

Figure 2.4. Indexed pine pulpwood (top) and pine sawtimber (bottom) inventory by representative forest market pathway. Dashed lines indicate the case without climate change. Solid lines are results from 20 climate models each for RCP scenarios 4.5 and 8.5.

Prices

Prices are meaningful for the constant harvest, quantity demanded and fully economic scenarios, but implied prices for the pure biological case are presented in Appendix B (Figure B.3). For the quantity demanded and constant harvest scenarios, the prices are an effect of chosen harvest quantities, whereas the fully economic scenario uses prices to determine economically optimal harvest quantities. The fully economic scenario also uses prices in land use change calculations, in which high timber prices cause conversion of marginal agricultural land to forestry and vice versa.

In all cases, the prices under carbon fertilization are lower than in the case without carbon fertilization (Figure 2.4). The quantity demanded scenario produces up to a six-fold increase in pine pulpwood prices by the 2040s due to the lack of a price mechanism to dampen harvest quantities. This scenario produces the highest long-term pine sawtimber prices as well.

Since harvests in the quantity demanded scenario do not react to price, price becomes an exogenous scarcity measure governed by the supply curve alone. During the ramp-up phase for demand, inventory growth outpaces demand growth for pine sawtimber but falls short of demand growth for pine pulpwood, resulting in a price decrease and a price increase, respectively. In contrast, the constant harvest case maintains low implicit prices for both products, declining over the study period. Recalling Figure 2.2, these trends reflect the expected dynamics. With a stationary demand curve in the constant harvest case, shifting timber inventories become a dominant cause of price trends. And with low removals in the constant harvest case, the total inventory surges, reducing prices.

Under the constant harvest scenario, both pine sawtimber and pulpwood prices are projected to decline gradually by about 80% by the end of the study period. The fully economic case projects pine pulpwood prices fluctuating at levels between the two harvest mode scenarios with an upper bound of twice the starting price. The fully economic case also displays slightly higher sawtimber prices in the first few decades of the study period due to the previously noted higher removal level and falls between the two harvest mode scenarios over the long run.

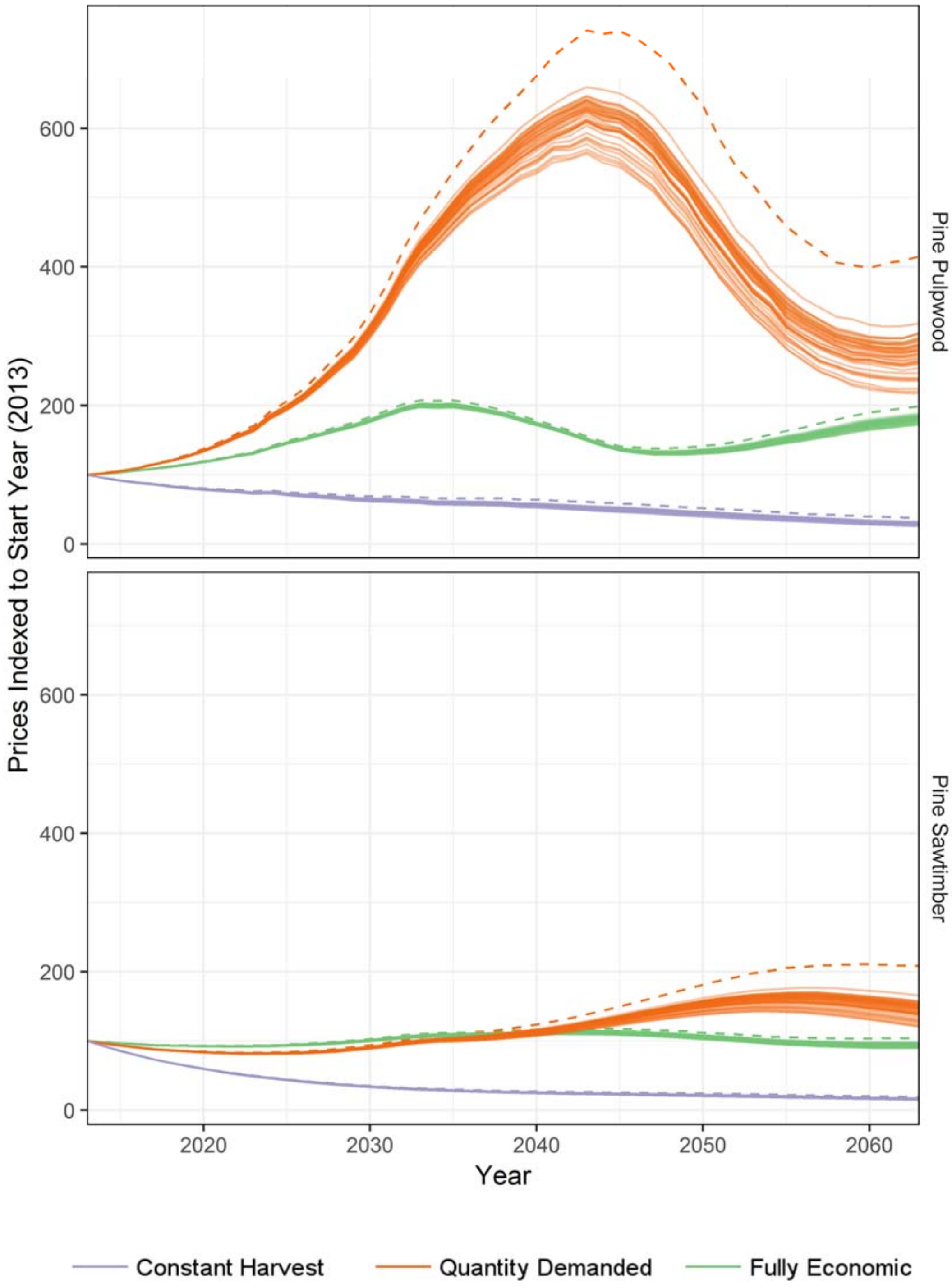

Figure 2.5. Indexed pine pulpwood (top) and pine sawtimber (bottom) prices for three representative forest market pathways. Dashed lines indicate the case without climate change. Solid lines are results from 20 climate models each for RCP scenarios 4.5 and 8.5.

Forest Carbon

The inventory results proxy forest carbon trends because live tree carbon is the bulk of forest carbon, but Figure 2.5 shows the forest carbon stock over time in absolute terms, including pools for live trees, standing dead trees, understory, down and dead trees, and forest floor. The pure biological and constant harvest scenarios accumulate approximately 1.5 billion and 1 billion metric tons of carbon, respectively. The quantity demanded scenario goes through a cycle of net carbon gain then net loss, ending slightly above the starting point. Thus, the carbon stock in the quantity demanded scenario is effectively unchanged over the long term. Forest carbon in the fully economic scenario increases by approximately 0.3 billion metric tons and levels out, remaining stable until the end of the study period. In contrast to the quantity demanded scenario, the fully economic scenario unambiguously gains in forest carbon.

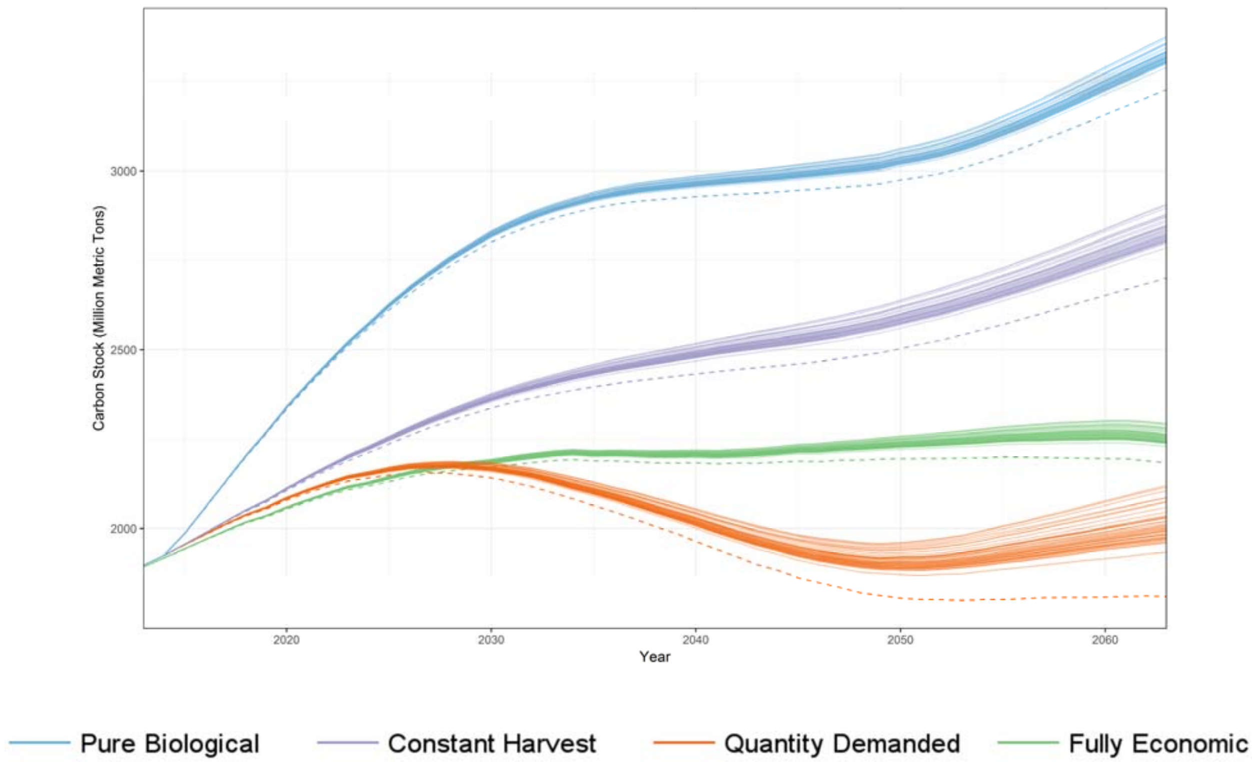

Figure 2.6. Total pine carbon stock under four representative forest market pathways.

Forest Area and Soil Carbon

We also present additional nuanced results on forest carbon dynamics that should inform the interpretation of Figure 2.5. Recall that the fully economic case allows for land use change, whereas the other scenarios do not. Forest hectares peak at approximately 28.5 million hectares in the early 2030s, an increase of about 2.5 million hectares from the starting period (Figure 2.6). However, by 2035 when timber demand plateaus, forest hectares begin to decline. By the end of the study period, the case without climate change ends with a net gain in forest hectares, but climate model cases show an average decline of 0.5 million hectares.

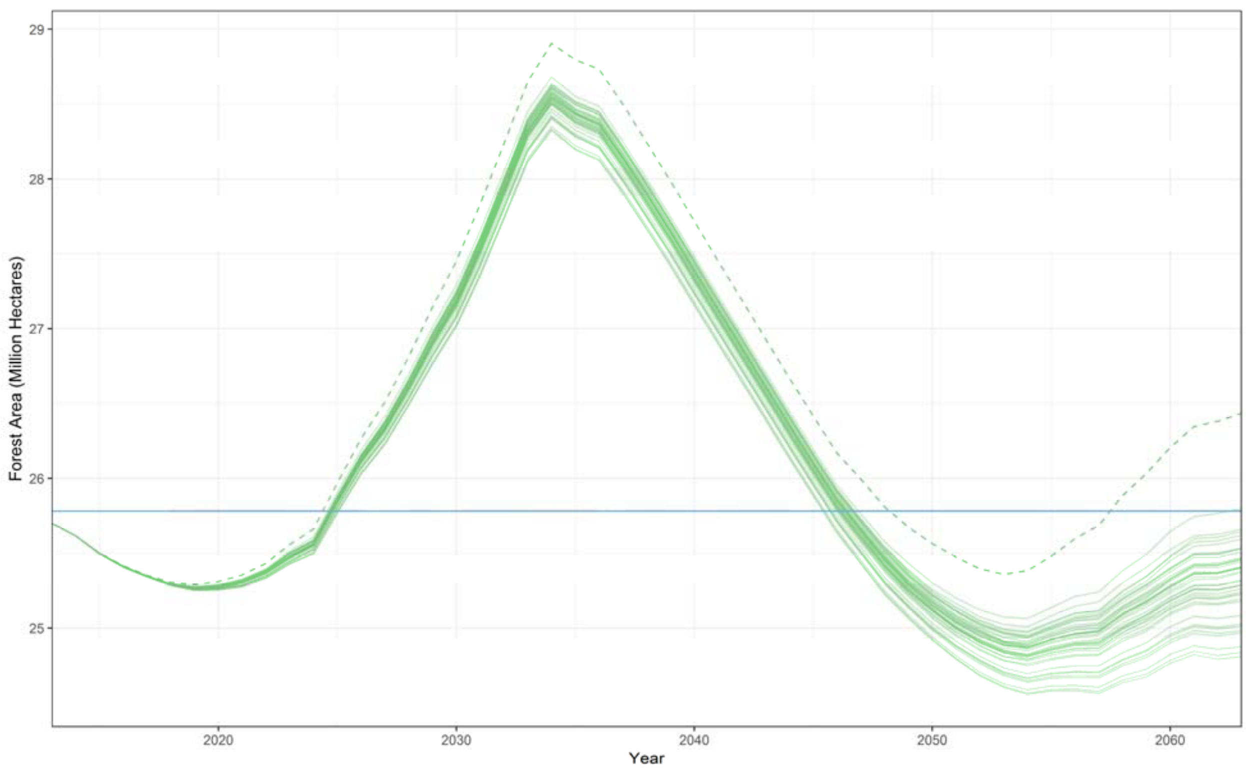

Figure 2.7. Total pine area under the fully economic case under climate change (solid green line) and without climate change (dotted green line), compared to the other cases which did not allow land use change (horizontal line).

Conversion of land to and from forestry has consequences for soil carbon. Using Smith et al. (2006) carbon estimates, soil carbon increases by about 35.9 million metric tons at peak forest area and decreases by 7.1 million metric tons in the US south at the end of the study period, relative to the starting period. These fluctuations are small compared to the roughly 300 million metric tons of forest carbon accumulated over the study period.

Discounted Welfare Comparisons

The effects of carbon fertilization on forest inventory are more prominent towards the end of the study period, as is the divergence in prices within scenarios. The comparisons of discounted producer and consumer surplus within the four scenarios show that the inclusion of carbon fertilization has limited impact on welfare analysis (Table 2.2). The differences in the pure biological cases with and without climate change are negligible since the scenario pushes demand to zero.

The fully economic scenario allows demand to adapt to supply, stabilizing and suppressing welfare measurement differences. However, the results show that the case without climate change slightly overstates producer surplus and understates consumer surplus compared to the case with climate change, due to increased supply in the climate change case.

The constant harvest scenario uses a stationary demand curve. In this case carbon fertilization is expected to shift the supply curve to the right through the inventory supply shifter. The welfare measures show that the case without climate change gives a slightly higher producer surplus, attributable to higher prices in that case. Differences in consumer surplus is zero.

Finally, the quantity demanded scenario shows the largest differences between cases. Omitting carbon fertilization from the model run means overstating producer surplus by 12% for this scenario. Recalling Figure 2.4, the large price differences between cases at the end of the study period are a prime explanation for this result.

Table 2.2. Percent error comparisons within scenarios by producer surplus (PS) and consumer surplus (CS) ranked by absolute value of maximum error.

Rank	Scenario	PS Error	CS Error
1	pure biological	-0.01%	-0.02%
2	fully economic	1.25%	-0.97%
3	constant harvest	2.07%	0.00%
4	quantity demanded	11.94%	1.09%

Among the scenarios, the fully economic scenario with climate change is the most detailed in behavioral and biophysical terms. It is useful to understand how alternative modeling assumptions compare to this case in welfare terms. Table 2.3 makes this comparison and reiterates what visual inspection shows in the preceding figures, that the quantity demanded case is the closest proxy of the fully economic scenario, followed by the constant harvest and pure biological scenarios. The cases that include carbon fertilization tend to show less error, and the compounding of simplifying assumptions leads to greater errors in producer surplus.

Table 2.3. Percent error and assumption comparisons among scenarios by producer surplus (PS) and consumer surplus (CS) ranked by absolute value of maximum error.

Rank	Scenario	PS Error	CS Error	Carbon Fertilization	Demand	Demand Mode	Land Use Change
1	fully economic (cc)	-	-	yes	increase	yes	yes
2	fully economic	1.2%	-1.0%	no	increase	yes	yes
3	quantity demanded (cc)	30.2%	-0.4%	yes	increase	no	no
4	quantity demanded	45.8%	0.7%	no	increase	no	no
5	constant harvest (cc)	-56.4%	-38.6%	yes	constant	no	no
6	constant harvest	-55.5%	-38.6%	no	constant	no	no
7	pure biological (cc)	-88.2%	-74.4%	yes	decrease	no	no
8	pure biological	-88.2%	-74.4%	no	decrease	no	no

Discussion

The results reveal some important features regarding the interaction among forests, carbon fertilization, and timber markets. The study findings are consistent with previous related studies. Regardless of scenario, results demonstrate an unequivocal increase in forest inventory in all climate change cases, relative to the case without climate change. The difference at the end of the study period between cases with- and without-climate change are approximately equal to the range among results of cases with climate change. Correspondingly, prices are lower and forest carbon stocks are higher with carbon fertilization than without. Our findings are similar to Sohngen and Tian (2016), which also reported higher sawtimber and pulpwood harvests and lower timber prices (15% lower than the baseline) under climate change scenarios. With these features of the results we can draw the conclusion that studies which omit carbon fertilization effects of climate change have understated future forest inventory and forest carbon and overstated price levels.

As the figures and welfare analysis showed, the four scenarios themselves differ more from each other than the cases with and without climate change. This implies that demand scenarios and differences in modeling assumptions potentially have a greater effect on projections than the carbon fertilization effect. Furthermore, this means that the choice of model and modeling assumptions can have a more profound effect on projections about forests, hence policy recommendations, than the inclusion of carbon fertilization effects.

There are also important observations to make about the scenarios in terms of their time paths. Time paths of prices and harvest quantities are critical inputs into any policy analysis, especially in terms of discounted costs and benefits. Recall that the constant harvest and quantity demanded scenarios use the so-called harvest mode, which employs no price feedback on harvest quantities. In each of the response variables, these two scenarios serve roughly as bounding limits for the fully economic scenario. The quantity demanded case shows the largest long-term difference between the cases with and without climate change. The higher harvest intensity in pulpwood associated with this scenario has long-term inventory consequences in sawtimber. However, this higher harvest intensity also allows the quantity demanded case to plant more young trees, which have the most to gain from CO_2 fertilization as it ramps up over time. The constant harvest case, in contrast, shows dynamics dominated by inventory growth. The timing of peaks and troughs for the fully economic case diverges from both the constant harvest and quantity demanded cases. The quantity demanded scenario shows the lowest inventory and highest prices by the end of the study period. In the fully economic case, price increases encourage both a moderation of harvests and conversion of land to forestry, each offering an escape valve for prices.

Because the quantity demanded scenario ignores prices, it loses some interconnectivity between product classes that we see in the fully economic case. The fully economic scenario reduces pine pulpwood harvests and increases pine sawtimber harvests due to price effects. This causes more pulpwood-aged trees to later grow into the sawtimber age classes, producing a positive effect on forest inventory and forest carbon for the fully economic scenario. But the lack of price coordination in the quantity demanded case results in an unrealistic six-fold price surge for pine pulpwood in the later years of the study period. The differences between the quantity demanded and fully economic cases reveal that the decision to treat prices as exogenous or endogenous, respectively, can have substantial impacts on the pathways of harvests and forest inventory.

The results of this study track forest carbon and for the fully economic scenario give an approximation for soil carbon. Carbon stored in forest products is not analyzed in this study, but the fully economic case suggests that lower prices and higher removals in the carbon fertilization cases would lead to more carbon storage in forest products compared to the case without climate change. Similar to this result, Tian et al. (2018) reported that U.S. forests will remain a carbon sink for the coming century, primarily due to intensively managed forests. As previous studies have shown, the final use of pine pulpwood, whether for building materials or biomass, would affect the carbon balance. The present study makes no claim about final product uses, however like previous studies (e.g. Kim et al., 2018), land use in forestry responds positively to increasing forest product demand. However, the present study shows that forest growth, spurred by carbon fertilization, would eventually cause forested area to decline as prices decline.

Study Limitations

The analysis in this paper imposes some necessary boundaries. Particularly, the focus of this paper is climate change impacts on pine plantations, which currently account for over two-thirds of pine harvests in the southern US. We also include naturally regenerated pine forests which have historically been the primary natural forest converted to pine plantations. The impact of including natural pine forest was small. We focus on long term precipitation, temperature, and CO2 effects on forest growth, but do not include considerations of increased risk due to episodic events such as wildfire, hurricanes or pests. If stock effects of increasing frequency had been included in the analysis, we would expect the resulting reduction in inventory to cause leftward shifts in the supply curve in affected regions. Such a shift would increase prices temporarily, leading to some alleviation of downward price trends resulting from CO_2 fertilization. Following the logic of the results, the stabilization or increase in prices could then have a positive impact on keeping land in the forestland use. However, a behavioral response to increased episodic risks could be shorter timber rotation lengths, making the impact on timber rents and supply more complex in the future. Furthermore, the analysis did not contain linkages to global markets, which could have provided a means of tempering large price increases or decreases, potentially providing additional support for higher sawtimber prices or a lower pulpwood prices in some of the model runs.

Given that the model runs in this analysis extend beyond 2060, we should acknowledge the additional uncertainty stemming from structural changes not included in the analysis. The results did not consider the impact on forest productivity of improved tree genetics through plant breeding or cloning. Faster growing trees on the landscape would have the effect of amplifying the results of this analysis. Nor do the results identify the source of the structural change assumed in the increasing demand scenario. Future developments in wood products could cause significant deviation from the demand trajectories used in this analysis.

Since CO_2 fertilization of hardwoods is not included in the data, the analysis also omits hardwood and mixed hardwood stands, which occupy the majority of forestland but less of the forest economic activity in the US South. The inclusion of increased hardwood growth from climate change would have resulted in an analogous increase in forest carbon in the hardwood forest types, and price decreases of a similar nature would be expected. Furthermore, the analysis does not include ecological or biodiversity changes resulting from changes in forest growth or extent. The loss of pine forestland in the long-run under climate change cases suggests a loss in biodiversity, to the extent that pine plantations promote biodiversity beyond agricultural land.

Conclusion

While at first glance carbon fertilization could be a silver lining for forests under climate change, the present study shows that the implications are more nuanced. While rising prices would contribute to additional forest area in the medium term, carbon fertilization would eventually undermine and potentially reverse this trend in forest area, while still adding to total forest carbon. In the interest of capturing carbon through forestation and keeping it in forests, forest soils and forest products, policies that directly or indirectly support higher timber prices would be effective tools. Higher prices could come from a combination of supply restrictions or demand stimulations. Payments for afforestation with conservation easement-style restrictions, or a forestry equivalent of the conservation reserve program would be candidates for supply side solutions. For solutions based on demand, subsidies for the use of cross-laminated timber in built structures, replacing carbon intensive steel and concrete, could potentially keep timber prices high enough to retain more forestland. Unforeseen technological changes in the forest products industry could either reduce the demand for stumpage, in the case of efficiency, or increase demand, in the case of timber products not yet developed.

This study demonstrates the effects of carbon fertilization on timber markets in the US southeast under increasingly sophisticated economic assumptions. In doing so, the study shows that previous business as usual scenarios that did not account for carbon fertilization would have underrepresented forest inventory and overrepresented prices. These differences would have caused bias in welfare measures used for policy analysis. While the analysis is limited in its ability to provide guidance for developing policy, which should reflect linkages across economic sectors and international markets, the results show that detailed regional models can offer valuable insights to local resource and market dynamics.

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CHAPTER 3:
Forest Landowner Topologies: from Parcels to People

Introduction

Classically, researchers divide forest landowners in the United States into two groups—industrial and non-industrial[7]. Industrial forestland owners, ostensibly driven by commercial aims, could summarily be described as interested in harvesting timber (Kline & Alig, 2005) and more responsive to timber prices (Prestemon & Wear, 2000). In contrast, non-industrial private forest (NIPF) landowners have been described as having

[7] This taxonomy, developed by the US Forest Service, initially distinguished between vertically integrated firms and those who only owned timberland. Due to tax policy changes in the 1990's, vertical integration became a less favored ownership structure.

diverse reasons for owning forestland, associated with some combination of financial and non-financial preferences (Bengston, Service, Butler, & Asah, 2008; B. J. Butler et al., 2016) and consequently show a lower harvest response to timber prices as measured by a price elasticity of supply (Prestemon & Wear, 2000).

As undirected providers of ecosystem services and suppliers of annual timber harvests, NIPF landowners (hereafter *forest landowners*) collectively provide a substantial portion of market and nonmarket goods and services. The more complex or nuanced behavior among forest landowners has driven research in the preceding decades. Considerable research was devoted to understanding how NIPF preferences impact their propensity to harvest, measured under various notions of *availability* (Beuter, Johnson, & Scheurman, 1976; de Steiguer et al., 1989; Gregersen, Houghtaling, & Rubinstein, 1979; Holley, 1970; Kingsley & Powell, 1977; Knight & McClure, 1968, 1974; Van Hess & Hedlund, 1980). Related is the question of reforestation by NIPF landowners, affecting timber supply in the future. Early work on this question found evidence that investment theory was a satisfactory explanation of reforestation, with significant and positive associations between income levels and knowledge of cost-sharing policies (Royer, 1987; Royer & Moulton, 1987).

Most analyses examining NIPF landowner behavior have been static in nature, but to predict long-term consequences of forest landowner behavior, it is useful to incorporate empirical observations and theory into dynamic models. The purpose of this paper is to contribute to this literature by developing an empirical description of both the physical and preferential landscape occupied by forest landowners, with the goal of providing empirical inputs into a dynamic model of forest landowners. A dimension of this investigation is to seek a better explanation of price responsiveness.

Literature Review

Recent studies of forest landowner behavior fall into the categories of econometric, typological and dynamic. The discussion below summarizes these three areas or research.

Probit, Logit and Other Models

Most of the econometric or statistical models used to predict forest landowner harvest behavior have been probit, logit or ordinary least squares (OLS) models (Beach, Pattanayak, Yang, Murray, & Abt, 2005). The analytical advantage of probit and logit models is that they typically model a binary response variable. Because harvests either occur or do not occur on a piece of land, this model form is both convenient and realistic.

Through 2005 this literature is extensively reviewed and summarized in Beach et al. (2005), which determined that the variables most commonly used and most often found to be significant in describing forest landowner harvest behavior (and their direction of influence) are timber prices (+), plot size (+), growing stock (+) and income (–). However, in subsets of studies significant variables with a clear overall association included land value (–), harvesting cost (–), policy assistance (+), tax rate (–), education (+), age (–), site quality (+), amenity values (–), road accessibility (+) and tree biodiversity (–) (Beach et al., 2005). Reforestation among forest landowners appears to be primarily driven by planting costs (–,+) and cost share (–,+) and assistance (+) programs (Beach et al., 2005).

Recent papers have considered additional model designs. For an area in western Virginia, harvest intensity (percentage of an area harvested) was shown to be influenced by land and landowner characteristics, based on a logit model of multiple bounded discrete choice survey results (Vokoun, Amacher, & Wear, 2006). Absenteeism (–), the number of forested acres (–,+), the length of ownership (+), number of children (+), and the presence of built structures (–,+) showed significant marginal effects, in which the direction of influence changed with respect to harvest intensity (Vokoun et al., 2006). A multinomial logit model is less commonly used for propensity to harvest, but has been used to explain tropical deforestation (Mahapatra & Kant, 2005), forest landowners response to climate change (Blennow, Persson, Persson, & Hanewinkel, 2016), the relationship of urbanization and timberland (Zhang & Nagubadi, 2005), and willingness to accept bids for biomass (Shivan & Mehmood, 2012).

Recent research has examined additional explanatory variables. A paper studied the effect of gender on forest management and found that female forest land landowners were more likely to be concerned with climate change, less likely to own their land for recreation, hunting or timber, and more likely to be passive managers (S. M. Butler, Huff, Snyder, Butler, & Tyrrell, 2018).

Researchers have also investigated spatial dimensions of forest landowner behavior, hypothesizing that proximity to neighbors, mills and sources of information affect landowner behavior. For a multi-county area in Missouri, a Bayesian spatial autocorrelation probit model showed a significant influence of geographic and social proximity (+) on willingness to harvest, in addition to timber preference (+), previous harvest experience (+) , age (–), and income greater than $50,000 (+) (Aguilar, Cai, & Butler, 2017). A study of Virginia landowners examined characteristics that significantly affected cooperation between neighboring landowners (Vokoun, Amacher, Sullivan, & Wear, 2010). Significant factors included household income (+), forested acres (+), previous experience selling timber (+), the presence of structures on the property (–), investment objective (+), college education (+), whether they hunted on their land in the past year (–), the number of private individuals owning neighboring parcels (NPI) (–), and whether they hunted or fished on a neighbor's property (+) (Vokoun et al., 2010).

Landowner Typologies

Landowner typologies are another stream of literature aimed at understanding forest landowner behavior. The purpose of a typology is to divide a complex social phenomenon into categories more easily studied, though still heterogeneous. These studies have used forest landowner surveys to elicit notions of subgroups or clusters among landowners (Favada, Karppinen, Kuuluvainen, Mikkola, & Stavness, 2009; Finley & Kittredge, 2006; Majumdar, Laband, Teeter, & Butler, 2009; Majumdar, Teeter, & Butler, 2008). These studies tend to group landowners based on common management preferences, such as "Thoreau, Muir and Jane Doe" (Finley & Kittredge, 2006) or "Timber, Nontimber, and Multiple-objective" (Majumdar et al., 2008). Additional European examples are detailed in Sotirov, Sallnäs, & Eriksson (2017).

Areas for Development

The most recent and thorough review of the forest landowner literature analyzed 129 articles published from 1970 to 2014 (Silver, Leahy, Weiskittel, Noblet, & Kittredge, 2015). The paper ranked published articles on their level of empiricism according to a five-category evidence rating scale ranging from "Highest" to "Lowest," finding that only five reviewed studies used actual harvest behavior ("Highest"), whereas the rest used statistical methods to correlate landowner characteristics to past harvest behavior

(“Higher”) or harvest attitude (“Lowest”). The review notes that parcel size (+) , price per acre from harvesting (+), income (–,+), absenteeism(–), farming activities (–,+), education (+) and age (–) are among the most cited and significant predictors of intention to harvest or actual harvest behavior (Silver et al., 2015).   Studies reviewed by Silver et al., (2015), regardless of whether they received a high or low evidence rating, predicted the same direction of influence for those variables with a definitive direction. For variables with mixed results on direction of influence (income and farming activities), most studies with lower evidence ratings agree with most high-ranked studies, which suggests that the effort required to obtain actual harvest data may not yield a marginal benefit in research results. Furthermore, an attribute of studies not considered by the evidence rating criteria is whether the study described behavior over time.

Dynamic Models of Forest Landowners

Forest succession drives market and non-market benefit streams. Forest management decisions are timing decisions. However, there are few examples of dynamic analyses. The first and primary examples of such efforts are dynamic econometric models. A probit analysis on FIA plot data, incorporating timber value from two periods, distance from roads and plot volume, found no significant effect of timber value on harvest probability by non-industrial forest landowners or on public land, but did find timber value to be significant for industrial landowners (Prestemon & Wear, 2000). Another model, the Sub-Regional Timber Supply (SRTS) model, differentiates price elasticities of supply between corporate and non-corporate timberland owners, categories descended from the industrial/non-industrial delineation in FIA data (R. Abt et al., 2009). However, in practice SRTS model runs do not implement this feature due to a lack of current empirical research on price elasticity of supply differences between corporate and non-corporate timberland owners.

A diverse portfolio of landowners with different objectives implies that agent-based models might provide additional insight. This approach could exploit nuanced differences rather than impose binary pre-determined categories. Agent-based models (ABMs) are increasingly used in forest economics and forest science[8].The first known attempt to dynamically model forest landowner types was the Forest Agent-Based Landowner Economy (FABLE) model, in which harvest behavior was governed by agent type, timber price, growing stock, discount rate and amenity values (Henderson, 2011). The outcomes of a later version of the model were validated by estimating inventory elasticities and price elasticities of supply and demand, then comparing those values to values found in

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[8] (CenRADS, 2016; Henderson, 2011; Henderson & Abt, 2016; Hiesl, Waring, & Benjamin, 2015; Holm, Thees, Lemm, Olschewski, & Hilty, 2018; Huff et al., 2015; James, 2018; Kostadinov, Holm, Steubing, Thees, & Lemm, 2014; Leahy et al., 2013; Rammer & Seidl, 2015; Seidl, Albrich, Thom, & Rammer, 2018; Sotirov et al., 2017; West et al., 2018)

the literature (Henderson & Abt, 2016). Another agent-based, dynamic model of forest landowners for the state of Maine used empirical data on forest management objectives in combination with a discrete set of randomly distributed beliefs and management actions to model the forest economy (Leahy, Reeves, Bell, Straub, & Wilson, 2013). A third example modeled the forest sector by allocating to agents empirically derived objectives and driving the model dynamics with a peer-to-peer network, in which harvests were determined by trust of foresters (Huff, Leahy, Hiebeler, Weiskittel, & Noblet, 2015).

Each of the preceding ABMs contain strengths and weaknesses in addition to specializations toward distinct research questions[9]. Whereas FABLE contained stylized landowner characteristics, the other ABMs contained landowner characteristics based on empirical survey data. While FABLE employed model dynamics consistent with economic theory, the latter two models used relatively ad-hoc mechanisms to determine model dynamics. Black-box or ad-hoc modeling is an issue in agent-based modeling generally (Crooks, Castle, & Batty, 2008). The widespread adoption of the "Overview, Operation and Design" (ODD) protocol[10] has made model structures more transparent by

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[9] To differing degrees, ABMs are distinct from harvest probability models because they attempt to model behavior directly rather than randomly. While characteristics of agents in an ABM may derive from distributions, agent behavior is deliberate. For example, in Henderson & Abt (2016) the bids calculated by agents determine whether harvests occur, and the bids change over time based on new perceptions of the agents' environment.
[10] Appendix C Table C.1 presents documentation for FABLE using the ODD protocol.

standardizing model documentation (Grimm et al., 2006, 2010). However, development in forest economics ABMs beyond ad-hoc notions and toward empiricism is lagging.

Empirical Forest Landowner Characteristics

The objective of this research is to develop a set of empirical relationships for forest landowners with practical applications in agent-based modeling of forest economics. To gain an empirical understanding of forest landowner characteristics in the US, the best available data source is the National Woodland Owner Survey (NWOS). While the survey does not contain direct linkages between prices and harvest behavior, it does contain information about the respondent's physical resource, their management preferences, past harvest behavior, and self-assessed likelihood of future harvests. The data also contain variables that suggest financial interests and motivations. This information can be useful in concert with economic theory to improve dynamic modeling of forest landowners, particularly agent-based models like FABLE.

Methods

The following methodology develops empirical joint distributions of landowner and forest characteristics. The goal is to summarize data in a way that gives flexibility in developing a downstream agent-based model. To preserve future modeling options, we examine the data along three parallel summary pathways: (1) a production possibilities perspective and cluster analysis, (2) a probit analysis, and (3) conditional probability analysis by parcel size.

NWOS Data

The population in the NWOS data is all US land, of which data was only collected for private forest landowners, whether family, corporate, or other private forest owners (B. J. Butler et al., 2016). The data analyzed here includes only family and other private forest landowners. States are the strata in the NWOS sampling design (B. J. Butler et al., 2016), and the probability of being sampled is proportional to size of the parcel (Dickinson & Butler, 2013). As a result, the survey underrepresents small parcels and over-represents large parcels relative to the true population. To obtain population estimates, the Hansen-Hurwitz estimator, which weights observations with selection probabilities, is recommended to adjust for the sampling design (Dickinson & Butler, 2013).

Variable selection

Because the NWOS data set contains potentially sensitive personal information, the entirety of the data set is not available to researchers. Access to the data is limited to conditions of a Memorandum of Understanding between the USDA Forest Service and the cooperating institution and investigators. A preselected subset of variables of interest must accompany an application to use the data. Appendix C Table C.2 contains this list of variables. The data set used for this study included 170 variables and 10,109 observations for 48 states in the contiguous and continental United States.

Production possibilities and cluster analysis

The data set is large, and the first iteration of managing the large numbers of variables was to rely on stated management objectives and the concept of a production possibilities frontier. Following Majumdar et al. (2008), this summary pathway treats the landowner as a utility maximizer, in which the stated preferences of landowners' management objectives represent the combinations of market- and non-market-oriented activities that most satisfy the landowners' needs and desires.

A caveat here is that stated preferences alone do not necessarily translate into real, material outcomes. Decisions in the real world are constrained by exogenous factors such as prices and a forest inventory endowed by historical developments, which together with landowner management preferences produce an outcome. Still, it is fair to view stated management objectives as a psychological constraint, shaping part of an agent-based model's structure.

In the NWOS data, the "reasons for owning wooded land" variables give us stated management objectives. These are Likert scale data, an ordinal scale with five options. Figure 3.1 summarizes the responses to 16 management objective questions. Five variables (Part of Home, Part of Cabin, Part of Farm, Raise Family, and Non-timber Products) had greater than 25% of responses in the "not applicable" category. Some disagreement exists about whether analyses should treat Likert data as interval data. Attempts to find means and standard deviations of Likert data requires, for example, treating one person's "moderately important" rating the same as another person's "moderately important" rating. Since these ratings are subjective, they may not actually represent the same level of conviction.

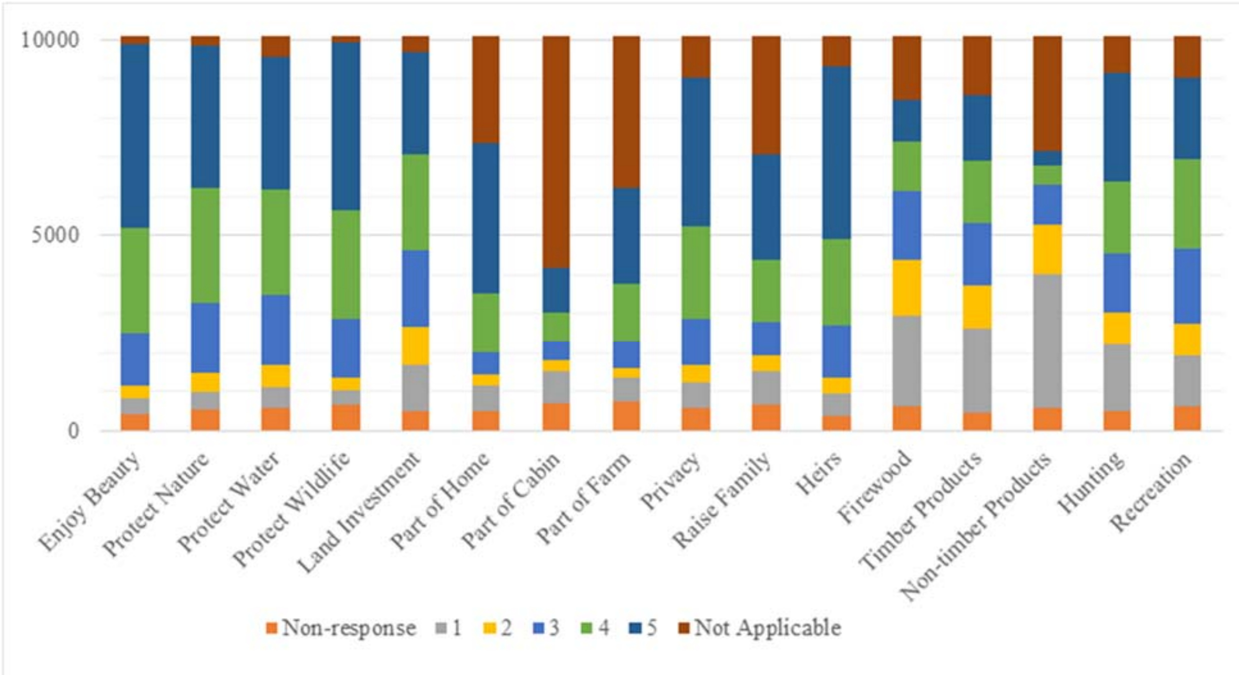

Figure 3.1. Proportions of National Woodland Owner Survey responses for 16 reasons for owning wooded land. Numbers indicate: (1) Not important, (2) Of little importance, (3) Moderately important, (4) Important, and (5) Very important. The total sample size is 10,109.

However, under the assumption that a respondent's own ratings are ordinally consistent, performing mathematical operations on these individual level data is meaningful. We develop a relative timber objective (RTO) index to compare relative preferences of timber harvesting to a set of non-timber alternatives. The index does not include the five variables with high non-response (>25%). In order maximize the polarization of the RTO index, the calculation uses Majumbdar et al. (2008) as a guide for selecting non-timber variables. These variable include enjoying beauty, protecting nature, protecting water, protecting wildlife, privacy, and recreation (Majumdar et al., 2008). The following equation produces the RTO index:

$$RTO_m = \frac{T_m}{\frac{\sum_n \delta_n N_{mn}}{\sum_n \delta_n}} \tag{3.1}$$

where m is a survey observation[11], n is an index of non-timber preferences, and δ is a delta function that equals 0 in cases of non-response and 1 otherwise[12]. To retain more observations responses of "not applicable" for the timber preference were coded to a value of 0.1, which is half the value that can be achieved with maximum non-timber responses of 5 and a response of 1 for timber. The code used for non-response observations that could not be reconciled in this manner is "NA." After performing the calculations in Equation 3.1 for each survey response and eliminating non-response, the remaining sample size is 7,420.

The RTO index produces non-unique results but is useful for a few reasons. First, it collapses multiple preferences into a single measure. Second, it normalizes survey responses relative to the survey responder's own subjective anchor. This feature allows for better cross-comparison with other survey responses.

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[11] Ranging from 1 to 10,109

[12] Practically, the delta function is an option to remove "NA" values. The pseudocode version of the denominator of Equation 1 is simply:
ntmean ← rowMeans(nontimbervector, na.rm = TRUE, dims = 1)

Subjective management preferences held by landowners are not readily available in data sets outside NWOS. In order to connect RTO to objective measures in external data sets and given the empirical findings in the reviewed literature (Beach et al., 2005; Silver et al., 2015), we investigate the connection between RTO and parcel size (wooded acres). We use graphical analysis and bivariate kernel density estimation to establish what relationship RTO has to parcel size.

The RTO index polarizes stated preferences by design, but it is only useful if it explains behavior. Propensity to harvest is the key variable of interest for this analysis. It is measured in the survey using revealed and stated preference variables, namely whether the landowner has ever harvested timber and whether they plan to cut timber for sale in the future. We examined the explanatory power of the RTO index and these two variables using hierarchical cluster analysis. Next, bivariate kernel density estimation[13] allows for the visualization of the density of observations in parcel size-RTO space, rather than relying only on scatter plots of raw data.

[13] The kde2d function in the MASS package for R statistical programming software produces this output (Venables & Ripley, 2002). This procedure uses the following settings: (1) default normal reference bandwidth, (2) n = 500 grid points in the x and y directions, and (3) x limits (RTO) on [0.1, max(x)] and y limits (parcel size) on [0, max(y)]. The procedure applies to national scale and state level data.

Probit models

The reviewed literature also used demographic variables to explain harvest behavior. The purpose of the probit analysis is to explain how such additional variables may relate to the self-reported likelihood of future timber harvests. This phase of exploration replicates the standard probit analysis methodology of Aguilar et al. (2017) with the exception of some variable substitutions[14]. This technique involves converting the Likert scale data to binary variables such that "important" and "very important" responses, or "4" and "5" respectively, are coded as "1" and otherwise coded as "0." The dependent variable of interest is willingness to harvest, represented by a stated likelihood of future harvests. The scales of the probit analysis are national and states. The advantage of the national case is that it provides a high sample size. State cases are useful for determining which variables remain significant even with a small sample size, and how the relationships vary by region. Furthermore, we used dummy variables to capture regional fixed effects, with the Interior region as the null case. The state level analysis drops the regional dummy variables and the Past-NA variable. The resulting model is:

[14] In lieu of a gender variable, this analysis uses a variable for management by couples (two owners), and a variable called "coop" representing management by greater than two owners. Instead of sawtimber volume, the analysis uses a "forest cover" variable that measures a parcel's fraction of forestation.

$$
\begin{aligned}
Willing = \beta_0 &+ \beta_1 Beauty + \beta_2 Privacy + \beta_3 Timber + \beta_4 PastHarvest + \beta_5 PastNA \\
&+ \beta_6 Couple + \beta_7 Coop + \beta_8 Retired + \beta_9 Education + \beta_{10} Income \\
&+ \beta_{11} IncomeNA + \beta_{12} WoodAcres + \beta_{13} ForestCover \\
&+ \beta_{14} Pacific + \beta_{15} South + \beta_{16} North
\end{aligned} \tag{3.2}
$$

Table 3.1 defines variables and gives the anticipated effects of each variables and the current related literature.

Table 3.1. Variables for probit analysis: attributes of landowners.

Variable	Coding Rule	NWOS Variables	Predicted Relationship	Reason (a priori)	Reason (a posteriori)
Beauty	1: 4 or 5 0: otherwise	OBJ_BEA	−	Timber harvests detract from aesthetics	(Aguilar et al., 2017; Majumdar et al., 2008)
Privacy	1: 4 or 5 0: otherwise	OBJ_PRI	−	Timber harvests reduce privacy	(Aguilar et al., 2017; Majumdar et al., 2008)
Timber	1: 4 or 5 0: otherwise	OBJ_TIM	+	A preference for harvesting timber increases timber harvests	(Aguilar et al., 2017; Majumdar et al., 2008)
Past Harvest	1: 1 0: otherwise	CUT_LOG_SALE	+	Revealed preference for timber harvests	(Aguilar et al., 2017; Vokoun et al., 2010, 2006)
Past-NA	1: non-response 0: otherwise	CUT_LOG_SALE	NA	NA	NA
Willing	1: 4 or 5 0: otherwise	FUT_CUT_SALE	NA (dependent variable)	Stated Preference for future timber harvests	NA
Couple	1: 2 owners 0: otherwise	OWNERS_NUMBER	−	Increased likelihood that a female is part of decisions. Most individual owners are male.	(Aguilar et al., 2017; S. M. Butler et al., 2018; Umaerus, Högvall Nordin, & Lidestav, 2017)
Coop	1: > 2 owners 0: otherwise	OWNERS_NUMBER	+	Increases rival land uses, thereby increasing tendency to monetize the property; money is fungible	NA
Retired	1: retired* 0: otherwise	OWN1_RET OWN1_AGE	−	Being retired suggests a lower financial orientation	(Aguilar et al., 2017; Beach et al., 2005)

Table 3.2. Continued.

Variable	Coding Rule	NWOS Variables	Predicted Relationship	Reason (a priori)	Reason (a posteriori)
Education	1: ≥ 4[ρ] 0: otherwise	OWN1_EDU OWN2_EDU	+	Positively correlated with wealth and financial motives	(Aguilar et al., 2017; Beach et al., 2005)
Income	1: ≥ 100 0: otherwise	INCOME	+	Positively correlated with wealth and financial motives	(Aguilar et al., 2017; Vokoun et al., 2006)
Income-NA	1: non-response 0: otherwise	INCOME	NA	NA	NA
Wood Acres	1: ≥ 500 0: otherwise	AC_WOOD	+	Positively correlated with wealth and land taxes, which may necessitate harvests	(Aguilar et al., 2017; Beach et al., 2005)
Percent Wood	$\frac{\textit{Wooded Acres}}{\textit{Total Acres}}$	AC_WOOD AC_LAND	NA	Not used in the analysis; used to derive Forest Cover	NA
Forest Cover	1: ≥ 80% 0: otherwise	Percent Wood	+	High forested area is suggestive of higher *timber volume*[ν]	[ν](Aguilar et al., 2017)
South	1: FIA South 0: otherwise	QUEST_STATE	+	Large timber producing area	NA
North	1: FIA North 0: otherwise	QUEST_STATE	+	Timber producing area but less than South	NA
Pacific	1: FIA PNW 0: otherwise	QUEST_STATE	+	Timber producing area	NA

[*] For non-response cases, a backup value derived from age ≥ 62.

[ρ] Either owner has at least an associate degree.

While the choice of the probit model for the analysis results in a loss of heterogeneity due to aggregating the Likert scale survey responses, Figure 3.2 illustrates the underlying logic behind this choice. To relate likelihood of harvesting to timber supply and economic equilibrium is to admit the binary outcome in a given period. Those landowners make up the supply curve to the left of equilibrium have a 100% likelihood of harvesting, and those to the right have no chance. The principle goal of the probit regressions is to identify variables that situate landowners to the left or right of economic equilibrium.

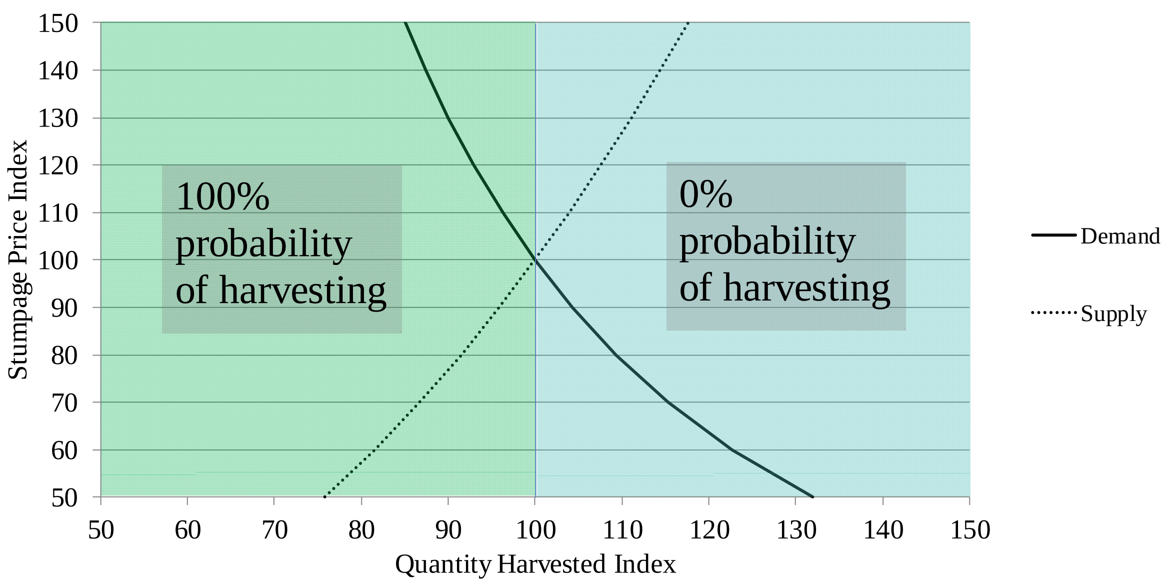


Figure 3.2. Relationship between likelihood of harvesting and economic equilibrium in a given period.

Conditional Probability Tables

The third technique focuses on the practical matter of predicting landowner behavior based on observable attributes. It also seeks to understand the underlying mechanisms of the previous two analytical paths. In agent-based models (ABMs) it is important to connect agents, or landowners, to their environments, or parcels. To build a bottom-up ABM, researchers could use readily available GIS and land cover databases which list parcel sizes to infer landowner behavior. For the state of North Carolina in particular, the NC OneMap database lists the acreage of every parcel in the state[15] (NC Geographic Information Coordinating Council, 2018).

Forested acreage is a subset of total acreage. To understand their relationship we perform a discrete bivariate contingency analysis on the natural logarithm (log) of acreage and the log of wooded acres, using integers as break points and rounding down[16]. This detail may be necessary if available land cover databases only contain total acreage. Next, for each discrete level of log of wooded acres, we examine the likelihood of landowner characteristics at national and state scales.

---

[15] Appendix C Figure C.2 shows a map of North Carolina and the regional distribution of parcel sizes.

[16] Log transformations of highly skewed raw data result in bell-shaped distributions.

Accounting for sampling design

Population estimates based on NWOS data must account for the sampling design. The default strata of the NWOS are states, and the sampling selection is proportional to size. Dickinson & Butler (2013) therefore advise that population estimates of attributes derive from using the unbiased Hansen-Hurwitz estimator:

$$\hat{Y}_{hd} = \frac{A_h}{n_h} \sum_{i=1}^{n_h} \frac{y_{hi} d_{hi}}{a_{hi}} \tag{3.3}$$

where h is the state, i is an ownership (observation), n is the sample size, A is total land area, a is land area, y is the value of the attribute, and d is a binary variable taking a value of 1 if the ownership is in the domain of interest and taking a value of 0 otherwise. We convert the values of attributes to binary representations of Likert scale data as in the probit analysis, with the exception that non-responses are preserved and coded as -1. Converting population estimates into population proportions eliminates the constant terms in Equation 3. This is useful for parameterizing an agent-based model based on the distribution of agent characteristics. The estimated population proportion, $\%\hat{Y}_{nh}$, is the area-weighted sum of responses in each of the three domains {-1,0,1} divided by the sum of inverse area in all domains. With indices and variables defined as above, the estimated population proportion is:

$$\%\hat{Y}_{hd} = \frac{\sum_{i=1}^{n_h} \frac{d_{hi}}{a_{hi}}}{\sum_{i=1}^{n_h} \frac{1}{a_{hi}}} \tag{3.4}$$

We calculate these population proportions for 162 binary variables, with “friendly names” given by Appendix C Table C.3. For reproducibility, exported tables track components of the calculations, including sample size by response or non-response, the sum of inverse areas for the denominator of Equation 4, in-sample proportions, population proportions, and additional elements as shown in Appendix C Table C.4.

Results

The methodology used three summary pathways to describe landowner behavior: a cluster analysis based on a production possibilities perspective, a probit analysis, and conditional probability tables. The following discussion presents selected and sufficient results for each method. Additional results are available as part of the Data Appendix.

Production Possibilities and Cluster Analysis

For the production possibilities pathway, a scatter plot of relative timber objective (RTO) versus parcel size (log of wooded acres), shows an upward trending relationship (Figure 3.3). This confirms that parcel size positively correlates with a higher preference for harvesting timber relative to non-timber alternatives. From the basic observation that urbanization tends to cause more fragmentation of parcels and smaller parcel sizes, whereas large and forested parcels tend to exist in more rural areas, this result is not surprising. The positive correlation between parcel size and timber objectives also corroborates studies explored in the literature review.

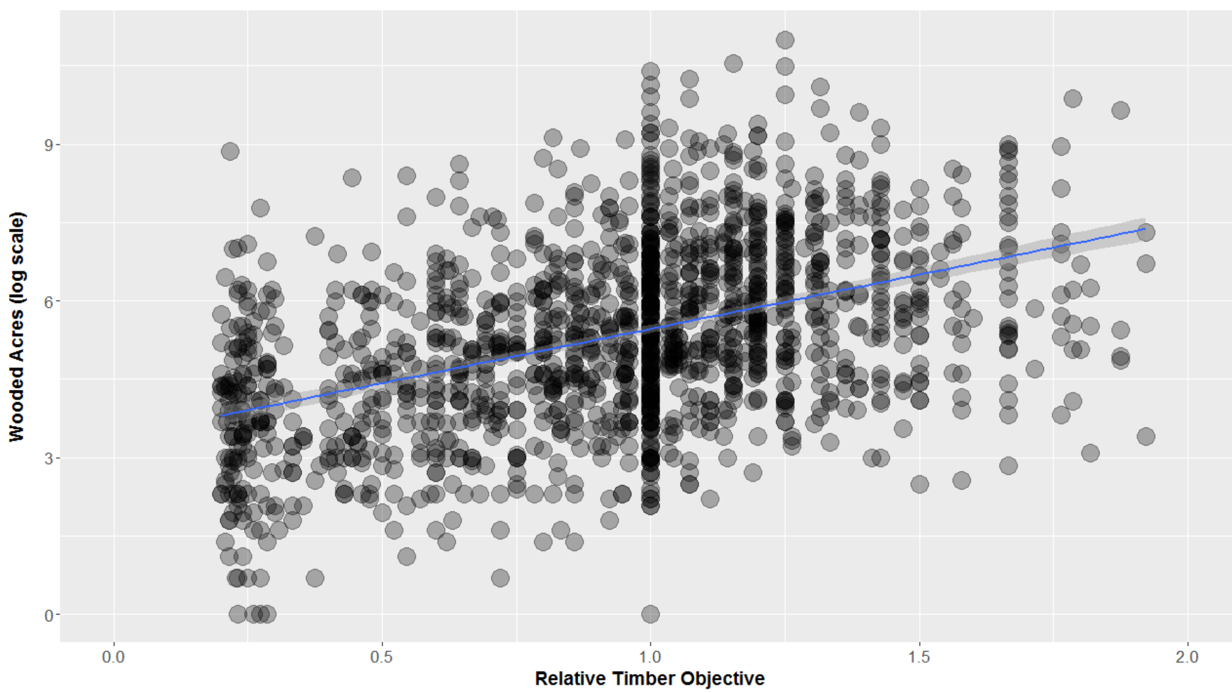


Figure 3.3. Scatter plot and linear regression of relative timber objective versus log of wooded acres.

We use hierarchical cluster analysis to assess whether or not the stated relative timber objectives corroborate with past harvest behavior and future plans to harvest[17]. Cluster analysis results depend on how clusters are structured. At a cutoff height of just above 2, four clusters can be identified (Figure 3.4). In Figure 3.4 purple corresponds to large parcels with low RTO, blue corresponds to smaller parcels with high RTO, light green corresponds to small parcels with low RTO, and dark green corresponds to large parcels with high RTO (Figure 3.5). We also observe that the purple and blue cases are the smallest clusters, representing outliers from the trend that otherwise progresses from low-low to high-high. The purple cases are landowners that have the material potential (wooded acres) to harvest timber but lack the objective. The blue cases are landowners that have the objective but have lower material potential to produce timber relative to those landowners with high parcel size.

[17] Appendix C Figure C.2. shows that future likelihood of timber harvests are related positively to RTO and parcel size.

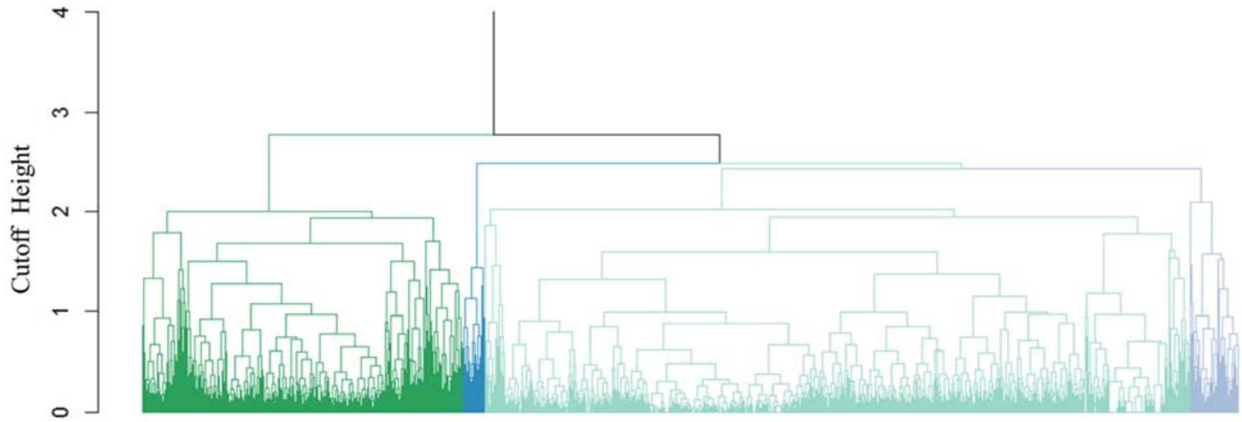


Figure 3.4. Hierarchical cluster analysis using average linkage clustering and Euclidean distance.

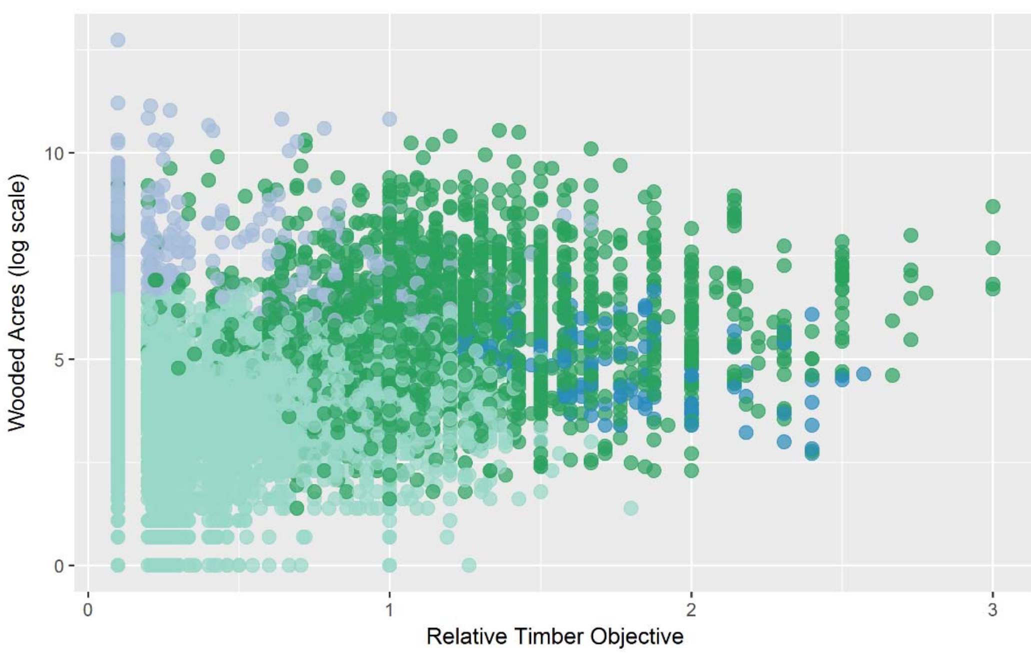


Figure 3.5. Selection of four clusters shows two smaller outlier groups (purple and blue).

Decreasing the clusters by one results in a merger between purple and light green clusters (Figure 3.6), and decreasing the clusters once again merges blue into light green (Figure 3.7). Naming the light green cases "non-timber" and the dark green cases "timber," the results show that not only does the positive correlation between RTO and parcel size exist, but also the likelihood of past harvests and future harvests are lower in the bottom left quadrant of RTO-parcel size space and higher in the top right quadrant.

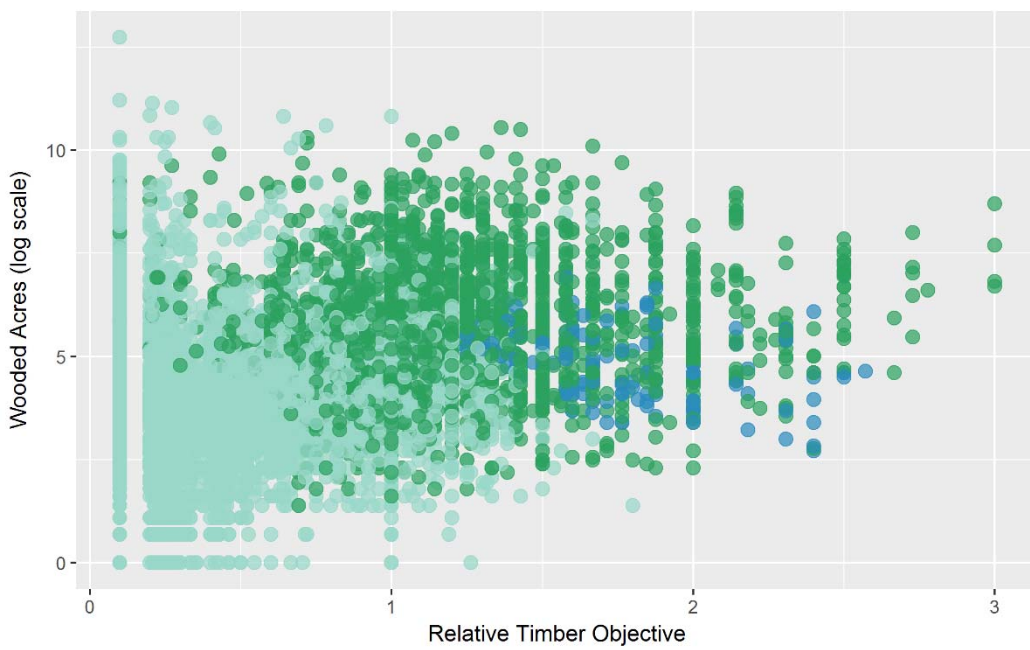


Figure 3.6. Selection of three clusters shows a closer relationship between the purple cluster and the light green cluster than the other two.

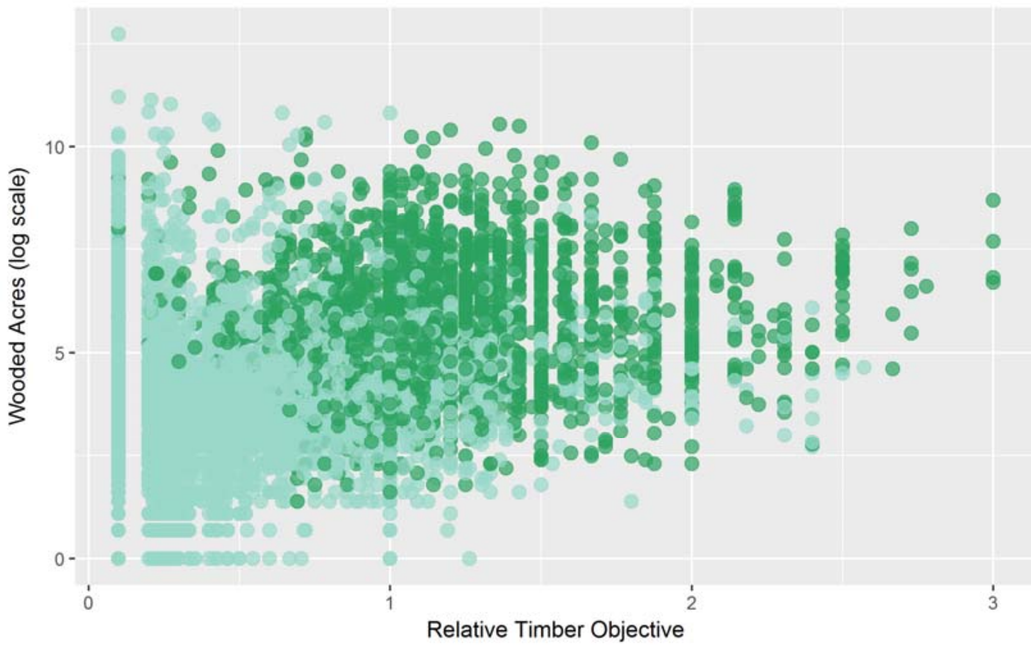


Figure 3.7. Selection of two clusters shows that the two outlier groups are ultimately closer to the light green group.

Figure 3.8 shows the overlapping density distributions of parcel sizes for non-timber and timber landowners and indicates that the mean parcel size is larger for timber landowners. Considerable overlap still exists in these density distributions. However, recalling that the horizontal axis in Figure 3.8 uses a log scale, the means are further apart than they appear. The mean for non-timber cluster is approximately 90 acres, compared to a mean of 245 acres for the timber cluster.

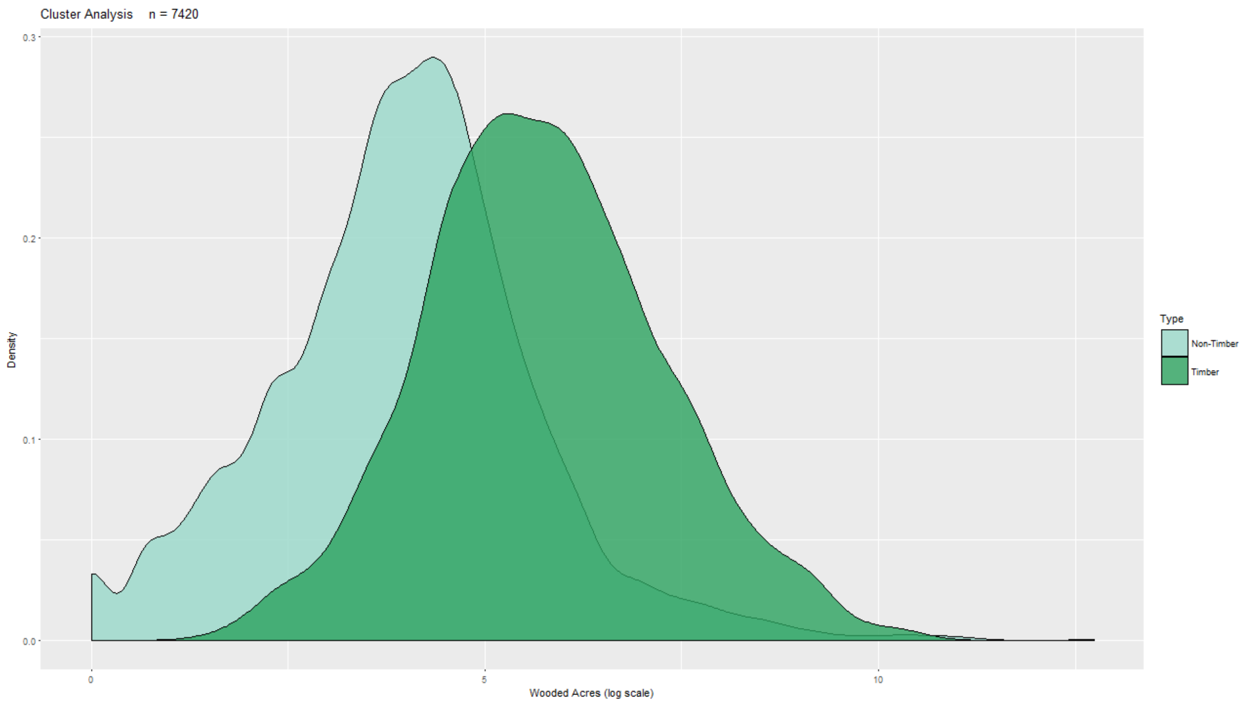


Figure 3.8. Density distributions of wooded acres (log scale) for the non-timber (light green) and timber (dark green) clusters shows a higher mean for the timber cluster.

A shortcoming of the scatter plot of timber and non-timber clusters is the inability to see the density of observations clearly in RTO-parcel size space. A bivariate kernel density estimation for the national scale data shows an essentially bimodal distribution in the data, and when the clusters are isolated, we see non-timber landowners concentered near zero on the RTO axis and timber landowners concentrated near one on the RTO axis (Figure 3.9). Furthermore, timber landowners have a higher average, maximum and minimum parcel size. Overlaying the isolated clusters provides additional detail (Figure 3.10).

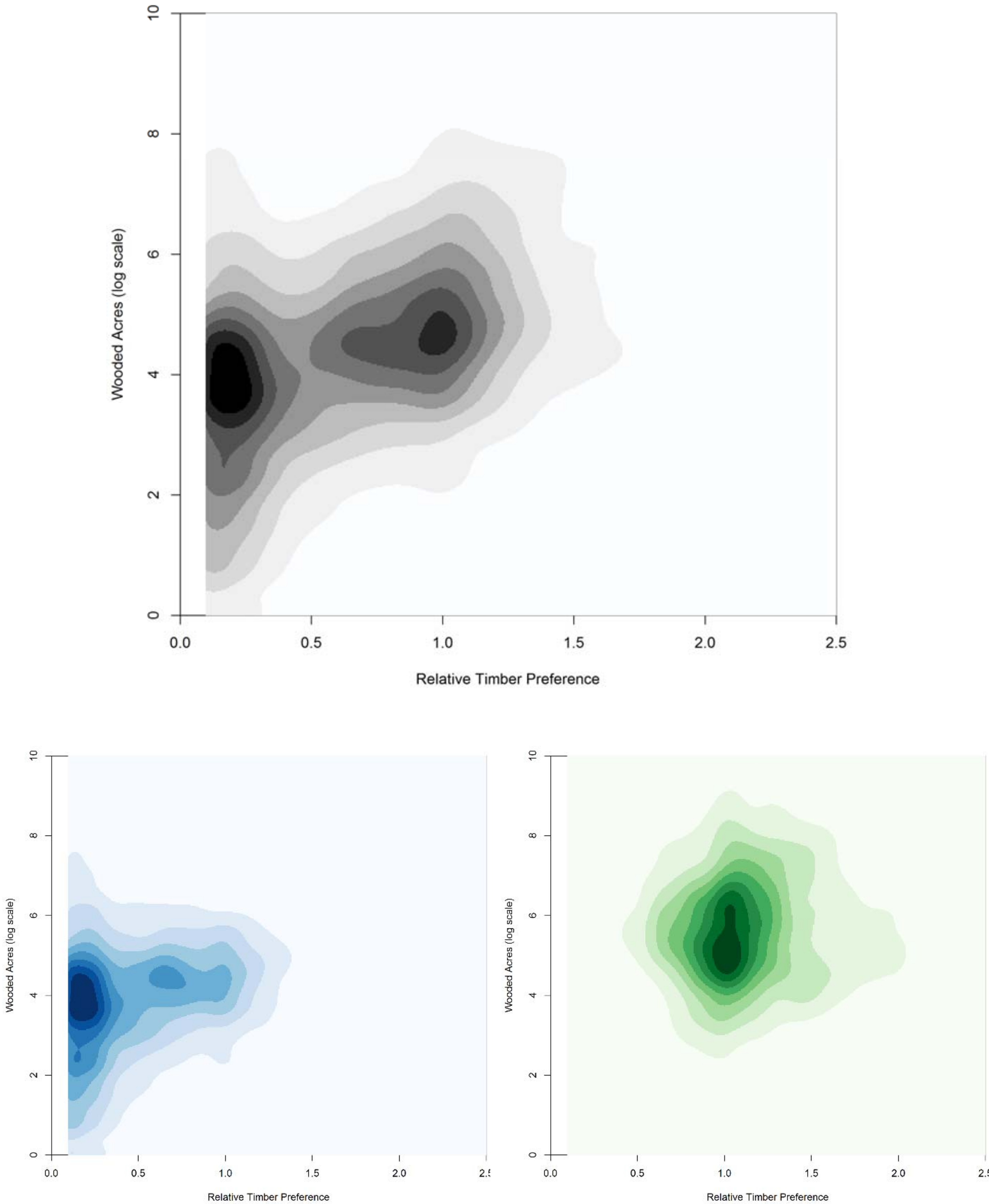


Figure 3.9. Plots of bivariate kernel density estimates at the national scale for all owners (top), the non-timber cluster (bottom left) and the timber cluster (bottom right).

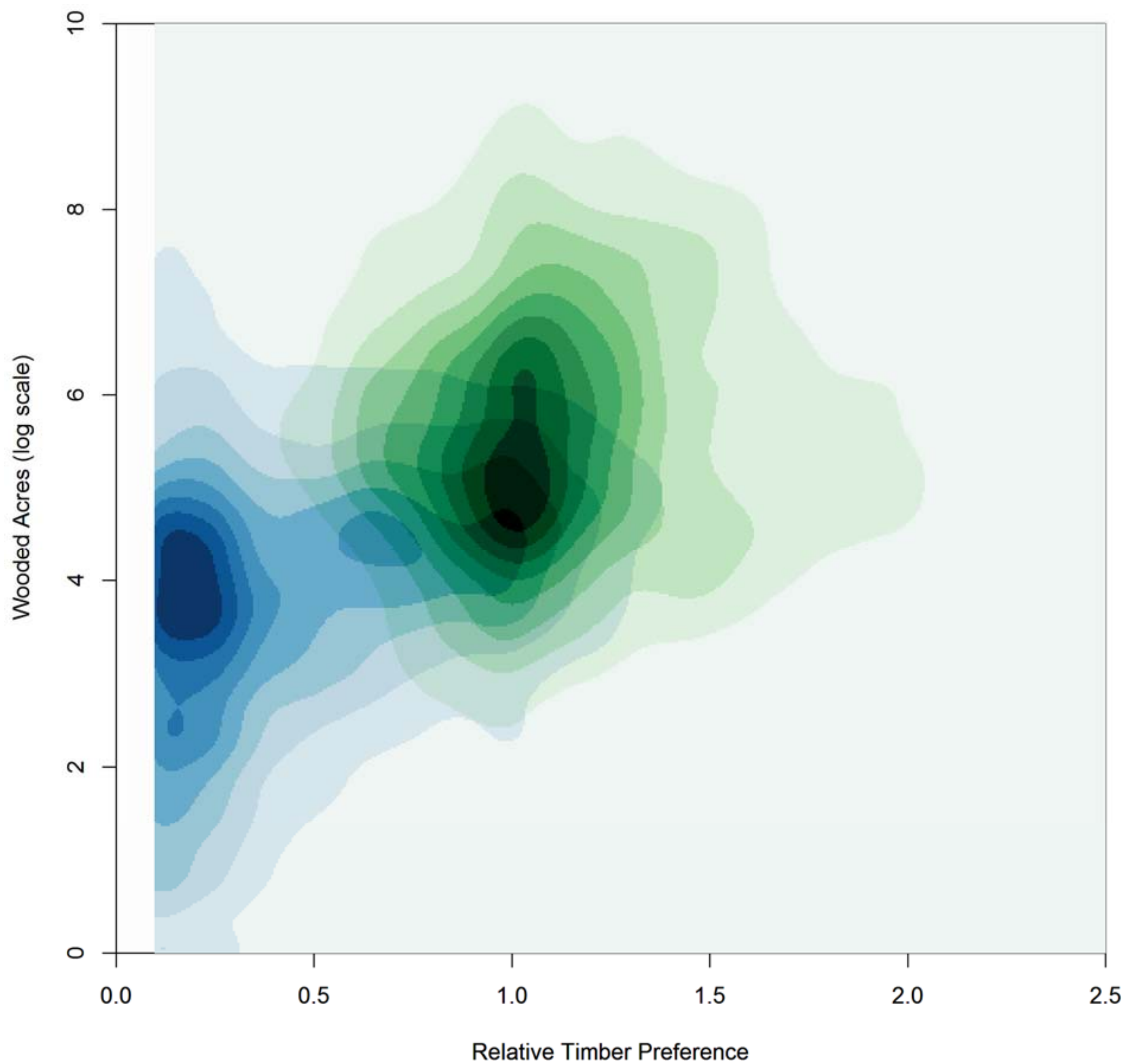


Figure 3.10. Overlay of bivariate kernel density plots at the national scale for the non-timber cluster (blue) and the timber cluster (green).

Probit Analysis

The preceding analysis shows that landowners with a higher timber objective relative to non-timber objectives tend to be located on larger parcels and those same landowners tend to have harvested timber in the past and claim a higher future likelihood of harvesting timber. The probit analysis seeks to determine how additional variables relate to the self-reported likelihood of future timber harvests ("Willing").

The national scale probit analysis benefits from a high sample size (n = 7,197) and finds all variables significant except five (Table 3.2). The five variables that were not found to be significant were the management objective of beauty ("Beauty"), non-response on past harvests ("Past-NA"), management by two owners ("Couple"), non-response on income ("Income-NA"), and being located in the Pacific Northwest ("Pacific"). The variables Beauty, Couple and Pacific took on the predicted sign for the relationship. Variables found to be significant (and their sign) include Privacy (–), Timber (+), Past Harvest (+), Coop (+), Retired (–), Education (+), Income (+), Wood Acres (+), Forest Cover (+), South (+) and North (+). These results corroborate the direction of influence of variables found to be significant by Aguilar et al. (2017), with positive associations for stated preferences for harvesting timber, previous harvest experience and higher income, and a negative relationship with ages beyond retirement age. The percent correctly predicted, which measures model performance, is 72.7, comparable to scores ranging between 72.4 and 75.6 for models in Aguilar et al. (2017). The findings also agree with the studies cited in the literature review, showing a significant positive relationship between likelihood of future harvests and parcel size and education and a negative relationship with privacy. A unique result from this analysis was the finding of a significant positive relationship between having three or more owners ("Coop") and the likelihood of future timber harvests.

Table 3.3. Results for the national scale multivariate probit analysis (n = 7,197) on future likelihood of timber harvest ("Willing").

Variable	Estimate	Std. Error	z value	Pr(>|z|)	Type I Error Level
(Intercept)	-2.042	0.103	-19.916	< 2e-16	$< \alpha = 0.001$
Beauty	-0.034	0.048	-0.712	0.476	
Privacy	-0.068	0.041	-1.649	0.099	$< \alpha = 0.1$
Timber	1.039	0.039	26.514	< 2e-16	$< \alpha = 0.001$
Past Harvest	0.773	0.042	18.577	< 2e-16	$< \alpha = 0.001$
Past-NA	0.037	0.058	0.635	0.526	
Couple	-0.016	0.042	-0.384	0.701	
Coop	0.151	0.055	2.721	6.51e-3	$< \alpha = 0.01$
Retired	-0.198	0.038	-5.178	2.24e-7	$< \alpha = 0.001$
Education	0.146	0.039	3.708	2.09e-4	$< \alpha = 0.001$
Income	0.134	0.046	2.938	3.30e-3	$< \alpha = 0.01$
Income-NA	0.058	0.050	1.142	0.254	
Wood Acres	0.692	0.054	12.763	< 2e-16	$< \alpha = 0.001$
Forest Cover	0.136	0.037	3.685	2.29e-4	$< \alpha = 0.001$
South	0.555	0.087	6.415	1.41e-10	$< \alpha = 0.001$
North	0.568	0.085	6.709	1.96e-11	$< \alpha = 0.001$
Pacific	0.126	0.124	1.015	0.310	
Percent Correctly Predicted:	72.7				

The result of the national probit analysis corroborates the cluster analysis by showing that future likelihood of timber harvest are positively associated with a timber objective, previous timber harvests and larger parcel size. The result also suggests that additional demographic variables are also associated with future likelihood of timber harvests. However, large sample sizes alone can lead to higher significance levels. Therefore, the analysis for the state of North Carolina provides a vehicle for determining significant empirical relationships at a smaller scale.

The probit analysis for North Carolina shows three significant variables at a 0.05 significance level or better: Beauty (–), Timber (+) and Wood Acres (+) (Table 3.3). The model correctly predicts 72.9 percent of observations. Estimated parameter values of the significant variables match the hypothesized direction of influence. The direction of influence for non-significant variables did not match the hypothesized direction of influence in every case. Privacy, Couple, Retired, and Education were not significant and had opposite signs compared to the national analysis. Forest Cover and Coop were significant at a 0.1 level and in the hypothesized direction.

Table 3.4. Results for North Carolina for the multivariate probit analysis on future likelihood of timber harvest ("Willing").

Variable	Estimate	Std. Error	z value	Pr(>|z|)	Type I Error Level
(Intercept)	-1.719	0.574	-2.994	0.003	$< \alpha = 0.01$
Beauty	-0.776	0.361	-2.149	0.032	$< \alpha = 0.05$
Privacy	0.182	0.333	0.547	0.584	
Timber	1.224	0.345	3.551	3.8E-04	$< \alpha = 0.001$
PastHarvest	0.297	0.332	0.894	0.371	
Couple	0.338	0.323	1.045	0.296	
Coop	0.745	0.429	1.738	0.082	$< \alpha = 0.1$
Retired	0.214	0.335	0.639	0.523	
Education	-0.224	0.315	-0.71	0.478	
Income	0.646	0.379	1.703	0.089	$< \alpha = 0.1$
UnknownIncome	0.362	0.470	0.771	0.441	
WoodAcres	1.208	0.421	2.867	0.004	$< \alpha = 0.01$
ForestCover	0.552	0.292	1.892	0.058	$< \alpha = 0.1$

Percent Correctly Predicted: 72.9

For other states in the southern US, similar patterns emerge compared to the national and North Carolina model, while showing variation on some individual variables. Across the board, having a timber management objective is the only variable that is significant in each state for a minimum 0.05 significance level (Table 3.4). Parcel size is significant in 9 out the 12 states, and previous harvests is significant in 5 out of the 12 states. A minority of states show a significant effect of Beauty, Couple, Income and Unknown Income.

Table 3.5. Summary of significant variables for southern states and their significance level.

Variable	Alabama	Arkansas	Florida	Georgia	Louisiana	Mississippi	North Carolina	South Carolina	Tennessee	Texas	Virginia	Kentucky	**Count**
(Intercept)	-2.15 ***	-2.74 ***	-2.10 **	-1.56 **	-2.34 ***	-1.55 **	-1.72 **	-1.66 ***	-2.57 ***	-1.62 **	-2.18 ***	-1.32 **	**12**
Beauty							-0.78 *		0.80 *				**2**
Privacy													**0**
Timber	1.40 ***	2.35 ***	1.58 ***	1.15 ***	1.03 **	1.33 ***	1.22 ***	1.58 ***	1.63 ***	1.58 ***	1.17 ***	0.66 *	**12**
Past Harvest		0.97 *		1.23 ***						0.81 **	0.68 **	0.83 **	**5**
Couple						0.56 *		-0.60 *					**2**
Coop													**0**
Retired													**0**
Education													**0**
Income	0.64 *	0.97 *						0.72 *					**3**
Unknown Income						0.91 *							**1**
Wood Acres	1.24 ***		0.71 *	1.11 ***	1.30 **	0.83 **	1.21 **	0.95 **			1.44 ***	0.79 *	**9**
Forest Cover													**0**

Significance codes: ***$\alpha < 0.001$, **$\alpha < 0.01$, *$< \alpha < 0.05$

Conditional Population Proportions

The probit analysis shows that a timber management objective and parcel size are the most reliable predictors of future likelihood of timber harvests at the state level. The cluster analysis showed that timber management objectives, parcel size and future likelihood of timber harvests are co-located in the so-called timber cluster, which overlaps the non-timber cluster. From the standpoint of a researcher, timber management objectives and future likelihood of timber harvests are costly to observe. Thus, the third strand of analysis focuses on relating management objectives to parcel size, which is directly observable in public databases.

First, we tabulate the conditional probabilities of the total area and wooded area of parcels at the national scale. The NWOS surveys forestland, so the anticipated result is a high level of forestation. The conditional probability table provides the likely forested area given an observation of total parcel area, color-coded such that a darker shade of green indicates a higher conditional probability (Table 3.5). On a discrete log scale basis (rounded down), we see that with national scale data most parcels are forested at the maximum discrete level (on average 62.4%), and most of the remaining parcels have wooded area at one level below total area (on average 26.5%). Results for North Carolina shows a similar pattern (Table 6).

Table 3.6. Discrete log of acres versus discrete log of wooded acres for the national scale analysis.

	Log of Wooded Acres												
Log of Acres	NA	0	1	2	3	4	5	6	7	8	9	10	11
NA	0.830	0.000	0.004	0.018	0.022	0.022	0.036	0.040	0.013	0.004	0.004	0.004	0.000
0	0.119	0.881	-	-	-	-	-	-	-	-	-	-	-
1	0.049	0.451	0.500	-	-	-	-	-	-	-	-	-	-
2	0.029	0.069	0.202	0.701	-	-	-	-	-	-	-	-	-
3	0.035	0.008	0.020	0.216	0.720	-	-	-	-	-	-	-	-
4	0.020	0.000	0.002	0.034	0.246	0.697	-	-	-	-	-	-	-
5	0.023	0.002	0.003	0.007	0.064	0.257	0.644	-	-	-	-	-	-
6	0.023	0.000	0.000	0.004	0.029	0.090	0.318	0.535	-	-	-	-	-
7	0.022	0.002	0.002	0.006	0.011	0.043	0.103	0.329	0.483	-	-	-	-
8	0.015	0.000	0.000	0.006	0.008	0.017	0.036	0.095	0.283	0.541	-	-	-
9	0.014	0.000	0.000	0.000	0.000	0.014	0.000	0.042	0.056	0.282	0.592	-	-
10	0.014	0.000	0.000	0.000	0.000	0.029	0.029	0.043	0.043	0.086	0.200	0.557	-
11	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.091	0.000	0.091	0.136	0.636

Table 3.7. Discrete log of acres versus discrete log of wooded acres for North Carolina.

	Log of Wooded Acres											
Log of Acres	NA	0	1	2	3	4	5	6	7	8	9	10
NA	0.600	0.000	0.000	0.000	0.000	0.000	0.400	0.000	0.000	0.000	0.000	0.000
0	-	-	-	-	-	-	-	-	-	-	-	-
1	0.000	0.000	1.000	-	-	-	-	-	-	-	-	-
2	0.000	0.091	0.273	0.636	-	-	-	-	-	-	-	-
3	0.000	0.000	0.000	0.267	0.733	-	-	-	-	-	-	-
4	0.030	0.000	0.000	0.030	0.364	0.576	-	-	-	-	-	-
5	0.109	0.036	0.000	0.018	0.036	0.127	0.673	-	-	-	-	-
6	0.053	0.000	0.000	0.000	0.000	0.053	0.281	0.614	-	-	-	-
7	0.000	0.000	0.000	0.000	0.000	0.037	0.000	0.296	0.667	-	-	-
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.143	0.214	0.643	-	-
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.333	0.667	-
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.500	0.500

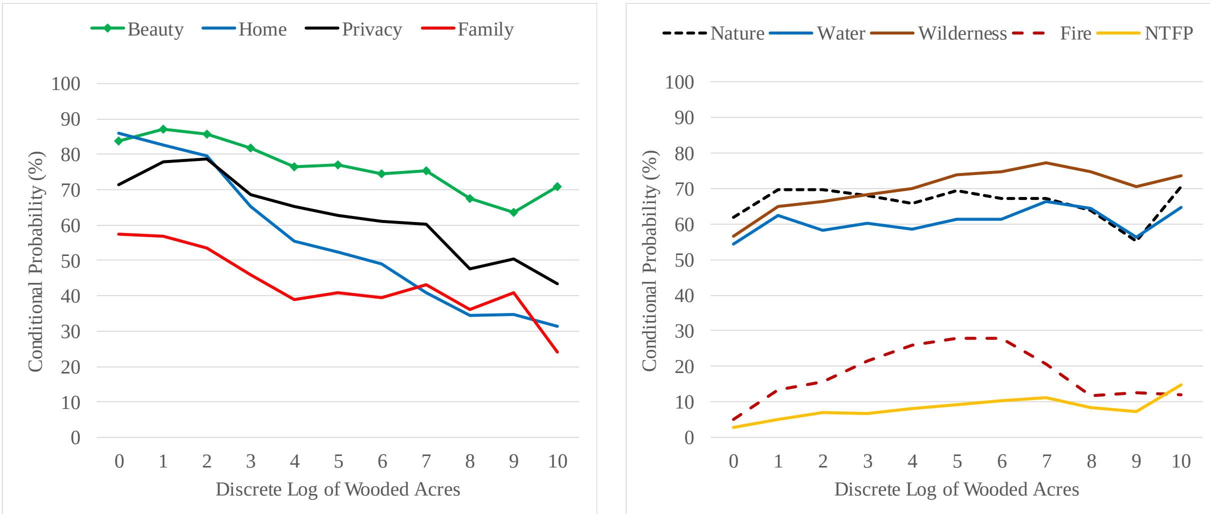
Psychological Aspects of Landowners

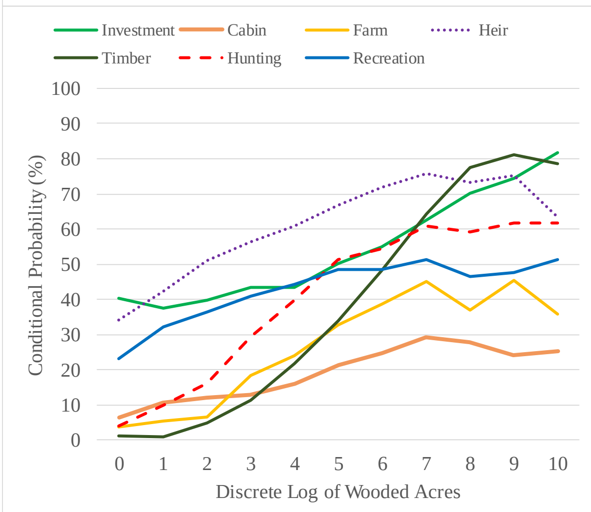
Given a level of discrete log of wooded acres, we then examine the conditional probabilities (population proportions) of the management objectives in the NWOS data having ratings of important or very important. Some management objectives have little relationship with wooded area, whereas others show an obvious positive or negative relationship (Table 3.7). From the heat map visual aid in Table 3.7, we see that a timber management objective is the most sharply correlated to wooded acres, ranging from near zero interest in timber for the lowest wooded acres level to around 80% at the highest wooded acreages. We also see consistently high proportions for beauty, nature, water, and wilderness across acreage categories, whereas the objectives of cabin, fire management and non-timber forest products are less prevalent across the spectrum of parcel size.

Table 3.8. Discrete log of wooded acres (DWA) and population proportions of Management Objectives at the national scale.

DWA	Beauty	Nature	Water	Wilderness	Investment	Home	Cabin	Farm	Privacy	Family	Child	Fire	Timber	NTFP	Hunting	Recreation
NA	0.441	0.525	0.446	0.441	0.29	0.578	0.084	0.046	0.348	0.356	0.474	0.096	0.054	0.093	0.176	0.068
0	0.838	0.618	0.543	0.567	0.404	0.86	0.063	0.038	0.715	0.574	0.34	0.05	0.013	0.029	0.041	0.231
1	0.87	0.697	0.625	0.65	0.375	0.825	0.106	0.053	0.779	0.568	0.424	0.133	0.008	0.05	0.099	0.321
2	0.858	0.697	0.583	0.664	0.397	0.795	0.119	0.066	0.786	0.535	0.51	0.157	0.049	0.069	0.16	0.363
3	0.818	0.679	0.603	0.683	0.434	0.652	0.128	0.183	0.686	0.458	0.564	0.215	0.113	0.067	0.293	0.408
4	0.764	0.659	0.586	0.701	0.434	0.555	0.159	0.241	0.652	0.39	0.609	0.259	0.218	0.081	0.398	0.442
5	0.769	0.694	0.613	0.74	0.501	0.523	0.213	0.326	0.627	0.408	0.667	0.279	0.338	0.091	0.512	0.486
6	0.744	0.672	0.613	0.746	0.548	0.491	0.248	0.387	0.611	0.395	0.717	0.278	0.481	0.104	0.543	0.486
7	0.752	0.672	0.664	0.772	0.626	0.41	0.293	0.45	0.602	0.431	0.759	0.206	0.642	0.111	0.609	0.514
8	0.675	0.639	0.644	0.748	0.702	0.346	0.277	0.369	0.477	0.361	0.732	0.117	0.776	0.084	0.593	0.466
9	0.636	0.552	0.562	0.706	0.744	0.348	0.24	0.455	0.504	0.408	0.751	0.127	0.812	0.073	0.618	0.476
10	0.709	0.706	0.646	0.735	0.817	0.315	0.251	0.359	0.434	0.242	0.633	0.119	0.785	0.149	0.618	0.514

A graphical perspective on this data reveals that nature, water, wilderness, fire and non-timber forest products show a flat relationship with DWA (Figure 3.11). Objectives that positively correlate with DWA are investment, cabin, farming, heirs, timber, and recreation. Those with a negative relationship to DWA are beauty, home, privacy, and family. Relating these observations to the national scale probit analysis, we gain an empirical perspective for why beauty and privacy showed a negative relationship to future likelihood of timber harvest. Beauty and privacy show a negative relationship with both higher wooded acres and a timber objective.





Variable	Slope of Linear Trendline
Home	-5.93
Privacy	-3.31
Family	-2.61
Beauty	-2.07
Nature	-0.28
Fire	0.18
Water	0.54
NTFP	0.77
Wilderness	1.39
Cabin	2.15
Recreation	2.36
Heir	3.54
Farm	4.37
Investment	4.50
Hunting	6.4
Timber	9.62

Figure 3.11. Population proportions by discrete log of wooded acres having a negative relationship (top left), neutral relationship (top right), and positive relationship (bottom left). These relationship categories are defined by a cutoff of +/- 2 for the slope of linear trendlines (bottom right).

The relationships between other psychological variables and parcel size are also of interest. The “concerns” category in the NWOS data offers an opportunity to look at an additional psychological aspect of forest landownership. The national scale population probabilities table shows less pronounced changes compared to the management objectives (Table 3.8). While management objectives relate to a landowner’s ability to take action on their land, the concerns of landowners represented in the NWOS data largely reflect exogenous factors that are out of the landowner’s control.

Table 3.9. Discrete log of wooded acres and population proportions of Concerns at the national scale.

DWA	Air Pollution	Trespassing	Lack of Water	Climate	Water Pollution	Fire	Noise	Animal	Dumping	Disease	Tax	Invasive	Development	Heir	Storms
NA	0.207	0.327	0.216	0.129	0.299	0.349	0.182	0.150	0.417	0.395	0.417	0.226	0.267	0.288	0.338
0	0.379	0.422	0.331	0.327	0.423	0.400	0.241	0.136	0.484	0.477	0.567	0.387	0.344	0.406	0.416
1	0.407	0.494	0.304	0.328	0.557	0.458	0.318	0.183	0.602	0.562	0.691	0.457	0.508	0.588	0.515
2	0.433	0.514	0.322	0.318	0.452	0.484	0.370	0.216	0.572	0.511	0.669	0.412	0.439	0.537	0.446
3	0.373	0.594	0.321	0.316	0.497	0.494	0.354	0.168	0.610	0.562	0.679	0.430	0.420	0.595	0.395
4	0.353	0.615	0.289	0.285	0.468	0.478	0.360	0.165	0.608	0.544	0.649	0.422	0.369	0.627	0.378
5	0.356	0.661	0.312	0.295	0.471	0.519	0.382	0.177	0.647	0.586	0.675	0.447	0.364	0.675	0.418
6	0.322	0.672	0.335	0.283	0.458	0.537	0.382	0.200	0.648	0.601	0.716	0.459	0.370	0.693	0.449
7	0.318	0.716	0.418	0.288	0.478	0.579	0.394	0.247	0.693	0.635	0.735	0.500	0.345	0.749	0.482
8	0.285	0.698	0.438	0.253	0.441	0.635	0.322	0.293	0.665	0.632	0.759	0.552	0.266	0.719	0.577
9	0.334	0.721	0.504	0.196	0.489	0.630	0.391	0.253	0.698	0.717	0.792	0.564	0.226	0.814	0.545
10	0.324	0.801	0.585	0.342	0.543	0.689	0.224	0.379	0.779	0.696	0.864	0.595	0.268	0.781	0.560

Still, for virtually all variables a positive or neutral relationship between DWA and concerns is evident (Figure 3.12). The concerns that trend downward as DWA increases are concerns for development and air pollution, likely related to the generalization that small parcels are closer to urban areas where development takes place and pollution is concentrated.

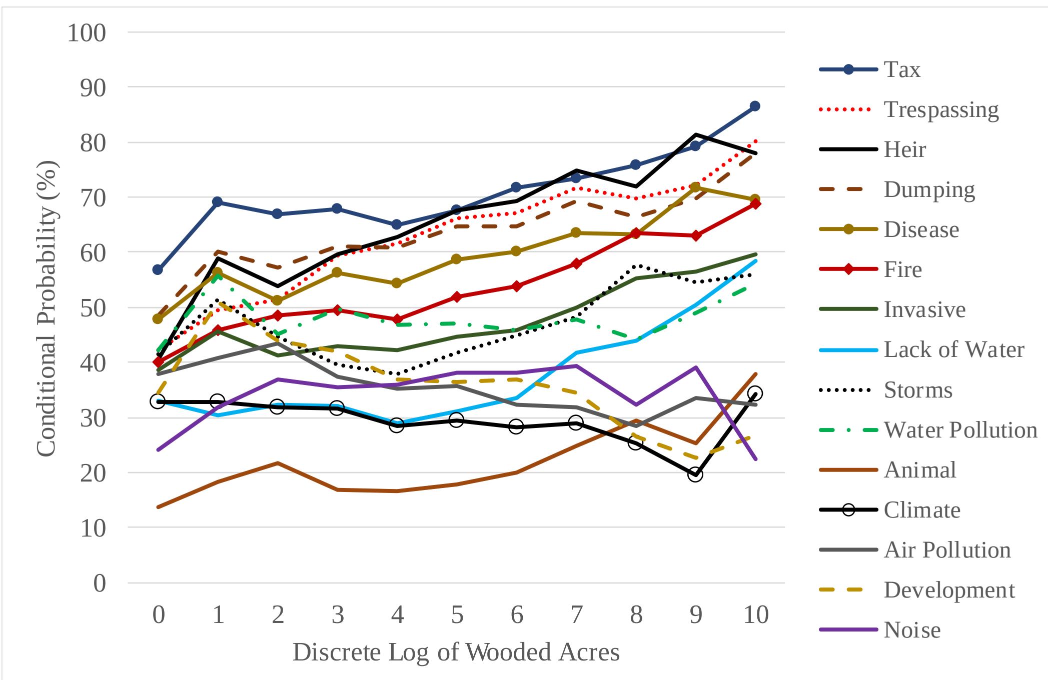


Figure 3.12. Population proportions of concerns for the national scale analysis.

Another category of NWOS data with applications for agent-based model is the “advice” category, since this information can improve the realism of “awareness” or bounded rationality of agents in agent-based models. The primary advice question asks whether landowners have sought advice in the last five years, following up with questions on the topic of the advice (Table 3.9). Population proportions at the national level show an increase with increasing parcel size (Figure 3.13). The proportion increases with parcel size most strongly with advice for timber ("timber production"), and at a similar pace for advice about wilderness ("wildlife and wild plant habitat)", conservation ("land conservation"), fire ("fire safety"), and disease ("insects or plant diseases").

Table 3.10. Discrete log of wooded acres and population proportions of Advice at the national scale.

DWA	Advice (Any)	Conservation	Other	Fire	Wilderness	Disease	Timber
NA	0.014	0.004	0.000	0.001	0.150	0.006	0.004
0	0.082	0.012	0.006	0.029	0.136	0.047	0.012
1	0.101	0.013	0.029	0.007	0.183	0.068	-
2	0.095	0.030	0.014	0.009	0.216	0.033	0.009
3	0.132	0.047	0.015	0.021	0.168	0.044	0.048
4	0.230	0.075	0.019	0.019	0.165	0.050	0.111
5	0.309	0.116	0.020	0.036	0.177	0.070	0.187
6	0.444	0.145	0.026	0.068	0.200	0.104	0.319
7	0.616	0.273	0.029	0.172	0.247	0.176	0.470
8	0.709	0.313	0.029	0.220	0.293	0.264	0.505
9	0.726	0.328	0.038	0.261	0.253	0.306	0.559
10	0.786	0.366	-	0.348	0.379	0.325	0.727

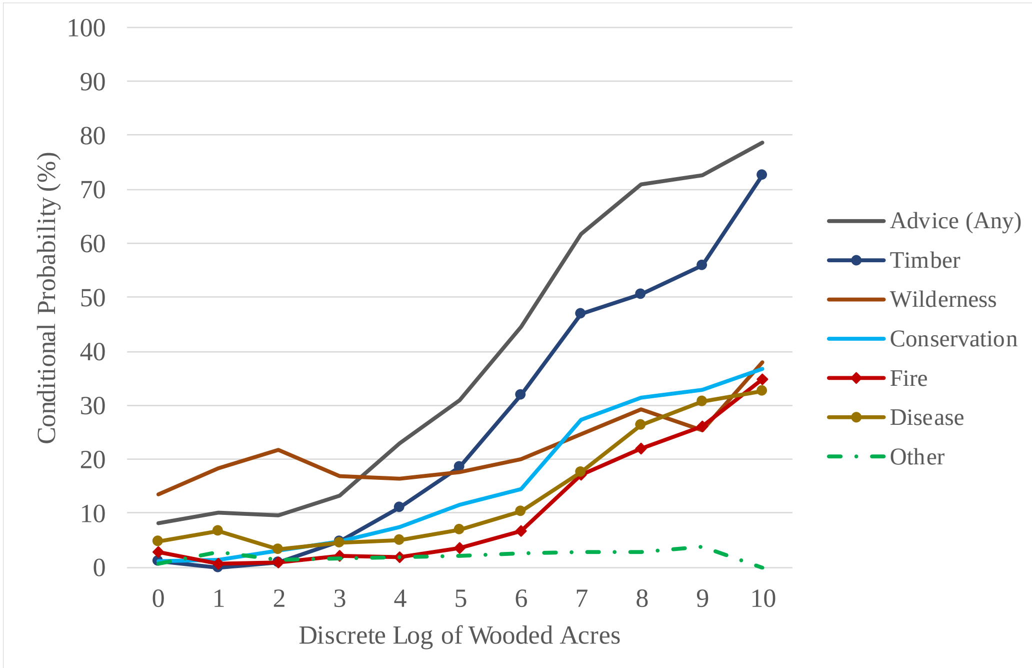


Figure 3.13. Population percentages of landowners who have received any advice on their forestland management in the last 5 years and the topic of the advice.

The implication of the results for advice are that in addition to certain management preferences being associated with increasing parcel size, information-seeking activities also increase. Landowners on large parcels are thus more pro-active and more likely to seek professional or expert advice on management. This finding is useful for agent-based models of forest landowners because it suggests that modeling landowners on larger parcels should entail their having current information or information that aligns to expert opinion, whereas landowners on smaller parcels may have "fuzzier" information sets. This finding is further corroborated by the observation that of those landowners who have harvested timber in the past, those with higher parcel sizes are more likely to have used a logger or forester in the operation (Figure 3.14).

DWA	Used Logger	Used Forester
NA	0.105	0.037
0	0.110	0.069
1	0.168	0.155
2	0.114	0.082
3	0.158	0.124
4	0.247	0.207
5	0.310	0.259
6	0.408	0.358
7	0.499	0.450
8	0.586	0.574
9	0.600	0.556
10	0.777	0.723

Figure 3.14. Of those who harvested any wood products, the probability that the landowner used a logger and/or a forester.

Also telling is the relationship of sources of advice and parcel size. The source of advice can provide clues not only of the content of information received by landowners, but also the cost of the information. Each category of advice tends to increase with parcel size (Table 3.10). Interestingly, a crossover in the likelihood of seeking information from private sources versus state sources occurs at the threshold DWA = 5 (Figure 3.15).

State, or public, information is generally free, whereas private information carries some cost. Therefore, this threshold represents an inflection point where landowners perceive it is cost effective to buy information. This threshold is also consistent with the crossover from the non-timber cluster to the timber cluster in Figure 3.10. Furthermore, an important observation is that family and neighbors form a minor part of the information set of landowners, though increasing with parcel size. In an ABM context, this suggests that geographic relationships among agents is a lesser consideration for the information content agents receive. Instead, the majority of information provided to landowners comes from private or public institutions that are not necessarily local.

Table 3.11. Discrete log of wooded acres and population proportions of Sources of Advice at the national scale.

DWA	State	Private	Other	Neighbor	Federal
NA	0.005	0.004	0	0.002	0.001
0	0.012	0.041	0.012	-	-
1	0.024	0.051	0.011	0.015	0.005
2	0.055	0.021	0.01	0.013	0.005
3	0.063	0.035	0.008	0.021	0.017
4	0.104	0.087	0.014	0.024	0.022
5	0.15	0.158	0.017	0.041	0.04
6	0.205	0.254	0.027	0.067	0.053
7	0.328	0.379	0.055	0.126	0.094
8	0.357	0.47	0.043	0.124	0.148
9	0.353	0.541	0.034	0.152	0.087
10	0.353	0.645	0.054	0.166	0.119

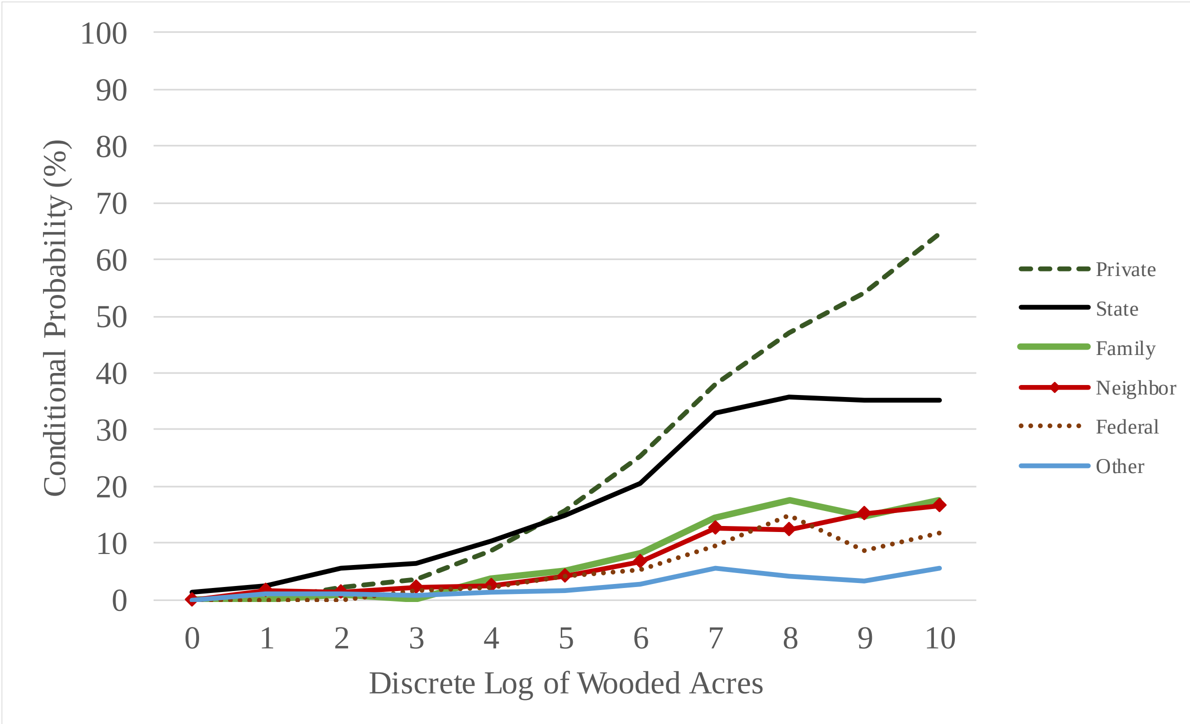


Figure 3.15. Graphical representation of population proportions of sources of advice conditioned on discrete log of wooded acres.

To summarize, the preceding results showed that parcel size relates positively to the likelihood that landowners possess timber management objectives and other objectives compatible with a rural setting. Landowners with larger parcels generally have more concern about exogenous impacts on their land. Furthermore, they are more likely to have sought advice on any topic, especially timber, and to have sought advice from experts, transitioning to more reliance on private information sources over public sources at higher parcel sizes.

Previous Experience of Landowners

The data reveal similar relationships in past sales activity of forest products and services. Of the range of harvestable forest products, wood products are the most likely to have been harvested (Table 3.11). Overall, harvest of non-timber forest products, with the exception of landscaping products (e.g. pine straw), are less likely to have occurred than wood products harvests, but more likely to occur on larger parcels. The top five products, ranked from most likely to least, are logs, wood chips, unwanted trees, firewood, and landscaping products (Figure 3.16). The preponderance of leasing activity also increases with parcel size (Table 12). Hunting is by far the most likely leasing activity and shows a strong positive correlation with parcel size (Figure 3.17).

Table 3.12. Forest products sold at any time by the current owner of the parcel.

DWA	Logging	Wood Chips	Unwanted Trees	Firewood	Landscaping Products	Decorative Products	Miscellaneous Wood Removal	Edible Forest Products	Medicinal Forest Products	Miscellaneous NTFP
NA	0.050	0.003	0.005	0.008	0.000	0.031	0.000	0.002	0.001	0.001
0	0.002	-	-	-	-	-	0.000	-	-	-
1	0.028	-	0.011	0.005	-	-	-	-	-	-
2	0.043	0.004	0.011	0.015	-	0.005	0.003	0.004	0.002	-
3	0.132	0.022	0.018	0.045	0.004	-	0.002	0.010	0.002	0.000
4	0.246	0.028	0.038	0.055	0.007	0.007	0.006	0.008	0.009	0.004
5	0.374	0.052	0.054	0.090	0.005	0.010	0.012	0.014	0.007	0.006
6	0.491	0.127	0.088	0.123	0.017	0.017	0.014	0.022	0.011	0.005
7	0.581	0.221	0.164	0.122	0.039	0.022	0.018	0.037	0.010	0.012
8	0.685	0.341	0.245	0.141	0.051	0.028	0.027	0.011	0.013	-
9	0.674	0.436	0.310	0.187	0.131	0.017	0.010	0.011	0.006	0.006
10	0.872	0.528	0.322	0.181	0.163	0.023	-	-	0.024	-

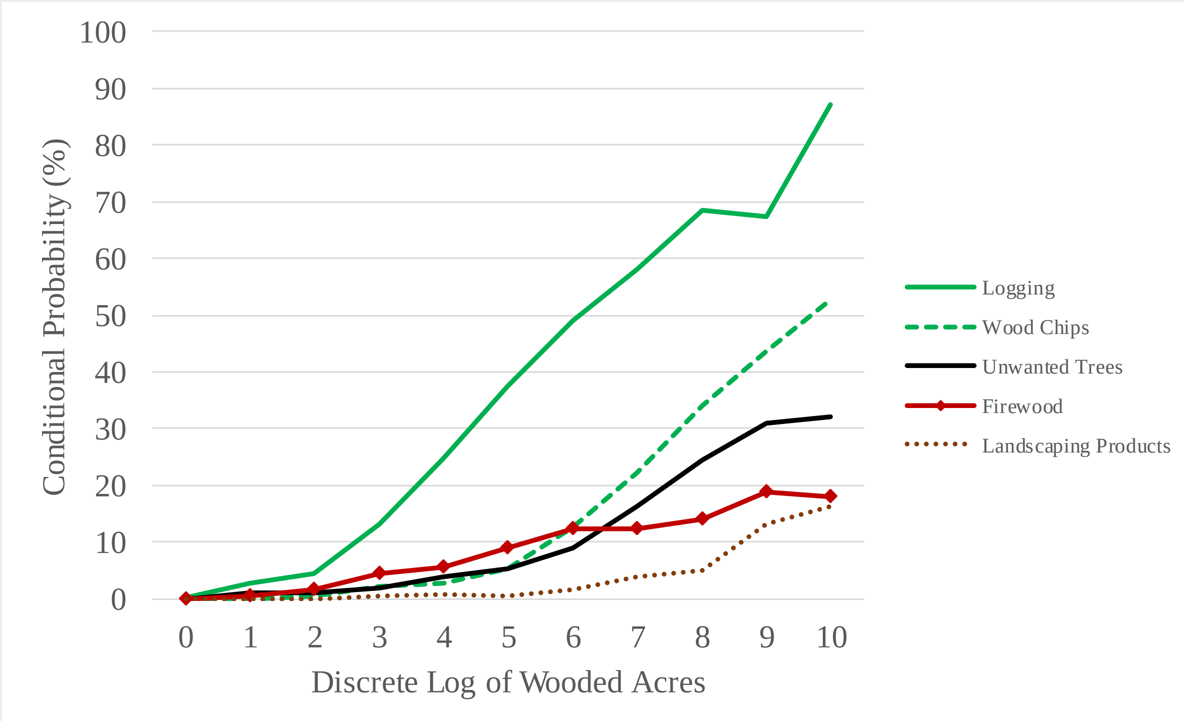


Figure 3.16. Five forest products most commonly sold and their population proportions by discrete log of wooded acres.

Table 3.13. Previous leasing activity

DWA	Lease (Any)	Carbon Capture	Land Conservation	Livestock Grazing	Hunting	Other	Recreation	Public Water Protection	Wildlife Habitat
NA	0.013	-	0.001	0.003	0.006	0.003	0.000	0.000	0.001
0	0.000	-	-	-	0.000	-	-	-	-
1	0.020	-	-	0.005	-	0.000	-	-	-
2	0.028	-	-	0.004	0.010	0.003	0.006	0.003	0.003
3	0.057	0.003	0.003	0.007	0.012	0.020	0.006	0.001	0.004
4	0.086	0.001	0.010	0.020	0.030	0.020	0.008	0.001	0.006
5	0.116	0.001	0.015	0.021	0.048	0.020	0.010	0.002	0.005
6	0.229	0.005	0.036	0.036	0.130	0.039	0.020	0.004	0.010
7	0.384	0.007	0.056	0.070	0.255	0.048	0.040	-	0.021
8	0.557	0.008	0.111	0.076	0.447	0.019	0.071	0.009	0.042
9	0.708	0.005	0.136	0.123	0.596	0.071	0.096	-	0.026
10	0.698	0.003	0.144	0.117	0.612	0.067	0.138	-	0.069

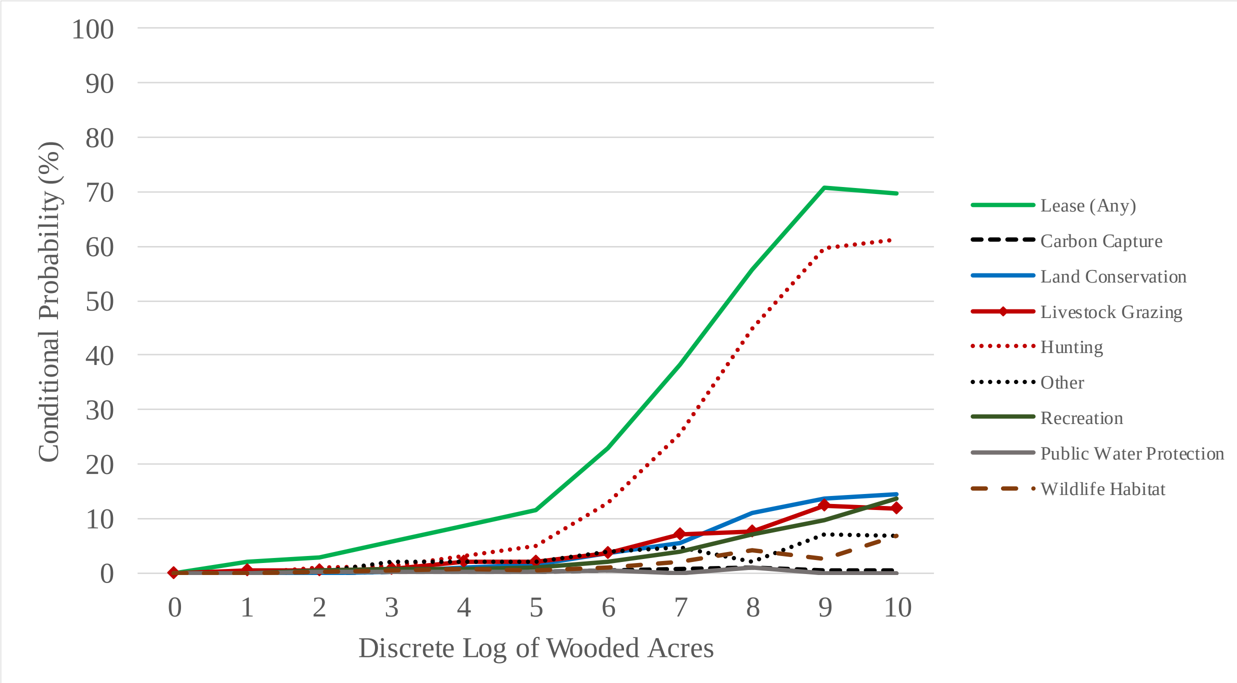


Figure 3.17. Graphical perspective on leasing activity.

Plans of Landowners

As for planned forest management activities, the self-reported likelihood of timber harvests (for sale), as the probit analysis and cluster analysis showed, increases with parcel size. In fact, with the exception of collecting non-timber forest products, every forest management activity tends to increase with parcel size (Table 3.13; Figure 3.18). Larger parcels are also more likely to have a management plan, which formalizes a respondents' statement of future intentions.

Table 3.14. Landowners' self-reported likely forest management actions in the next five years, and population proportion of parcels with a management plan.

DWA	Tree Removal (sale)	Tree Removal (personal)	Collect NTFP	Reduce Fire Hazard	Controlled Burn	Reduce Invasive Species	Reduce Insects or Diseases	Road Construction or	Trail Construction or	Improve Wildlife Habitat	Livestock Grazing	**Management Plan**
NA	0.012	0.162	0.135	0.100	0.063	0.163	0.090	0.090	0.088	0.128	0.079	0.018
0	0.012	0.170	0.071	0.108	0.017	0.139	0.122	0.022	0.056	0.133	-	0.035
1	0.024	0.345	0.102	0.121	0.071	0.196	0.210	0.048	0.085	0.215	0.021	0.009
2	0.025	0.289	0.159	0.165	0.067	0.208	0.193	0.074	0.144	0.243	0.049	0.039
3	0.080	0.350	0.162	0.175	0.050	0.216	0.155	0.106	0.215	0.301	0.074	0.078
4	0.127	0.356	0.177	0.157	0.060	0.188	0.132	0.132	0.263	0.352	0.084	0.159
5	0.222	0.392	0.177	0.167	0.093	0.223	0.155	0.172	0.339	0.433	0.108	0.254
6	0.367	0.395	0.203	0.185	0.114	0.240	0.139	0.237	0.371	0.465	0.136	0.361
7	0.531	0.353	0.186	0.326	0.238	0.322	0.205	0.430	0.427	0.583	0.166	0.517
8	0.662	0.274	0.143	0.415	0.427	0.400	0.269	0.515	0.396	0.622	0.122	0.551
9	0.709	0.244	0.170	0.425	0.393	0.402	0.297	0.615	0.356	0.527	0.200	0.553
10	0.892	0.387	0.212	0.634	0.563	0.380	0.317	0.703	0.449	0.707	0.191	0.701

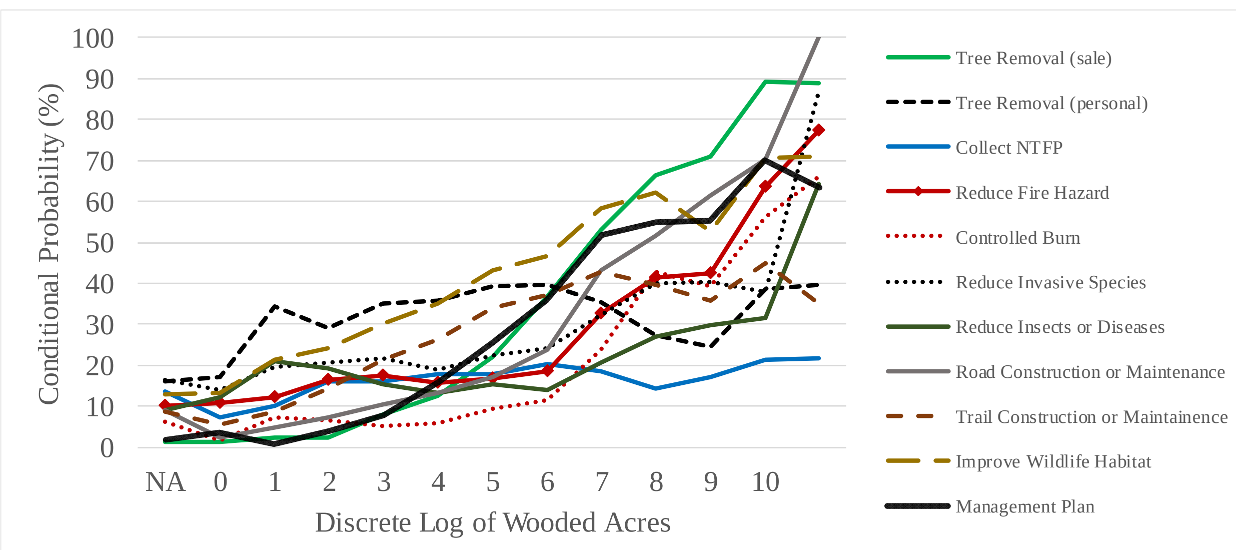


Figure 3.18. Graphical perspective on landowners' self-reported likely forest management activities in the next five years, and the population proportion of parcels with an active management plan.

Demographics of Landowners

Derived and stated demographic characteristics of landowners provide insight into the cluster analysis and probit model results and show relationships with discrete log of wooded acres (Table 3.14). The Couple variable and Coop variable are mutually exclusive, with a null case of a single landowner. The Retired1 and Education1 variable in Table 3.14 reports the population proportion of retired first owners and those with an associate's degree or greater. All survey responses have a first owner. The values for the Retired2 and Education2 variables are global and calculated only from responses that have more than one owner.

As with the cluster analysis and probit models, we observe that the timber cluster increases with parcel size. In an agent-based model with discrete landowner types (e.g. Henderson & Abt, 2016), the table offers a simpler manner for implementing the findings than the other methods, and the cluster encapsulates stated management objectives, past harvest behavior and likelihood of future harvests.

Also of note is that having three or more owners is positively correlated with parcel size, whereas having two owners is negatively correlated (Figure 3.19). An uptick in educational attainment of 30% occurs as parcel size increases from least to greatest. Retirement status of first owners peaks in the middle of parcel size range, and retirement status and education for second owners is neutral with respect to parcel size.

Table 3.15. Derived and stated landowner characteristics.

DWA	Timber Cluster	Couple	Coop	Retired1	Retired2	Education1	Education2	Income
NA	-	0.530	0.023	0.402	0.097	0.303	0.129	0.285
0	-	0.717	0.023	0.260	0.143	0.313	0.257	0.252
1	-	0.615	0.027	0.293	0.071	0.331	0.190	0.249
2	0.007	0.667	0.037	0.322	0.180	0.349	0.216	0.224
3	0.062	0.614	0.054	0.367	0.193	0.303	0.203	0.183
4	0.095	0.534	0.095	0.405	0.176	0.305	0.167	0.180
5	0.171	0.526	0.125	0.422	0.189	0.330	0.163	0.190
6	0.337	0.474	0.189	0.436	0.184	0.392	0.188	0.233
7	0.568	0.436	0.255	0.395	0.188	0.479	0.200	0.323
8	0.676	0.338	0.380	0.404	0.181	0.485	0.221	0.416
9	0.684	0.268	0.489	0.269	0.128	0.489	0.156	0.493
10	0.814	0.257	0.580	0.165	0.077	0.604	0.233	0.653

Figure 3.19. Graphical perspective on derived and stated demographics of landowners.

Regional Comparisons

As an example of regional comparisons, Figure 3.20 shows the population proportions of the timber cluster by region. A notable lack of smoothness is evident in the Pacific region. The sample size per discrete level of wooded acres is smaller in the extremes (Table 3.15), so the sharp movements for the Pacific region could be due to low-resolution data. The NWOS aimed to obtain satisfactory sample sizes at the state level, and the Pacific region contains only three states: Washington, Oregon and California. Because the analysis cuts across two variables, sample sizes at the extremes begin to be insufficient at small regions and state levels.

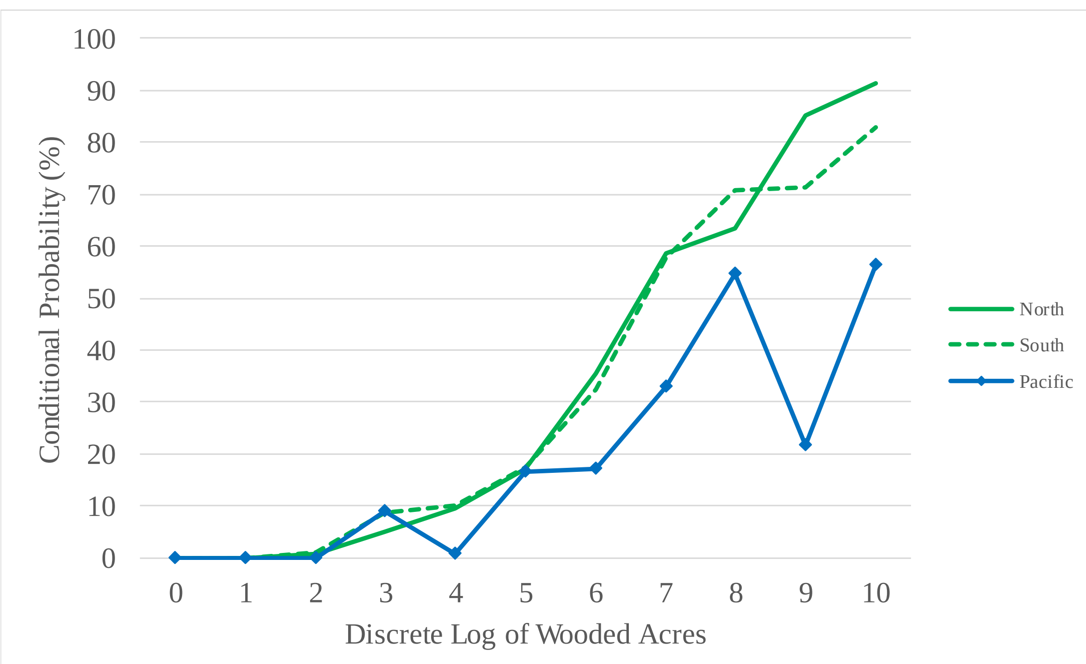


Figure 3.20. Timber cluster population proportion by discrete log of wooded acres by region.

Table 3.16. Sample size by value for Cluster by discrete log of wooded acres in the Pacific region.

	Sample size			
DWA	Non-response	Nontimber Cluster	Timber Cluster	TOTAL
NA	20	-	-	20
0	3	2	-	5
1	1	4	-	5
2	3	14	-	17
3	9	34	5	48
4	10	33	2	45
5	6	41	12	59
6	16	34	11	61
7	7	20	17	44
8	7	10	21	38
9	8	8	5	21
10	1	2	5	8

State Level Population Proportions

For state analyses, sample size per level of discrete log of wooded acres drops considerably, particularly at the extremes of DWA as it did for the Pacific region. For example, for many variables the sample size for $\text{DWA} = \{0,1,9,10\}$ ranged from 1 to 5. Appendix C Table C.6 collates population proportion results for management objectives in North Carolina, and Appendix C Table C.7 summarizes concerns. To summarize results for North Carolina for comparison with national results, we compare slopes of linear trendlines for management objectives, as done in Figure 3.11 (Table 3.16). Using the same relationship categories as Figure 3.11, we see that Privacy, Cabin, Home, and Family change categories compared to the national analysis. Recall from Figure 3.1 that the latter four variables had high non-response rates, and recall from Table 3.3 that Privacy was not a significant predictor of the likelihood of timber harvests for North Carolina.

Table 3.17. Slope of linear fit trend line for discrete log of wooded acres versus population proportion of management objectives in North Carolina, compared with the national scale. Cells are color-coded to represent a strong negative relationship ($slope \leq -2$, pink), relatively neutral relationship ($|slope| \leq 2$, yellow), or a strong positive relationship ($slope \geq 2$, green).

Variable	Slope of Linear Trendline (NC)	Slope of Linear Trendline (National)
Beauty	-2.32	-2.07
Water	-1.97	0.54
Privacy	-1.37	-3.31
Wilderness	-0.73	1.39
Fire	-0.6	0.18
Cabin	-0.45	2.15
Home	0.51	-5.93
NTFP	0.75	0.77
Nature	1.53	-0.28
Heir	3.01	3.54
Family	3.06	-2.61
Investment	3.15	4.5
Farm	4	4.37
Recreation	4.1	2.36
Hunting	4.18	6.4
Timber	9.61	9.62

Discussion

The objective of this research was to develop a set of empirical relationships for non-corporate forest landowners with practical applications in agent-based modeling of forest economics. The three strands of analysis lead to interrelated conclusions about forest landowners and the parcels they occupy. First, the production possibilities and cluster analysis approach informed by Majumdar et al., (2008) showed that the two dimensions of wooded acres and stated management objectives offer a good description of previous and planned timber harvest behavior. In this two dimensional space, the "timber" cluster of landowners are more disposed towards managing for timber relative to alternatives and have more wooded acres at their disposal. In other words, both their biophysical constraints and mental objections are relaxed compared to their counterparts. This finding comports with previous literature that found a positive and significant relationship between plot size and timber harvesting behavior (Beach et al., 2005; Binkley, 1981; Boyd, 1984; Prestemon & Wear, 2000).

To create a dynamic agent-based model of forest landowners, we require some guidance about which factors empirically relate to future timber harvests. The national level probit analysis was able to uncover significant relationships between future likelihood of timber harvests and stated management preferences, demographic characteristics and parcel characteristics. However, at the state level the available data support a more restricted set of explanatory variables, principally stated management objectives and wooded acres. Together with the cluster analysis, we find that stated management objectives and parcel size are important features to include in models on both theoretical and empirical grounds. In the results for southern states, a few states showed a significant and positive relationship between income and likelihood of timber harvests. This result agrees with the typology analysis in Majumdar et al., (2008) and statistical analysis in other studies (Aguilar et al., 2017; Vokoun et al., 2006), and disagrees with other studies that found a negative relationship (Beach et al., 2005; Binkley, 1981).

We are better able to understand and validate the results of the cluster and probit analyses by the use of the conditional probability tables derived for the third part of the analysis. For related reasons, the two-dimensional density plots of clusters showed a fair amount of overlap, and the probit analysis showed only an acceptable ability to predict future likelihood of timber harvests. Both shortcomings relate to the complexity and explanatory cost of aggregation across heterogeneous agents. The conditional probability tables solve this by discretizing wooded acres and calculating population probabilities within each level. This practical solution allows for populating agent-based models directly given a level of parcel size. The findings of this conditional probability analysis validate the other two methods while also providing detail about relationships in the data. In the form of a maxim, landowners with larger parcel sizes engage in more forest management, display a greater propensity to monetize their property, and show an increasing likelihood of using expert opinions and services, with a greater tendency to rely on private sources of information at higher parcel sizes.

The conditional probabilities also provide evidence for the veracity of stated management preferences and future management operations. Landowners with larger parcels are more likely to have a management plan in place. The existence of a management plan suggests that stated management objectives and planned future management actions are in writing and not mere whims. Furthermore, we can trust stated objectives and future plans because landowners with larger parcels likely pay for private information and hire professional foresters. We would not expect landowners to undergo costly activities like planting trees without a serious commitment to sell forest products in the future.

Study Limitations

A limitation of this analysis is that the conversion of Likert scale data to binary responses as done in Aguilar et al., (2017) and elsewhere resulted in some loss of heterogeneity by aggregation. An alternative model form that better preserves heterogeneity is multinomial logistic regression.

Conclusion

The results suggest new interpretations of timber supply curves, illustrated in Figure 3.21, where region A represents timber landowners and region B represents non-timber landowners.

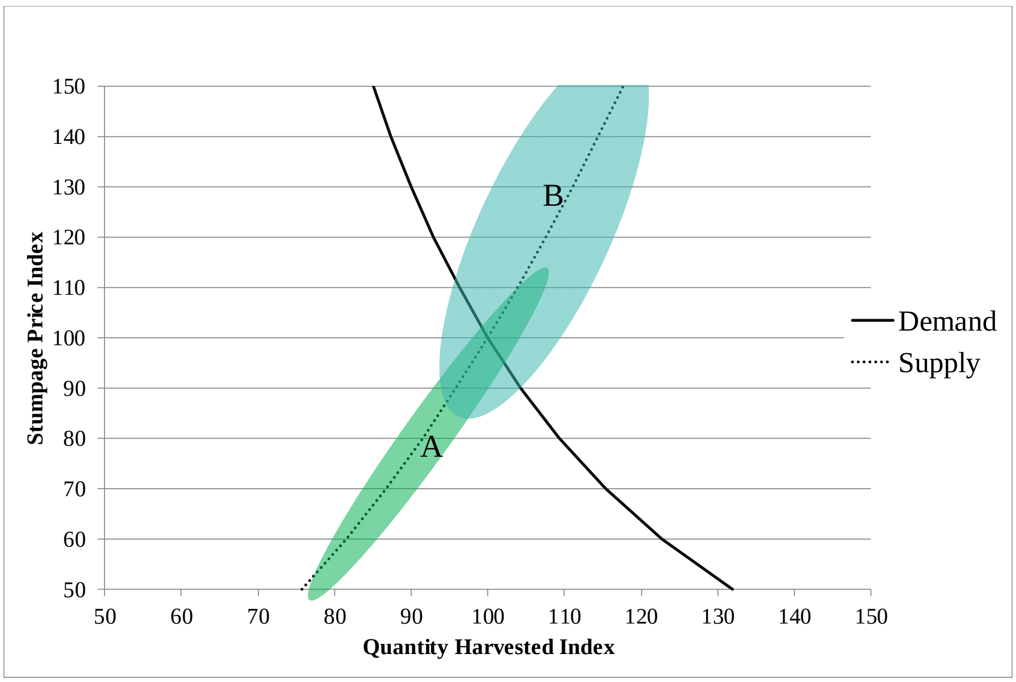


Figure 3.21. Supply and demand curves with conceptual regions A and B occupied by timber and non-timber landowners, respectively.

Landowners who have harvested timber in the past, overlapping considerably those who plan to harvest in the future, are among the producers forming the portion of the supply curve to the left equilibrium with demand. In Figure 3.21, landowners in region A tend to have larger parcel sizes than those in region B, echoing the results from Figure

3.8. Moving up and to the right along the supply curve generally indicates a transition to smaller parcel sizes, lesser likelihood that the landowner has a management plan, and less likelihood of exposure to private and public information sources. Each of the preceding factors is consistent with a supply curve that invokes increasing marginal costs.

However, regarding the implications for model dynamics, landowners in region A have expectations closer to expert information (represented by the narrow ellipse), whereas those in region B have less connection to expert information (wide ellipse). A deterministic supply curve (a fixed-parameter function like Equations 1.1 and 1.2) is ill-equipped to describe this phenomena, whereas the computational methods used in agent-based models could.

The finding that parcel size correlates to timber harvests is unsurprising from the principle of returns to scale and the fact that development, hence parcelization, tends to occur more in urban rather than rural areas. However, forest economic models have yet to actualize this observation, and that task is particularly suited to agent-based models. Using the population proportion estimates derived in this study, a proliferation of bottom-up forest economic models is possible.

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APPENDICES

APPENDIX A

Table A.1. Comparison of Four Global Forest Sector Models.

Model (citation used for each item below unless otherwise specified)	**GFPM** (Buongiorno, Zhu, Zhang, Turner, & Tomberlin, 2003)	**GTM** (B. Sohngen, Mendelsohn, & Sedjo, 2006)	**GLOBIOM** (Havlík et al., 2011)	**FASOMGHG** (D. Adams et al., 2005) later revised in: (Ohrel et al., 2010)
Foresight Regime	Myopic, recursive (Sjølie, Latta, Adams, & Solberg, 2011)[18]	perfect foresight version of rational expectations (Sjølie et al., 2011)[19]	Recursive, price endogenous mathematical programming	Perfect foresight version of rational expectations
Timber product categories	5[20]	1: roundwood	5[21]	6[22]
Trade handling	Tariffs represented by import costs, trade inertia parameters	No[23]	Trade occurs between 11 regions that can be disaggregated to 27	US-Canada-RoW[24]
Forest resource model	Not explicit, nonrestrictive, linear	Indexed forest stocks with growth rates specific to regions.	Downscaled forest resource[25]	Acres[26]
Land use change	N/A	Yes	Yes	Yes
Validation process	Multiple[27]	Results compared to theory	-	Self-validating by rational expectations

[18] Short term determined by market equilibrium. Long term determined by politics, technology trends and markets.

[19] "forward-looking dynamic model of global timber markets"

[20] : "roundwood (fuelwood and charcoal, industrial roundwood, including other industrial roundwood, as defined by FAO), sawnwood and sleepers, wood-based panels (plywood and veneer sheets, particleboard, fiberboard), total fiber furnish (mechanical pulp, chemical pulp and semichemical pulp, other fiber pulp, wastepaper), and paper and paperboard (newsprint, printing and writing paper, other paper and paperboard)"

[21] "saw logs, pulp logs, other industrial logs, traditional fuel wood, and biomass for energy. Saw logs, pulp logs and biomass for energy are further processed. "

[22] Timber and Log products: Sawtimber, pulpwood, fuelwood for hardwood and softwood. Solid wood products: 9 products, Fiber products: 23 products, (Table 7-9 in FASOMGHG specifications)

[23] However, "The model accounts for trade by assuming that each region has a distinct constant marginal cost of transporting timber to its major demand region. Regional price differences therefore exist, but are assumed to follow the law of one price."

[24] Endogenous trade of softwood, OSB and 14 fiber products between US and Canada, other trade flows are exogenous (p. 371 in FASOMGHG specifications)

[25] "mean annual increment for the current management, is obtained by downscaling biomass stock data from the [2006 Global Forest Resources Assessment] from the country level to a 0.5°x0.5°grid...These are used to parameterize mean annual increment curves. Finally, the sawlogs share is estimated by the tree size, which in turn depends on yield and rotation time. "

[26] Represents timberland in acres based on aggregating to several strata: management intensity, forest type, age cohort, region, owner type, site productivity. Assumes even-aged stands.

[27] Adoption of the base software, accepted applications, "comparison of the base-year solution with the actual data," comparison of model predictions to a historical period, MARE

Table A.1. Continued.

Timber demand determinants	Income in each country, input-output coefficients (for intermediate products)	Country population and per capita income	Population, GDP Bioenergy use Diet patterns Processing costs and coefficients International trade costs	Not explicit. Uses a single national demand region with a fixed transportation cost.
Timber supply determinants	Exogenously determined by technology, recycling policy (paper only), production capacity, trade and environmental policies	-	"implicit product supply functions based on detailed, geographically explicit, Leontief production functions"	Supply curves based on own price elasticity
Supply elasticity	Parameters based on the literature	Endogenous (see 1999)	-	Own-price elasticity for each forest product
General solution framework	Spatial partial equilibrium FSM	-	Equilibrium determined by maximizing consumer and producer surplus	-
Base software	PELPS IV, price endogenous linear programming, links with LINDO API and Excel Macros	"GAMS, using the MINOS solver"	-	GAMS, General Algebraic Modeling System
Timber inventory data source	N/A – see CH 10. FAO	-	Land use and other detailed data from: (FAO, ISRIC, USGS, NASA, CRU UEA, JRC, IFRPI, IFA, WISE, etc.)	RPA
Solution type (optimized, time path, etc.)	Maximize yearly consumer and producer surplus assuming market equilibrium in the short run (the long run is not optimal and is controlled by policy)	-	-	Five year equilibrium and land use allocations with rational expectations.
Heterogeneous yield functions	N/A	Yes – uses agro-ecological zones	Yes – mean annual increment is downscaled from FAO biomass stock data	Yes, e.g. varies by management intensity and site productivity, based on ATLAS
Technology change	Exogenous scenarios	-	Production technologies vary by location characteristics	Adaptable – e.g. advances in tree genetics, short rotation forestry

Table A.1. Continued.

Cost types	Transport costs (freight costs and tariffs), manufacturing (excluding raw material costs),	"costs associated with accessing, harvesting, and transporting timber." regeneration costs (included management intensity choice), costs of new land	"Harvesting costs are adjusted for slope and tree size." Processing costs, establishment costs	Regeneration, harvest, transport, manufacturing, and others
Mill representation	"Capacity increases or decreases according to new investments that depend on past global production and the profitability of production in different countries, as revealed by the shadow price of capacity."	N/A	Pulp and paper mill locations (RISI data) used for processing costs, conversion coefficients to final products	Manufacturing coefficients for different products
Greenhouse gas or life-cycle analysis integration	Indirectly through calculating Harvested Wood Products Contribution	In combination with the DICE (Nordhaus & Boyer, 2000) model in (Brent Sohngen & Mendelsohn, 2003)	Yes	Yes
Biomass utilization	No bioenergy products	-	"Ethanol (1st gen.), Biodiesel (1st gen.), Ethanol (2nd gen), Methanol, Heat, Power, Gas, Fuel wood"	Possible biofuel configurations
Timber management (intensive v. otherwise)	N/A	"management intensity determined at the time of planting", may change	Four management systems are considered (irrigated, high input – rainfed, low input – rainfed and subsistence management systems)	23 management intensity classes, some of which are species or region-specific (p. 142)
Fine scale	country	-	SimU's (simulation units). Some data exist on 0.5°x0.5° cells	Aggregated strata
Welfare analysis	Yes (Buongiorno et al., 2003)	-	Equilibrium by maximizing consumer and producer surplus (2011)	Equilibrium found by maximizing producer and consumer surplus (p. 132)

APPENDIX B

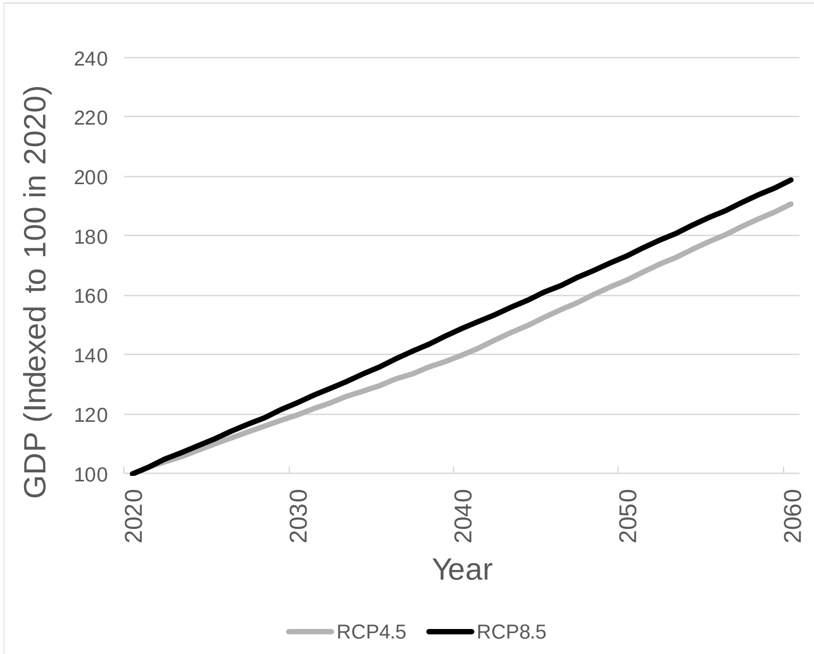

Figure B.1. US economic growth under RCP scenarios 4.5 and 8.5 reflects an approximate 2% annual growth rate during the study period.

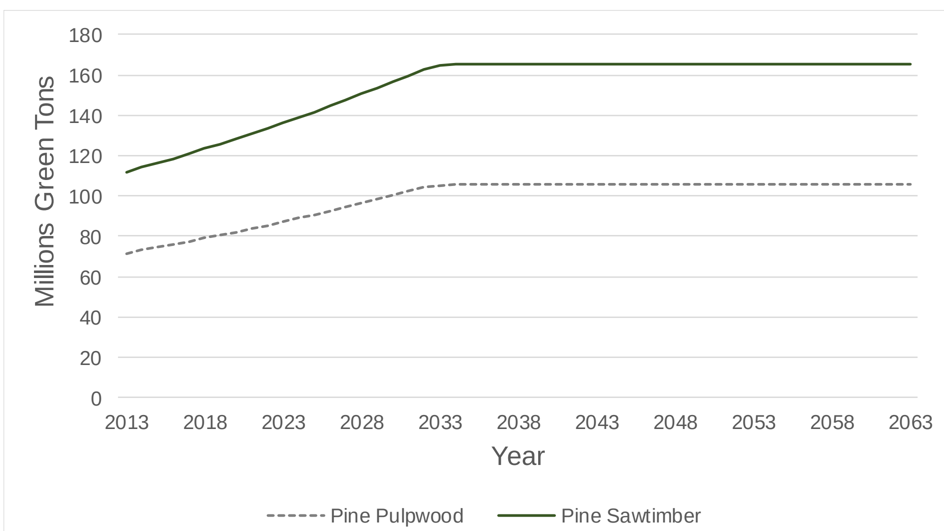

Figure B.2. Demand scenarios in green tons for pine sawtimber (solid green) and pine pulpwood (dashed gray) for the *quantity demanded* and *fully economic* scenarios.

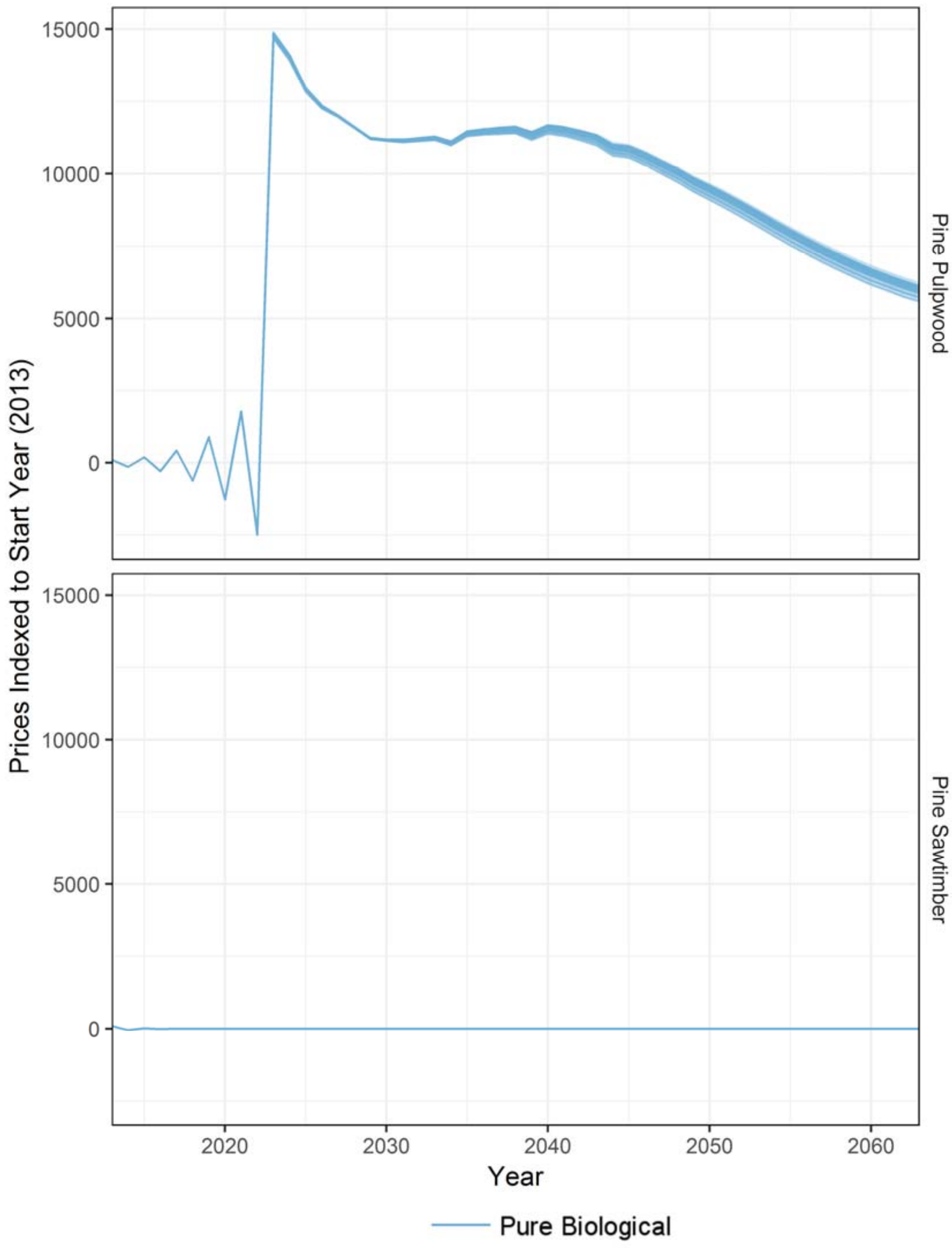

Figure B.3. Indexed pine pulpwood and pine sawtimber inventory for the pure biological case. With near zero harvests, prices become meaningless.

Table B.1. Metanalysis of *3-PG summary models*. Mean model parameters and standard errors by sub-region, averaging across two RCP scenarios and twenty climate models.

	Intercept		Age Class		Age Class^2		Planting Year		Fitness	
Sub-Region	β_0	$S.E._0$	β_1	$S.E._1$	β_2	$S.E._2$	β_3	$S.E._3$	R^2	R^2_{adj}
AL-NCtrl	-767.87	11.12	37.109	0.1854	-1.1775	0.0123	0.3648	0.00545	0.993	0.992
AL-North	-813.00	11.95	38.039	0.1993	-1.2097	0.0132	0.3870	0.00586	0.992	0.992
AL-SE	-658.96	10.01	36.880	0.1669	-1.1750	0.0111	0.3112	0.00491	0.994	0.994
AL-SW_N	-639.88	9.77	35.996	0.1629	-1.1397	0.0108	0.3019	0.00479	0.994	0.994
AL-SW_S	-674.35	9.89	34.011	0.1649	-1.0480	0.0109	0.3193	0.00485	0.993	0.993
AL-WCtrl	-702.09	10.32	35.872	0.1722	-1.1309	0.0114	0.3325	0.00506	0.993	0.993
AR-SW	-633.46	9.61	34.905	0.1602	-1.0953	0.0106	0.2990	0.00471	0.994	0.994
FL-Ctrl	-580.31	11.31	40.073	0.1887	-1.2714	0.0125	0.2734	0.00555	0.993	0.993
FL-NE	-613.24	9.96	38.349	0.1661	-1.2187	0.0110	0.2890	0.00488	0.994	0.994
FL-NW	-660.22	9.60	36.342	0.1601	-1.1452	0.0106	0.3121	0.00471	0.994	0.994
GA-Ctrl	-680.77	10.09	32.315	0.1682	-0.9589	0.0111	0.3229	0.00495	0.993	0.993
GA-NCtrl	-789.43	11.27	37.271	0.1879	-1.1785	0.0124	0.3754	0.00552	0.992	0.992
GA-North	-912.45	13.03	38.113	0.2174	-1.2054	0.0144	0.4360	0.00639	0.990	0.990
GA-SE	-654.10	9.67	32.440	0.1612	-0.9597	0.0107	0.3099	0.00474	0.993	0.993
GA-SW	-609.41	9.09	33.879	0.1517	-1.0356	0.0100	0.2873	0.00446	0.994	0.994
LA-NDelt	-549.13	8.90	34.688	0.1484	-1.1121	0.0098	0.2583	0.00436	0.994	0.994
LA-NW	-564.94	8.88	34.340	0.1481	-1.0774	0.0098	0.2654	0.00435	0.994	0.994
LA-SE	-641.25	9.68	37.020	0.1615	-1.1752	0.0107	0.3027	0.00475	0.994	0.994
LA-SW	-586.42	9.58	36.694	0.1598	-1.1723	0.0106	0.2764	0.00470	0.994	0.994
MS-Ctrl	-649.05	9.93	36.508	0.1656	-1.1621	0.0110	0.3064	0.00487	0.994	0.994
MS-North	-715.82	10.62	36.505	0.1771	-1.1587	0.0117	0.3392	0.00521	0.993	0.993
MS-South	-644.09	9.64	34.168	0.1607	-1.0582	0.0106	0.3043	0.00473	0.994	0.994
MS-SW	-623.21	9.69	36.983	0.1617	-1.1818	0.0107	0.2937	0.00475	0.994	0.994
NC-NCP	-856.74	11.95	36.588	0.1993	-1.1504	0.0132	0.4089	0.00586	0.991	0.991
NC-Pdm	-839.97	11.77	33.004	0.1963	-0.9979	0.0130	0.4010	0.00577	0.990	0.990
NC-SCP	-806.96	11.12	35.816	0.1855	-1.1139	0.0123	0.3842	0.00545	0.992	0.992
SC-NCP	-757.32	10.56	34.200	0.1761	-1.0404	0.0117	0.3601	0.00518	0.993	0.993
SC-Pdm	-802.43	11.36	32.345	0.1894	-0.9564	0.0125	0.3828	0.00557	0.991	0.991
SC-SCP	-711.61	10.14	33.292	0.1692	-0.9996	0.0112	0.3378	0.00497	0.993	0.993
TX-NE	-567.41	9.71	28.043	0.1619	-0.7753	0.0107	0.2690	0.00476	0.992	0.992
TX-SE	-549.68	8.90	32.894	0.1484	-0.9879	0.0098	0.2591	0.00436	0.994	0.994
VA-CP	-939.50	13.08	34.208	0.2181	-1.0369	0.0144	0.4498	0.00641	0.989	0.989
VA-S_Pdm	-983.76	14.84	30.425	0.2475	-0.8687	0.0164	0.4725	0.00728	0.983	0.983

APPENDIX C

Table C.1. Summary of the Forest Agent-Based Landowner Economy (FABLE) model under the ODD Protocol (Grimm et al., 2006, 2010).

ODD Protocol Category		Implementation in FABLE
1	Purpose	Agent-based model of forest markets in the US Southeast
2	Entities: forest landowner agents	Timber NIPF Non-timber NIPF Corporate
	State variables:	Real discount rates ranging from 3% to 8% Parcel size Age class distribution of stands Timber preference index Timber yield curves Location
	Scales:	Annual timestep Parcel scale model of the US Southeast
	Environment:	Market price Demand CO_2 fertilization
3	Process overview and scheduling	Agent creation and timber stand creation || timber growth > opportunity cost calculation > bidding > market clearing price > harvesting > next model year
4	Basic principles:	Opportunity cost Production possibility frontier Industry supply curve
	Emergence:	Market price
	Adaptation:	Price expectation
	Objectives:	Utility maximization
	Learning:	Bounded rationality mode: improve past price discovery after a sale.
	Prediction:	Agents forecast timber yield
	Sensing:	Discount rate Stand volumes
	Interaction:	---
	Stochasticity:	Agents draw from distributions for initial conditions.
	Collectives:	Regional market
	Observation:	Implicit supply elasticity Implicit inventory elasticity Carbon sequestration Forest Inventory Market prices Average harvest age Removals Age class structure
5	Initialization:	Model is reproducible using pre-prepared input files based on empirical data.
6	Input data:	Empirical bivariate distribution of wooded acres and timber preference index derived from NWOS. FIA inventory and removals data by county CO_2 fertilization derived from PINEMAP 3-PG
7	Submodels:	Agents use equations to calculate bids based on opportunity costs.

Table C.2. Selection of National Woodland Owner Survey Variables.

OWNTYPE	CUT_CHIP_PERS	LEASE_ACT_OTH	HELP_WOOD
OWNERS_NUMBER	CUT_CHIP_SALE	CERT_KNOW	HELP_TRAN
AC_LAND	CUT_CHIP_OTH	CERT_KNOW	HELP_EASE
AC_WOOD	CUT_CHIP_NO	EASE_KNOW	HELP_COST
PARC_MULTI	CUT_UNWAN_PERS	EASE	HELP_TAX
PARC_MULTI_NUMBER	CUT_UNWAN_SALE	EASE_5YR	HELP_TIM
OBJ_BEA	CUT_UNWAN_OTH	REC_HOW_HUNT	HELP_OTH
OBJ_NAT	CUT_UNWAN_NO	REC_HOW_FISH	HELP_TYPE_TALK
OBJ_WAT	CUT_OTH_PERS	REC_HOW_HIKE	HELP_TYPE_VISIT
OBJ_WIL	CUT_OTH_SALE	REC_HOW_BIKE	HELP_TYPE_WRIT
OBJ_INV	CUT_OTH_OTH	REC_HOW_CAMP	HELP_TYPE_NET
OBJ_HOM	CUT_OTH_NO	REC_HOW_HORSE	HELP_TYPE_CONF
OBJ_CAB	CUT_FORESTER	REC_HOW_SKI	HELP_TYPE_OTH
OBJ_FAR	CUT_LOGGER	REC_HOW_OHV	HELP_TYPE_NA
OBJ_PRI	NTFP_EDIB_PERS	REC_HOW_OTH	CNC_AIR
OBJ_FAM	NTFP_EDIB_SALE	ADVICE	CNC_OHV
OBJ_CHILD	NTFP_EDIB_NO	ADV_TOP_INS	CNC_ANIM
OBJ_FIRE	NTFP_MEDI_PERS	ADV_TOP_WILD	CNC_DEV
OBJ_TIM	NTFP_MEDI_SALE	ADV_TOP_TIM	CNC_WAT_LACK
OBJ_NTFP	NTFP_MEDI_NO	ADV_TOP_CONS	CNC_CLIM
OBJ_HUNT	NTFP_LAND_PERS	ADV_TOP_FIRE	CNC_TAX
OBJ_REC	NTFP_LAND_NO	ADV_TOP_OTH	CNC_INVA
ACQ_TYPE_INHERITED	NTFP_LAND_SALE	ADV_METH_TALK	CNC_HEIR
ACQ_SRC_PARENT	NTFP_DECO_PERS	ADV_METH_VISIT	CNC_DUMP
ACQ_SRC_SPOUSE	NTFP_DECO_SALE	ADV_METH_WRIT	CNC_TRES
ACQ_SRC_FAM	NTFP_DECO_NO	ADV_METH_NET	CNC_INS
TRAN	NTFP_OTH_PERS	ADV_METH_CONF	CNC_WAT_POL
TRAN_TO_CHILD	NTFP_OTH_SALE	ADV_METH_OTH	CNC_FIRE
TRAN_TO_FAM	NTFP_OTH_NO	ADV_SRC_STATE	CNC_STORM
MAN_OWN	FUT_CUT_SALE	ADV_SRC_FED	CNC_OTH
MAN_SPOUSE	FUT_CUT_PERS	ADV_SRC_PRIV	ATT_WOODED
MAN_CHILD	FUT_NTFP	ADV_SRC_OWNER	ATT_SELL
MAN_PARENT	FUT_RED_FIRE	ADV_SRC_FAM	OWN1_RET
MAN_FAM	FUT_CONTROL_BURN	ADV_SRC_OTH	OWN2_RET
MAN_PARTNER	FUT_INVA		OWN1_AGE
MAN_FORESTER	FUT_INS		OWN2_AGE
MAN_OTH	FUT_ROAD		OWN1_EDU
MAN_PLAN	FUT_TRAIL		OWN2_EDU
MAN_PLAN_IMPLEMENT	FUT_WILD		INCOME
MAN_PLAN_WRITER	FUT_GRAZE		INC_WOOD
CUT_FIRE_PERS	LEASE		
CUT_FIRE_SALE	LEASE_ACT_HUNT		
CUT_FIRE_OTH	LEASE_ACT_REC		
CUT_FIRE_NO	LEASE_ACT_GRAZE		
CUT_LOG_PERS	LEASE_ACT_CONS		
CUT_LOG_SALE	LEASE_ACT_CARB		
CUT_LOG_OTH	LEASE_ACT_WAT		
CUT_LOG_NO	LEASE_ACT_WILD		

Figure C.1. Parcel size map of North Carolina ranging from small (green) to large (red).

Table C.3. Crosswalk of binary versions of NWOS variables (denoted with a “B” suffix) and their friendly names.

Variable	Friendly Name	Variable	Friendly Name	Variable	Friendly Name	Variable	Friendly Name
QUEST_STATE	State	CUT_FIRE_PERSB	FirewoodPers	FUT_INVAB	FutureInsect	FUT_INSB	FutureInsect
DiscAcres	DiscAcres	CUT_FIRE_SALEB	FirewoodSale	FUT_ROADB	FutureRoad	ADV_SRC_EXTB	SourceExtens
DiscWooded	DiscWood	CUT_FIRE_OTHB	FirewoodOther	FUT_TRAILB	FutureTrail	ADV_SRC_STATE_OTHB	SourceStOther
Couple	Couple	CUT_FIRE_NOB	FirewoodNone	FUT_WILDB	FutureWild	ADV_SRC_FEDB	SourceFederal
Coop	Coop	CUT_CHIP_PERSB	ChipsPers	FUT_GRAZEB	FutureGraze	ADV_SRC_PRIVB	SourcePrivate
Education1	Education1	CUT_CHIP_SALEB	ChipsSale	LEASEB	Lease	ADV_SRC_OWNERB	SourceNeighbor
Education2	Education2	CUT_CHIP_OTHB	ChipsOther	LEASE_ACT_HUNTB	LeaseHunt	ADV_SRC_FAMB	SourceFamily
Income	Income	CUT_CHIP_NOB	ChipsNone	LEASE_ACT_RECB	LeaseRec	ADV_SRC_OTHB	SourceOther
ForestCover	ForestCover	CUT_FENCE_PERSB	FencePers	LEASE_ACT_GRAZEB	LeaseGraze	HELP_WOODB	HelpWoodMgmt
OBJ_BEAB	Beauty	CUT_FENCE_SALEB	FenceSale	LEASE_ACT_LOGB	LeaseLog	HELP_TRANB	HelpTransferHeir
OBJ_NATB	Nature	CUT_FENCE_OTHB	FenceOther	LEASE_ACT_CONSB	LeaseConserve	HELP_EASEB	HelpEasement
OBJ_WATB	Water	CUT_FENCE_NOB	FenceNone	LEASE_ACT_CARBB	LeaseCarbon	HELP_COSTB	HelpCostShare
OBJ_WILB	Wilderness	CUT_UNWAN_PERSB	ClearPers	LEASE_ACT_WATB	LeaseWater	HELP_TAXB	HelpTaxes
OBJ_INVB	Investment	CUT_UNWAN_SALEB	ClearSale	LEASE_ACT_WILDB	LeaseWild	HELP_TIMB	HelpTimber
OBJ_HOMB	Home	CUT_UNWAN_OTHB	ClearOther	LEASE_ACT_OTHB	LeaseOther	HELP_OTHB	HelpOther
OBJ_CABB	Cabin	CUT_UNWAN_NOB	ClearNone	CERT_KNOWB	KnowCert	HELP_TYPE_TALKB	TypeHelpTalk
OBJ_FARB	Farm	CUT_OTH_PERSB	MiscCutPers	CERTB	Certified	HELP_TYPE_VISITB	TypeHelpVisit
OBJ_PRIB	Privacy	CUT_OTH_SALEB	MiscCutSale	EASE_KNOWB	KnowEase	HELP_TYPE_WRITB	TypeHelpWrite
OBJ_FAMB	Family	CUT_OTH_OTHB	MiscCutOther	EASEB	Easement	HELP_TYPE_NETB	TypeHelpNet
OBJ_CHILDB	Child	CUT_OTH_NOB	MiscCutNone	EASE_5YRB	Easement5	HELP_TYPE_CONFB	TypeHelpConf
OBJ_FIREB	Fire	CUT_FORESTERB	CutForester	REC_HOW_HUNTB	RecreateHunt	HELP_TYPE_OTHB	TypeHelpOther
OBJ_TIMB	Timber	CUT_LOGGERB	CutLogger	REC_HOW_FISHB	RecreateFish	HELP_TYPE_NAB	TypeHelpNone
OBJ_NTFPB	NTFP	NTFP_EDIB_PERSB	EdiblePers	REC_HOW_HIKEB	RecreateHike	CNC_AIRB	ConcernAir
OBJ_HUNTB	Hunting	NTFP_EDIB_SALEB	EdibleSale	REC_HOW_BIKEB	RecreateBike	CNC_OHVB	ConcernNoise
OBJ_RECB	Recreation	NTFP_EDIB_NOB	EdibleNone	REC_HOW_CAMPB	RecreateCamp	CNC_ANIMB	ConcernAnimal
ACQ_TYPE_INHERITB	Acquired	NTFP_MEDI_PERSB	MedicPers	REC_HOW_HORSEB	RecreateHorse	CNC_DEVB	ConcernDevelop
TRAN_TO_CHILDB	TransChild	NTFP_MEDI_SALEB	MedicSale	REC_HOW_SKIB	RecreateSki	CNC_WAT_LACKB	ConcernNoWater
TRAN_TO_FAMB	TransFamily	NTFP_MEDI_NOB	MedicNone	REC_HOW_OHVB	RecreateATV	CNC_CLIMB	ConcernClimate
MAN_OWNB	ManageSelf	NTFP_LAND_PERSB	ScapePers	REC_HOW_OTHB	RecreateOther	CNC_TAXB	ConcernTax
MAN_SPOUSEB	ManageSpouse	NTFP_LAND_SALEB	ScapeSale	ADVICEB	Advice	CNC_INVAB	ConcernInvasive
MAN_CHILDB	ManageChild	NTFP_LAND_NOB	ScapeNone	ADV_TOP_INSB	AdviceDisease	CNC_HEIRB	ConcernHeir
MAN_PARENTB	ManageParent	NTFP_DECO_PERSB	DecorPers	ADV_TOP_WILDB	AdviceWilderness	CNC_DUMPB	ConcernDump
MAN_FAMB	ManageFamily	NTFP_DECO_SALEB	DecorSale	ADV_TOP_TIMB	AdviceTimber	CNC_TRESB	ConcernTrespass
MAN_PARTNERB	ManagePartner	NTFP_DECO_NOB	DecorNone	ADV_TOP_CONSB	AdviceConserve	CNC_INSB	ConcernDisease
MAN_FORESTERB	ManageForester	NTFP_OTH_PERSB	MiscNtfpPers	ADV_TOP_FIREB	AdviceFire	CNC_WAT_POLB	ConcernWaterPol
MAN_OTHB	ManageOther	NTFP_OTH_SALEB	MiscNtfpSale	ADV_TOP_OTHB	AdviceOther	CNC_FIREB	ConcernFire
MAN_PLANB	MgmtPlan	NTFP_OTH_NOB	MiscNtfpNone	ADV_METH_TALKB	MethodTalk	CNC_STORMB	ConcernStorm
MAN_PLAN_IMPLEMENTB	MgmtPlanWork	FUT_CUT_SALEB	FutureSale	ADV_METH_VISITB	MethodVisit	CNC_OTHB	ConcernOther
MAN_PLAN_WRITERB	MgmtPlanWriter	FUT_CUT_PERSB	FuturePers	ADV_METH_WRITB	MethodWrite	ATT_WOODEDB	StayWooded
CUT_LOG_PERSB	LoggingPers	FUT_NTFPB	FutureNtfp	ADV_METH_NETB	MethodNet	ATT_SELLB	BuyMeOut
CUT_LOG_SALEB	LoggingSale	FUT_RED_FIREB	FutureFireHaz	ADV_METH_CONFB	MethodConfer	OWN1_RETB	Retired1
CUT_LOG_OTHB	LoggingOther	FUT_CONTROL_BURNB	FutureCtrlBurn	ADV_METH_OTHB	MethodOther	OWN2_RETB	Retired2
CUT_LOG_NOB	LoggingNone	FUT_INVAB	FutureInvasive	ADV_SRC_STATEB	SourceState		

Table C.4. Representative table (National, OBJ_TIM) to be included in the data summary appendix.[28]

DiscWooded	nTimber-1	nTimber0	nTimber1	Timber-1	Timber0	Timber1	acTimber-1	acTimber0	acTimber1	PPTimber-1	PPTimber0	PPTimber1	XbrTimber-1	XbrTimber0	XbrTimber1	acrTimber-1	acrTimber0	acrTimber1	VxbTimber	BmeanTimbe
-1	134	179	86	0.336	0.449	0.216	2.558	13.015	0.892	0.155	0.790	0.054	2.8E-04	1.4E-03	9.8E-05	49048	35580.5	43409	1.2E-07	0.325
0	7	127	3	0.051	0.927	0.022	4.460	79.665	1.078	0.052	0.935	0.013	4.9E-04	8.7E-03	1.2E-04	116	1561	160	8.2E-07	0.023
1	3	148	4	0.019	0.955	0.026	0.660	44.438	0.371	0.015	0.977	0.008	7.2E-05	4.9E-03	4.1E-05	20	2537	89	2.0E-07	0.026
2	25	470	38	0.047	0.882	0.071	2.851	70.359	3.767	0.037	0.914	0.049	3.1E-04	7.7E-03	4.1E-04	1758	16126	1781	1.6E-07	0.075
3	27	898	139	0.025	0.844	0.131	1.298	44.369	5.829	0.025	0.862	0.113	1.4E-04	4.9E-03	6.4E-04	2739	45025	10470	3.6E-08	0.134
4	66	1244	387	0.039	0.733	0.228	1.066	23.912	6.982	0.033	0.748	0.218	1.2E-04	2.6E-03	7.6E-04	7896	130863	64697	7.1E-09	0.237
5	71	1371	781	0.032	0.617	0.351	0.565	11.501	6.167	0.031	0.631	0.338	6.2E-05	1.3E-03	6.8E-04	12222	259535	147116	1.4E-09	0.363
6	47	800	803	0.028	0.485	0.487	0.151	2.753	2.687	0.027	0.492	0.481	1.7E-05	3.0E-04	2.9E-04	15281	356967	330838	2.0E-10	0.501
7	10	250	463	0.014	0.346	0.640	0.010	0.328	0.605	0.011	0.348	0.642	1.1E-06	3.6E-05	6.6E-05	13419	329735	479159	1.5E-11	0.649
8	8	80	264	0.023	0.227	0.750	0.004	0.036	0.139	0.023	0.201	0.776	4.5E-07	3.9E-06	1.5E-05	16617	239655	567572	1.1E-12	0.767
9	1	28	115	0.007	0.194	0.799	1.4E-04	0.005	0.023	0.005	0.183	0.812	1.5E-08	5.6E-07	2.5E-06	7120	235117	1050968	7.3E-14	0.804
10	1	8	35	0.023	0.182	0.795	7.7E-05	0.001	0.003	0.022	0.193	0.785	8.4E-09	7.4E-08	3.0E-07	13000	104754	526102	3.7E-15	0.814
11	-	2	12	0.000	0.143	0.857	-	4.9E-05	3.8E-04	-	0.112	0.888	-	5.3E-09	4.2E-08	-	82500	395128	1.7E-16	0.857

[28] Definitions of variables given in Table B.4.

Table C.5. Definitions of variables in Table B.3.

Variable	Definition
BmeanLoggingSale	Population proportions disregarding non-response: PPLoggingSale1/(PPLoggingSale1+ PPLoggingSale0)
VxbLoggingSale	Variance in the number of ownerships for all responses[29]
acrLoggingSale1	Aggregate acres of land of responses 4, 5
acrLoggingSale0	Aggregate acres of land of responses 1, 2, 3
acrLoggingSale-1	Aggregate acres of land of non-response
XbrLoggingSale1	Sum of area-weighted responses (4, 5) divided by sample size of those responses[30]
XbrLoggingSale0	Sum of area-weighted responses (1, 2, 3) divided by sample size of those responses[4]
XbrLoggingSale-1	Sum of area-weighted non-responses divided by sample size of those responses[4]
PPLoggingSale1	Population proportion of responses 4, 5 (Equation 4)
PPLoggingSale0	Population proportion of responses 1, 2, 3 (Equation 4)
PPLoggingSale-1	Population proportion of non-response (Equation 4)
acLoggingSale1	Sum over inverse areas (AC_LAND) of responses 4, 5 (Equation 4, denominator)
acLoggingSale0	Sum over inverse areas (AC_LAND) responses 1, 2, 3 (Equation 4, denominator)
acLoggingSale-1	Sum over inverse areas (AC_LAND) of non-response (Equation 4, denominator)
LoggingSale1	Within-sample proportion of responses 4, 5
LoggingSale0	Within-sample proportion of responses 1, 2, 3
LoggingSale-1	Within-sample proportion of non-response
nLoggingSale1	Sampe size of responses 4, 5 for variable CUT_LOG_SALE
nLoggingSale0	Sample size of responses 1, 2, 3 for variable CUT_LOG_SALE
nLoggingSale-1	Sample size of non-response for variable CUT_LOG_SALE
DiscWooded	Discrete log of wooded acres, rounded down

[29] See $\widehat{var}(\widehat{N}_{hd})$ in Equation 2, page 30 in B. J. Butler et al., (2016). In this case, $\bar{x}$ is the sum of XbrLoggingSale$i$ for i=(-1,0,1).

[30] See $\bar{x}$ in Equation 1, page 30 in B. J. Butler et al., (2016)

Table C.6. Discrete log of wooded acres (DWA) and population proportions of Management Objectives in North Carolina.

DWA	Beauty	Nature	Water	Wilderness	Investment	Home	Cabin	Farm	Privacy	Family	Child	Fire	Timber	NTFP	Hunting	Recreation
NA	0.781	0.872	0.872	0.773	0.680	0.416	NA	0.716	0.294	0.364	0.798	0.158	0.264	0.317	0.422	0.256
0	1.000	0.078	0.954	0.954	0.954	NA	0.922	0.032	0.968	NA	0.078	0.046	0.032	NA	0.046	0.046
1	1.000	1.000	1.000	0.776	0.597	1.000	NA	0.149	0.373	0.373	0.552	0.149	NA	NA	0.149	0.149
2	0.721	0.594	0.488	0.594	0.291	0.403	0.291	NA	0.635	0.324	0.778	0.117	NA	0.012	0.117	0.149
3	0.500	0.437	0.581	0.616	0.481	0.639	NA	0.175	0.527	0.400	0.620	0.286	0.139	0.021	0.283	0.235
4	0.613	0.605	0.643	0.645	0.607	0.519	0.185	0.307	0.651	0.491	0.855	0.279	0.287	0.066	0.216	0.209
5	0.764	0.831	0.715	0.861	0.678	0.593	0.212	0.525	0.707	0.447	0.747	0.162	0.404	0.062	0.495	0.531
6	0.617	0.618	0.627	0.732	0.705	0.498	0.248	0.555	0.536	0.454	0.846	0.136	0.729	0.079	0.530	0.381
7	0.825	0.805	0.604	0.760	0.812	0.370	0.124	0.529	0.582	0.387	0.684	0.142	0.828	0.175	0.661	0.258
8	0.623	0.794	1.000	0.854	0.801	0.190	0.104	0.465	0.218	0.409	0.863	0.104	0.839	0.265	0.497	0.365
9	0.665	0.665	0.557	0.598	1.000	0.726	0.455	0.730	0.469	0.640	0.700	NA	0.892	0.130	0.467	0.685
10	NA	NA	NA	1.000	1.000	1.000	NA	NA	NA	NA	NA	NA	1.000	NA	0.484	NA

Table C.7. Discrete log of wooded acres and population proportions of Concerns in North Carolina.

DWA	Air Pollution	Trespassing	Lack of Water	Climate	Water Pollution	Fire	Noise	Animal	Dumping	Disease	Tax	Invasive	Development	Heir	Storms
NA	0.23	0.49	0.34	0.11	0.30	0.46	0.24	0.14	0.50	0.30	0.65	0.11	0.23	0.51	0.30
0	0.00	0.97	0.97	0.00	0.97	0.97	0.97	0.00	0.97	0.97	0.97	0.97	0.97	0.00	0.97
1	0.55	0.73	0.00	0.00	0.73	0.55	0.55	0.00	0.73	0.73	0.73	0.18	0.55	0.18	0.55
2	0.36	0.95	0.36	0.36	0.77	0.78	0.47	0.36	0.73	0.76	1.00	0.52	0.47	0.66	0.68
3	0.54	0.46	0.41	0.48	0.63	0.55	0.29	0.13	0.42	0.37	0.76	0.34	0.38	0.60	0.32
4	0.59	0.63	0.46	0.38	0.51	0.58	0.46	0.29	0.64	0.66	0.85	0.37	0.44	0.77	0.48
5	0.38	0.87	0.48	0.38	0.47	0.84	0.44	0.23	0.79	0.71	0.86	0.52	0.54	0.79	0.55
6	0.42	0.76	0.35	0.33	0.57	0.78	0.57	0.27	0.76	0.78	0.90	0.37	0.49	0.75	0.63
7	0.48	0.96	0.51	0.41	0.53	0.90	0.60	0.20	0.94	0.81	0.89	0.27	0.54	0.78	0.72
8	0.39	0.79	0.70	0.24	0.63	0.72	0.42	0.16	0.73	0.58	0.91	0.70	0.28	0.64	0.81
9	0.00	0.80	0.77	0.00	0.57	1.00	0.00	0.74	0.80	1.00	1.00	0.77	0.22	1.00	0.77
10	0.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00

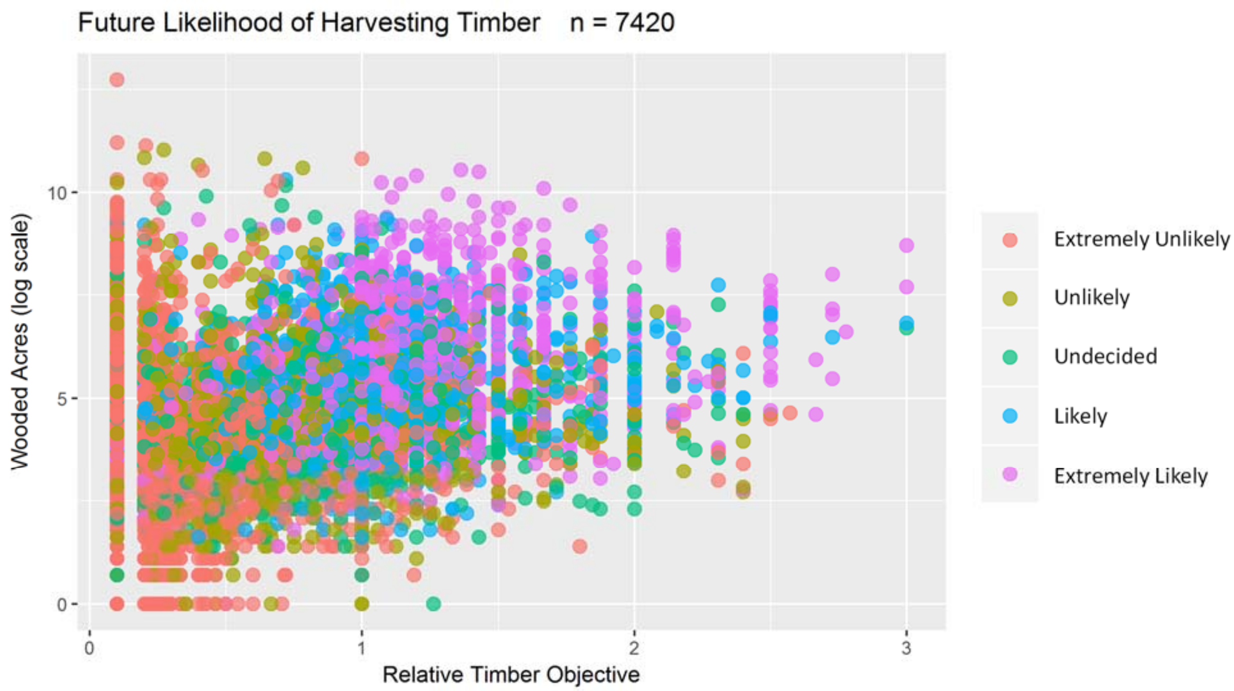

Figure C.2. Scatterplot of relative timber objective versus log of wooded acres color-coded by stated future likelihood of timber harvest.

DATA APPENDIX

The data appendix that follows contains two parts:

(1) Population proportions of forest landowner attributes at the national scale. Friendly names for the given attribute are cross-referenced with the standard NWOS variable name in Appendix C Table C.3. Exceptions to the preceding are the variables “MeanAcre” and “MeanWood.” Respectively, these are binary variables indicated whether landowners own parcels with less than (or equal to) or greater than the mean acres or mean wooded acres, respectively. These are means of the untransformed acreage measures. Pages: 156 – 237.

(2) Probit model results at the state level, for states with sufficient and complete samples for selected variables, and at the national level (without regional dummy variables and the PastUnknown variable as in Table 3.2). Pages 238 – 266.

Table DA.1. Sample sizes (n) and population proportions (PP) by response to Acquired and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	43	201	155	0.283	0.569	0.148
0	3	119	15	0.019	0.897	0.084
1	2	139	14	0.011	0.915	0.074
2	8	438	87	0.012	0.851	0.137
3	11	815	238	0.009	0.808	0.183
4	17	1182	498	0.012	0.723	0.265
5	28	1442	753	0.015	0.669	0.316
6	30	979	641	0.020	0.606	0.375
7	10	378	335	0.014	0.519	0.467
8	4	176	172	0.013	0.480	0.507
9	1	67	76	0.010	0.469	0.521
10	2	24	18	0.053	0.537	0.409
11		9	5		0.605	0.395

Table DA.2. Sample sizes (n) and population proportions (PP) by response to Advice and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	55	255	89	0.241	0.745	0.014
0	6	120	11	0.033	0.884	0.082
1	2	140	13	0.012	0.887	0.101
2	7	471	55	0.008	0.896	0.095
3	14	908	142	0.010	0.858	0.132
4	21	1309	367	0.013	0.757	0.230
5	32	1508	683	0.014	0.677	0.309
6	22	907	721	0.014	0.542	0.444
7	9	264	450	0.013	0.371	0.616
8	4	99	249	0.011	0.281	0.709
9	2	41	101	0.008	0.265	0.726
10	2	7	35	0.032	0.182	0.786
11		5	9		0.355	0.645

Table DA.3. Sample sizes (n) and population proportions (PP) by response to AdviceConserve and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	77	285	37	0.257	0.739	0.004
0	19	117	1	0.130	0.858	0.012
1	14	139	2	0.085	0.903	0.013
2	37	481	15	0.065	0.905	0.030
3	75	938	51	0.063	0.890	0.047
4	130	1455	112	0.076	0.848	0.075
5	153	1809	261	0.067	0.817	0.116
6	141	1270	239	0.079	0.776	0.145
7	65	455	203	0.080	0.647	0.273
8	34	206	112	0.093	0.594	0.313
9	14	83	47	0.112	0.560	0.328
10	3	23	18	0.053	0.580	0.366
11		8	6		0.599	0.401

Table DA.4. Sample sizes (n) and population proportions (PP) by response to AdviceDisease and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	77	298	24	0.257	0.736	0.006
0	19	113	5	0.130	0.823	0.047
1	14	133	8	0.085	0.848	0.068
2	37	480	16	0.065	0.903	0.033
3	75	945	44	0.063	0.892	0.044
4	130	1488	79	0.076	0.874	0.050
5	153	1920	150	0.067	0.863	0.070
6	141	1337	172	0.079	0.817	0.104
7	65	532	126	0.080	0.743	0.176
8	34	227	91	0.093	0.643	0.264
9	14	86	44	0.112	0.581	0.306
10	3	25	16	0.053	0.622	0.325
11		7	7		0.512	0.488

Table DA.5. Sample sizes (n) and population proportions (PP) by response to AdviceFire and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	99	284	16	0.263	0.736	0.001
0	25	109	3	0.177	0.794	0.029
1	18	136	1	0.108	0.884	0.007
2	49	480	4	0.088	0.903	0.009
3	107	940	17	0.100	0.879	0.021
4	167	1501	29	0.102	0.879	0.019
5	247	1902	74	0.115	0.849	0.036
6	208	1330	112	0.124	0.809	0.068
7	87	510	126	0.115	0.713	0.172
8	45	227	80	0.131	0.649	0.220
9	19	86	39	0.158	0.580	0.261
10	3	24	17	0.053	0.599	0.348
11		7	7		0.530	0.470

Table DA.6. Sample sizes (n) and population proportions (PP) by response to AdviceOther and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	77	318	4	0.257	0.742	0.000
0	19	117	1	0.130	0.864	0.006
1	14	137	4	0.085	0.886	0.029
2	37	487	9	0.065	0.922	0.014
3	75	975	14	0.063	0.921	0.015
4	130	1537	30	0.076	0.905	0.019
5	153	2023	47	0.067	0.913	0.020
6	141	1468	41	0.079	0.894	0.026
7	65	638	20	0.080	0.890	0.029
8	34	307	11	0.093	0.878	0.029
9	14	125	5	0.112	0.850	0.038
10	3	41		0.053	0.947	
11		14			1.000	

Table DA.7. Sample sizes (n) and population proportions (PP) by response to AdviceTimber and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	77	267	55	0.257	0.739	0.004
0	19	115	3	0.130	0.858	0.012
1	14	141		0.085	0.915	
2	37	489	7	0.065	0.927	0.009
3	75	939	50	0.063	0.889	0.048
4	130	1387	180	0.076	0.813	0.111
5	153	1659	411	0.067	0.747	0.187
6	141	1000	509	0.079	0.602	0.319
7	65	325	333	0.080	0.450	0.470
8	34	142	176	0.093	0.402	0.505
9	14	51	79	0.112	0.329	0.559
10	3	9	32	0.053	0.220	0.727
11		7	7		0.530	0.470

Table DA.8. Sample sizes (n) and population proportions (PP) by response to AdviceWilderness and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	77	290	32	0.257	0.739	0.004
0	19	115	3	0.130	0.835	0.035
1	14	139	2	0.085	0.899	0.016
2	37	488	8	0.065	0.921	0.014
3	75	953	36	0.063	0.905	0.031
4	130	1460	107	0.076	0.857	0.067
5	153	1804	266	0.067	0.809	0.124
6	141	1243	266	0.079	0.756	0.165
7	65	455	203	0.080	0.632	0.288
8	34	180	138	0.093	0.510	0.397
9	14	85	45	0.112	0.587	0.301
10	3	20	21	0.053	0.512	0.434
11		8	6		0.588	0.412

Table DA.9. Sample sizes (n) and population proportions (PP) by response to Beauty and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	130	100	169	0.140	0.419	0.441
0	2	23	112	0.012	0.150	0.838
1	2	24	129	0.013	0.117	0.870
2	15	82	436	0.020	0.122	0.858
3	19	207	838	0.015	0.167	0.818
4	56	401	1240	0.029	0.208	0.764
5	58	505	1660	0.024	0.206	0.769
6	47	404	1199	0.027	0.229	0.744
7	15	168	540	0.020	0.228	0.752
8	17	93	242	0.045	0.280	0.675
9	7	47	90	0.034	0.330	0.636
10	4	11	29	0.068	0.223	0.709
11	2	4	8	0.119	0.337	0.544

Table DA.10. Sample sizes (n) and population proportions (PP) by response to BuyMeOut and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	95	239	65	0.336	0.522	0.142
0	5	97	35	0.023	0.705	0.272
1	4	106	45	0.028	0.674	0.298
2	28	384	121	0.049	0.722	0.229
3	42	762	260	0.030	0.703	0.267
4	69	1270	358	0.035	0.736	0.229
5	93	1634	496	0.037	0.718	0.245
6	87	1224	339	0.046	0.738	0.216
7	20	538	165	0.028	0.746	0.226
8	10	263	79	0.029	0.745	0.227
9	6	104	34	0.034	0.714	0.252
10		28	16		0.646	0.354
11		10	4		0.678	0.322

Table DA.11. Sample sizes (n) and population proportions (PP) by response to Cabin and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	154	213	32	0.217	0.700	0.084
0	6	122	9	0.049	0.888	0.063
1	5	136	14	0.026	0.868	0.106
2	33	440	60	0.045	0.836	0.119
3	51	891	122	0.049	0.823	0.128
4	106	1339	252	0.060	0.781	0.159
5	120	1664	439	0.051	0.737	0.213
6	107	1152	391	0.061	0.691	0.248
7	30	489	204	0.039	0.667	0.293
8	19	233	100	0.054	0.669	0.277
9	7	100	37	0.057	0.703	0.240
10	5	28	11	0.083	0.666	0.251
11	3	7	4	0.180	0.513	0.307

Table DA.12. Sample sizes (n) and population proportions (PP) by response to Certified and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	71	197	131	0.297	0.439	0.263
0	11	92	34	0.103	0.666	0.231
1	6	108	41	0.035	0.685	0.281
2	36	352	145	0.070	0.636	0.293
3	53	750	261	0.052	0.686	0.262
4	92	1225	380	0.051	0.713	0.236
5	114	1540	569	0.053	0.677	0.269
6	76	1121	453	0.047	0.670	0.283
7	24	473	226	0.028	0.663	0.309
8	16	213	123	0.047	0.592	0.361
9	9	80	55	0.057	0.577	0.366
10	1	31	12	0.024	0.721	0.255
11		7	7		0.429	0.571

Table DA.13. Sample sizes (n) and population proportions (PP) by response to Child and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	123	80	196	0.148	0.379	0.474
0	5	82	50	0.040	0.620	0.340
1	2	77	76	0.007	0.569	0.424
2	14	248	271	0.017	0.473	0.510
3	17	415	632	0.015	0.420	0.564
4	52	569	1076	0.030	0.361	0.609
5	51	650	1522	0.024	0.309	0.667
6	45	414	1191	0.025	0.258	0.717
7	14	156	553	0.018	0.223	0.759
8	11	83	258	0.030	0.238	0.732
9	3	34	107	0.015	0.234	0.751
10	4	12	28	0.073	0.294	0.633
11	1	2	11	0.064	0.114	0.822

Table DA.14. Sample sizes (n) and population proportions (PP) by response to ChipsNone and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	248	27	124	0.490	0.065	0.446
0	74	5	58	0.550	0.045	0.405
1	74	7	74	0.469	0.059	0.472
2	271	19	243	0.499	0.040	0.461
3	495	41	528	0.466	0.041	0.494
4	844	93	760	0.481	0.062	0.457
5	1070	150	1003	0.471	0.066	0.463
6	795	240	615	0.464	0.149	0.387
7	289	172	262	0.381	0.243	0.376
8	133	127	92	0.366	0.363	0.271
9	51	62	31	0.339	0.449	0.212
10	12	23	9	0.277	0.552	0.172
11	5	7	2	0.317	0.569	0.114

Table DA.15. Sample sizes (n) and population proportions (PP) by response to ChipsOther and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	248	149	2	0.490	0.509	0.001
0	74	62	1	0.550	0.438	0.012
1	74	77	4	0.469	0.493	0.038
2	271	259	3	0.499	0.493	0.008
3	495	561	8	0.466	0.527	0.007
4	844	834	19	0.481	0.507	0.012
5	1070	1145	8	0.471	0.526	0.003
6	795	837	18	0.464	0.526	0.010
7	289	428	6	0.381	0.610	0.009
8	133	215	4	0.366	0.626	0.008
9	51	91	2	0.339	0.646	0.014
10	12	31	1	0.277	0.695	0.028
11	5	9		0.317	0.683	

Table DA.16. Sample sizes (n) and population proportions (PP) by response to ChipsPers and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	248	147	4	0.490	0.449	0.062
0	74	59	4	0.550	0.417	0.033
1	74	78	3	0.469	0.511	0.021
2	271	248	14	0.499	0.473	0.028
3	495	554	15	0.466	0.519	0.015
4	844	823	30	0.481	0.498	0.021
5	1070	1127	26	0.471	0.517	0.012
6	795	824	31	0.464	0.514	0.022
7	289	416	18	0.381	0.598	0.021
8	133	211	8	0.366	0.610	0.025
9	51	89	4	0.339	0.630	0.030
10	12	29	3	0.277	0.671	0.052
11	5	8	1	0.317	0.590	0.093

Table DA.17. Sample sizes (n) and population proportions (PP) by response to ChipsSale and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	248	128	23	0.490	0.507	0.003
0	74	63		0.550	0.450	
1	74	81		0.469	0.531	
2	271	260	2	0.499	0.498	0.004
3	495	549	20	0.466	0.512	0.022
4	844	809	44	0.481	0.491	0.028
5	1070	1034	119	0.471	0.477	0.052
6	795	646	209	0.464	0.408	0.127
7	289	281	153	0.381	0.399	0.221
8	133	100	119	0.366	0.293	0.341
9	51	33	60	0.339	0.225	0.436
10	12	11	21	0.277	0.195	0.528
11	5	2	7	0.317	0.114	0.569

Table DA.18. Sample sizes (n) and population proportions (PP) by response to ClearNone and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	207	105	87	0.398	0.170	0.431
0	53	41	43	0.400	0.305	0.295
1	49	70	36	0.288	0.509	0.203
2	181	225	127	0.327	0.446	0.227
3	379	373	312	0.354	0.357	0.289
4	660	538	499	0.370	0.330	0.300
5	855	754	614	0.379	0.335	0.286
6	692	590	368	0.408	0.350	0.242
7	281	291	151	0.378	0.400	0.223
8	146	157	49	0.409	0.432	0.158
9	50	70	24	0.330	0.498	0.172
10	13	24	7	0.294	0.539	0.166
11	4	6	4	0.266	0.370	0.364

Table DA.19. Sample sizes (n) and population proportions (PP) by response to ClearOther and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	207	158	34	0.398	0.531	0.071
0	53	69	15	0.400	0.465	0.135
1	49	76	30	0.288	0.484	0.228
2	181	272	80	0.327	0.508	0.165
3	379	546	139	0.354	0.512	0.134
4	660	876	161	0.370	0.538	0.091
5	855	1077	291	0.379	0.496	0.125
6	692	726	232	0.408	0.460	0.132
7	281	348	94	0.378	0.501	0.121
8	146	162	44	0.409	0.468	0.122
9	50	71	23	0.330	0.491	0.179
10	13	22	9	0.294	0.508	0.197
11	4	8	2	0.266	0.636	0.098

Table DA.20. Sample sizes (n) and population proportions (PP) by response to ClearPers and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	207	148	44	0.398	0.508	0.094
0	53	58	26	0.400	0.430	0.170
1	49	66	40	0.288	0.431	0.281
2	181	212	140	0.327	0.397	0.276
3	379	464	221	0.354	0.437	0.210
4	660	708	329	0.370	0.422	0.207
5	855	987	381	0.379	0.448	0.173
6	692	706	252	0.408	0.435	0.157
7	281	342	100	0.378	0.483	0.139
8	146	173	33	0.409	0.498	0.092
9	50	87	7	0.330	0.627	0.043
10	13	26	5	0.294	0.599	0.107
11	4	9	1	0.266	0.680	0.054

Table DA.21. Sample sizes (n) and population proportions (PP) by response to ClearSale and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	207	163	29	0.398	0.597	0.005
0	53	84		0.400	0.600	
1	49	105	1	0.288	0.701	0.011
2	181	343	9	0.327	0.662	0.011
3	379	666	19	0.354	0.628	0.018
4	660	978	59	0.370	0.592	0.038
5	855	1246	122	0.379	0.568	0.054
6	692	808	150	0.408	0.505	0.088
7	281	326	116	0.378	0.458	0.164
8	146	117	89	0.409	0.346	0.245
9	50	49	45	0.330	0.360	0.310
10	13	18	13	0.294	0.383	0.322
11	4	6	4	0.266	0.462	0.272

Table DA.22. Sample sizes (n) and population proportions (PP) by response to Cluster and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	399			1.000		
0	54	83		0.395	0.605	
1	45	110		0.263	0.737	
2	157	371	5	0.275	0.718	0.007
3	263	734	67	0.239	0.699	0.062
4	464	1066	167	0.255	0.650	0.095
5	532	1294	397	0.235	0.594	0.171
6	425	665	560	0.248	0.416	0.337
7	151	154	418	0.199	0.232	0.568
8	75	42	235	0.206	0.117	0.676
9	33	16	95	0.198	0.118	0.684
10	8	2	34	0.144	0.043	0.814
11	7	2	5	0.499	0.112	0.388

Table DA.23. Sample sizes (n) and population proportions (PP) by response to ConcernAir and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	167	139	93	0.403	0.389	0.207
0	38	49	50	0.266	0.355	0.379
1	25	72	58	0.130	0.463	0.407
2	112	216	205	0.187	0.379	0.433
3	190	481	393	0.180	0.447	0.373
4	354	756	587	0.197	0.450	0.353
5	441	1020	762	0.194	0.450	0.356
6	359	770	521	0.207	0.471	0.322
7	131	361	231	0.171	0.510	0.318
8	67	183	102	0.197	0.518	0.285
9	22	73	49	0.170	0.496	0.334
10	3	28	13	0.054	0.623	0.324
11		9	5		0.623	0.377

Table DA.24. Sample sizes (n) and population proportions (PP) by response to ConcernAnimal and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	145	195	59	0.402	0.448	0.150
0	37	82	18	0.259	0.605	0.136
1	20	110	25	0.104	0.713	0.183
2	93	336	104	0.151	0.633	0.216
3	166	715	183	0.154	0.679	0.168
4	321	1092	284	0.176	0.659	0.165
5	354	1450	419	0.151	0.673	0.177
6	296	1014	340	0.166	0.634	0.200
7	114	427	182	0.144	0.609	0.247
8	53	197	102	0.145	0.562	0.293
9	18	91	35	0.130	0.617	0.253
10	4	24	16	0.080	0.541	0.379
11		7	7		0.485	0.515

Table DA.25. Sample sizes (n) and population proportions (PP) by response to ConcernClimate and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	148	180	71	0.405	0.466	0.129
0	36	58	43	0.251	0.423	0.327
1	20	86	49	0.110	0.563	0.328
2	95	284	154	0.151	0.531	0.318
3	166	574	324	0.151	0.534	0.316
4	320	924	453	0.174	0.540	0.285
5	354	1235	634	0.148	0.556	0.295
6	301	893	456	0.169	0.548	0.283
7	114	405	204	0.145	0.568	0.288
8	52	212	88	0.140	0.607	0.253
9	17	98	29	0.122	0.682	0.196
10	2	26	16	0.036	0.622	0.342
11	1	10	3	0.055	0.703	0.242

Table DA.26. Sample sizes (n) and population proportions (PP) by response to ConcernDevelop and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	149	163	87	0.406	0.328	0.267
0	36	55	46	0.247	0.409	0.344
1	20	60	75	0.106	0.386	0.508
2	93	227	213	0.152	0.409	0.439
3	172	469	423	0.152	0.428	0.420
4	329	771	597	0.182	0.450	0.369
5	349	1092	782	0.145	0.490	0.364
6	305	765	580	0.171	0.459	0.370
7	113	363	247	0.140	0.515	0.345
8	57	200	95	0.160	0.574	0.266
9	18	93	33	0.132	0.642	0.226
10	4	29	11	0.064	0.668	0.268
11		9	5		0.655	0.345

Table DA.27. Sample sizes (n) and population proportions (PP) by response to ConcernDisease and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	138	99	162	0.370	0.235	0.395
0	34	42	61	0.233	0.290	0.477
1	20	57	78	0.099	0.339	0.562
2	93	173	267	0.158	0.330	0.511
3	162	302	600	0.150	0.289	0.562
4	306	480	911	0.167	0.289	0.544
5	342	604	1277	0.144	0.270	0.586
6	280	409	961	0.154	0.246	0.601
7	107	161	455	0.135	0.231	0.635
8	52	79	221	0.140	0.228	0.632
9	17	24	103	0.122	0.161	0.717
10	1	11	32	0.022	0.282	0.696
11			14			1.000

Table DA.28. Sample sizes (n) and population proportions (PP) by response to ConcernDump and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	128	94	177	0.358	0.225	0.417
0	33	42	62	0.221	0.295	0.484
1	19	48	88	0.099	0.300	0.602
2	91	153	289	0.148	0.280	0.572
3	150	278	636	0.135	0.254	0.610
4	295	389	1013	0.158	0.234	0.608
5	314	498	1411	0.130	0.223	0.647
6	268	338	1044	0.149	0.204	0.648
7	99	130	494	0.124	0.183	0.693
8	46	71	235	0.126	0.209	0.665
9	15	28	101	0.111	0.191	0.698
10	2	7	35	0.053	0.169	0.779
11		2	12		0.147	0.853

Table DA.29. Sample sizes (n) and population proportions (PP) by response to ConcernFire and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	153	97	149	0.358	0.293	0.349
0	39	46	52	0.278	0.322	0.400
1	24	66	65	0.123	0.419	0.458
2	104	188	241	0.176	0.341	0.484
3	182	388	494	0.173	0.333	0.494
4	339	601	757	0.187	0.335	0.478
5	430	679	1114	0.189	0.292	0.519
6	337	468	845	0.194	0.270	0.537
7	127	182	414	0.167	0.255	0.579
8	58	73	221	0.166	0.199	0.635
9	23	28	93	0.179	0.191	0.630
10	1	11	32	0.022	0.290	0.689
11		1	13		0.093	0.907

Table DA.30. Sample sizes (n) and population proportions (PP) by response to ConcernHeir and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	122	80	197	0.376	0.336	0.288
0	36	49	52	0.247	0.347	0.406
1	20	44	91	0.106	0.306	0.588
2	89	165	279	0.147	0.316	0.537
3	154	273	637	0.140	0.265	0.595
4	281	367	1049	0.148	0.225	0.627
5	300	433	1490	0.124	0.202	0.675
6	259	260	1131	0.144	0.163	0.693
7	99	84	540	0.126	0.125	0.749
8	45	52	255	0.122	0.159	0.719
9	15	11	118	0.111	0.075	0.814
10	4	6	34	0.064	0.155	0.781
11		4	10		0.308	0.692

Table DA.31. Sample sizes (n) and population proportions (PP) by response to ConcernInvasive and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	148	142	109	0.402	0.372	0.226
0	36	52	49	0.257	0.357	0.387
1	20	68	67	0.099	0.444	0.457
2	97	229	207	0.162	0.426	0.412
3	160	447	457	0.145	0.425	0.430
4	304	684	709	0.162	0.416	0.422
5	345	890	988	0.144	0.409	0.447
6	294	602	754	0.163	0.378	0.459
7	110	252	361	0.139	0.361	0.500
8	53	101	198	0.147	0.301	0.552
9	19	43	82	0.132	0.304	0.564
10	1	15	28	0.022	0.383	0.595
11		2	12		0.121	0.879

Table DA.32. Sample sizes (n) and population proportions (PP) by response to ConcernNoise and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	146	155	98	0.407	0.411	0.182
0	37	66	34	0.247	0.512	0.241
1	21	88	46	0.111	0.571	0.318
2	100	255	178	0.160	0.471	0.370
3	169	531	364	0.152	0.494	0.354
4	329	785	583	0.180	0.461	0.360
5	354	1045	824	0.146	0.471	0.382
6	302	746	602	0.169	0.449	0.382
7	113	326	284	0.145	0.461	0.394
8	57	184	111	0.158	0.519	0.322
9	18	71	55	0.134	0.476	0.391
10	2	32	10	0.040	0.736	0.224
11		8	6		0.545	0.455

Table DA.33. Sample sizes (n) and population proportions (PP) by response to ConcernNoWater and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	141	169	89	0.401	0.383	0.216
0	35	60	42	0.245	0.424	0.331
1	20	87	48	0.102	0.594	0.304
2	93	278	162	0.152	0.526	0.322
3	163	562	339	0.149	0.530	0.321
4	315	890	492	0.173	0.538	0.289
5	348	1172	703	0.147	0.540	0.312
6	297	798	555	0.165	0.500	0.335
7	106	309	308	0.134	0.448	0.418
8	54	141	157	0.150	0.412	0.438
9	16	55	73	0.116	0.379	0.504
10	2	16	26	0.040	0.375	0.585
11		8	6		0.587	0.413

Table DA.34. Sample sizes (n) and population proportions (PP) by response to ConcernOther and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	382	15	2	0.915	0.084	0.000
0	131	5	1	0.945	0.049	0.006
1	147	7	1	0.946	0.046	0.007
2	491	37	5	0.924	0.064	0.012
3	1007	42	15	0.944	0.038	0.019
4	1620	60	17	0.954	0.034	0.012
5	2134	66	23	0.958	0.032	0.010
6	1569	37	44	0.948	0.023	0.029
7	695	15	13	0.957	0.024	0.020
8	338	6	8	0.959	0.015	0.026
9	137	3	4	0.954	0.022	0.024
10	40	2	2	0.917	0.043	0.040
11	12	1	1	0.825	0.095	0.080

Table DA.35. Sample sizes (n) and population proportions (PP) by response to Concern-Storm and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	140	127	132	0.409	0.253	0.338
0	35	50	52	0.245	0.339	0.416
1	20	63	72	0.110	0.375	0.515
2	92	224	217	0.155	0.399	0.446
3	159	484	421	0.146	0.459	0.395
4	312	759	626	0.169	0.453	0.378
5	338	947	938	0.144	0.438	0.418
6	286	649	715	0.157	0.394	0.449
7	106	264	353	0.132	0.385	0.482
8	51	104	197	0.141	0.283	0.577
9	17	49	78	0.119	0.336	0.545
10	3	16	25	0.054	0.386	0.560
11	1	6	7	0.064	0.392	0.544

Table DA.36. Sample sizes (n) and population proportions (PP) by response to ConcernTax and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	127	65	207	0.378	0.204	0.417
0	34	27	76	0.241	0.192	0.567
1	21	32	102	0.099	0.209	0.691
2	87	107	339	0.142	0.189	0.669
3	147	202	715	0.131	0.190	0.679
4	288	335	1074	0.155	0.196	0.649
5	304	416	1503	0.127	0.198	0.675
6	259	236	1155	0.142	0.143	0.716
7	89	108	526	0.110	0.154	0.735
8	46	39	267	0.126	0.115	0.759
9	15	14	115	0.111	0.097	0.792
10	2	3	39	0.053	0.084	0.864
11		1	13		0.070	0.930

Table DA.37. Sample sizes (n) and population proportions (PP) by response to Concern-Trespass and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	127	97	175	0.368	0.305	0.327
0	33	49	55	0.229	0.348	0.422
1	21	59	75	0.110	0.396	0.494
2	91	176	266	0.149	0.337	0.514
3	150	272	642	0.132	0.274	0.594
4	291	374	1032	0.157	0.227	0.615
5	303	469	1451	0.127	0.211	0.661
6	255	293	1102	0.141	0.187	0.672
7	98	109	516	0.124	0.161	0.716
8	46	59	247	0.126	0.177	0.698
9	15	26	103	0.111	0.168	0.721
10	1	7	36	0.022	0.177	0.801
11		1	13		0.093	0.907

Table DA.38. Sample sizes (n) and population proportions (PP) by response to Concern-WaterPol and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	162	118	119	0.378	0.324	0.299
0	38	42	57	0.266	0.310	0.423
1	23	51	81	0.122	0.320	0.557
2	105	196	232	0.173	0.375	0.452
3	189	360	515	0.178	0.324	0.497
4	343	573	781	0.189	0.343	0.468
5	429	774	1020	0.187	0.342	0.471
6	349	562	739	0.201	0.341	0.458
7	126	258	339	0.166	0.357	0.478
8	63	133	156	0.182	0.378	0.441
9	22	51	71	0.170	0.341	0.489
10	3	19	22	0.054	0.404	0.543
11		7	7		0.483	0.517

Table DA.39. Sample sizes (n) and population proportions (PP) by response to Coop and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	62	286	51	0.144	0.833	0.023
0	4	130	3	0.047	0.930	0.023
1	8	142	5	0.034	0.939	0.027
2	25	487	21	0.042	0.921	0.037
3	56	938	70	0.059	0.887	0.054
4	85	1435	177	0.055	0.849	0.095
5	142	1780	301	0.064	0.811	0.125
6	83	1235	332	0.050	0.761	0.189
7	42	492	189	0.062	0.683	0.255
8	28	187	137	0.084	0.536	0.380
9	10	61	73	0.074	0.436	0.489
10	3	18	23	0.051	0.369	0.580
11		8	6		0.511	0.489

Table DA.40. Sample sizes (n) and population proportions (PP) by response to Couple and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	62	168	169	0.144	0.326	0.530
0	4	39	94	0.047	0.236	0.717
1	8	54	93	0.034	0.351	0.615
2	25	162	346	0.042	0.291	0.667
3	56	355	653	0.059	0.327	0.614
4	85	698	914	0.055	0.410	0.534
5	142	913	1168	0.064	0.410	0.526
6	83	797	770	0.050	0.476	0.474
7	42	370	311	0.062	0.503	0.436
8	28	206	118	0.084	0.577	0.338
9	10	97	37	0.074	0.657	0.268
10	3	29	12	0.051	0.692	0.257
11		10	4		0.736	0.264

Table DA.41. Sample sizes (n) and population proportions (PP) by response to CutForester and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	140	163	96	0.315	0.648	0.037
0	54	74	9	0.379	0.552	0.069
1	49	87	19	0.303	0.543	0.155
2	150	347	36	0.276	0.642	0.082
3	260	656	148	0.262	0.614	0.124
4	438	913	346	0.251	0.542	0.207
5	537	1098	588	0.245	0.496	0.259
6	414	645	591	0.252	0.389	0.358
7	162	237	324	0.218	0.332	0.450
8	74	83	195	0.203	0.223	0.574
9	28	32	84	0.223	0.222	0.556
10	5	7	32	0.130	0.146	0.723
11	1	2	11	0.070	0.113	0.817

Table DA.42. Sample sizes (n) and population proportions (PP) by response to CutLogger and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	149	147	103	0.337	0.558	0.105
0	53	69	15	0.373	0.517	0.110
1	53	80	22	0.347	0.486	0.168
2	152	325	56	0.279	0.607	0.114
3	260	621	183	0.257	0.585	0.158
4	453	819	425	0.260	0.493	0.247
5	557	954	712	0.252	0.438	0.310
6	433	544	673	0.261	0.332	0.408
7	166	200	357	0.224	0.278	0.499
8	78	75	199	0.212	0.201	0.586
9	27	26	91	0.216	0.184	0.600
10	4	7	33	0.096	0.127	0.777
11	1	3	10	0.070	0.189	0.741

Table DA.43. Sample sizes (n) and population proportions (PP) by response to DecorNone and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	124	31	244	0.280	0.071	0.649
0	45	11	81	0.315	0.083	0.602
1	34	19	102	0.206	0.122	0.672
2	127	65	341	0.222	0.129	0.649
3	207	113	744	0.203	0.113	0.684
4	371	188	1138	0.204	0.117	0.679
5	436	249	1538	0.192	0.107	0.702
6	363	217	1070	0.215	0.136	0.649
7	136	97	490	0.175	0.142	0.683
8	63	37	252	0.168	0.098	0.734
9	28	20	96	0.189	0.137	0.674
10	4	6	34	0.065	0.137	0.797
11	3	2	9	0.199	0.174	0.628

Table DA.44. Sample sizes (n) and population proportions (PP) by response to DecorPers and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	124	248	27	0.280	0.680	0.040
0	45	81	11	0.315	0.602	0.083
1	34	102	19	0.206	0.672	0.122
2	127	343	63	0.222	0.651	0.126
3	207	744	113	0.203	0.684	0.113
4	371	1146	180	0.204	0.685	0.112
5	436	1554	233	0.192	0.709	0.100
6	363	1098	189	0.215	0.665	0.121
7	136	500	87	0.175	0.697	0.128
8	63	259	30	0.168	0.754	0.078
9	28	98	18	0.189	0.686	0.125
10	4	34	6	0.065	0.797	0.137
11	3	10	1	0.199	0.705	0.097

Table DA.45. Sample sizes (n) and population proportions (PP) by response to DecorSale and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	124	271	4	0.280	0.689	0.031
0	45	92		0.315	0.685	
1	34	121		0.206	0.794	
2	127	403	3	0.222	0.773	0.005
3	207	857		0.203	0.797	
4	371	1315	11	0.204	0.789	0.007
5	436	1765	22	0.192	0.799	0.010
6	363	1257	30	0.215	0.768	0.017
7	136	573	14	0.175	0.803	0.022
8	63	280	9	0.168	0.804	0.028
9	28	113	3	0.189	0.794	0.017
10	4	39	1	0.065	0.912	0.023
11	3	10	1	0.199	0.724	0.077

Table DA.46. Sample sizes (n) and population proportions (PP) by response to Easement and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	54	288	57	0.267	0.652	0.081
0	5	108	24	0.040	0.781	0.179
1	4	121	30	0.022	0.783	0.195
2	13	430	90	0.027	0.808	0.165
3	10	881	173	0.010	0.811	0.179
4	26	1438	233	0.017	0.843	0.140
5	41	1857	325	0.015	0.836	0.149
6	26	1375	249	0.015	0.836	0.148
7	10	598	115	0.013	0.820	0.167
8	4	288	60	0.012	0.815	0.172
9	3	113	28	0.013	0.780	0.207
10	1	36	7	0.010	0.820	0.170
11		12	2		0.847	0.153

Table DA.47. Sample sizes (n) and population proportions (PP) by response to Easement5 and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	104	288	7	0.238	0.750	0.012
0	34	101	2	0.241	0.741	0.018
1	25	128	2	0.136	0.858	0.006
2	96	431	6	0.171	0.817	0.012
3	153	894	17	0.146	0.838	0.016
4	282	1378	37	0.152	0.825	0.023
5	332	1841	50	0.140	0.836	0.024
6	268	1343	39	0.154	0.825	0.021
7	97	603	23	0.128	0.844	0.028
8	42	302	8	0.113	0.864	0.023
9	15	126	3	0.114	0.867	0.019
10	1	39	4	0.022	0.884	0.094
11		14			1.000	

Table DA.48. Sample sizes (n) and population proportions (PP) by response to EdibleNone and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	112	58	229	0.304	0.099	0.597
0	42	15	80	0.300	0.098	0.602
1	36	25	94	0.219	0.178	0.604
2	114	106	313	0.203	0.204	0.593
3	194	238	632	0.188	0.230	0.582
4	330	394	973	0.179	0.241	0.580
5	370	574	1279	0.162	0.257	0.582
6	312	443	895	0.183	0.277	0.540
7	115	180	428	0.148	0.259	0.593
8	54	57	241	0.144	0.158	0.698
9	24	25	95	0.164	0.166	0.669
10	3	12	29	0.054	0.255	0.692
11	1	4	9	0.055	0.317	0.628

Table DA.49. Sample sizes (n) and population proportions (PP) by response to EdiblePers and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	112	230	57	0.304	0.597	0.099
0	42	80	15	0.300	0.602	0.098
1	36	94	25	0.219	0.604	0.178
2	114	315	104	0.203	0.597	0.200
3	194	641	229	0.188	0.591	0.221
4	330	985	382	0.179	0.587	0.234
5	370	1296	557	0.162	0.588	0.251
6	312	911	427	0.183	0.548	0.269
7	115	442	166	0.148	0.614	0.238
8	54	243	55	0.144	0.702	0.154
9	24	95	25	0.164	0.669	0.166
10	3	29	12	0.054	0.692	0.255
11	1	10	3	0.055	0.705	0.240

Table DA.50. Sample sizes (n) and population proportions (PP) by response to EdibleSale and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	112	284	3	0.304	0.694	0.002
0	42	95		0.300	0.700	
1	36	119		0.219	0.781	
2	114	417	2	0.203	0.793	0.004
3	194	857	13	0.188	0.802	0.010
4	330	1352	15	0.179	0.814	0.008
5	370	1818	35	0.162	0.825	0.014
6	312	1301	37	0.183	0.795	0.022
7	115	583	25	0.148	0.815	0.037
8	54	293	5	0.144	0.845	0.011
9	24	118	2	0.164	0.825	0.011
10	3	41		0.054	0.946	
11	1	12	1	0.055	0.868	0.077

Table DA.51. Sample sizes (n) and population proportions (PP) by response to Education1 and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	135	169	95	0.199	0.498	0.303
0	46	47	44	0.326	0.361	0.313
1	38	71	46	0.220	0.449	0.331
2	127	242	164	0.225	0.426	0.349
3	223	529	312	0.216	0.480	0.303
4	363	846	488	0.204	0.491	0.305
5	465	1052	706	0.208	0.463	0.330
6	379	634	637	0.221	0.387	0.392
7	153	234	336	0.200	0.321	0.479
8	80	103	169	0.225	0.289	0.485
9	43	32	69	0.315	0.197	0.489
10	5	10	29	0.132	0.264	0.604
11	5	4	5	0.419	0.234	0.348

Table DA.52. Sample sizes (n) and population proportions (PP) by response to Education2 and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	269	84	46	0.593	0.278	0.129
0	70	34	33	0.468	0.275	0.257
1	91	40	24	0.590	0.219	0.190
2	278	149	106	0.494	0.290	0.216
3	569	290	205	0.526	0.271	0.203
4	992	429	276	0.581	0.252	0.167
5	1255	606	362	0.568	0.269	0.163
6	991	341	318	0.593	0.219	0.188
7	449	133	141	0.606	0.195	0.200
8	224	54	74	0.634	0.145	0.221
9	96	24	24	0.690	0.154	0.156
10	25	8	11	0.565	0.202	0.233
11	11	2	1	0.819	0.102	0.080

Table DA.53. Sample sizes (n) and population proportions (PP) by response to Family and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	149	143	107	0.156	0.488	0.356
0	9	51	77	0.058	0.368	0.574
1	5	62	88	0.030	0.402	0.568
2	28	232	273	0.038	0.427	0.535
3	37	521	506	0.034	0.508	0.458
4	93	908	696	0.055	0.555	0.390
5	117	1152	954	0.054	0.538	0.408
6	92	875	683	0.055	0.550	0.395
7	29	366	328	0.038	0.531	0.431
8	22	199	131	0.066	0.573	0.361
9	8	77	59	0.043	0.549	0.408
10	4	30	10	0.073	0.685	0.242
11	2	5	7	0.119	0.359	0.522

Table DA.54. Sample sizes (n) and population proportions (PP) by response to Farm and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	154	141	104	0.217	0.738	0.046
0	7	116	14	0.067	0.896	0.038
1	6	129	20	0.038	0.909	0.053
2	34	417	82	0.052	0.881	0.066
3	49	696	319	0.048	0.769	0.183
4	97	1004	596	0.063	0.697	0.241
5	135	1173	915	0.061	0.613	0.326
6	113	796	741	0.068	0.545	0.387
7	40	326	357	0.055	0.495	0.450
8	27	181	144	0.083	0.548	0.369
9	8	69	67	0.048	0.497	0.455
10	5	22	17	0.096	0.545	0.359
11	2	6	6	0.119	0.430	0.451

Table DA.55. Sample sizes (n) and population proportions (PP) by response to Fire and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	143	192	64	0.174	0.730	0.096
0	9	120	8	0.064	0.886	0.050
1	3	124	28	0.015	0.852	0.133
2	26	420	87	0.039	0.803	0.157
3	31	798	235	0.027	0.757	0.215
4	84	1174	439	0.048	0.693	0.259
5	106	1491	626	0.049	0.671	0.279
6	74	1126	450	0.045	0.677	0.278
7	28	546	149	0.039	0.755	0.206
8	20	293	39	0.063	0.820	0.117
9	9	117	18	0.052	0.820	0.127
10	5	34	5	0.098	0.783	0.119
11	2	9	3	0.119	0.685	0.196

Table DA.56. Sample sizes (n) and population proportions (PP) by response to Firewood-None and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	166	153	80	0.360	0.223	0.417
0	57	34	46	0.407	0.259	0.334
1	51	63	41	0.328	0.410	0.262
2	173	218	142	0.323	0.406	0.270
3	267	540	257	0.253	0.502	0.245
4	488	850	359	0.275	0.507	0.218
5	580	1222	421	0.252	0.540	0.209
6	487	911	252	0.287	0.554	0.159
7	215	380	128	0.293	0.524	0.183
8	118	174	60	0.329	0.487	0.184
9	53	69	22	0.362	0.479	0.160
10	11	28	5	0.231	0.631	0.138
11	4	7	3	0.244	0.511	0.245

Table DA.57. Sample sizes (n) and population proportions (PP) by response to FirewoodOther and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	166	226	7	0.360	0.638	0.002
0	57	74	6	0.407	0.546	0.047
1	51	99	5	0.328	0.628	0.045
2	173	341	19	0.323	0.633	0.044
3	267	757	40	0.253	0.710	0.037
4	488	1149	60	0.275	0.693	0.032
5	580	1561	82	0.252	0.717	0.032
6	487	1082	81	0.287	0.666	0.047
7	215	484	24	0.293	0.677	0.031
8	118	222	12	0.329	0.641	0.030
9	53	80	11	0.362	0.556	0.082
10	11	32	1	0.231	0.750	0.019
11	4	9	1	0.244	0.659	0.097

Table DA.58. Sample sizes (n) and population proportions (PP) by response to FirewoodPers and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	166	109	124	0.360	0.424	0.217
0	57	52	28	0.407	0.381	0.212
1	51	45	59	0.328	0.296	0.376
2	173	160	200	0.323	0.313	0.364
3	267	321	476	0.253	0.301	0.446
4	488	459	750	0.275	0.271	0.455
5	580	554	1089	0.252	0.264	0.484
6	487	366	797	0.287	0.228	0.485
7	215	169	339	0.293	0.237	0.470
8	118	94	140	0.329	0.285	0.386
9	53	42	49	0.362	0.310	0.328
10	11	9	24	0.231	0.238	0.531
11	4	5	5	0.244	0.424	0.332

Table DA.59. Sample sizes (n) and population proportions (PP) by response to FirewoodSale and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	166	197	36	0.360	0.632	0.008
0	57	80		0.407	0.593	
1	51	103	1	0.328	0.667	0.005
2	173	352	8	0.323	0.661	0.015
3	267	746	51	0.253	0.702	0.045
4	488	1113	96	0.275	0.671	0.055
5	580	1448	195	0.252	0.658	0.090
6	487	963	200	0.287	0.590	0.123
7	215	420	88	0.293	0.585	0.122
8	118	188	46	0.329	0.530	0.141
9	53	65	26	0.362	0.451	0.187
10	11	25	8	0.231	0.588	0.181
11	4	6	4	0.244	0.477	0.280

Table DA.60. Sample sizes (n) and population proportions (PP) by response to ForestCover and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	399			1		
0		78	59		0.308	0.692
1	1	113	41	0	0.549	0.451
2	4	322	207	0	0.441	0.559
3	5	617	442	0	0.358	0.642
4	5	953	739	0	0.367	0.633
5	8	1170	1045	0	0.372	0.628
6	9	752	889	0	0.325	0.675
7	3	276	444	0	0.264	0.736
8	1	104	247	0	0.215	0.785
9	1	39	104	0	0.188	0.812
10	1	8	35	0	0.118	0.882
11		1	13		0.058	0.942

Table DA.61. Sample sizes (n) and population proportions (PP) by response to FutureCtrlBurn and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	154	215	30	0.343	0.594	0.063
0	51	83	3	0.367	0.616	0.017
1	42	103	10	0.256	0.673	0.071
2	132	365	36	0.231	0.702	0.067
3	224	775	65	0.211	0.738	0.050
4	425	1170	102	0.232	0.708	0.060
5	531	1489	203	0.236	0.671	0.093
6	437	1004	209	0.257	0.629	0.114
7	164	377	182	0.220	0.542	0.238
8	64	131	157	0.173	0.401	0.427
9	27	57	60	0.189	0.418	0.393
10	7	11	26	0.152	0.284	0.563
11	2	3	9	0.113	0.228	0.659

Table DA.62. Sample sizes (n) and population proportions (PP) by response to FutureFireHaz and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	169	189	41	0.350	0.550	0.100
0	54	70	13	0.397	0.495	0.108
1	46	92	17	0.267	0.612	0.121
2	140	312	81	0.246	0.589	0.165
3	248	648	168	0.239	0.586	0.175
4	467	999	231	0.262	0.581	0.157
5	602	1272	349	0.270	0.563	0.167
6	486	852	312	0.288	0.527	0.185
7	182	307	234	0.245	0.430	0.326
8	82	118	152	0.233	0.351	0.415
9	33	46	65	0.235	0.339	0.425
10	5	10	29	0.118	0.247	0.634
11	1	2	11	0.055	0.174	0.771

Table DA.63. Sample sizes (n) and population proportions (PP) by response to FutureGraze and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	143	208	48	0.336	0.585	0.079
0	49	88		0.356	0.644	
1	40	108	7	0.234	0.746	0.021
2	131	364	38	0.230	0.721	0.049
3	209	723	132	0.198	0.728	0.074
4	409	1090	198	0.228	0.688	0.084
5	494	1415	314	0.221	0.671	0.108
6	427	956	267	0.256	0.608	0.136
7	174	410	139	0.230	0.604	0.166
8	82	214	56	0.231	0.647	0.122
9	35	76	33	0.239	0.560	0.200
10	8	26	10	0.173	0.636	0.191
11	4	5	5	0.282	0.393	0.325

Table DA.64. Sample sizes (n) and population proportions (PP) by response to FutureInsect and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	152	206	41	0.338	0.571	0.090
0	48	72	17	0.344	0.534	0.122
1	41	88	26	0.247	0.543	0.210
2	134	298	101	0.235	0.572	0.193
3	222	682	160	0.205	0.640	0.155
4	420	1062	215	0.232	0.636	0.132
5	510	1383	330	0.223	0.622	0.155
6	443	970	237	0.257	0.604	0.139
7	176	392	155	0.238	0.557	0.205
8	80	176	96	0.215	0.516	0.269
9	33	66	45	0.226	0.477	0.297
10	8	21	15	0.187	0.496	0.317
11	2	3	9	0.119	0.239	0.641

Table DA.65. Sample sizes (n) and population proportions (PP) by response to FutureInvasive and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	150	190	59	0.345	0.492	0.163
0	46	72	19	0.332	0.529	0.139
1	39	86	30	0.232	0.572	0.196
2	129	293	111	0.227	0.564	0.208
3	216	607	241	0.202	0.582	0.216
4	409	955	333	0.224	0.589	0.188
5	480	1232	511	0.213	0.564	0.223
6	412	822	416	0.241	0.520	0.240
7	161	326	236	0.213	0.465	0.322
8	72	129	151	0.199	0.401	0.400
9	31	52	61	0.207	0.391	0.402
10	7	18	19	0.156	0.464	0.380
11	1	1	12	0.055	0.077	0.868

Table DA.66. Sample sizes (n) and population proportions (PP) by response to FutureNtfp and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	156	210	33	0.337	0.529	0.135
0	51	77	9	0.367	0.561	0.071
1	40	100	15	0.246	0.652	0.102
2	129	326	78	0.226	0.616	0.159
3	227	671	166	0.209	0.629	0.162
4	411	1001	285	0.221	0.603	0.177
5	511	1325	387	0.222	0.601	0.177
6	427	904	319	0.248	0.549	0.203
7	176	420	127	0.236	0.579	0.186
8	82	218	52	0.223	0.634	0.143
9	34	87	23	0.223	0.607	0.170
10	7	28	9	0.159	0.629	0.212
11	3	8	3	0.189	0.593	0.218

Table DA.67. Sample sizes (n) and population proportions (PP) by response to FuturePers and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	137	172	90	0.334	0.504	0.162
0	43	70	24	0.317	0.513	0.170
1	37	67	51	0.215	0.440	0.345
2	123	257	153	0.215	0.496	0.289
3	194	498	372	0.184	0.465	0.350
4	358	761	578	0.196	0.447	0.356
5	422	934	867	0.184	0.425	0.392
6	367	646	637	0.214	0.391	0.395
7	151	319	253	0.203	0.444	0.353
8	77	178	97	0.205	0.521	0.274
9	34	74	36	0.226	0.530	0.244
10	5	22	17	0.096	0.517	0.387
11	2	6	6	0.125	0.478	0.397

Table DA.68. Sample sizes (n) and population proportions (PP) by response to FutureRoad and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	152	201	46	0.340	0.569	0.090
0	49	84	4	0.356	0.623	0.022
1	42	105	8	0.250	0.702	0.048
2	132	360	41	0.236	0.689	0.074
3	225	733	106	0.209	0.685	0.106
4	416	1079	202	0.223	0.646	0.132
5	508	1345	370	0.223	0.605	0.172
6	401	866	383	0.236	0.527	0.237
7	140	283	300	0.181	0.389	0.430
8	65	105	182	0.176	0.309	0.515
9	22	33	89	0.158	0.227	0.615
10	4	8	32	0.083	0.215	0.703
11			14			1.000

Table DA.69. Sample sizes (n) and population proportions (PP) by response to FutureSale and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	120	205	74	0.331	0.657	0.012
0	49	86	2	0.357	0.631	0.012
1	40	112	3	0.237	0.739	0.024
2	124	392	17	0.224	0.750	0.025
3	213	764	87	0.195	0.725	0.080
4	359	1113	225	0.195	0.678	0.127
5	383	1328	512	0.170	0.608	0.222
6	301	738	611	0.175	0.458	0.367
7	106	231	386	0.135	0.334	0.531
8	43	79	230	0.111	0.227	0.662
9	17	25	102	0.129	0.162	0.709
10	1	4	39	0.022	0.086	0.892
11		2	12		0.112	0.888

Table DA.70. Sample sizes (n) and population proportions (PP) by response to FutureTrail and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	148	191	60	0.342	0.571	0.088
0	51	78	8	0.373	0.571	0.056
1	40	103	12	0.239	0.676	0.085
2	130	328	75	0.225	0.631	0.144
3	221	619	224	0.204	0.580	0.215
4	402	883	412	0.218	0.519	0.263
5	473	1047	703	0.205	0.456	0.339
6	384	681	585	0.222	0.407	0.371
7	150	276	297	0.198	0.375	0.427
8	75	136	141	0.204	0.400	0.396
9	31	61	52	0.205	0.439	0.356
10	6	18	20	0.138	0.413	0.449
11	3	6	5	0.174	0.475	0.351

Table DA.71. Sample sizes (n) and population proportions (PP) by response to FutureWild and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	149	158	92	0.405	0.467	0.128
0	47	72	18	0.338	0.529	0.133
1	38	86	31	0.231	0.554	0.215
2	125	272	136	0.221	0.536	0.243
3	206	521	337	0.197	0.502	0.301
4	380	734	583	0.209	0.438	0.352
5	458	832	933	0.198	0.369	0.433
6	364	539	747	0.210	0.325	0.465
7	131	179	413	0.172	0.245	0.583
8	55	77	220	0.148	0.230	0.622
9	24	42	78	0.170	0.303	0.527
10	4	8	32	0.090	0.202	0.707
11	1	3	10	0.055	0.236	0.709

Table DA.72. Sample sizes (n) and population proportions (PP) by response to HelpCost-Share and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	153	172	74	0.370	0.566	0.063
0	34	95	8	0.241	0.710	0.049
1	26	109	20	0.132	0.719	0.149
2	110	328	95	0.194	0.623	0.182
3	182	624	258	0.162	0.604	0.235
4	344	921	432	0.183	0.555	0.262
5	382	1110	731	0.162	0.504	0.334
6	322	701	627	0.183	0.429	0.388
7	112	294	317	0.142	0.408	0.450
8	59	129	164	0.164	0.365	0.471
9	23	54	67	0.162	0.389	0.448
10	4	20	20	0.082	0.490	0.428
11		10	4		0.751	0.249

Table DA.73. Sample sizes (n) and population proportions (PP) by response to HelpEasement and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	150	201	48	0.359	0.541	0.100
0	34	97	6	0.241	0.716	0.044
1	23	113	19	0.119	0.756	0.125
2	107	367	59	0.187	0.704	0.108
3	174	734	156	0.153	0.696	0.151
4	350	1085	262	0.186	0.643	0.171
5	392	1427	404	0.166	0.642	0.192
6	330	1019	301	0.189	0.631	0.180
7	122	434	167	0.153	0.613	0.234
8	57	218	77	0.160	0.611	0.229
9	21	87	36	0.145	0.613	0.242
10	5	28	11	0.101	0.639	0.260
11		13	1		0.946	0.054

Table DA.74. Sample sizes (n) and population proportions (PP) by response to HelpOther and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	370	26	3	0.894	0.105	0.001
0	116	20	1	0.826	0.168	0.006
1	132	22	1	0.866	0.127	0.007
2	476	51	6	0.893	0.095	0.013
3	990	65	9	0.928	0.063	0.009
4	1588	91	18	0.935	0.053	0.013
5	2097	102	24	0.943	0.045	0.012
6	1588	42	20	0.961	0.027	0.012
7	689	22	12	0.940	0.039	0.021
8	342	5	5	0.972	0.013	0.015
9	139	3	2	0.963	0.020	0.017
10	41	1	2	0.939	0.030	0.031
11	12	2		0.887	0.113	

Table DA.75. Sample sizes (n) and population proportions (PP) by response to HelpTaxes and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	155	116	128	0.369	0.432	0.199
0	37	73	27	0.262	0.530	0.208
1	26	64	65	0.131	0.417	0.451
2	111	184	238	0.195	0.341	0.465
3	191	368	505	0.175	0.331	0.494
4	362	542	793	0.197	0.315	0.488
5	449	582	1192	0.198	0.255	0.547
6	366	341	943	0.214	0.204	0.582
7	127	141	455	0.165	0.194	0.640
8	62	61	229	0.176	0.172	0.651
9	22	17	105	0.166	0.109	0.725
10	3	5	36	0.064	0.124	0.812
11	1	3	10	0.058	0.169	0.773

Table DA.76. Sample sizes (n) and population proportions (PP) by response to HelpTimber and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	149	158	92	0.375	0.489	0.136
0	36	98	3	0.256	0.727	0.018
1	27	119	9	0.136	0.807	0.058
2	110	379	44	0.194	0.736	0.070
3	189	706	169	0.169	0.686	0.145
4	375	917	405	0.204	0.548	0.248
5	408	984	831	0.173	0.451	0.376
6	329	504	817	0.191	0.309	0.500
7	110	168	445	0.138	0.237	0.625
8	53	64	235	0.145	0.180	0.675
9	16	27	101	0.111	0.199	0.690
10	3	3	38	0.064	0.060	0.875
11		3	11		0.190	0.810

Table DA.77. Sample sizes (n) and population proportions (PP) by response to HelpTransferHeir and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	149	149	101	0.370	0.390	0.240
0	34	88	15	0.241	0.666	0.093
1	22	98	35	0.111	0.648	0.241
2	110	310	113	0.194	0.598	0.208
3	174	540	350	0.154	0.511	0.335
4	332	806	559	0.180	0.486	0.335
5	367	965	891	0.156	0.433	0.412
6	315	635	700	0.177	0.391	0.432
7	116	259	348	0.146	0.372	0.482
8	52	124	176	0.146	0.363	0.491
9	19	56	69	0.126	0.393	0.481
10	3	19	22	0.064	0.477	0.458
11		7	7		0.460	0.540

Table DA.78. Sample sizes (n) and population proportions (PP) by response to HelpWoodMgmt and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	139	145	115	0.360	0.487	0.153
0	34	86	17	0.241	0.648	0.111
1	22	96	37	0.111	0.610	0.279
2	102	282	149	0.179	0.530	0.291
3	158	517	389	0.137	0.485	0.378
4	313	746	638	0.171	0.436	0.392
5	347	898	978	0.147	0.391	0.462
6	290	574	786	0.165	0.347	0.488
7	103	244	376	0.132	0.340	0.528
8	50	110	192	0.138	0.316	0.546
9	18	52	74	0.123	0.360	0.517
10	3	19	22	0.064	0.447	0.488
11		9	5		0.601	0.399

Table DA.79. Sample sizes (n) and population proportions (PP) by response to Home and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	130	121	148	0.166	0.257	0.578
0	3	20	114	0.018	0.122	0.860
1	4	26	125	0.012	0.163	0.825
2	16	114	403	0.019	0.187	0.795
3	33	358	673	0.032	0.316	0.652
4	73	672	952	0.040	0.405	0.555
5	75	954	1194	0.034	0.443	0.523
6	69	741	840	0.040	0.469	0.491
7	24	400	299	0.034	0.555	0.410
8	23	200	129	0.074	0.580	0.346
9	7	88	49	0.046	0.606	0.348
10	4	26	14	0.083	0.602	0.315
11	3	6	5	0.177	0.489	0.334

Table DA.80. Sample sizes (n) and population proportions (PP) by response to Hunting and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	140	158	101	0.152	0.673	0.176
0	8	120	9	0.064	0.895	0.041
1	5	127	23	0.020	0.881	0.099
2	24	405	104	0.029	0.811	0.160
3	33	672	359	0.032	0.675	0.293
4	65	910	722	0.037	0.565	0.398
5	74	978	1171	0.033	0.454	0.512
6	57	685	908	0.035	0.422	0.543
7	19	269	435	0.027	0.365	0.609
8	13	129	210	0.037	0.370	0.593
9	4	51	89	0.024	0.358	0.618
10	1	18	25	0.022	0.360	0.618
11	1	7	6	0.093	0.448	0.460

Table DA.81. Sample sizes (n) and population proportions (PP) by response to Income and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	189	159	51	0.260	0.455	0.285
0	48	51	38	0.342	0.406	0.252
1	49	76	30	0.297	0.455	0.249
2	166	258	109	0.308	0.469	0.224
3	322	555	187	0.306	0.511	0.183
4	516	894	287	0.296	0.524	0.180
5	687	1114	422	0.307	0.503	0.190
6	542	712	396	0.323	0.444	0.233
7	215	267	241	0.288	0.388	0.323
8	98	101	153	0.283	0.301	0.416
9	50	22	72	0.375	0.132	0.493
10	7	7	30	0.171	0.176	0.653
11	5		9	0.412		0.588

Table DA.82. Sample sizes (n) and population proportions (PP) by response to Investment and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	141	126	132	0.191	0.518	0.290
0	6	78	53	0.040	0.556	0.404
1	5	90	60	0.022	0.604	0.375
2	27	303	203	0.035	0.567	0.397
3	35	572	457	0.033	0.533	0.434
4	70	868	759	0.034	0.532	0.434
5	76	1035	1112	0.032	0.467	0.501
6	58	667	925	0.036	0.416	0.548
7	13	248	462	0.016	0.358	0.626
8	12	94	246	0.033	0.265	0.702
9	3	30	111	0.025	0.232	0.744
10	1	7	36	0.022	0.161	0.817
11	1	2	11	0.055	0.155	0.790

Table DA.83. Sample sizes (n) and population proportions (PP) by response to KnowCert and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	91	290	18	0.189	0.810	0.001
0	32	102	3	0.227	0.754	0.019
1	20	132	3	0.102	0.884	0.013
2	85	441	7	0.146	0.839	0.015
3	132	902	30	0.119	0.858	0.023
4	258	1380	59	0.137	0.830	0.034
5	289	1801	133	0.124	0.821	0.055
6	252	1231	167	0.142	0.751	0.107
7	88	501	134	0.112	0.696	0.192
8	41	209	102	0.111	0.590	0.299
9	17	71	56	0.127	0.500	0.374
10	2	25	17	0.050	0.598	0.352
11		5	9		0.308	0.692

Table DA.84. Sample sizes (n) and population proportions (PP) by response to KnowEase and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	95	269	35	0.193	0.728	0.080
0	34	96	7	0.241	0.706	0.053
1	20	126	9	0.091	0.866	0.042
2	82	416	35	0.140	0.790	0.070
3	136	840	88	0.124	0.797	0.079
4	255	1292	150	0.136	0.784	0.080
5	284	1671	268	0.120	0.762	0.118
6	241	1158	251	0.136	0.715	0.149
7	88	480	155	0.114	0.675	0.211
8	39	211	102	0.104	0.616	0.280
9	16	76	52	0.122	0.524	0.354
10	1	25	18	0.022	0.545	0.433
11		9	5		0.629	0.371

Table DA.85. Sample sizes (n) and population proportions (PP) by response to Lease and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	52	262	85	0.240	0.747	0.013
0	1	135	1	0.003	0.997	0.000
1	4	146	5	0.026	0.955	0.020
2	9	502	22	0.015	0.957	0.028
3	7	981	76	0.007	0.936	0.057
4	22	1503	172	0.012	0.901	0.086
5	33	1885	305	0.014	0.870	0.116
6	21	1213	416	0.014	0.756	0.229
7	7	420	296	0.010	0.607	0.384
8	5	147	200	0.019	0.424	0.557
9	4	38	102	0.016	0.276	0.708
10	1	11	32	0.020	0.282	0.698
11		3	11		0.207	0.793

Table DA.86. Sample sizes (n) and population proportions (PP) by response to LeaseCarbon and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	79	320		0.054	0.946	
0	44	93		0.311	0.689	
1	33	122		0.187	0.813	
2	107	426		0.195	0.805	
3	187	875	2	0.189	0.808	0.003
4	306	1390	1	0.175	0.825	0.001
5	378	1842	3	0.173	0.826	0.001
6	302	1339	9	0.179	0.816	0.005
7	105	612	6	0.139	0.853	0.007
8	49	300	3	0.142	0.850	0.008
9	17	126	1	0.147	0.848	0.005
10	1	42	1	0.022	0.975	0.003
11		14			1.000	

Table DA.87. Sample sizes (n) and population proportions (PP) by response to LeaseConserve and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	79	308	12	0.054	0.945	0.001
0	44	93		0.311	0.689	
1	33	122		0.187	0.813	
2	107	426		0.195	0.805	
3	187	872	5	0.189	0.809	0.003
4	306	1369	22	0.175	0.815	0.010
5	378	1805	40	0.173	0.812	0.015
6	302	1284	64	0.179	0.785	0.036
7	105	570	48	0.139	0.805	0.056
8	49	261	42	0.142	0.747	0.111
9	17	106	21	0.147	0.717	0.136
10	1	34	9	0.022	0.834	0.144
11		10	4		0.697	0.303

Table DA.88. Sample sizes (n) and population proportions (PP) by response to LeaseGraze and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	79	299	21	0.054	0.943	0.003
0	44	93		0.311	0.689	
1	33	121	1	0.187	0.807	0.005
2	107	422	4	0.195	0.802	0.004
3	187	859	18	0.189	0.804	0.007
4	306	1346	45	0.175	0.805	0.020
5	378	1777	68	0.173	0.806	0.021
6	302	1273	75	0.179	0.785	0.036
7	105	562	56	0.139	0.791	0.070
8	49	269	34	0.142	0.782	0.076
9	17	107	20	0.147	0.729	0.123
10	1	38	5	0.022	0.861	0.117
11		11	3		0.813	0.187

Table DA.89. Sample sizes (n) and population proportions (PP) by response to LeaseHunt and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	79	269	51	0.054	0.940	0.006
0	44	92	1	0.311	0.689	0.000
1	33	122		0.187	0.813	
2	107	420	6	0.195	0.796	0.010
3	187	857	20	0.189	0.799	0.012
4	306	1323	68	0.175	0.795	0.030
5	378	1708	137	0.173	0.779	0.048
6	302	1104	244	0.179	0.691	0.130
7	105	416	202	0.139	0.606	0.255
8	49	148	155	0.142	0.411	0.447
9	17	41	86	0.147	0.256	0.596
10	1	14	29	0.022	0.366	0.612
11		3	11		0.207	0.793

Table DA.90. Sample sizes (n) and population proportions (PP) by response to LeaseOther and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	78	312	9	0.053	0.944	0.003
0	44	93		0.311	0.689	
1	33	121	1	0.187	0.812	0.000
2	107	423	3	0.195	0.803	0.003
3	186	858	20	0.188	0.792	0.020
4	305	1359	33	0.174	0.806	0.020
5	375	1808	40	0.172	0.808	0.020
6	302	1288	60	0.179	0.782	0.039
7	103	591	29	0.138	0.814	0.048
8	48	298	6	0.137	0.844	0.019
9	17	117	10	0.147	0.782	0.071
10	1	40	3	0.022	0.911	0.067
11		14			1.000	

Table DA.91. Sample sizes (n) and population proportions (PP) by response to LeaseRec and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	79	310	10	0.054	0.945	0.000
0	44	93		0.311	0.689	
1	33	122		0.187	0.813	
2	107	422	4	0.195	0.800	0.006
3	187	871	6	0.189	0.805	0.006
4	306	1380	11	0.175	0.818	0.008
5	378	1820	25	0.173	0.817	0.010
6	302	1313	35	0.179	0.801	0.020
7	105	588	30	0.139	0.821	0.040
8	49	277	26	0.142	0.787	0.071
9	17	112	15	0.147	0.756	0.096
10	1	37	6	0.022	0.840	0.138
11		10	4		0.758	0.242

Table DA.92. Sample sizes (n) and population proportions (PP) by response to LeaseWater and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	79	319	1	0.054	0.946	0.000
0	44	93		0.311	0.689	
1	33	122		0.187	0.813	
2	107	425	1	0.195	0.803	0.003
3	187	876	1	0.189	0.811	0.001
4	306	1389	2	0.175	0.824	0.001
5	378	1841	4	0.173	0.825	0.002
6	302	1341	7	0.179	0.817	0.004
7	105	618		0.139	0.861	
8	49	300	3	0.142	0.849	0.009
9	17	127		0.147	0.853	
10	1	43		0.022	0.978	
11		13	1		0.936	0.064

Table DA.93. Sample sizes (n) and population proportions (PP) by response to LeaseWild and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	79	311	9	0.054	0.945	0.001
0	44	93		0.311	0.689	
1	33	122		0.187	0.813	
2	107	424	2	0.195	0.802	0.003
3	187	872	5	0.189	0.807	0.004
4	306	1381	10	0.175	0.819	0.006
5	378	1832	13	0.173	0.823	0.005
6	302	1329	19	0.179	0.811	0.010
7	105	601	17	0.139	0.840	0.021
8	49	285	18	0.142	0.816	0.042
9	17	122	5	0.147	0.826	0.026
10	1	40	3	0.022	0.909	0.069
11		14			1.000	

Table DA.94. Sample sizes (n) and population proportions (PP) by response to LoggingNone and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	163	142	94	0.448	0.059	0.493
0	69	9	59	0.507	0.073	0.420
1	74	12	69	0.462	0.071	0.467
2	239	74	220	0.453	0.115	0.433
3	366	266	432	0.371	0.219	0.410
4	568	628	501	0.330	0.359	0.311
5	610	1045	568	0.274	0.450	0.276
6	430	930	290	0.257	0.554	0.189
7	142	466	115	0.187	0.650	0.163
8	60	257	35	0.166	0.736	0.098
9	22	107	15	0.161	0.727	0.112
10	4	39	1	0.068	0.921	0.011
11	2	12		0.112	0.888	

Table DA.95. Sample sizes (n) and population proportions (PP) by response to LoggingOther and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	163	230	6	0.448	0.548	0.004
0	69	66	2	0.507	0.476	0.018
1	74	79	2	0.462	0.527	0.011
2	239	285	9	0.453	0.527	0.020
3	366	672	26	0.371	0.603	0.026
4	568	1077	52	0.330	0.635	0.035
5	610	1556	57	0.274	0.700	0.026
6	430	1174	46	0.257	0.715	0.028
7	142	561	20	0.187	0.784	0.029
8	60	285	7	0.166	0.817	0.017
9	22	117	5	0.161	0.802	0.037
10	4	38	2	0.068	0.873	0.060
11	2	12		0.112	0.888	

Table DA.96. Sample sizes (n) and population proportions (PP) by response to LoggingPers and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	163	207	29	0.448	0.546	0.006
0	69	62	6	0.507	0.440	0.053
1	74	76	5	0.462	0.506	0.032
2	239	261	33	0.453	0.496	0.052
3	366	617	81	0.371	0.546	0.083
4	568	955	174	0.330	0.569	0.101
5	610	1357	256	0.274	0.619	0.107
6	430	1010	210	0.257	0.620	0.123
7	142	491	90	0.187	0.692	0.122
8	60	264	28	0.166	0.747	0.086
9	22	108	14	0.161	0.740	0.099
10	4	35	5	0.068	0.844	0.089
11	2	9	3	0.112	0.638	0.249

Table DA.97. Sample sizes (n) and population proportions (PP) by response to LoggingSale and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	163	120	116	0.448	0.502	0.050
0	69	67	1	0.507	0.491	0.002
1	74	76	5	0.462	0.510	0.028
2	239	262	32	0.453	0.505	0.043
3	366	516	182	0.371	0.497	0.132
4	568	680	449	0.330	0.424	0.246
5	610	744	869	0.274	0.352	0.374
6	430	402	818	0.257	0.252	0.491
7	142	165	416	0.187	0.232	0.581
8	60	53	239	0.166	0.149	0.685
9	22	23	99	0.161	0.164	0.674
10	4	4	36	0.068	0.060	0.872
11	2		12	0.112		0.888

Table DA.98. Sample sizes (n) and population proportions (PP) by response to ManageChild and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	49	334	16	0.247	0.739	0.014
0	8	127	2	0.054	0.928	0.018
1	3	151	1	0.019	0.970	0.011
2	25	497	11	0.048	0.935	0.016
3	18	998	48	0.016	0.947	0.037
4	42	1574	81	0.028	0.925	0.047
5	51	2036	136	0.027	0.916	0.057
6	40	1505	105	0.027	0.916	0.058
7	16	658	49	0.027	0.905	0.068
8	6	320	26	0.021	0.900	0.079
9	3	127	14	0.018	0.877	0.106
10	2	41	1	0.053	0.932	0.014
11		13	1		0.917	0.083

Table DA.99. Sample sizes (n) and population proportions (PP) by response to Manage-Family and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	49	322	28	0.247	0.741	0.012
0	8	127	2	0.054	0.944	0.002
1	3	150	2	0.019	0.970	0.011
2	25	498	10	0.048	0.934	0.017
3	18	1015	31	0.016	0.957	0.026
4	42	1594	61	0.028	0.940	0.032
5	51	2077	95	0.027	0.930	0.043
6	40	1523	87	0.027	0.918	0.055
7	16	666	41	0.027	0.916	0.057
8	6	321	25	0.021	0.902	0.077
9	3	128	13	0.018	0.896	0.086
10	2	40	2	0.053	0.908	0.039
11		13	1		0.907	0.093

Table DA.100. Sample sizes (n) and population proportions (PP) by response to Manage-Forester and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	49	311	39	0.247	0.748	0.005
0	8	129		0.054	0.946	
1	3	151	1	0.019	0.981	0.000
2	25	504	4	0.048	0.948	0.004
3	18	1026	20	0.016	0.968	0.015
4	42	1569	86	0.028	0.914	0.058
5	51	1988	184	0.027	0.885	0.088
6	40	1378	232	0.027	0.830	0.143
7	16	571	136	0.027	0.782	0.191
8	6	268	78	0.021	0.743	0.236
9	3	99	42	0.018	0.672	0.310
10	2	24	18	0.053	0.498	0.449
11		6	8		0.413	0.587

Table DA.101. Sample sizes (n) and population proportions (PP) by response to ManageOther and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	49	329	21	0.247	0.747	0.006
0	8	119	10	0.054	0.877	0.069
1	3	148	4	0.019	0.955	0.027
2	25	490	18	0.048	0.919	0.033
3	18	1027	19	0.016	0.963	0.021
4	42	1606	49	0.028	0.946	0.026
5	51	2113	59	0.027	0.947	0.026
6	40	1542	68	0.027	0.933	0.040
7	16	681	26	0.027	0.939	0.034
8	6	334	12	0.021	0.949	0.030
9	3	132	9	0.018	0.911	0.071
10	2	36	6	0.053	0.793	0.154
11		14			1.000	

Table DA.102. Sample sizes (n) and population proportions (PP) by response to ManageParent and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	49	349	1	0.247	0.753	0.000
0	8	129		0.054	0.946	
1	3	152		0.019	0.981	
2	25	508		0.048	0.952	
3	18	1039	7	0.016	0.976	0.008
4	42	1647	8	0.028	0.967	0.005
5	51	2152	20	0.027	0.965	0.008
6	40	1592	18	0.027	0.964	0.010
7	16	695	12	0.027	0.959	0.013
8	6	340	6	0.021	0.961	0.018
9	3	141		0.018	0.982	
10	2	42		0.053	0.947	
11		13	1		0.907	0.093

Table DA.103. Sample sizes (n) and population proportions (PP) by response to ManagePartner and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	49	343	7	0.247	0.752	0.001
0	8	129		0.054	0.946	
1	3	152		0.019	0.981	
2	25	508		0.048	0.952	
3	18	1038	8	0.016	0.978	0.005
4	42	1636	19	0.028	0.964	0.008
5	51	2146	26	0.027	0.963	0.011
6	40	1565	45	0.027	0.950	0.024
7	16	689	18	0.027	0.955	0.018
8	6	339	7	0.021	0.960	0.019
9	3	131	10	0.018	0.904	0.079
10	2	39	3	0.053	0.864	0.082
11		14			1.000	

Table DA.104. Sample sizes (n) and population proportions (PP) by response to ManageSelf and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	49	57	293	0.247	0.031	0.722
0	8	11	118	0.054	0.059	0.887
1	3	10	142	0.019	0.077	0.904
2	25	45	463	0.048	0.076	0.876
3	18	78	968	0.016	0.069	0.915
4	42	143	1512	0.028	0.084	0.888
5	51	214	1958	0.027	0.096	0.877
6	40	195	1415	0.027	0.116	0.857
7	16	100	607	0.027	0.130	0.843
8	6	49	297	0.021	0.136	0.843
9	3	24	117	0.018	0.180	0.802
10	2	11	31	0.053	0.274	0.673
11		6	8		0.451	0.549

Table DA.105. Sample sizes (n) and population proportions (PP) by response to Manage-Spouse and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	49	284	66	0.247	0.502	0.251
0	8	90	39	0.054	0.638	0.308
1	3	105	47	0.019	0.663	0.319
2	25	342	166	0.048	0.615	0.336
3	18	737	309	0.016	0.679	0.305
4	42	1296	359	0.028	0.751	0.221
5	51	1700	472	0.027	0.756	0.217
6	40	1319	291	0.027	0.797	0.177
7	16	607	100	0.027	0.825	0.148
8	6	307	39	0.021	0.864	0.115
9	3	122	19	0.018	0.843	0.139
10	2	40	2	0.053	0.897	0.049
11		14			1.000	

Table DA.106. Sample sizes (n) and population proportions (PP) by response to MeanAcre and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	186	199	14	0	1.000	0.000
0		137			1.000	
1	1	154		0	1.000	
2	4	525	4	0	1.000	0.000
3	5	1055	4	0	1.000	0.000
4	5	1678	14	0	1.000	0.000
5	8	2193	22	0	0.999	0.001
6	9	1578	63	0	0.993	0.007
7	3	528	192	0	0.861	0.139
8	1		351	0		1.000
9	1		143	0		1.000
10	1		43	0		1.000
11			14			1.000

Table DA.107. Sample sizes (n) and population proportions (PP) by response to MeanWood and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	399			1		
0		137			1.000	
1		155			1.000	
2		533			1.000	
3		1064			1.000	
4		1697			1.000	
5		2223			1.000	
6		1650			1.000	
7		330	393		0.567	0.433
8			352			1.000
9			144			1.000
10			44			1.000
11			14			1.000

Table DA.108. Sample sizes (n) and population proportions (PP) by response to MedicNone and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	131	8	260	0.312	0.005	0.683
0	45		92	0.321		0.679
1	38		117	0.229		0.771
2	128	11	394	0.223	0.024	0.753
3	226	11	827	0.222	0.010	0.768
4	389	54	1254	0.212	0.033	0.755
5	443	70	1710	0.194	0.029	0.778
6	380	71	1199	0.225	0.048	0.727
7	147	28	548	0.190	0.039	0.771
8	66	13	273	0.176	0.032	0.792
9	29	3	112	0.198	0.019	0.783
10	6	3	35	0.113	0.072	0.815
11	2		12	0.138		0.862

Table DA.109. Sample sizes (n) and population proportions (PP) by response to MedicPers and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	131	262	6	0.312	0.684	0.004
0	45	92		0.321	0.679	
1	38	117		0.229	0.771	
2	128	395	10	0.223	0.756	0.022
3	226	830	8	0.222	0.769	0.008
4	389	1269	39	0.212	0.765	0.023
5	443	1724	56	0.194	0.783	0.023
6	380	1216	54	0.225	0.738	0.037
7	147	554	22	0.190	0.779	0.032
8	66	276	10	0.176	0.800	0.024
9	29	112	3	0.198	0.783	0.019
10	6	36	2	0.113	0.838	0.048
11	2	12		0.138	0.862	

Table DA.110. Sample sizes (n) and population proportions (PP) by response to MedicSale and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	131	266	2	0.312	0.687	0.001
0	45	92		0.321	0.679	
1	38	117		0.229	0.771	
2	128	404	1	0.223	0.775	0.002
3	226	835	3	0.222	0.776	0.002
4	389	1293	15	0.212	0.779	0.009
5	443	1764	16	0.194	0.800	0.007
6	380	1251	19	0.225	0.764	0.011
7	147	569	7	0.190	0.800	0.010
8	66	281	5	0.176	0.811	0.013
9	29	114	1	0.198	0.796	0.006
10	6	37	1	0.113	0.863	0.024
11	2	12		0.138	0.862	

Table DA.111. Sample sizes (n) and population proportions (PP) by response to MethodConfer and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	102	283	14	0.262	0.736	0.002
0	25	112		0.177	0.823	
1	17	138		0.097	0.903	
2	51	481	1	0.096	0.901	0.003
3	105	943	16	0.096	0.888	0.016
4	166	1487	44	0.101	0.871	0.028
5	264	1855	104	0.122	0.833	0.045
6	219	1306	125	0.131	0.794	0.075
7	97	518	108	0.130	0.719	0.151
8	50	230	72	0.142	0.657	0.201
9	23	89	32	0.190	0.591	0.219
10	4	21	19	0.083	0.540	0.377
11		11	3		0.799	0.201

Table DA.112. Sample sizes (n) and population proportions (PP) by response to MethodNet and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	102	293	4	0.262	0.737	0.001
0	25	109	3	0.177	0.788	0.035
1	17	137	1	0.097	0.892	0.011
2	51	475	7	0.096	0.893	0.011
3	105	947	12	0.096	0.891	0.013
4	166	1515	16	0.101	0.890	0.009
5	264	1916	43	0.122	0.859	0.019
6	219	1366	65	0.131	0.830	0.039
7	97	585	41	0.130	0.814	0.056
8	50	274	28	0.142	0.782	0.075
9	23	110	11	0.190	0.735	0.075
10	4	36	4	0.083	0.824	0.093
11		13	1		0.920	0.080

Table DA.113. Sample sizes (n) and population proportions (PP) by response to MethodOther and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	102	294	3	0.262	0.737	0.001
0	25	112		0.177	0.823	
1	17	137	1	0.097	0.897	0.005
2	51	481	1	0.096	0.902	0.002
3	105	951	8	0.096	0.897	0.007
4	166	1512	19	0.101	0.890	0.009
5	264	1940	19	0.122	0.869	0.009
6	219	1411	20	0.131	0.856	0.013
7	97	607	19	0.130	0.841	0.029
8	50	289	13	0.142	0.817	0.041
9	23	121		0.190	0.810	
10	4	38	2	0.083	0.873	0.044
11		14			1.000	

Table DA.114. Sample sizes (n) and population proportions (PP) by response to MethodTalk and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	102	249	48	0.262	0.730	0.008
0	25	104	8	0.177	0.758	0.065
1	17	132	6	0.097	0.859	0.044
2	51	458	24	0.096	0.871	0.034
3	105	882	77	0.096	0.829	0.075
4	166	1342	189	0.101	0.777	0.121
5	264	1608	351	0.122	0.723	0.155
6	219	988	443	0.131	0.597	0.272
7	97	328	298	0.130	0.461	0.409
8	50	136	166	0.142	0.388	0.469
9	23	52	69	0.190	0.336	0.474
10	4	17	23	0.083	0.428	0.489
11		7	7		0.516	0.484

Table DA.115. Sample sizes (n) and population proportions (PP) by response to MethodVisit and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	102	276	21	0.262	0.735	0.003
0	25	108	4	0.177	0.793	0.029
1	17	133	5	0.097	0.855	0.048
2	51	462	20	0.096	0.871	0.033
3	105	906	53	0.096	0.853	0.051
4	166	1384	147	0.101	0.807	0.092
5	264	1687	272	0.122	0.752	0.126
6	219	1128	303	0.131	0.681	0.188
7	97	415	211	0.130	0.573	0.297
8	50	192	110	0.142	0.561	0.297
9	23	76	45	0.190	0.505	0.305
10	4	18	22	0.083	0.441	0.476
11		11	3		0.799	0.201

Table DA.116. Sample sizes (n) and population proportions (PP) by response to MethodWrite and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	102	281	16	0.262	0.736	0.002
0	25	111	1	0.177	0.811	0.012
1	17	135	3	0.097	0.882	0.020
2	51	474	8	0.096	0.892	0.012
3	105	929	30	0.096	0.870	0.034
4	166	1467	64	0.101	0.860	0.039
5	264	1805	154	0.122	0.809	0.069
6	219	1267	164	0.131	0.766	0.103
7	97	517	109	0.130	0.712	0.158
8	50	247	55	0.142	0.706	0.151
9	23	93	28	0.190	0.621	0.189
10	4	34	6	0.083	0.787	0.130
11		10	4		0.707	0.293

Table DA.117. Sample sizes (n) and population proportions (PP) by response to MgmtPlan and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	70	248	81	0.254	0.728	0.018
0	6	127	4	0.037	0.927	0.035
1	3	147	5	0.019	0.972	0.009
2	15	499	19	0.025	0.935	0.039
3	27	951	86	0.026	0.895	0.078
4	44	1396	257	0.025	0.816	0.159
5	55	1618	550	0.027	0.719	0.254
6	53	1015	582	0.033	0.605	0.361
7	17	337	369	0.021	0.462	0.517
8	6	153	193	0.020	0.429	0.551
9	2	60	82	0.013	0.435	0.553
10	2	12	30	0.053	0.245	0.701
11		6	8		0.367	0.633

Table DA.118. Sample sizes (n) and population proportions (PP) by response to MgmtPlan-Work and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	121	226	52	0.278	0.715	0.007
0	34	100	3	0.234	0.742	0.024
1	21	133	1	0.106	0.893	0.000
2	92	435	6	0.160	0.827	0.013
3	160	847	57	0.143	0.804	0.052
4	304	1218	175	0.162	0.728	0.110
5	373	1451	399	0.164	0.653	0.183
6	339	882	429	0.197	0.533	0.269
7	143	304	276	0.190	0.422	0.388
8	66	138	148	0.183	0.389	0.428
9	25	55	64	0.179	0.381	0.439
10	9	13	22	0.204	0.277	0.519
11	2	6	6	0.165	0.367	0.467

Table DA.119. Sample sizes (n) and population proportions (PP) by response to MgmtPlan-Writer and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	116	265	18	0.283	0.714	0.003
0	34	103		0.234	0.766	
1	23	132		0.114	0.886	
2	92	435	6	0.163	0.826	0.011
3	162	873	29	0.147	0.826	0.028
4	297	1327	73	0.158	0.801	0.042
5	324	1720	179	0.144	0.780	0.077
6	290	1187	173	0.166	0.726	0.108
7	102	534	87	0.131	0.741	0.128
8	47	285	20	0.127	0.814	0.060
9	15	120	9	0.121	0.816	0.064
10	3	38	3	0.075	0.866	0.059
11		14			1.000	

Table DA.120. Sample sizes (n) and population proportions (PP) by response to MiscCut-None and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	345	12	42	0.788	0.050	0.162
0	110	14	13	0.780	0.108	0.112
1	120	14	21	0.734	0.131	0.135
2	407	60	66	0.749	0.126	0.125
3	852	79	133	0.792	0.077	0.131
4	1400	92	205	0.815	0.057	0.128
5	1864	132	227	0.836	0.056	0.108
6	1435	87	128	0.865	0.052	0.083
7	618	55	50	0.849	0.077	0.074
8	316	19	17	0.898	0.052	0.050
9	134	3	7	0.932	0.013	0.054
10	36	3	5	0.813	0.068	0.119
11	12		2	0.835		0.165

Table DA.121. Sample sizes (n) and population proportions (PP) by response to MiscCutOther and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	345	53	1	0.788	0.212	0.000
0	110	18	9	0.780	0.154	0.067
1	120	24	11	0.734	0.164	0.102
2	408	91	34	0.750	0.178	0.071
3	853	162	49	0.792	0.159	0.049
4	1402	243	52	0.816	0.151	0.033
5	1867	296	60	0.837	0.138	0.025
6	1437	168	45	0.866	0.107	0.027
7	618	77	28	0.849	0.110	0.041
8	316	26	10	0.898	0.077	0.025
9	134	9	1	0.932	0.065	0.003
10	36	5	3	0.813	0.119	0.068
11	12	2		0.835	0.165	

Table DA.122. Sample sizes (n) and population proportions (PP) by response to MiscCutPers and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	345	46	8	0.788	0.162	0.050
0	111	21	5	0.791	0.156	0.053
1	121	31	3	0.741	0.229	0.029
2	407	102	24	0.749	0.200	0.052
3	853	182	29	0.794	0.179	0.027
4	1400	264	33	0.815	0.165	0.020
5	1868	312	43	0.838	0.141	0.021
6	1439	191	20	0.867	0.120	0.013
7	618	91	14	0.849	0.131	0.020
8	316	36		0.898	0.102	
9	134	10		0.932	0.068	
10	37	7		0.841	0.159	
11	12	2		0.835	0.165	

Table DA.123. Sample sizes (n) and population proportions (PP) by response to MiscCutSale and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	345	51	3	0.788	0.212	0.000
0	111	25	1	0.791	0.209	0.000
1	121	34		0.741	0.259	
2	408	123	2	0.750	0.247	0.003
3	854	208	2	0.794	0.203	0.002
4	1402	286	9	0.816	0.178	0.006
5	1871	320	32	0.839	0.149	0.012
6	1437	187	26	0.866	0.120	0.014
7	618	90	15	0.849	0.133	0.018
8	316	27	9	0.898	0.075	0.027
9	134	8	2	0.932	0.057	0.010
10	37	7		0.841	0.159	
11	12	2		0.835	0.165	

Table DA.124. Sample sizes (n) and population proportions (PP) by response to MiscNtfp-None and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	315	9	75	0.723	0.009	0.268
0	112		25	0.782		0.218
1	121	1	33	0.761	0.004	0.235
2	414	4	115	0.765	0.007	0.229
3	846	5	213	0.792	0.005	0.202
4	1325	22	350	0.773	0.014	0.212
5	1752	34	437	0.787	0.017	0.196
6	1358	26	266	0.829	0.016	0.155
7	599	15	109	0.819	0.022	0.159
8	298	2	52	0.843	0.006	0.151
9	116	4	24	0.803	0.016	0.181
10	34		10	0.785		0.215
11	11	1	2	0.792	0.055	0.153

Table DA.125. Sample sizes (n) and population proportions (PP) by response to MiscNtfp-Pers and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	315	78	6	0.723	0.269	0.008
0	112	25		0.782	0.218	
1	121	33	1	0.761	0.235	0.004
2	414	115	4	0.765	0.229	0.007
3	846	213	5	0.792	0.202	0.005
4	1324	355	18	0.773	0.216	0.012
5	1752	446	25	0.787	0.200	0.013
6	1356	272	22	0.828	0.158	0.014
7	599	115	9	0.819	0.167	0.013
8	298	52	2	0.843	0.151	0.006
9	116	26	2	0.803	0.187	0.009
10	34	10		0.785	0.215	
11	11	3		0.792	0.208	

Table DA.126. Sample sizes (n) and population proportions (PP) by response to MiscNtfp-Sale and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	315	81	3	0.723	0.276	0.001
0	112	25		0.782	0.218	
1	121	34		0.761	0.239	
2	414	119		0.765	0.235	
3	846	217	1	0.792	0.207	0.000
4	1325	367	5	0.773	0.223	0.004
5	1751	460	12	0.787	0.207	0.006
6	1357	283	10	0.829	0.166	0.005
7	598	116	9	0.818	0.170	0.012
8	298	54		0.843	0.157	
9	116	26	2	0.803	0.190	0.006
10	34	10		0.785	0.215	
11	10	2	2	0.748	0.153	0.099

Table DA.127. Sample sizes (n) and population proportions (PP) by response to Nature and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	138	101	160	0.154	0.322	0.525
0	4	51	82	0.032	0.350	0.618
1	2	43	110	0.007	0.295	0.697
2	20	152	361	0.029	0.274	0.697
3	32	316	716	0.031	0.290	0.679
4	76	531	1090	0.040	0.301	0.659
5	90	626	1507	0.039	0.267	0.694
6	69	484	1097	0.040	0.288	0.672
7	23	218	482	0.030	0.298	0.672
8	15	110	227	0.043	0.318	0.639
9	7	54	83	0.040	0.408	0.552
10	3	11	30	0.054	0.240	0.706
11	2	6	6	0.119	0.463	0.418

Table DA.128. Sample sizes (n) and population proportions (PP) by response to NTFP and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	144	221	34	0.152	0.755	0.093
0	8	125	4	0.058	0.912	0.029
1	4	144	7	0.022	0.928	0.050
2	22	476	35	0.028	0.903	0.069
3	30	955	79	0.031	0.902	0.067
4	81	1475	141	0.045	0.874	0.081
5	93	1920	210	0.039	0.870	0.091
6	79	1404	167	0.048	0.848	0.104
7	29	619	75	0.038	0.851	0.111
8	20	304	28	0.060	0.856	0.084
9	5	127	12	0.029	0.898	0.073
10	4	35	5	0.073	0.778	0.149
11	2	11	1	0.119	0.804	0.077

Table DA.129. Sample sizes (n) and population proportions (PP) by response to Privacy and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	145	117	137	0.214	0.438	0.348
0	6	34	97	0.049	0.236	0.715
1	3	32	120	0.008	0.214	0.779
2	25	117	391	0.028	0.186	0.786
3	40	327	697	0.032	0.282	0.686
4	76	547	1074	0.044	0.304	0.652
5	102	739	1382	0.046	0.327	0.627
6	83	570	997	0.049	0.340	0.611
7	28	263	432	0.040	0.358	0.602
8	19	158	175	0.057	0.465	0.477
9	9	66	69	0.046	0.451	0.504
10	4	21	19	0.073	0.493	0.434
11	2	4	8	0.119	0.342	0.539

Table DA.130. Sample sizes (n) and population proportions (PP) by response to RecreateATV and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	109	214	76	0.273	0.671	0.057
0	42	89	6	0.291	0.663	0.046
1	34	108	13	0.201	0.742	0.057
2	105	352	76	0.190	0.682	0.128
3	178	651	235	0.172	0.619	0.208
4	309	974	414	0.172	0.581	0.247
5	334	1171	718	0.145	0.530	0.325
6	275	799	576	0.157	0.491	0.353
7	99	318	306	0.130	0.436	0.434
8	43	158	151	0.112	0.467	0.421
9	15	78	51	0.121	0.522	0.356
10	3	19	22	0.051	0.447	0.502
11		4	10		0.332	0.668

Table DA.131. Sample sizes (n) and population proportions (PP) by response to Recreate-Bike and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	109	273	17	0.273	0.726	0.002
0	42	85	10	0.291	0.643	0.066
1	34	111	10	0.201	0.723	0.076
2	105	408	20	0.190	0.768	0.043
3	178	837	49	0.172	0.770	0.058
4	309	1297	91	0.172	0.769	0.060
5	334	1768	121	0.145	0.796	0.059
6	275	1241	134	0.157	0.761	0.082
7	99	554	70	0.130	0.772	0.098
8	43	273	36	0.112	0.787	0.101
9	15	113	16	0.121	0.767	0.112
10	3	31	10	0.051	0.735	0.214
11		12	2		0.881	0.119

Table DA.132. Sample sizes (n) and population proportions (PP) by response to Recreate-Camp and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	109	260	30	0.273	0.695	0.032
0	42	87	8	0.291	0.644	0.065
1	34	109	12	0.201	0.717	0.082
2	105	389	39	0.190	0.746	0.065
3	178	767	119	0.172	0.700	0.128
4	309	1187	201	0.172	0.704	0.124
5	334	1538	351	0.145	0.685	0.169
6	275	1100	275	0.157	0.678	0.165
7	99	455	169	0.130	0.636	0.234
8	43	227	82	0.112	0.662	0.226
9	15	94	35	0.121	0.645	0.233
10	3	28	13	0.051	0.648	0.301
11		9	5		0.669	0.331

Table DA.133. Sample sizes (n) and population proportions (PP) by response to Recreate-Fish and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	109	227	63	0.273	0.672	0.056
0	42	90	5	0.291	0.670	0.039
1	34	112	9	0.201	0.769	0.030
2	105	394	34	0.190	0.757	0.053
3	178	738	148	0.172	0.715	0.113
4	309	1128	260	0.172	0.701	0.127
5	334	1428	461	0.145	0.670	0.185
6	275	881	494	0.157	0.568	0.276
7	99	356	268	0.130	0.522	0.348
8	43	142	167	0.112	0.428	0.460
9	15	55	74	0.121	0.370	0.508
10	3	14	27	0.051	0.308	0.641
11		4	10		0.354	0.646

Table DA.134. Sample sizes (n) and population proportions (PP) by response to Recreate-Hike and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	109	163	127	0.273	0.568	0.159
0	42	51	44	0.291	0.402	0.307
1	34	56	65	0.201	0.392	0.407
2	105	183	245	0.190	0.334	0.477
3	178	383	503	0.172	0.328	0.500
4	309	583	805	0.172	0.324	0.504
5	334	712	1177	0.145	0.303	0.551
6	275	507	868	0.157	0.305	0.538
7	99	233	391	0.130	0.316	0.554
8	43	141	168	0.112	0.408	0.480
9	15	54	75	0.121	0.349	0.530
10	3	19	22	0.051	0.448	0.501
11		4	10		0.354	0.646

Table DA.135. Sample sizes (n) and population proportions (PP) by response to Recreate-Horse and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	109	247	43	0.273	0.692	0.035
0	42	92	3	0.291	0.695	0.014
1	34	120	1	0.201	0.797	0.002
2	105	394	34	0.190	0.772	0.039
3	178	786	100	0.172	0.756	0.072
4	309	1235	153	0.172	0.743	0.085
5	334	1575	314	0.145	0.724	0.131
6	275	1107	268	0.157	0.690	0.154
7	99	480	144	0.130	0.676	0.193
8	43	224	85	0.112	0.664	0.224
9	15	86	43	0.121	0.614	0.265
10	3	23	18	0.051	0.564	0.385
11		10	4		0.747	0.253

Table DA.136. Sample sizes (n) and population proportions (PP) by response to Recreate-Hunt and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	109	81	209	0.273	0.570	0.158
0	42	80	15	0.291	0.640	0.068
1	34	88	33	0.201	0.652	0.147
2	105	261	167	0.190	0.551	0.260
3	178	321	565	0.172	0.369	0.459
4	309	349	1039	0.172	0.252	0.576
5	334	311	1578	0.145	0.158	0.697
6	275	168	1207	0.157	0.111	0.732
7	99	68	556	0.130	0.100	0.770
8	43	21	288	0.112	0.068	0.820
9	15	14	115	0.121	0.105	0.774
10	3	4	37	0.051	0.106	0.843
11			14			1.000

Table DA.137. Sample sizes (n) and population proportions (PP) by response to RecreateOther and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	109	286	4	0.273	0.722	0.005
0	42	91	4	0.291	0.684	0.025
1	34	115	6	0.201	0.746	0.053
2	105	408	20	0.190	0.764	0.046
3	178	863	23	0.172	0.803	0.025
4	309	1339	49	0.172	0.798	0.030
5	334	1825	64	0.145	0.824	0.030
6	275	1336	39	0.157	0.817	0.026
7	99	608	16	0.130	0.844	0.025
8	43	302	7	0.112	0.867	0.021
9	15	126	3	0.121	0.865	0.014
10	3	39	2	0.051	0.890	0.059
11		14			1.000	

Table DA.138. Sample sizes (n) and population proportions (PP) by response to RecreateSki and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	109	255	35	0.273	0.717	0.010
0	42	88	7	0.291	0.657	0.052
1	34	110	11	0.201	0.746	0.053
2	105	400	28	0.190	0.758	0.052
3	178	808	78	0.172	0.747	0.081
4	309	1215	173	0.172	0.720	0.108
5	334	1589	300	0.145	0.715	0.140
6	275	1130	245	0.157	0.680	0.163
7	99	539	85	0.130	0.737	0.133
8	43	280	29	0.112	0.802	0.086
9	15	115	14	0.121	0.772	0.107
10	3	35	6	0.051	0.791	0.158
11		11	3		0.786	0.214

Table DA.139. Sample sizes (n) and population proportions (PP) by response to Recreation and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	142	171	86	0.154	0.778	0.068
0	8	96	33	0.064	0.705	0.231
1	5	101	49	0.017	0.661	0.321
2	21	321	191	0.030	0.607	0.363
3	50	591	423	0.045	0.546	0.408
4	86	889	722	0.050	0.508	0.442
5	102	1075	1046	0.047	0.467	0.486
6	85	779	786	0.054	0.460	0.486
7	33	327	363	0.046	0.440	0.514
8	14	175	163	0.038	0.496	0.466
9	9	67	68	0.056	0.468	0.476
10	5	18	21	0.073	0.413	0.514
11	1	9	4	0.055	0.651	0.294

Table DA.140. Sample sizes (n) and population proportions (PP) by response to Retired1 and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	128	84	187	0.164	0.434	0.402
0	45	59	33	0.323	0.417	0.260
1	38	70	47	0.212	0.495	0.293
2	125	228	180	0.227	0.451	0.322
3	226	442	396	0.218	0.415	0.367
4	351	650	696	0.197	0.398	0.405
5	465	820	938	0.208	0.369	0.422
6	380	573	697	0.220	0.344	0.436
7	149	298	276	0.198	0.406	0.395
8	78	136	138	0.219	0.377	0.404
9	42	63	39	0.307	0.424	0.269
10	7	30	7	0.172	0.663	0.165
11	4	9	1	0.355	0.590	0.055

Table DA.141. Sample sizes (n) and population proportions (PP) by response to Retired2 and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	169	171	59	0.191	0.712	0.097
0	49	72	16	0.347	0.510	0.143
1	48	94	13	0.302	0.626	0.071
2	168	268	97	0.298	0.521	0.180
3	337	534	193	0.301	0.506	0.193
4	551	845	301	0.305	0.519	0.176
5	748	1045	430	0.329	0.482	0.189
6	613	739	298	0.353	0.463	0.184
7	297	297	129	0.397	0.415	0.188
8	148	143	61	0.409	0.411	0.181
9	83	42	19	0.598	0.275	0.128
10	22	19	3	0.518	0.405	0.077
11	8	5	1	0.626	0.295	0.080

Table DA.142. Sample sizes (n) and population proportions (PP) by response to ScapeNone and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	126	29	244	0.307	0.016	0.677
0	43	11	83	0.306	0.082	0.612
1	37	15	103	0.231	0.103	0.666
2	126	76	331	0.226	0.160	0.614
3	202	129	733	0.194	0.129	0.677
4	374	182	1141	0.203	0.111	0.686
5	421	252	1550	0.184	0.114	0.702
6	352	200	1098	0.207	0.126	0.667
7	134	101	488	0.170	0.138	0.692
8	60	44	248	0.158	0.122	0.720
9	22	32	90	0.149	0.221	0.630
10	4	10	30	0.079	0.241	0.680
11	2	3	9	0.138	0.218	0.645

Table DA.143. Sample sizes (n) and population proportions (PP) by response to ScapePers and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	126	246	27	0.307	0.677	0.016
0	43	83	11	0.306	0.612	0.082
1	37	103	15	0.231	0.666	0.103
2	126	331	76	0.226	0.614	0.160
3	202	735	127	0.194	0.679	0.127
4	374	1149	174	0.203	0.692	0.105
5	421	1562	240	0.184	0.706	0.110
6	352	1122	176	0.207	0.681	0.111
7	134	510	79	0.170	0.722	0.107
8	60	262	30	0.158	0.761	0.081
9	22	106	16	0.149	0.741	0.110
10	4	36	4	0.079	0.843	0.078
11	2	10	2	0.138	0.722	0.141

Table DA.144. Sample sizes (n) and population proportions (PP) by response to ScapeSale and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	126	270	3	0.307	0.693	0.000
0	43	94		0.306	0.694	
1	37	118		0.231	0.769	
2	126	407		0.226	0.774	
3	202	857	5	0.194	0.802	0.004
4	374	1313	10	0.203	0.790	0.007
5	421	1788	14	0.184	0.811	0.005
6	352	1269	29	0.207	0.776	0.017
7	134	561	28	0.170	0.791	0.039
8	60	274	18	0.158	0.791	0.051
9	22	103	19	0.149	0.720	0.131
10	4	34	6	0.079	0.758	0.163
11	2	10	2	0.138	0.724	0.138

Table DA.145. Sample sizes (n) and population proportions (PP) by response to SourceFamily and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	79	297	23	0.260	0.738	0.002
0	20	116	1	0.130	0.858	0.012
1	14	139	2	0.085	0.903	0.013
2	35	493	5	0.060	0.931	0.008
3	73	958	33	0.062	0.902	0.036
4	126	1515	56	0.073	0.890	0.037
5	149	1962	112	0.063	0.886	0.051
6	141	1371	138	0.080	0.837	0.083
7	63	556	104	0.080	0.777	0.143
8	31	261	60	0.082	0.743	0.175
9	12	109	23	0.096	0.756	0.148
10	5	30	9	0.087	0.739	0.175
11		11	3		0.760	0.240

Table DA.146. Sample sizes (n) and population proportions (PP) by response to SourceFederal and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	101	291	7	0.265	0.733	0.001
0	26	111		0.177	0.823	
1	18	136	1	0.108	0.886	0.005
2	47	482	4	0.083	0.912	0.005
3	105	939	20	0.099	0.884	0.017
4	163	1498	36	0.099	0.880	0.022
5	243	1888	92	0.112	0.848	0.040
6	208	1352	90	0.124	0.822	0.053
7	85	567	71	0.114	0.792	0.094
8	42	259	51	0.119	0.732	0.148
9	17	113	14	0.142	0.771	0.087
10	5	33	6	0.087	0.795	0.119
11		13	1		0.917	0.083

Table DA.147. Sample sizes (n) and population proportions (PP) by response to SourceNeighbor and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	79	301	19	0.260	0.738	0.002
0	20	117		0.130	0.870	
1	14	139	2	0.085	0.901	0.015
2	35	490	8	0.060	0.926	0.013
3	73	972	19	0.062	0.917	0.021
4	126	1534	37	0.073	0.903	0.024
5	149	1983	91	0.063	0.895	0.041
6	141	1396	113	0.080	0.853	0.067
7	63	573	87	0.080	0.794	0.126
8	31	277	44	0.082	0.794	0.124
9	12	109	23	0.096	0.753	0.152
10	5	31	8	0.087	0.748	0.166
11		11	3		0.763	0.237

Table DA.148. Sample sizes (n) and population proportions (PP) by response to SourceOther and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	79	317	3	0.260	0.740	0.000
0	20	116	1	0.130	0.858	0.012
1	14	140	1	0.085	0.904	0.011
2	35	492	6	0.060	0.929	0.010
3	73	983	8	0.062	0.930	0.008
4	126	1549	22	0.073	0.913	0.014
5	149	2040	34	0.063	0.920	0.017
6	141	1466	43	0.080	0.893	0.027
7	63	623	37	0.080	0.865	0.055
8	31	305	16	0.082	0.876	0.043
9	12	127	5	0.096	0.870	0.034
10	5	36	3	0.087	0.859	0.054
11		13	1		0.956	0.044

Table DA.149. Sample sizes (n) and population proportions (PP) by response to SourcePrivate and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	79	276	44	0.260	0.736	0.004
0	20	111	6	0.130	0.829	0.041
1	14	134	7	0.085	0.864	0.051
2	35	487	11	0.060	0.919	0.021
3	73	954	37	0.062	0.903	0.035
4	126	1441	130	0.073	0.841	0.087
5	149	1742	332	0.063	0.778	0.158
6	141	1102	407	0.080	0.666	0.254
7	63	387	273	0.080	0.541	0.379
8	31	160	161	0.082	0.449	0.470
9	12	58	74	0.096	0.364	0.541
10	5	11	28	0.087	0.268	0.645
11		7	7		0.535	0.465

Table DA.150. Sample sizes (n) and population proportions (PP) by response to SourceState and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	79	281	39	0.260	0.735	0.005
0	20	116	1	0.130	0.858	0.012
1	14	138	3	0.085	0.892	0.024
2	35	468	30	0.060	0.885	0.055
3	73	924	67	0.062	0.875	0.063
4	126	1398	173	0.073	0.823	0.104
5	149	1731	343	0.063	0.787	0.150
6	141	1173	336	0.080	0.715	0.205
7	63	431	229	0.080	0.592	0.328
8	31	194	127	0.082	0.562	0.357
9	12	80	52	0.096	0.551	0.353
10	5	23	16	0.087	0.561	0.353
11		9	5		0.658	0.342

Table DA.151. Sample sizes (n) and population proportions (PP) by response to StayWooded and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	72	66	261	0.292	0.256	0.452
0	4	21	112	0.021	0.123	0.856
1	2	14	139	0.018	0.085	0.897
2	11	57	465	0.017	0.090	0.893
3	31	127	906	0.023	0.113	0.864
4	40	233	1424	0.021	0.135	0.845
5	55	298	1870	0.023	0.127	0.851
6	50	198	1402	0.028	0.108	0.865
7	13	82	628	0.018	0.100	0.882
8	4	52	296	0.014	0.141	0.845
9	5	17	122	0.034	0.096	0.871
10		10	34		0.242	0.758
11		2	12		0.153	0.847

Table DA.152. Sample sizes (n) and population proportions (PP) by response to Timber and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	134	179	86	0.155	0.790	0.054
0	7	127	3	0.052	0.935	0.013
1	3	148	4	0.015	0.977	0.008
2	25	470	38	0.037	0.914	0.049
3	27	898	139	0.025	0.862	0.113
4	66	1244	387	0.033	0.748	0.218
5	71	1371	781	0.031	0.631	0.338
6	47	800	803	0.027	0.492	0.481
7	10	250	463	0.011	0.348	0.642
8	8	80	264	0.023	0.201	0.776
9	1	28	115	0.005	0.183	0.812
10	1	8	35	0.022	0.193	0.785
11		2	12		0.112	0.888

Table DA.153. Sample sizes (n) and population proportions (PP) by response to TransChild and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	120	243	36	0.264	0.690	0.046
0	47	89	1	0.330	0.658	0.012
1	36	112	7	0.206	0.770	0.024
2	119	392	22	0.217	0.748	0.035
3	213	798	53	0.208	0.750	0.042
4	350	1251	96	0.197	0.753	0.051
5	425	1661	137	0.194	0.750	0.057
6	348	1183	119	0.208	0.721	0.071
7	130	531	62	0.174	0.736	0.090
8	52	259	41	0.147	0.749	0.104
9	18	101	25	0.150	0.685	0.165
10	3	38	3	0.075	0.870	0.055
11		9	5		0.626	0.374

Table DA.154. Sample sizes (n) and population proportions (PP) by response to TransFamily and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	120	262	17	0.264	0.665	0.071
0	47	89	1	0.330	0.664	0.006
1	36	119		0.206	0.794	
2	119	405	9	0.217	0.768	0.015
3	213	835	16	0.208	0.777	0.015
4	350	1297	50	0.197	0.770	0.034
5	425	1728	70	0.194	0.774	0.032
6	348	1257	45	0.208	0.767	0.025
7	130	575	18	0.174	0.801	0.025
8	52	289	11	0.147	0.819	0.034
9	18	120	6	0.150	0.801	0.049
10	3	38	3	0.075	0.853	0.071
11		14			1.000	

Table DA.155. Sample sizes (n) and population proportions (PP) by response to TypeHelpConf and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	110	243	46	0.361	0.537	0.102
0	35	98	4	0.253	0.712	0.035
1	22	125	8	0.110	0.822	0.067
2	87	406	40	0.149	0.775	0.076
3	153	781	130	0.136	0.736	0.128
4	280	1204	213	0.144	0.727	0.129
5	318	1549	356	0.131	0.703	0.165
6	261	1069	320	0.147	0.664	0.189
7	97	437	189	0.124	0.600	0.277
8	44	203	105	0.120	0.579	0.302
9	18	88	38	0.140	0.590	0.271
10	3	26	15	0.068	0.604	0.328
11		9	5		0.591	0.409

Table DA.156. Sample sizes (n) and population proportions (PP) by response to TypeHelpNet and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	110	242	47	0.361	0.508	0.131
0	35	77	25	0.253	0.565	0.182
1	22	86	47	0.110	0.517	0.373
2	87	309	137	0.149	0.562	0.289
3	153	649	262	0.136	0.580	0.284
4	280	1052	365	0.144	0.616	0.240
5	318	1419	486	0.131	0.632	0.237
6	261	1010	379	0.147	0.615	0.238
7	97	442	184	0.124	0.611	0.266
8	44	212	96	0.120	0.605	0.276
9	18	85	41	0.140	0.570	0.290
10	3	29	12	0.068	0.658	0.274
11		11	3		0.802	0.198

Table DA.157. Sample sizes (n) and population proportions (PP) by response to TypeHelp-None and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	110	218	71	0.361	0.403	0.236
0	35	67	35	0.253	0.486	0.261
1	22	103	30	0.110	0.720	0.170
2	87	343	103	0.149	0.677	0.174
3	153	750	161	0.136	0.729	0.134
4	280	1146	271	0.144	0.712	0.144
5	318	1641	264	0.131	0.753	0.116
6	261	1234	155	0.147	0.760	0.093
7	97	569	57	0.124	0.803	0.074
8	44	280	28	0.120	0.798	0.082
9	18	111	15	0.140	0.759	0.101
10	3	38	3	0.068	0.851	0.081
11		12	2		0.868	0.132

Table DA.158. Sample sizes (n) and population proportions (PP) by response to Type-HelpOther and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	110	284	5	0.361	0.632	0.007
0	35	101	1	0.253	0.741	0.006
1	22	132	1	0.110	0.883	0.007
2	87	443	3	0.149	0.847	0.004
3	153	907	4	0.136	0.859	0.005
4	280	1401	16	0.144	0.843	0.013
5	318	1888	17	0.131	0.861	0.008
6	262	1370	18	0.147	0.842	0.011
7	97	619	7	0.124	0.866	0.010
8	44	302	6	0.120	0.861	0.020
9	18	123	3	0.140	0.838	0.023
10	3	41		0.068	0.932	
11		14			1.000	

Table DA.159. Sample sizes (n) and population proportions (PP) by response to TypeHelpTalk and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	110	200	89	0.361	0.556	0.083
0	35	88	14	0.253	0.649	0.099
1	22	108	25	0.110	0.710	0.180
2	87	361	85	0.149	0.695	0.156
3	153	651	260	0.136	0.609	0.254
4	280	985	432	0.144	0.580	0.276
5	318	1198	707	0.131	0.544	0.325
6	261	743	646	0.147	0.452	0.401
7	97	329	297	0.124	0.455	0.421
8	44	147	161	0.120	0.438	0.443
9	18	66	60	0.140	0.462	0.398
10	3	22	19	0.068	0.520	0.412
11		10	4		0.713	0.287

Table DA.160. Sample sizes (n) and population proportions (PP) by response to TypeHelpVisit and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	110	216	73	0.361	0.501	0.138
0	35	87	15	0.253	0.654	0.093
1	22	119	14	0.110	0.809	0.081
2	87	357	89	0.149	0.693	0.158
3	153	658	253	0.136	0.624	0.240
4	280	1033	384	0.144	0.615	0.241
5	318	1273	632	0.131	0.575	0.294
6	261	872	517	0.147	0.541	0.312
7	97	376	250	0.124	0.518	0.358
8	44	193	115	0.120	0.557	0.323
9	18	93	33	0.140	0.639	0.221
10	3	29	12	0.068	0.666	0.266
11		13	1		0.917	0.083

Table DA.161. Sample sizes (n) and population proportions (PP) by response to TypeHelpWrite and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	110	140	149	0.361	0.274	0.365
0	35	59	43	0.253	0.441	0.307
1	22	67	66	0.110	0.418	0.472
2	87	222	224	0.149	0.413	0.438
3	153	360	551	0.136	0.328	0.536
4	280	594	823	0.144	0.347	0.509
5	318	767	1138	0.131	0.337	0.532
6	261	539	850	0.147	0.330	0.523
7	97	239	387	0.124	0.319	0.558
8	44	122	186	0.120	0.355	0.526
9	18	51	75	0.140	0.352	0.508
10	3	22	19	0.068	0.519	0.413
11		2	12		0.132	0.868

Table DA.162. Sample sizes (n) and population proportions (PP) by response to Water and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	141	104	154	0.163	0.390	0.446
0	4	62	71	0.026	0.431	0.543
1	2	55	98	0.007	0.368	0.625
2	26	209	298	0.028	0.389	0.583
3	37	374	653	0.037	0.359	0.603
4	82	624	991	0.043	0.371	0.586
5	97	766	1360	0.043	0.344	0.613
6	70	557	1023	0.042	0.345	0.613
7	21	221	481	0.029	0.307	0.664
8	17	105	230	0.048	0.308	0.644
9	5	53	86	0.034	0.404	0.562
10	5	12	27	0.100	0.253	0.646
11	3	6	5	0.177	0.463	0.360

Table DA.163. Sample sizes (n) and population proportions (PP) by response to Wilderness and discrete log of wooded acres (DWA) at the national level.

DWA	n (NA)	n (0)	n (1)	PP (NA)	PP (0)	PP (1)
NA	138	83	178	0.269	0.289	0.441
0	7	52	78	0.061	0.372	0.567
1	11	42	102	0.061	0.289	0.650
2	30	155	348	0.046	0.290	0.664
3	52	277	735	0.058	0.259	0.683
4	86	443	1168	0.050	0.249	0.701
5	105	496	1622	0.049	0.211	0.740
6	84	347	1219	0.053	0.201	0.746
7	34	133	556	0.050	0.178	0.772
8	14	73	265	0.040	0.212	0.748
9	6	37	101	0.040	0.254	0.706
10	4	9	31	0.082	0.183	0.735
11	2	5	7	0.099	0.432	0.470

Table DA.164 Results for Alabama for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 189)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-2.15436	0.54244	-3.972	7.14e-05	$\alpha < 0.001$
Beauty	0.14530	0.33689	0.431	0.6662	
Privacy	-0.26906	0.26796	-1.004	0.3153	
Timber	1.40116	0.28772	4.870	1.12e-06	$\alpha < 0.001$
PastHarvest	0.39454	0.27077	1.457	0.1451	
Couple	0.32443	0.28716	1.130	0.2586	
Coop	0.42353	0.35346	1.198	0.2308	
Retired	0.30072	0.26829	1.121	0.2623	
Education	0.02526	0.26876	0.094	0.9251	
Income	0.63847	0.31875	2.003	0.0452	$\alpha < 0.05$
UnknownIncome	-0.10082	0.35435	-0.285	0.7760	
WoodAcres	1.24011	0.28266	4.387	1.15e-05	$\alpha < 0.001$
ForestCover	0.21118	0.25749	0.820	0.4121	

Percent correctly predicted: 75.8

Table DA.165 Results for Arkansas for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 157)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-2.740788	0.636749	-4.304	1.67e-05	$\alpha < 0.001$
Beauty	-0.057549	0.397032	-0.145	0.8848	
Privacy	0.203405	0.363720	0.559	0.5760	
Timber	2.345669	0.339142	6.916	4.63e-12	$\alpha < 0.001$
PastHarvest	0.970251	0.324660	2.989	0.0028	$\alpha < 0.01$
Couple	-0.185124	0.348528	-0.531	0.5953	
Coop	0.567947	0.459162	1.237	0.2161	
Retired	0.459678	0.325724	1.411	0.1582	
Education	0.574515	0.328470	1.749	0.0803	$\alpha < 0.1$
Income	0.970420	0.439429	2.208	0.0272	$\alpha < 0.05$
UnknownIncome	-0.009347	0.432252	-0.022	0.9827	
WoodAcres	-0.135517	0.379866	-0.357	0.7213	
ForestCover	-0.106458	0.302825	-0.352	0.7252	

Percent correctly predicted: 81.5

Table DA.166 Results for California for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 101)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.23186	1.10521	-1.115	0.2650	
Beauty	-0.10433	0.74851	-0.139	0.8891	
Privacy	-0.55380	0.79803	-0.694	0.4877	
Timber	1.40168	0.66214	2.117	0.0343	$\alpha < 0.05$
PastHarvest	2.06709	0.71814	2.878	0.0040	$\alpha < 0.01$
Couple	-1.65394	0.98090	-1.686	0.0918	$\alpha < 0.1$
Coop	-1.32622	0.84209	-1.575	0.1153	
Retired	-0.75350	0.69817	-1.079	0.2805	
Education	-0.09946	0.65742	-0.151	0.8797	
Income	-0.37233	0.65838	-0.566	0.5717	
UnknownIncome	0.07984	0.95616	0.084	0.9335	
WoodAcres	1.32825	0.72209	1.839	0.0659	$\alpha < 0.1$
ForestCover	0.43585	0.63159	0.690	0.4901	

Percent correctly predicted: 90.2

Table DA.167 Results for Connecticut for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 161)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-2.52507	0.86261	-2.927	0.00342	$\alpha < 0.01$
Beauty	0.33651	0.65706	0.512	0.60855	
Privacy	0.22212	0.39713	0.559	0.57595	
Timber	1.97522	0.44546	4.434	9.24e-06	$\alpha < 0.001$
PastHarvest	1.72840	0.38126	4.533	5.81e-06	$\alpha < 0.001$
Couple	0.03339	0.37872	0.088	0.92975	
Coop	0.29721	0.56315	0.528	0.59767	
Retired	0.19638	0.32077	0.612	0.54039	
Education	0.02149	0.38037	0.056	0.95495	
Income	0.39530	0.37500	1.054	0.29182	
UnknownIncome	0.22433	0.49002	0.458	0.64710	
WoodAcres	3.38236	376.75418	0.009	0.99284	
ForestCover	-0.32546	0.34040	-0.956	0.33902	

Percent correctly predicted: 84.2

Table DA.168 Results for Delaware for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 170)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-2.47354	0.57049	-4.336	1.45e-05	$\alpha < 0.001$
Beauty	0.17437	0.35519	0.491	0.623481	
Privacy	0.33214	0.34208	0.971	0.331573	
Timber	1.03010	0.32913	3.130	0.001749	$\alpha < 0.01$
PastHarvest	0.69304	0.32587	2.127	0.033439	$\alpha < 0.05$
Couple	-0.17372	0.36353	-0.478	0.632735	
Coop	0.84152	0.44192	1.904	0.056881	$\alpha < 0.1$
Retired	-0.08701	0.31024	-0.280	0.779115	
Education	-0.22867	0.30687	-0.745	0.456168	
Income	0.43542	0.34902	1.248	0.212199	
UnknownIncome	-0.13068	0.40684	-0.321	0.748046	
WoodAcres	-4.38642	251.48031	-0.017	0.986084	
ForestCover	1.16543	0.33774	3.451	0.000559	$\alpha < 0.001$

Percent correctly predicted: 82.5

Table DA.169 Results for Florida for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 132)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-2.09601	0.65047	-3.222	0.00127	$\alpha < 0.01$
Beauty	0.32087	0.40786	0.787	0.43145	
Privacy	-0.28325	0.31109	-0.911	0.36255	
Timber	1.58256	0.33311	4.751	2.03e-06	$\alpha < 0.001$
PastHarvest	0.23306	0.33653	0.693	0.48860	
Couple	0.38889	0.36767	1.058	0.29018	
Coop	-0.01425	0.41167	-0.035	0.97239	
Retired	0.22934	0.29656	0.773	0.43932	
Education	-0.42138	0.31285	-1.347	0.17801	
Income	0.50863	0.32459	1.567	0.11712	
UnknownIncome	-0.71122	0.51913	-1.370	0.17068	
WoodAcres	0.70857	0.34128	2.076	0.03787	$\alpha < 0.05$
ForestCover	0.39790	0.32361	1.230	0.21886	

Percent correctly predicted: 73.3

Table DA.170 Results for Georgia for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 169)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.5643	0.5080	-3.079	0.002075	$\alpha < 0.01$
Beauty	-0.5395	0.3676	-1.467	0.142251	
Privacy	0.3606	0.3496	1.032	0.302248	
Timber	1.1490	0.2834	4.055	5.01e-05	$\alpha < 0.001$
PastHarvest	1.2300	0.3091	3.980	6.90e-05	$\alpha < 0.001$
Couple	-0.1114	0.2932	-0.380	0.703918	
Coop	0.3186	0.4244	0.751	0.452840	
Retired	-0.4888	0.3034	-1.611	0.107182	
Education	0.1957	0.2901	0.675	0.499869	
Income	0.3004	0.3352	0.896	0.370015	
UnknownIncome	0.0649	0.3715	0.175	0.861328	
WoodAcres	1.1121	0.3312	3.358	0.000786	$\alpha < 0.001$
ForestCover	0.1142	0.2738	0.417	0.676677	

Percent correctly predicted: 77.7

Table DA.171 Results for Illinois for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 145)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-3.6264	0.7885	-4.599	4.24e-06	$\alpha < 0.001$
Beauty	-0.8918	0.4485	-1.988	0.0468	$\alpha < 0.05$
Privacy	0.4758	0.4074	1.168	0.2428	
Timber	1.8458	0.4410	4.185	2.85e-05	$\alpha < 0.001$
PastHarvest	0.7748	0.3937	1.968	0.0491	$\alpha < 0.05$
Couple	0.7488	0.4690	1.597	0.1104	
Coop	0.6917	0.5623	1.230	0.2186	
Retired	0.1672	0.3565	0.469	0.6390	
Education	1.0605	0.4172	2.542	0.0110	$\alpha < 0.05$
Income	0.5879	0.4274	1.376	0.1689	
UnknownIncome	-0.3563	0.5280	-0.675	0.4998	
WoodAcres	-0.4781	0.8839	-0.541	0.5886	
ForestCover	0.9829	0.4430	2.219	0.0265	$\alpha < 0.05$

Percent correctly predicted: 85.4

Table DA.172 Results for Indiana for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 203)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-0.82139	0.38453	-2.136	0.032675	$\alpha < 0.05$
Beauty	-0.53408	0.30314	-1.762	0.078098	$\alpha < 0.1$
Privacy	-0.01137	0.26261	-0.043	0.965471	
Timber	0.53380	0.24212	2.205	0.027472	$\alpha < 0.05$
PastHarvest	0.86780	0.24360	3.562	0.000368	$\alpha < 0.001$
Couple	-0.05433	0.27168	-0.200	0.841488	
Coop	-0.07136	0.36566	-0.195	0.845263	
Retired	-0.11026	0.23559	-0.468	0.639784	
Education	-0.21892	0.23738	-0.922	0.356396	
Income	0.08348	0.31358	0.266	0.790080	
UnknownIncome	-0.05844	0.30966	-0.189	0.850321	
WoodAcres	0.37553	0.60064	0.625	0.531827	
ForestCover	-0.17004	0.29087	-0.585	0.558835	

Percent correctly predicted: 74.2

Table DA.173 Results for Iowa for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 114)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.078096	0.516561	-2.087	0.0369	$\alpha < 0.05$
Beauty	0.653093	0.379471	1.721	0.0852	$\alpha < 0.1$
Privacy	-0.564118	0.303678	-1.858	0.0632	$\alpha < 0.1$
Timber	0.535352	0.340018	1.574	0.1154	
PastHarvest	0.479028	0.296102	1.618	0.1057	
Couple	-0.349836	0.324624	-1.078	0.2812	
Coop	-0.217876	0.456861	-0.477	0.6334	
Retired	-0.135608	0.308235	-0.440	0.6600	
Education	-0.052591	0.291192	-0.181	0.8567	
Income	0.205082	0.356066	0.576	0.5646	
UnknownIncome	0.002281	0.419054	0.005	0.9957	
WoodAcres	-0.100847	0.990215	-0.102	0.9189	
ForestCover	0.232055	0.393916	0.589	0.5558	

Percent correctly predicted: 68.2

Table DA.174 Results for Kansas for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 101)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-3.0193	0.9665	-3.124	0.00178	$\alpha < 0.01$
Beauty	1.3108	0.8914	1.470	0.14143	
Privacy	-0.1994	0.6616	-0.301	0.76310	
Timber	2.2651	0.9921	2.283	0.02242	$\alpha < 0.05$
PastHarvest	1.2020	0.6472	1.857	0.06329	$\alpha < 0.1$
Couple	0.1860	0.7602	0.245	0.80670	
Coop	1.2297	0.9387	1.310	0.19020	
Retired	0.7193	0.6692	1.075	0.28238	
Education	-1.5107	0.9112	-1.658	0.09736	$\alpha < 0.1$
Income	-6.3107	546.1157	-0.012	0.99078	
UnknownIncome	-0.7106	0.7708	-0.922	0.35663	
WoodAcres	-5.6704	1215.9849	-0.005	0.99628	
ForestCover	-5.5779	797.4715	-0.007	0.99442	

Percent correctly predicted: 91.8

Table DA.175 Results for Kentucky for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 167)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.32424	0.42911	-3.086	0.00203	$\alpha < 0.01$
Beauty	-0.26869	0.30200	-0.890	0.37363	
Privacy	0.04105	0.28895	0.142	0.88702	
Timber	0.65533	0.27659	2.369	0.01782	$\alpha < 0.05$
PastHarvest	0.83353	0.26341	3.164	0.00155	$\alpha < 0.01$
Couple	0.27110	0.31577	0.859	0.39061	
Coop	-0.55058	0.47982	-1.147	0.25119	
Retired	-0.32537	0.26748	-1.216	0.22383	
Education	0.53754	0.27799	1.934	0.05315	$\alpha < 0.1$
Income	-0.09117	0.35288	-0.258	0.79612	
UnknownIncome	-0.73422	0.40548	-1.811	0.07018	$\alpha < 0.1$
WoodAcres	0.78588	0.37899	2.074	0.03811	$\alpha < 0.05$
ForestCover	-0.41325	0.28131	-1.469	0.14182	

Percent correctly predicted: 73.2

Table DA.176 Results for Louisiana for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 107)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-2.33533	0.69522	-3.359	0.000782	$\alpha < 0.001$
Beauty	0.19974	0.36169	0.552	0.580777	
Privacy	0.04783	0.35748	0.134	0.893564	
Timber	1.02781	0.35865	2.866	0.004159	$\alpha < 0.01$
PastHarvest	0.64950	0.36578	1.776	0.075786	$\alpha < 0.1$
Couple	0.48384	0.40251	1.202	0.229346	
Coop	-0.01824	0.41965	-0.043	0.965335	
Retired	0.18370	0.34804	0.528	0.597630	
Education	0.69684	0.37414	1.863	0.062532	$\alpha < 0.1$
Income	0.03181	0.38643	0.082	0.934401	
UnknownIncome	-0.25444	0.56489	-0.450	0.652407	
WoodAcres	1.30413	0.43951	2.967	0.003005	$\alpha < 0.01$
ForestCover	0.12086	0.33599	0.360	0.719060	

Percent correctly predicted: 73.8

Table DA.177 Results for Maine for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 205)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.34583	0.38903	-3.459	0.000541	$\alpha < 0.001$
Beauty	-0.33977	0.28651	-1.186	0.235669	
Privacy	0.17220	0.23773	0.724	0.468844	
Timber	1.03295	0.22471	4.597	4.29e-06	$\alpha < 0.001$
PastHarvest	0.96373	0.21993	4.382	1.18e-05	$\alpha < 0.001$
Couple	-0.12178	0.21938	-0.555	0.578837	
Coop	0.36364	0.43075	0.844	0.398561	
Retired	-0.12398	0.21717	-0.571	0.568089	
Education	0.46010	0.22688	2.028	0.042566	$\alpha < 0.05$
Income	-0.02379	0.31580	-0.075	0.939954	
UnknownIncome	-0.24361	0.31090	-0.784	0.433293	
WoodAcres	0.75442	0.33279	2.267	0.023393	$\alpha < 0.05$
ForestCover	0.10214	0.24381	0.419	0.675276	

Percent correctly predicted: 69.4

Table DA.178 Results for Maryland for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 293)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.62641	0.42809	-3.799	0.000145	$\alpha < 0.001$
Beauty	-0.10017	0.27290	-0.367	0.713574	
Privacy	0.04401	0.26725	0.165	0.869193	
Timber	0.97433	0.22324	4.365	1.27e-05	$\alpha < 0.001$
PastHarvest	0.57604	0.21878	2.633	0.008463	$\alpha < 0.01$
Couple	-0.06076	0.23799	-0.255	0.798492	
Coop	-0.24144	0.35764	-0.675	0.499616	
Retired	-0.16189	0.22627	-0.715	0.474337	
Education	0.31552	0.23498	1.343	0.179342	
Income	-0.05430	0.24760	-0.219	0.826429	
UnknownIncome	-0.40461	0.34466	-1.174	0.240415	
WoodAcres	1.49675	0.46604	3.212	0.001320	$\alpha < 0.01$
ForestCover	-0.04833	0.21523	-0.225	0.822321	

Percent correctly predicted: 80

Table DA.179 Results for Massachusetts for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 179)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-2.16279	0.52263	-4.138	3.50e-05	$\alpha < 0.001$
Beauty	0.12134	0.39820	0.305	0.760581	
Privacy	0.36928	0.30060	1.228	0.219262	
Timber	1.35780	0.29939	4.535	5.75e-06	$\alpha < 0.001$
PastHarvest	1.01386	0.27497	3.687	0.000227	$\alpha < 0.001$
Couple	-0.12226	0.29639	-0.412	0.679979	
Coop	0.32006	0.39725	0.806	0.420424	
Retired	0.07650	0.26697	0.287	0.774456	
Education	-0.05012	0.30036	-0.167	0.867486	
Income	0.33101	0.30526	1.084	0.278212	
UnknownIncome	0.42223	0.36459	1.158	0.246833	
WoodAcres	-0.23574	0.62329	-0.378	0.705267	
ForestCover	0.23860	0.26891	0.887	0.374935	

Percent correctly predicted: 78

Table DA.180 Results for Michigan for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 240)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.25361	0.39346	-3.186	0.00144	$\alpha < 0.01$
Beauty	-0.18639	0.27466	-0.679	0.49736	
Privacy	-0.09304	0.23813	-0.391	0.69601	
Timber	1.32793	0.22558	5.887	3.94e-09	$\alpha < 0.001$
PastHarvest	0.56531	0.21148	2.673	0.00752	$\alpha < 0.01$
Couple	0.20156	0.23332	0.864	0.38765	
Coop	-0.44449	0.35748	-1.243	0.21371	
Retired	-0.32669	0.21630	-1.510	0.13095	
Education	0.19183	0.23261	0.825	0.40954	
Income	0.24159	0.26210	0.922	0.35666	
UnknownIncome	-0.08257	0.31232	-0.264	0.79149	
WoodAcres	1.07398	0.46327	2.318	0.02044	$\alpha < 0.05$
ForestCover	-0.04084	0.21376	-0.191	0.84848	

Percent correctly predicted: 73.1

Table DA.181 Results for Minnesota for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 295)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.29006	0.31115	-4.146	3.38e-05	$\alpha < 0.001$
Beauty	0.18279	0.25820	0.708	0.4790	
Privacy	-0.10556	0.21235	-0.497	0.6191	
Timber	1.06607	0.21689	4.915	8.87e-07	$\alpha < 0.001$
PastHarvest	0.47946	0.20264	2.366	0.0180	$\alpha < 0.05$
Couple	-0.10271	0.22499	-0.456	0.6480	
Coop	0.34770	0.31350	1.109	0.2674	
Retired	-0.35305	0.19706	-1.792	0.0732	$\alpha < 0.1$
Education	0.19788	0.19905	0.994	0.3202	
Income	-0.09082	0.24905	-0.365	0.7154	
UnknownIncome	0.25263	0.27040	0.934	0.3502	
WoodAcres	0.95999	0.41089	2.336	0.0195	$\alpha < 0.05$
ForestCover	-0.18142	0.19484	-0.931	0.3518	

Percent correctly predicted: 73.6

Table DA.182 Results for Mississippi for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 148)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.5479	0.4763	-3.250	0.00115	$\alpha < 0.01$
Beauty	-0.3802	0.3256	-1.168	0.24292	
Privacy	0.3096	0.2722	1.137	0.25540	
Timber	1.3303	0.2968	4.481	7.41e-06	$\alpha < 0.001$
PastHarvest	0.2745	0.2714	1.011	0.31184	
Couple	0.5592	0.2830	1.976	0.04813	$\alpha < 0.05$
Coop	0.3867	0.3720	1.040	0.29854	
Retired	-0.2841	0.2585	-1.099	0.27167	
Education	0.4040	0.2723	1.484	0.13786	
Income	0.1309	0.3045	0.430	0.66721	
UnknownIncome	0.9090	0.4500	2.020	0.04336	$\alpha < 0.05$
WoodAcres	0.8267	0.3192	2.590	0.00960	$\alpha < 0.01$
ForestCover	0.1511	0.2656	0.569	0.56956	

Percent correctly predicted: 68

Table DA.183 Results for Missouri for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 270)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.24784	0.36897	-3.382	0.000720	$\alpha < 0.001$
Beauty	-0.71042	0.27314	-2.601	0.009297	$\alpha < 0.01$
Privacy	-0.37846	0.27118	-1.396	0.162829	
Timber	1.25348	0.24752	5.064	4.10e-07	$\alpha < 0.001$
PastHarvest	0.80335	0.23059	3.484	0.000494	$\alpha < 0.001$
Couple	0.34772	0.24981	1.392	0.163934	
Coop	0.46450	0.39597	1.173	0.240762	
Retired	0.08249	0.23287	0.354	0.723162	
Education	0.14710	0.22562	0.652	0.514422	
Income	-0.16644	0.31727	-0.525	0.599854	
UnknownIncome	-0.62707	0.35268	-1.778	0.075402	$\alpha < 0.1$
WoodAcres	1.64748	0.33719	4.886	1.03e-06	$\alpha < 0.001$
ForestCover	-0.37348	0.25768	-1.449	0.147224	

Percent correctly predicted: 80.3

Table DA.185 Results for New Hampshire for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 135)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-0.79511	0.51490	-1.544	0.1225	
Beauty	-0.01885	0.42467	-0.044	0.9646	
Privacy	-0.41782	0.31891	-1.310	0.1901	
Timber	1.43896	0.31552	4.561	5.1e-06	$\alpha < 0.001$
PastHarvest	0.31616	0.29139	1.085	0.2779	
Couple	-0.40145	0.29810	-1.347	0.1781	
Coop	-0.37517	0.43775	-0.857	0.3914	
Retired	-0.16655	0.27442	-0.607	0.5439	
Education	0.72853	0.33044	2.205	0.0275	$\alpha < 0.05$
Income	0.24017	0.30622	0.784	0.4329	
UnknownIncome	0.69428	0.41956	1.655	0.0980	$\alpha < 0.1$
WoodAcres	0.89258	0.41274	2.163	0.0306	$\alpha < 0.05$
ForestCover	-0.39389	0.32600	-1.208	0.2269	

Percent correctly predicted: 70.6

Table DA.186 Results for New Jersey for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 132)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.73619	0.57626	-3.013	0.00259	$\alpha < 0.01$
Beauty	0.52853	0.51192	1.032	0.30186	
Privacy	-0.28842	0.39442	-0.731	0.46463	
Timber	1.38285	0.54164	2.553	0.01068	$\alpha < 0.05$
PastHarvest	1.57512	0.50627	3.111	0.00186	$\alpha < 0.01$
Couple	-0.37404	0.41618	-0.899	0.36878	
Coop	1.22904	0.67081	1.832	0.06693	$\alpha < 0.1$
Retired	-0.61785	0.38635	-1.599	0.10977	
Education	1.06104	0.46017	2.306	0.02112	$\alpha < 0.05$
Income	-0.02411	0.38242	-0.063	0.94973	
UnknownIncome	-0.13438	0.50446	-0.266	0.78994	
WoodAcres	4.97213	314.21661	0.016	0.98737	
ForestCover	0.12574	0.31249	0.402	0.68741	

Percent correctly predicted: 79.3

Table DA.187 Results for New York for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 242)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.63209	0.38554	-4.233	2.30e-05	$\alpha < 0.001$
Beauty	0.32478	0.31012	1.047	0.294977	
Privacy	-0.09425	0.24658	-0.382	0.702291	
Timber	0.99825	0.20371	4.900	9.56e-07	$\alpha < 0.001$
PastHarvest	0.72334	0.20312	3.561	0.000369	$\alpha < 0.001$
Couple	-0.06051	0.22151	-0.273	0.784719	
Coop	-0.03333	0.40387	-0.083	0.934236	
Retired	-0.08676	0.21742	-0.399	0.689882	
Education	0.48928	0.21685	2.256	0.024050	$\alpha < 0.05$
Income	-0.39751	0.25194	-1.578	0.114608	
UnknownIncome	-0.16475	0.29204	-0.564	0.572665	
WoodAcres	1.78792	0.83157	2.150	0.031550	$\alpha < 0.05$
ForestCover	-0.19458	0.20206	-0.963	0.335566	

Percent correctly predicted: 70.2

Table DA.188 Results for North Carolina for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 134)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.7187	0.5741	-2.994	0.002753	$\alpha < 0.01$
Beauty	-0.7760	0.3610	-2.149	0.031595	$\alpha < 0.05$
Privacy	0.1822	0.3330	0.547	0.584373	
Timber	1.2244	0.3448	3.551	0.000384	$\alpha < 0.001$
PastHarvest	0.2965	0.3317	0.894	0.371340	
Couple	0.3376	0.3231	1.045	0.295954	
Coop	0.7449	0.4286	1.738	0.082242	$\alpha < 0.1$
Retired	0.2138	0.3346	0.639	0.522801	
Education	-0.2238	0.3151	-0.710	0.477588	
Income	0.6461	0.3794	1.703	0.088615	$\alpha < 0.1$
UnknownIncome	0.3621	0.4697	0.771	0.440843	
WoodAcres	1.2077	0.4212	2.867	0.004140	$\alpha < 0.01$
ForestCover	0.5518	0.2916	1.892	0.058429	$\alpha < 0.1$

Percent correctly predicted: 72.9

Table DA.189 Results for Ohio for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 185)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.208508	0.377668	-3.200	0.00137	$\alpha < 0.01$
Beauty	-0.035724	0.324231	-0.110	0.91227	
Privacy	-0.086521	0.266648	-0.324	0.74558	
Timber	0.989260	0.247862	3.991	6.57e-05	$\alpha < 0.001$
PastHarvest	0.367666	0.242897	1.514	0.13011	
Couple	0.057138	0.266733	0.214	0.83038	
Coop	-0.019522	0.435530	-0.045	0.96425	
Retired	-0.371732	0.250542	-1.484	0.13789	
Education	0.039131	0.244482	0.160	0.87284	
Income	0.259032	0.325922	0.795	0.42675	
UnknownIncome	-0.003726	0.334362	-0.011	0.99111	
WoodAcres	1.002220	0.559333	1.792	0.07316	$\alpha < 0.1$
ForestCover	-0.120102	0.259122	-0.463	0.64301	

Percent correctly predicted: 72.5

Table DA.190 Results for W. Oklahoma for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 127)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.5554	0.6110	-2.546	0.0109	$\alpha < 0.05$
Beauty	-0.5573	0.4901	-1.137	0.2555	
Privacy	0.5094	0.4593	1.109	0.2674	
Timber	1.9482	0.4522	4.308	1.65e-05	$\alpha < 0.001$
PastHarvest	0.6169	0.4183	1.475	0.1403	
Couple	-0.3514	0.4344	-0.809	0.4186	
Coop	0.2241	0.5183	0.432	0.6655	
Retired	-0.2260	0.4189	-0.540	0.5895	
Education	0.1541	0.3982	0.387	0.6989	
Income	0.1472	0.4237	0.347	0.7284	
UnknownIncome	-1.2010	0.9211	-1.304	0.1923	
WoodAcres	0.9581	0.3892	2.462	0.0138	$\alpha < 0.05$
ForestCover	-0.2547	0.3972	-0.641	0.5213	

Percent correctly predicted: 83.4

Table DA.191 Results for Oregon for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 98)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-2.35242	0.77629	-3.030	0.00244	$\alpha < 0.01$
Beauty	-0.03815	0.45654	-0.084	0.93340	
Privacy	0.06573	0.49760	0.132	0.89490	
Timber	1.30019	0.43610	2.981	0.00287	$\alpha < 0.01$
PastHarvest	1.00124	0.44089	2.271	0.02315	$\alpha < 0.05$
Couple	0.45810	0.42533	1.077	0.28147	
Coop	0.20784	0.49735	0.418	0.67602	
Retired	-1.30202	0.42020	-3.099	0.00194	$\alpha < 0.01$
Education	0.25512	0.37108	0.687	0.49177	
Income	0.41832	0.45447	0.920	0.35734	
UnknownIncome	0.45377	0.51022	0.889	0.37382	
WoodAcres	0.73575	0.37875	1.943	0.05207	$\alpha < 0.1$
ForestCover	0.72147	0.40131	1.798	0.07221	$\alpha < 0.1$

Percent correctly predicted: 75.6

Table DA.192 Results for Pennsylvania for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 203)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.249936	0.432376	-2.891	0.00384	$\alpha < 0.01$
Beauty	0.372995	0.338046	1.103	0.26986	
Privacy	-0.392008	0.254352	-1.541	0.12327	
Timber	0.652320	0.222539	2.931	0.00338	$\alpha < 0.01$
PastHarvest	0.744907	0.218978	3.402	0.00067	$\alpha < 0.001$
Couple	-0.420563	0.235997	-1.782	0.07474	$\alpha < 0.1$
Coop	0.039813	0.316298	0.126	0.89983	
Retired	0.216998	0.217513	0.998	0.31846	
Education	0.131071	0.228821	0.573	0.56677	
Income	0.012844	0.282147	0.046	0.96369	
UnknownIncome	0.092459	0.308059	0.300	0.76407	
WoodAcres	0.961866	0.406223	2.368	0.01789	$\alpha < 0.05$
ForestCover	0.003157	0.219469	0.014	0.98852	

Percent correctly predicted: 69.6

Table DA.193 Results for South Carolina for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 162)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.66073	0.46747	-3.553	0.000381	$\alpha < 0.001$
Beauty	0.03875	0.34731	0.112	0.911175	
Privacy	0.01482	0.28168	0.053	0.958050	
Timber	1.57706	0.32303	4.882	1.05e-06	$\alpha < 0.001$
PastHarvest	0.17434	0.27945	0.624	0.532711	
Couple	-0.59634	0.28992	-2.057	0.039692	$\alpha < 0.05$
Coop	0.13214	0.36771	0.359	0.719325	
Retired	-0.18552	0.26682	-0.695	0.486865	
Education	-0.07844	0.28170	-0.278	0.780658	
Income	0.72200	0.31928	2.261	0.023739	$\alpha < 0.05$
UnknownIncome	0.59316	0.33006	1.797	0.072316	$\alpha < 0.1$
WoodAcres	0.95148	0.30392	3.131	0.001744	$\alpha < 0.01$
ForestCover	0.33901	0.26642	1.272	0.203207	

Percent correctly predicted: 72.1

Table DA.194 Results for Tennessee for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 202)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-2.56801	0.48428	-5.303	1.14e-07	$\alpha < 0.001$
Beauty	0.80025	0.36159	2.213	0.0269	$\alpha < 0.05$
Privacy	0.15743	0.26961	0.584	0.5593	
Timber	1.62734	0.27138	5.996	2.02e-09	$\alpha < 0.001$
PastHarvest	0.08082	0.25436	0.318	0.7507	
Couple	-0.46346	0.25941	-1.787	0.0740	$\alpha < 0.1$
Coop	0.02894	0.38655	0.075	0.9403	
Retired	0.04216	0.23252	0.181	0.8561	
Education	0.52422	0.26903	1.949	0.0513	$\alpha < 0.1$
Income	0.35811	0.27757	1.290	0.1970	
UnknownIncome	0.17050	0.34765	0.490	0.6238	
WoodAcres	0.17839	0.34952	0.510	0.6098	
ForestCover	-0.08076	0.24133	-0.335	0.7379	

Percent correctly predicted: 75.7

Table DA.195 Results for W. Texas for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 140)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.6215	0.5461	-2.969	0.00298	$\alpha < 0.01$
Beauty	-0.1505	0.3286	-0.458	0.64697	
Privacy	-0.4431	0.2946	-1.504	0.13251	
Timber	1.5790	0.3299	4.787	1.7e-06	$\alpha < 0.001$
PastHarvest	0.8078	0.2950	2.738	0.00618	$\alpha < 0.01$
Couple	0.1183	0.3243	0.365	0.71534	
Coop	0.3352	0.3886	0.862	0.38844	
Retired	-0.3578	0.2821	-1.268	0.20475	
Education	0.5604	0.3121	1.795	0.07261	$\alpha < 0.1$
Income	0.4511	0.3212	1.404	0.16021	
UnknownIncome	0.1386	0.4051	0.342	0.73222	
WoodAcres	0.2915	0.3120	0.934	0.35023	
ForestCover	-0.3476	0.3131	-1.110	0.26695	

Percent correctly predicted: 71.8

Table DA.196 Results for Vermont for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 419)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.29042	0.33288	-3.876	0.000106	$\alpha < 0.001$
Beauty	-0.04944	0.18941	-0.261	0.794088	
Privacy	-0.30364	0.14974	-2.028	0.042578	$\alpha < 0.05$
Timber	0.78383	0.15095	5.193	2.07e-07	$\alpha < 0.001$
PastHarvest	0.85348	0.14538	5.871	4.34e-09	$\alpha < 0.001$
Couple	-0.08515	0.15953	-0.534	0.593514	
Coop	-0.03912	0.22620	-0.173	0.862691	
Retired	0.06648	0.23440	0.284	0.776703	
Education	0.43390	0.25441	1.706	0.088099	$\alpha < 0.1$
Income	0.20326	0.24215	0.839	0.401246	
UnknownIncome	0.59243	0.25120	2.358	0.018356	$\alpha < 0.05$
WoodAcres	0.77909	0.27243	2.860	0.004239	$\alpha < 0.01$
ForestCover	0.11752	0.14574	0.806	0.420026	

Percent correctly predicted: 64.7

Table DA.197 Results for Virginia for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 192)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-2.18483	0.50693	-4.310	1.63e-05	$\alpha < 0.001$
Beauty	-0.07027	0.34774	-0.202	0.83986	
Privacy	0.04392	0.30065	0.146	0.88386	
Timber	1.16695	0.26033	4.483	7.37e-06	$\alpha < 0.001$
PastHarvest	0.68450	0.25884	2.645	0.00818	$\alpha < 0.01$
Couple	0.43735	0.28609	1.529	0.12633	
Coop	0.57445	0.38909	1.476	0.13983	
Retired	0.01651	0.26775	0.062	0.95083	
Education	0.33412	0.26148	1.278	0.20132	
Income	0.01449	0.31294	0.046	0.96308	
UnknownIncome	-0.26423	0.34853	-0.758	0.44838	
WoodAcres	1.43674	0.39231	3.662	0.00025	$\alpha < 0.001$
ForestCover	0.04796	0.25354	0.189	0.84996	

Percent correctly predicted: 77.5

Table DA.198 Results for Washington for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 84)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.377115	0.789712	-1.744	0.0812	$\alpha < 0.1$
Beauty	-0.893397	0.523033	-1.708	0.0876	$\alpha < 0.1$
Privacy	0.002104	0.439714	0.005	0.9962	
Timber	0.734554	0.462124	1.590	0.1119	
PastHarvest	1.418033	0.660334	2.147	0.0318	$\alpha < 0.05$
Couple	-0.403158	0.513255	-0.785	0.4322	
Coop	0.419305	0.695944	0.602	0.5468	
Retired	-0.908249	0.459921	-1.975	0.0483	$\alpha < 0.05$
Education	0.121137	0.454803	0.266	0.7900	
Income	0.540431	0.541486	0.998	0.3183	
UnknownIncome	-0.657535	0.897967	-0.732	0.4640	
WoodAcres	0.671560	0.518562	1.295	0.1953	
ForestCover	0.536988	0.436834	1.229	0.2190	

Percent correctly predicted: 78.9

Table DA.199 Results for West Virginia for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 198)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-0.86465	0.40033	-2.160	0.030786	$\alpha < 0.05$
Beauty	-0.34034	0.29483	-1.154	0.248358	
Privacy	-0.46356	0.26908	-1.723	0.084938	$\alpha < 0.1$
Timber	0.88125	0.24738	3.562	0.000368	$\alpha < 0.001$
PastHarvest	0.30823	0.23386	1.318	0.187492	
Couple	-0.13037	0.26822	-0.486	0.626920	
Coop	0.42321	0.32270	1.311	0.189699	
Retired	-0.26210	0.24136	-1.086	0.277515	
Education	0.01994	0.24363	0.082	0.934784	
Income	0.13761	0.30579	0.450	0.652709	
UnknownIncome	-0.33376	0.35559	-0.939	0.347924	
WoodAcres	0.53412	0.34844	1.533	0.125302	
ForestCover	0.28058	0.24919	1.126	0.260179	

Percent correctly predicted: 75.1

Table DA.200 Results for Wisconsin for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 323)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.284007	0.302909	-4.239	2.25e-05	$\alpha < 0.001$
Beauty	0.184055	0.232323	0.792	0.4282	
Privacy	-0.135075	0.188177	-0.718	0.4729	
Timber	1.035890	0.175281	5.910	3.42e-09	$\alpha < 0.001$
PastHarvest	1.057943	0.172664	6.127	8.95e-10	$\alpha < 0.001$
Couple	0.027570	0.194785	0.142	0.8874	
Coop	0.450836	0.259249	1.739	0.0820	$\alpha < 0.1$
Retired	-0.366767	0.178157	-2.059	0.0395	$\alpha < 0.05$
Education	-0.075729	0.177668	-0.426	0.6699	
Income	-0.168498	0.218757	-0.770	0.4411	
UnknownIncome	-0.482084	0.310117	-1.555	0.1201	
WoodAcres	0.742938	0.430697	1.725	0.0845	$\alpha < 0.1$
ForestCover	0.002543	0.169964	0.015	0.9881	

Percent correctly predicted: 69

Table DA.201 Results for the national scale for the multivariate probit analysis on future likelihood of timber harvest ("Willing"). (n = 7197)

	Estimate	Std. Error	z-value	Pr > |z|	Significance
(Intercept)	-1.528902	0.065868	-23.212	< 2e-16	$\alpha < 0.001$
Beauty	-0.038662	0.048112	-0.804	0.421635	
Privacy	-0.071499	0.040934	-1.747	0.080693	$\alpha < 0.1$
Timber	1.069769	0.038267	27.955	< 2e-16	$\alpha < 0.001$
PastHarvest	0.788514	0.037927	20.790	< 2e-16	$\alpha < 0.001$
Couple	-0.009979	0.041495	-0.240	0.809948	
Coop	0.139947	0.054831	2.552	0.010701	$\alpha < 0.05$
Retired	-0.195238	0.037842	-5.159	2.48e-07	$\alpha < 0.001$
Education	0.143086	0.039107	3.659	0.000253	$\alpha < 0.001$
Income	0.138222	0.045346	3.048	0.002302	$\alpha < 0.01$
UnknownIncome	0.073002	0.050216	1.454	0.146010	
WoodAcres	0.567549	0.049582	11.447	< 2e-16	$\alpha < 0.001$
ForestCover	0.139658	0.036621	3.814	0.000137	$\alpha < 0.001$

P̈ercent correctly predicted: 72.4