SILVA FENNICA

Silva Fennica 43(1) research articles

www.metla.fi/silvafennica · ISSN 0037-5330
The Finnish Society of Forest Science · The Finnish Forest Research Institute

Population, Economic Welfare and Holding Size Distribution of Private Forestland in Alabama, USA

Yi Pan, Yaoqi Zhang and Indrajit Majumdar

Pan, Y., Zhang, Y. & Majumdar, I. 2009. Population, economic welfare and holding size distribution of private forestland in Alabama, USA. Silva Fennica 43(1): 161–171.

This paper analyzes structural differences in holding size distribution of private forestland at the county level in Alabama, USA. The following categories are used to describe the timberland holding distribution: mean holding size, Gini coefficient of timberland holdings, and share of county timberland in holding sizes of fewer than 80 hectares and more than 800 hectares. Regressions are conducted to explore the socio-economic correlates of forestland holding size distribution. Results indicate that population density, age structure, urban-rural population structure, income structure and land tenure type are strongly associated with the forest holding size distribution.

Keywords private forestland owners, parcellation, consolidation, land tenure
Addresses Auburn University, School of Forestry and Wildlife Sciences, Auburn, AL 36849, USA
E-mail yaoqi.zhang@auburn.edu
Received 28 May 2008 **Revised** 20 November 2008 **Accepted** 19 December 2008
Available at http://www.metla.fi/silvafennica/full/sf43/sf431161pdf

1 Introduction

There are an estimated 250 million hectares of forestland in the conterminous United States (Smith et al. 2004). Nearly two-thirds, or 160 million hectares, are in private ownership. Studies and surveys conclude that forest ownership parcellation, characterized by the subdivision of land owned by a single large owner into multiple small owners, is occurring as indicated by dramatic increase in the number of ownerships and decrease in the average holding size (Butler and Leatherberry 2004).

Parcellation is an important socio-economic issue. Throughout history, class has been primarily divided by status of land holding. To some degree, this issue is like income distribution: We care not only about the average income but also about the distribution. Land holding size is also an important indicator of welfare and of socio-economic development (Tomaskovic-Devey and Roscigno 1997).

Parcellation also has ecological and environmental consequences. It is often viewed as a precursor of or is strongly related to fragmentation, which is the process of breaking up larger

contiguous parcels of homogeneous land cover into smaller parcels of heterogeneous land cover (Stanfield et al. 2002). Forests in smaller ownerships often tend to be more fragmented due to the presence of roads that allow for the owners to access their lands and the adoption of different management practices in terms of species, rotation, silviculture and using harvesting techniques. The small scale land holding is often not economically efficient for timber production purpose. Forest fragmentation is receiving significant attention as a result of concerns that it adversely affects wildlife habitat, watersheds, and timber production (e.g., Barlow et al. 1998, Wear et al. 1999, Munn et al. 2002, Kline et al. 2004a).

Forestland parcellation trends (especially in the smaller ownership category) and the ecological and environmental consequence have been observed over the past few decades (Healy and Short 1981, Healy 1984). It was observed that recreationalists, rural nonfarm residents, and land investors owned parcels in the 2–15 hectares range. In the parcellation process, local landowners and real estate agents have made a profitable business of splitting parcels to meet the new demand (Healy 1984). However, empirical analyses of this phenomenon are surprisingly scarce in the literature.

Comparatively, there is more literature in agriculture. Both agriculture and forestry are very much dependent on land. Schmitt (1991) and Allen and Lueck (1998) used transaction cost theory to explain why agriculture has largely resisted transition to large corporate ownership in Europe and North America. Much research considering the relationship between farm size and community well-being in the United States has found that a region with more wealthy population has more number of smaller farm land owners (Goldschmidt 1978, Dalecki and Gilles 1988, Swanson 1988, Labao and Schulman 1991, Rosset 1999). We are curious whether such a relationship exists between well-being of the population and timberland holding sizes.

The study by Ripatti (1996) is one of the first and perhaps still the most comprehensive study on the causes of forest parcellation (partitioning) in Finland. Findings from this study show that the odds of partitioning are about three times greater for jointly owned holdings than for family owned ones, and being a farmer, permanent residence had effects on partitioning.

Mehmood and Zhang (2001) found that death, urbanization, income, regulatory uncertainty, and financial assistance for landowners have significant impacts on the change in average holding size in the United States. Gobster and Rickenbach (2004) suggested that economies, demographics, values and motivations, globalization and technology, natural capital and policies are six main drivers of forestland parcellation. An aging population was especially cited as a driver of forestland parcellation.

In Alabama, Ratley (1972) is among the first to analyze the holding size at the county level. He found it was an important factor that influences how landowner markets his forest products. Instead of examining parcellation, Sisock (1998) focused on the consolidation issue (large owners) and well-being measured by poverty, net migration, unemployment and education. On a similar line, Bliss et al. (1998) suggested that socio-economic and environmental consequences may plausibly accompany a trend towards greater forestland consolidation in Alabama. Their findings concluded that forestland consolidation might be viewed as indicative of renewed economic vitality and growth, as regions in which most forestland is concentrated in large, privately owned tracts are extremely attractive to the forest industry.

Holding size is also affected by landscape and natural status. Sisock (1998) found that historical patterns of land ownership in Alabama were primarily attributable to local physiography and soil type. The state is often divided into three main physiographic regions: the Coastal Plain, Piedmont, and Upland (Healy 1985). Prior to the Civil War, the plantation system on the Coastal Plain was characterized by land concentration, production for commercial markets, a high degree of social stratification, and dependence upon slave labor (Skees and Swanson 1988, Sisock 1998). In contrast, the historical ownership pattern in the northern hill counties of the Upland consisted of a multitude of small ownerships. Steep slope terrains and low soil fertility were the limiting factors for timber management that resulted in an increase in small ownerships, wherein managing for timber production was not a major objective

for owning forestland by the landowner. The Piedmont region, with its landscape fluctuating from rolling to hilly, accommodated both plantations and small farms.

In the absence of consistent holding size distribution data over time, researchers have typically conducted mean level analysis of holding size distribution (e.g., Mehmood and Zhang 2001). An alternative that may overcome this problem is to examine the structural variation across regions to help shed some light on the changes across forestland holding size categories. The factors influencing the structural change in forestland holding in general still remain largely unexplored.

The motivation and purpose of this study is to investigate structural differences of forestland holding size and the potential factors associated with its distribution by using Alabama county data. Currently, there are 9.3 million hectares of forestland in Alabama that account for 71% of its total land area (Hartsell and Brown 2002). About 94% of Alabama's forestland (or about 8.74 million hectares) is privately owned (Smith et al. 2004). This study uses data on private forestland ownership at the county level to analyze structural differences across counties.

Our objective is to identify factors that might influence or be associated with the timberland holding distribution. Our hypothesis is that the socio-economic characteristics and natural conditions influence the forestland holding structure across counties. We believe that change in the socio-economic circumstances will lead to change in holding structure just like in other sectors of ownership. We begin with a discussion on empirical econometric models used in the study, followed by data description and the estimated results. Finally, we present our conclusions.

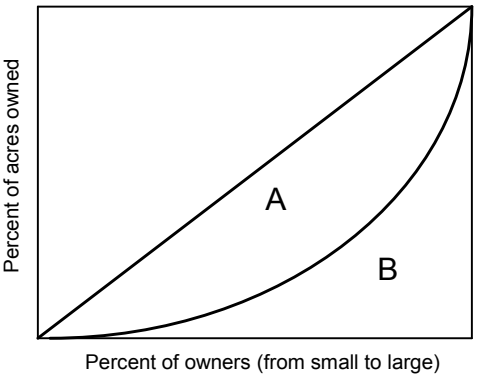

Fig. 1. Lorenz Curve for forestland distribution.

2 Empirical Econometric Models

2.1 Dependent Variables: Timberland Holding Distribution

Average holding size can be used to measure the general trend of the holding size, but it does a poor job in measuring the structure. In this study, we introduce two other measures of forestland distribution apart from the average holding size.

Based on the methodology to construct Gini-coefficient, which was developed by an Italian Statistician Corrado Gini (Gini 1921) and is used to describe the inequality of wealth or income within a population, we calculated a Gini-index of county timberland distribution. As shown in Fig. 1, the cumulative percent of forestland (Y axis) is plotted against the cumulative percent of forestland owners, providing the Lorenz curve of timberland holding size ordered from small to large. (Fig. 1), the Gini coefficient of timberland distribution is the ratio of $A/(A+B)$. This coefficient varies between 0, which reflects complete equality at $A=0$, and 1 which indicates complete inequality at $B=0$, meaning that one person owns all timberland. Perfect equality of distribution would be a straight line at 45 degrees ($A=0$).

To further explore the landownership holding distribution, we divide the whole land acreage into three holding size categories, such that each category shares approximately 1/3 of the total private forestland in the state. By employing this rule the threshold values are: fewer than 80 hectares

(small holding), 80–800 hectares (medium holding) and larger than 800 hectares (large holding). We believe that this is the most objective way of denoting timberland distribution given our data. The share of the three groups is used to measure the timberland holding structure. As forestland holding data in some counties were collected from holdings only larger than 4 hectares, the share of small holding in our study refers to the forestland holdings ranging from 4 to 80 hectares.

2.2 Independent Variables

Forest land owners adjust and optimize their holding size based on the changes in relative costs of the input factors and output prices. Some people might become new owners. Therefore, timberland holding size must be dynamic.

Owning and managing timberland reveals a mixed production and consumption behavior of the owner and varies significantly by the holding size. From a production perspective, owning timberland generates profits from producing timber and non-timber services (such as hunting leases) and land price appreciation. From a consumption perspective, owning timberland is not different from buying other products and services to maximize the utility subject to his/her income. Both production and consumption behavior would change in response to the change in prices and wealth. For example, the difference between the timber production motivated (forest industry) and the non-timber consumption motivated Non-Industrial Private Forests owners (NIPFs) in terms of their production behaviors has been documented by Newman and Wear (1993) and Liao (2007), among others. It is argued that small-scale forestry is associated with issues of significant transaction costs of environmental services (Zhang 2001, Zhang et al. 2005).

Studying the complexity of the mixed production and consumption behavior of the landowner within an economic framework requires including a bunch of relative prices in the model: home prices, food prices, transportation costs, timberland prices would be needed if we examine their consumption behavior, while timber price, capital costs, wages and timberland price might be considered more relevant for their production behavior. In this paper we examine natural and socio-economic factors that we believe would eventually determine the relative price of input factors and the relative value of timber and non-timber services from forests. In particular, amenity-value of the forestland, unlike home price, is totally unknown. This is important if we assume that the objective for the timberland owner is to maximize utility from the consumption of goods and services provided by the forest.

Due to the absence of data on economic variables such as relative prices, we assumed in our study that all individuals are faced with costs and prices that are fundamentally determined by their socio-economic environment. This implies that the structural differences in timberland holding sizes across region and time are the aggregated responses to the differences in demographic and economic factors, such as the population and per capita income across counties.

Population density is an important factor since it drives up the demand for forestland for a variety of purposes. As the population increases, more land is needed for residential use and for non-timber production, which increases the opportunity cost of timber production. Of course, population growth is also associated with increased demand for timber products, but the changes in demand for the two kinds of products (timber and non-timber) are not proportional since wood-based market products are more determined at global or at least at a larger regional level. Nagubadi and Zhang (2005) also suggested that population density was a key factor in the conversion of timberland and agricultural land to urban use. As we argued above, owning small forestland is fundamentally driven by the motivation of non-timber consumption purposes. More population will have more small owners.

In addition to population density, the population distribution in terms of age structure and rural-urban structure will also likely influence forestland holdings since their use of forestland varies. Studies have found that distribution of humans had strong ecological and environmental implications (Keilman 2003, Liu et al. 2003). Human inflicted urbanization impacts on habitat and loss in biodiversity had been widely acknowledged by researchers (McKinney 2002, Riley et al. 2003, Turner et al. 2004).

The impact of urban and rural population on holding size distribution has received little attention. Evidence from past studies has revealed that rural-urban migration had a significant impact on the change in land use and land cover (Grau et al. 2003). If the increase in population among the urban areas is caused by the migration from more rural areas, then the population density would decline in the rural areas, leading to forestland consolidation in those areas. Therefore, we hypothesize that not only the population density but also the spatial distribution of rural and urban areas may influence timberland holding structure.

Based on previous literature (Sisock 1998, Mehmood and Zhang 2001, Gobster and Rickenbach 2004), we know that socio-economic factors are associated with timberland holding size. Usually socio-economic well-being and its distribution are considered as the underlying forces for this change. The income Gini index quantifies income disparity (Volscho 2004) and may be a significant predictor of parcellation and consolidation (Sisock 1998). Therefore, income per capita and income Gini index, the two most important variables that measure average welfare and income disparity were included in the models.

Demographic factors may also be associated with the changes in the holding size (Gobster and Rickenbach 2004). For example, an aging population might be an indicator of more land transfers in the future, subsequent parcellation, and consequently an increase in the number of smaller holdings. It is also possible the elder land owners might have different objective of owning timberland. As income increases, living in or around the woods seems to be a growing lifestyle trend (DeCoster 1998). Private forestland availability may also affect the average holding size and the holding size structure.

Classic land use theory developed by David Ricardo and Johann von Thünen explain that land use change patterns are dependent on the relative rents to alternative land uses which in turn are influenced by the location and quality of land. The quality of land has a major influence on the likely use of land for either agricultural or forestry purposes (Hardie and Parks 1997, Mauldin et al. 1999, Ahn et al. 2001). It is also an important factor that determines whether forestland is used for timber production or for primarily recreational and environmental services. Our expectation is that better quality of land (lower value of the average land quality index (*AVLQ*)) will be associated with larger holding sizes where timber production is the primary objective.

Combining all these factors, the empirical models are specified as shown in Eq. 1. We expect these four regressions (the mean holding size, the *GINI* coefficient of forestland distribution, and the share of holding fewer than 80 hectares and larger than 800 hectares) to display the structural differences across Alabama counties. All these equations share the same independent variables but have different dependent variables that we use to measure the timberland holding distribution.

$$LnY_i = \alpha_0 + \alpha_1 LnPOPD + \alpha_2 LnOLDP + \alpha_3 LnRUPO + \alpha_4 LnINCP + \alpha_5 LnINGI + \alpha_6 LnFOIN + \alpha_7 LnFORC + \alpha_8 AVLQ + \varepsilon_i \quad \text{(Eq. 1)}$$

where $i = 1, 2, 3, 4$, Y_1 is the mean (mean county holding size of forestland), Y_2 is the GINI (Gini coefficient of county forestland distribution), Y_3 is LE80 (percent of county forestland in holdings fewer than 80 hectares), Y_4 is LA800 (percent of county forestland in holdings larger than 800 hectares). *POPD* stands for county population density, *OLDP* stands for the percentage of county population older than 65, *RUPO* is percent of county rural population, *INCP* is per capita county income in the year 2000, *INGI* is Gini index for family income within county, *FORC* is the county percentage of forestland out of the total land, and *FOIN* is the county percentage of individually or family-owned private timberland (excluding the forest industry-owned), and *AVLQ* represents the county average land quality index. Descriptive statistics for these variables are provided in Table 1.

We expect these four regressions jointly to display the structural difference in timberland holdings across the Alabama counties. Our intention to use several dependent variables is to see how the same independent variables affect the different aspects (since one variable is not good enough to catch the distribution issue) of the structure and holding size issue differently. For example, the socio-economic control variables in the models control the Mean and *LE*80, *LA*800.

Table 1. Summary statistics and description of dependent and independent variables.

Variable	Description	Mean	Std dev
MEAN	Mean holding size of forestland (Y1)	157	85
GINI	Gini coefficient of forestland holding size distribution (Y2)	0.71	0.08
*LE*80	Percent of forestland in holdings fewer than 80 hectares (%) (Y3)	37	17
*LA*800	Percent of forestland in holdings larger than 800 hectares (%) (Y4)	32	16
POPD	Persons per square mile	76	71
OLDP	Percent of persons 65 years old and over	14	2
RUPO	Percent of rural population	70	24
INCP	Per capital money income ($1000)	16	22.4
INGI	Gini index of family income (year 2000)	0.42	0.03
FORC	Forestland as percent of total land	65	15
FOIN	Individual family-owned forestland as percent of total forest land	68	15
AVLQ	Weighted average land capacity class of counties	4.38	0.79

We used the log transformation in both sides of Eq. 1, except for the independent variable *AVLQ*, which represents the county average land quality index. Since *AVLQ* is a categorical variable, it is inappropriate to make such a transformation. One important feature of our model is that almost all of the coefficients of this model have an interpretation as elasticity, except the one for *AVLQ*.

3 Data

The data for this study are at the county level. Forest ownership data are generated for 55 out of the 67 counties in Alabama from PFMT (Private Forest Management Team) landowner database maintained by the School of Forestry and Wildlife Sciences at Auburn University. The original data were obtained, based on the $0.10 fire tax on forest land from county tax offices in a variety of formats, with names, address, and acres of forest land for all forest landowners (public holdings were excluded). Since fire taxes are not collected on forest holdings of fewer than 4 hectares, forest land of fewer than 4 hectares is not reported in a number of counties. To remain consistent, we removed the holding size of fewer than 4 hectares. Considering the difficulties in distinguishing between the forestland owned by family or industry or Timber Investment management Organization (TIMO), we are only able to analyze holding size distribution including all private timberland across counties.

Socio-economic data were collected from the US Census Bureau, state and county quick facts in 2000 (U.S. Census Bureau, Census 2000a). Percent of forest cover was calculated from data in Forest Statistics for Alabama (Hartsell and Brown 2002).

Data on land quality were generated by the United States Census Bureau, Census of Agriculture (U.S. Census Bureau 1992). Land is classified into eight land capability classes (LCC) in decreasing order of land quality (Klingebiel and Montgomery 1961, Nagubadi and Zhang 2005). Empirical analyses show that the proportion of two higher land quality classes in the total land affects whether the land is put into agricultural or forestry use with better quality land allocated for agricultural use. The ratings for a land parcel range from 1 to 8, in which 1 stands for the most productive and 8 the least productive. The average land quality index (*AVLQ*) was calculated as a weighted average of acres in each land class in the county (Nagubadi and Zhang 2005).

The definition of population density in our study is persons per square mile. The mean value for the 55 counties is 76. Also, on an average across all the 55 counties, 70% of the population was rural. Technically, "rural" stands for any incorporated place or census designated place (CDP) outside urbanized areas with fewer than 2,500 inhabitants (U.S. Census Bureau, Census 2000b).

Per capita income is a good relative measure of the income totals available in each county (Bukenya 2002).The mean value of annual per capita income is $15 691 for our study area, compared

Table 2. Regression results on factors influencing the forestland holding and distribution.

	Mean	*GINI* Coeff. (S.E)	*LE*80	*LA*800
INTERCEPT	0.668	–6.332***	5.174***	–27.418***
	(4.726)	(1.365)	(4.466)	(9.929)
POPD	–0.629***	–0.101***	0.507	–0.502*
	(0.096)	(0.039)	(0.089)	(0.272)
OLDP	–0.594**	–0.066	0.545**	–0.395
	(0.302)	(0.084)	(0.238)	(0.47)
RUPO	–0.939***	–0.124**	0.786***	–0.314
	(0.159)	(0.054)	(0.161)	(0.38)
INCP	–0.093	0.185	0.16	0.299
	(0.492)	(0.144)	(0.486)	(0.89)
INGI	1.295***	0.051	–1.387***	–0.177
	(0.497)	(0.156)	(0.435)	(0.797)
FORC	0.56**	–0.045	–0.241	–0.71
	(0.277)	(0.091)	(0.241)	(0.809)
FOIN	–0.57***	–0.31***	0.724***	–1.676***
	(0.17)	(0.063)	(0.183)	(0.279)
AVLQ	–0.485**	0.032	0.411**	0.084
	(0.268)	(0.077)	(0.243)	(0.525)
Adjusted R^2	0.76	0.43	0.73	0.36

Note: *, ** and*** denote significances at 0.10, 0.05 and 0.01 levels

to $22 972 for the whole of the state and $28 546 for the nation in 1999. This difference is consistent with our previous explanation that we missed many wealthy counties located in metropolitan areas. For instance, two counties, Shelby and Jefferson, had above national average per capita income, but they are not included in our 55 counties. Data on Gini Index of Family Income were taken from Volscho (2004).

Percent of forest cover is also a critical variable affecting the distribution of forestland in each county. We calculated this variable from the data in Forest Statistics of Alabama (Hartsell and Brown 2002). Percent of forestland is calculated as the ratio of forestland area and total land area. As noted in Table 1, the average forest cover in our study area is 65%. The share of individual or family forest land ownership of the total forestland is also calculated and included as an explanatory variable.

The calculated mean value of average forestland holding size (*MEAN*), the Gini index of forest land holding distribution (*GINI*), the percent of forestland in holdings fewer than 80 hectares (*LE*80) and percent of forestland in holdings larger than 800 hectares (*LA*800) for the 55 counties are listed in Table 1 and were the dependent variables for our econometric models (see Eq. 1). Gini index of timberland holdings indicated that the private forestland is distributed extremely unequally in the southwestern area, while it is distributed comparably equally in the northern regions.

4 Results

The estimated results of the factors that influence the land holding structure are presented in Table 2. In general, the variables used significantly explain the variation in the 4 dependent variables measuring timberland holding structure. The *MEAN* and the *LE*80 models perform better relative to other models and have higher adjusted R square of 0.76 and 0.73 respectively. This means that our explanatory variables used to explain the average holding size (the mean) and small ownership (the percentage of land held fewer than 80 hectares) is much better than for the other two dependent variables (*GINI* and *LA*800). It also indicates that ownership structure change is quite complicated and has different trends in each category.

According to our expectations, it is likely that increasing population density (*POPD*) would drive down the mean holding size (*MEAN*) and percentage of timberland held by owners of more than 800 hectares (*LA*800). However, increasing population density causes more equal distribution of forestland, as measured by the Gini index (*GINI*) of land holding. Under a given supply of timberland, a larger population will lead to a larger demand for timberland. This is particularly driven by non-timber consumption purposes, such as for recreation and second homes that usually would not need holdings larger than 800 hectares. Also, the opportunity costs of owning large holdings for primarily non-timber benefits will be too large.

The percentage of elderly population (*OLDP*) has a negative impact on mean holding size (*MEAN*) but a positive impact on timber land held by small ownership (*LE*80). Its impact on *GINI* and share of large timber land holdings (*LA*800) is not statistically significant. This may be because a large share of elderly population holds only small tracts of timberland. In the *LE*80 model, the percent of persons 65 years old or more (*OLDP*) is closely related to parcellation. Some studies show that death rate is one of the major driving forces behind fragmentation and parcellation (DeCoster 1998, Mehmood and Zhang 2001). Since death rate is strongly related to the old population, *OLDP* serves as a proxy for death rate in our model. Thus, our estimated results of elderly population are consistent with previous studies.

Rural population has a statistically negative impact on the timberland distribution (*GINI*) and is positively correlated with small holdings (*LE*80), indicating that an increase in percent of rural population is related to less concentration of forestland among a few large holding owners. It also is indicative of a trend of forestland parcellation, with an increase in share of owners of small holdings and an associated decrease in the mean holding size. However, rural population does not show any significantly different impact for larger holdings, such as larger than 800 hectares (*LA*800).

Our results indicate that per capita income (*INCP*) has no impact on land holding distribution measured by all 4 dependent variables (see Table 2), but the income distribution measured by income Gini coefficient (*INGI*) does matter. Less equal income distribution is negatively correlated with the share of small land holdings but positively related to the mean size of timberland holdings. Theoretically, a negative impact on small holdings should have a positive impact on large holdings. Our results neither support nor reject this trend statistically. This may indicate that increasing income disparity is associated with more medium land holdings (e. g. 80–800 hectares) but not with large land holdings.

The percentage of forestland (*FORC*) has an impact on the mean size of land holdings (*MEAN*) as more timberland percentage scales up the holding size within any given distribution. This may also be due to the effects from supply side, but it does not have any impact on timber land distribution measured by the other three variables (*LE*80, *GINI* and *LA*800). The share of family-owned forestland (*FOIN*) that does not include forest industry or corporations has a big impact on all the 4 indicators of timberland distribution. More family-owned timberland will reduce the average holding size (*MEAN*) and share of large holdings (*LA*800) while increasing the share of small holdings (*LE*80) consequently decreasing the inequality of timberland distribution (*GINI*). The average land quality index (*AVLQ*) has a negative impact on the mean of the average holding size and is positively related to the share of small holdings. This is consistent with our expectations since better quality of land (lower value of the *AVLQ* index) has larger opportunity costs for small owners who usually do not use the land primarily for timber production.

5 Conclusions and Discussion

This paper analyzes the current forestland holdings at a county level in Alabama. Our results indicate that forestland holdings vary not only in average holding size but also in structure. Simply examining the mean holding size might not be adequate to catch the whole picture of timberland owning structure. For example, findings in other studies (Ripatti 1996, Zhang et al 2005) show that both parcellation and consolidation co-exist. In that case, the mean level cannot reflect the structural change.

Previous studies addressed the impacts of population growth and urbanization on forestland ownership and forestland use change (Alig and Plantinga 2004, Kline and Alig 2005). It is argued that private forestlands in the United States face increasing pressure from growing populations, resulting in greater numbers of people living in closer proximity to forests (Kline et al. 2004b). A contribution of this study is the finding that not only does the sheer number of population but also their structure, such as age structure and spatial distribution determine forestland ownership distribution.

In the cycle of a person's life, wealth, production and consumption behaviors, and preference and value to different products change all the time. The American population demography is experiencing significant changes currently. Therefore, it is important to consider age structure in empirical studies. In terms of spatial distribution, the likelihood of owning timberland and the size of holding are largely dependent on where timberland owners reside. A county that has a higher proportion of urban population would be significantly different from another county with a higher share of rural population. Our society is experiencing urbanization and urban sprawl as well as aging; therefore the spatial distribution and structure of age would be important issues when we address timberland holding and ownership change.

Our results indicate that welfare distribution and the share of small holding sizes, as well as average holding size, are related. This suggests that researchers examining timberland holding structure should expend greater efforts to collect accurate income distribution data as a measure of welfare. Our studies also support the relationship between the type of land tenure and holding size. It is not surprising that the forest industry tends to own large amounts of forestland, while family and individuals usually own small holdings. In the recent decade, major forest products companies have been selling their timberland to NIPFs, especially to TIMOs (Timberland Investment Management Organization). What kind of impact can we expect from this transfer? It should be an interesting area worthy of future investigation.

The implications of our study are not limited to Alabama. We expect that similar research could be done in other states in the South. Since our study is within Alabama, and we assume that all owners face similar tax system, tax issue is not included. If we examine the variation across the state, taxation is another important factor that influences the variation of timberland holding size as well as the types of ownerships (e.g., the industry, family or TIMOs) across a region and time. Therefore, the mechanisms of parcellation, timberland price, tax issue are also important aspects that are worth exploring in the future.

References

Ahn, S., Abt, R.C. & Plantinga, A.J. 2001. Land use in the south central United States: a further investigation on land use practices by forestland ownership. In: Southern Forest Economics Workgroup Conference Proceedings, 2002. p. 165–171.

Alig, R.J. & Plantinga, A.J. 2004. Future forestland area: Impacts from population growth and other factors that affect land values. Journal of Forestry 102(8): 19–24.

Allen, D.W. & Lueck, D. 1998. Risk sharing and agricultural contracts. Unpublished manuscript, Montana State University.

Barlow, S.A., Munn, I.A., Cleaves, D.A. & Evans, D.L. 1998. The effect of urban sprawl on timber harvesting. Journal of Forestry 96(12): 10–14.

Bliss, J.C., Sisock, M.L. & Birch, T.W. 1998. Ownership matters: forestland concentration in rural Alabama. Society and Natural Resources 11(4): 401–410.

Bukenya, J.O. 2002. Socio-economic review of the Ala-

bama black belt region. Research paper AGB2002-01, Alabama A&M University.

Butler, B.J. & Leatherberry, E.C. 2004. America's family forest owners. Journal of Forestry 102(7): 4–14.

Dalecki, M. & Gilles, J.L. 1988. Rural well-being and agricultural change in two farming regions. Rural Sociology 53(1): 40–55.

DeCoster, L.A. 1998. The boom in forest owners – a bust for forestry? Journal of Forestry 96(5): 25–28.

Gini, C. 1921. Measurement of inequality and incomes. The Economic Journal 31: 124–126.

Gobster, P.H. & Rickenbach, M.G. 2004. Private forestland parcelization and development in Wisconsin's Northwoods: perceptions of resource-oriented stakeholders. Landscape and Urban Planning 69(2–3): 165–182.

Goldschmidt, W. 1978. As you sow: three studies in the social consequences of agribusiness. Montclair, NJ: Allenhead, Osmun & Co. Publishers.

Grau, H.R., Aide, T.M., Zimmerman, J.K., Thomlinson, J.R., Helmer, E. & Zou, X. 2003. The ecological consequences of socioeconomic and land-use changes in postagriculture Puerto Rico. BioScience 53(12): 1159–1168.

Hardie, I.W. & Parks, P.J. 1997. Land use in a region with heterogenerous land quality: an application of an area base model. American Journal of Agricultural Economics 79(2): 299–310.

Hartsell, A.J. & Brown, M.J. 2002. Forest statistics for Alabama, 2000. USDA Southern Research Station, Resource Bulletin SRS-67.

Healy, R.G. & Short, J.L. 1981. The market for rural land: trends, issues, policies. The Conservation Foundation, Washington, DC.

— 1984. Forests in an urban civilization: land use, land markets, ownership, and recent trends. In: Bradley, G.A. (ed.). Land use and forest resources in a changing environment. University of Washington Press, Seattle and London.

— 1985. Competition for land in the American south: agriculture, human settlement, & the environment. Washington, DC: The Conservation Foundation. 333 p.

Keilman, N. 2003. The threat of small households. Nature 421(6922): 489–490.

Kline, J.D. & Alig, R.J. 2005. Forestland development and private forestry with examples from Oregon (USA). Forest Policy and Economics 7(5): 709–720.

— , Alig, R.J. & Garber Yonts, B. 2004a. Forestland social values and open space preservation. Journal of Forestry 102(8): 39–45.

— , Azuma, D.L. & Alig, R.J. 2004b. Population growth, urban expansion, and private forestry in Western Oregon. Forest Science 50(1): 33–43.

Klingebiel, A.A. & Montgomery, P.H. 1961. Land capability classification. U.S.D.A. Agricultural Handbook 210. Washington, DC.

Labao, L.M. & Schulman, M.D. 1991. Farming patterns, rural restructuring, and poverty: a comparative regional analysis. Rural Sociology 56(4): 565–602.

Liao, X. 2007. Forestry-related investments, pine pulpwood market, and stumpage supply by ownerships in the US South. Ph.D. dissertation, Auburn University, Auburn, AL.

Liu, J., Daily, G.C., Ehrlich, P.R. & Luck, G.W. 2003. Effects of household dynamics on resource consumption and biodiversity. Nature 421: 530–533.

Mauldin, T.E., Plantinga, A.J. & Alig, R.J. 1999. Land use in the lake states region: an analysis of past trends and projections of future changes. Portland. OR: U.S. Department of Agriculture, Pacific Northwest Research Station. Research paper PNW-PR-519.

McKinney, M.L. 2002. Why larger nations have disproportionate threat rates: area increases endemism and human population size. Biodiversity and Conservation 11(8): 1317–1325.

Mehmood, S.R. & Zhang, D. 2001. Forest parcelization in the United States: a study of contributing factors. Journal of Forestry 99(4): 30–34.

Munn, I.A., Barlow, S.A., Evans, D.L. & Cleaves, D. 2002. Urbanization's impact on timber harvesting in the south central United States. Journal of Environmental Management 64(1): 65–76.

Nagubadi, R.V. & Zhang, D. 2005. Determinants of timberland use by ownership and forest type in Alabama and Georgia. Journal of Agricultural and Applied Economics 37(1): 173–186.

Newman, D.H. & Wear, D.N. 1993. Comparing the production behavior of industrial and nonindustrial forest owners. American Journal of Agricultural Economics 75(3): 674–684.

Ratley, J.L. 1972. Characteristics, underlying causal factors, and marketing practices of forest landowners in forty southern Alabama counties. Master thesis, Auburn University, AL.

Riley, S.D., Sauvajot, R.M., Fuller, T.K., York, E.C.,

Kamradt, D.A., Bromley, C. & Wayne, R.K. 2003. Effect of urbanization and habitat fragmentation on bobcats and coyotes in southern California. Conservation Biology 17(2): 566–576.

Ripatti, P. 1996. Factors affecting partitioning of private forest holdings in Finland: a logit analysis. Acta Forestalia Fennica 252. 84 p.

Rosset, P. 1999. On the benefits of small farms. Food First (Winter 1999). Available at: http://www.foodfirst.org/pubs/backgrdrs/1999/w99v6n4.html (Accessed August 25, 2006).

Schmitt, G. 1991. Why is the agriculture of advanced western countries still organized by family farms? Will this continue to be so in the future? European Review of Agricultural Economics 18(3): 443–458.

Sisock, M.L. 1998. Unequal shares: forest land concentration and well-being in the rural Alabama. Master thesis, Auburn University. AL.

Skees, J.R. & Swanson, L.E. 1988. Farm structure and rural well-being in the South. In: Agriculture and Cummunity Change in the U.S. Louis E. Swanson, ed. Boulder, CO: Westview Press. p. 238–321.

Smith, W.B., Miles, P.D., Vissage, J.S. & Pugh, S.A. 2004. Forest resources of the United States, 2002. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station, General Technical Report NC-241.

Stanfield, B.J., Bliss, J.C. & Spies, T.A. 2002. Land ownership and landscape structure: a spatial analysis of sixty-six Oregon (USA) Coast Range watersheds. Landscape Ecology 17(8): 685–697.

Swanson, L.E. 1988 Agriculture and community change in the U.S. Boulder. CO: Westview Press.

Tomaskovic-Devey, D. & Roscigno, V.J. 1997. Uneven development and local inequality in the U.S. South: The role of outside investment, land elites, and racial dynamics. Sociological forum 12(4): 565–597.

Turner, W.R., Nakamura, T. & Dinetti, M. 2004. Global urbanization and the separation of humans from nature. BioScience 54(6): 585–590.

U.S. Census Bureau. 1992. 1992 Census of Agriculture. Table 18. 58 p.

U.S. Census Bureau. Census 2000a. Data for the State of Alabama, Available at: http://factfinder.census.gov/servlet/QTTable?_bm=y&-geo_id=04000US01&-qr_name=DEC_2000_SF3_U_DP3&-ds_name=DEC_2000_SF3_U&-redoLog=false (Accessed August 23, 2006).

U.S. Census Bureau. Census 2000b. Urban and rural classification. Available at: http://www.census.gov/geo/www/ua/ua_2k.html (Accessed August 23, 2006).

Volscho, T.W. 2004. Gini Index of family income by U.S. county, 2000. Available at: http://vm.uconn.edu/~twv00001/counties.htm (Accessed September 7, 2006).

Wear, D.N., Liu, R., Foreman, J.M. & Sheffield, R.M. 1999. The effects of population growth on timber management and inventories in Virginia. Forest Ecology and Management 118: 107–115.

Zhang, Y. 2001. Economics of transaction costs savings forestry. Ecological Economics 36(2): 197–204.

— , Zhang, D. & Schelhas, J. 2005. Small-scale non-industrial private forest ownership in the United States: Rational and Implications for forest management. Silva Fennica 39(3): 443–454.

Total of 51 references