Parcelization at the Wildland-Urban Interface: Effects on Forest Operations

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ABSTRACT – One of the most prevalent issues facing the forest industry today concerns the expanding Wildland-Urban Interface (WUI). As urban centers sprawl, what were once large tracts of managed forestland are being divided and sold – a process known as parcelization. As these parcels divide, the amount of land once under the management regime of a single landowner suddenly belongs to multiple independent owners, which presents several challenges. The increase in the number of property owners typically implies a land use change. Parcelization is known to have an effect on wildfire outbreak, habitat fragmentation, groundwater quality; and is ultimately the cause of heat islands, uplighting, point-source pollution, and other factors associated with growth and development. Property division also leads to smaller tract sizes available to forestry practices, and past research has shown that there are few consistent methods available for profitably extracting low-valued timber products from these smaller tracts. Parcelization also increases loggers’ moving and related costs by requiring more frequent equipment relocation. Therefore, the objective of this paper is to explore the effects of parcelization on South Carolina’s timber products industry, specifically the logistics of forest operations. Through a review of relevant literature, the effect of parcelization at the WUI on forest operations is explored, and a methodological survey designed to collect data from the members of the South Carolina logging community will be developed.

INTRODUCTION

Threat of development and associated urban sprawl has significantly affected forest management in the southern United States. Increasing human populations encourage the lateral growth of communities and cities, and in this process large, relatively unbroken tracts of managed land at the urban edge are divided into smaller parcels. When individual parcels are purchased, and some forest landowners resist pressure from developers, it may lead to a fragmentation of timber resources. This reduces the likelihood that those forested properties will later be managed or harvested (Barlow et al. 1998). Many forested landscapes are dissected by road networks, housing subdivisions, commercial strips, or by varied ownership values (Egan et al. 2000), and

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population density has been shown to have an inverse effect on probability of harvest (Sampson and DeCoster 2000, Wear et al. 1999). High productivity harvesting systems struggle to operate efficiently on smaller tracts, and there are minimum tract sizes (with various qualities of timber) that a logger may agree to operate on (Kittredge 1996). Reduced tract size may have severe consequences for the logger, whose productivity, and therefore profitability, relies on the principles of economies of scale (Row 1978, Cubbage 1982). Because of parcelization, firms dependent on Non-Industrial Private Forests (NIPFs) will need to adapt their harvesting systems in order to maximize productivity on smaller tracts, and to minimize their fixed costs.

**BACKGROUND**

The 2001 Federal Register (USDA and USDI 2001) divides the Wildland-Urban Interface (WUI) into two levels. The area where housing abuts vegetation is called the “interface”; where housing is dispersed throughout the wildland is called the “intermix”. Both these designations are generally referred to as the WUI, and many view it as a single entity. This is the area where the parcelization of contiguous tracts occurs – a process contributing to urban sprawl, habitat fragmentation, and reduced economic yield of managed resources, including forest products.

Though industrial forestland is being subdivided and sold for residential and recreational uses (Best 2002), the vast majority of privately owned forests in the U.S. are in the form of Non-Industrial Private Forests (NIPFs). NIPFs account for about 363 million acres of forestland in the U.S., owned by 10.3 million owners (Blinn et al. 2007), and average NIPF size is 24 acres (LaPierre and Germain 2005). According to Best (2002), 10 million acres of this land was lost to development between 1982 and 1997, with 70 percent more lost between 1992 and 1997 than from 1982 to 1991. Between 1978 and 1994, two million acres in NIPFs was divided into parcels less than 100 acres, and 8 percent of private forest area is in parcels less than 20 acres (Best 2002). The probability that these parcels will be managed is about 75 percent where population density is 19 people per square mile (Sampson and DeCoster 2000). Management is unlikely to occur where population density is 150 per square mile (Wear et al. 1999). Age is also a concern in NIPF ownership, in that 40 percent of owners are retired and will eventually sell their property (Macie and Hermansen 2003), putting the land at increased risk for development.

NIPFs are a major source of timber resources for loggers in the South. Metropolitan area in the southern U.S. increased from 9.8 percent in 1960, to 23.2 percent in 1990 (Barlow et al. 1998), and recent data would likely show a continued increase. Of the area considered forestland, 26 percent is in counties with more than 250,000 people, occupying about 28 million acres; 43 percent of which is unmanageable for timber resources (Barlow et al. 1998).
About 70 percent of forestland in the South is in NIPFs. In Alabama, 67 percent of forests are controlled by 432,000 NIPF owners; two-thirds of whom own less than 10 acres (Pan et al. 2007). Twelve percent of those owning more than 50 acres control approximately 85 percent of the state’s private forestland (Pan et al. 2007). In Georgia, Atlanta sprawl consumed about 355,500 acres between 1982 and 1997 (Best 2002). And, from 1982 to 1989, parcels less than 10 acres in size increased almost 7 percent, while parcels greater than 200 acres decreased about 18 percent (Greene et al. 1997). Since 1987, Georgia loggers have increased their weekly production by 83 percent, and production per man hour has increased more than 50 percent (Baker and Greene 2008). The number of fully mechanized crews has increased by about 15 percent, while logging companies have seen a decreased return on investment over the last 20 years (Baker and Greene 2008). Baker and Greene (2008) also found that clearcutting in Georgia has decreased from 80 percent to 32 percent during this time, implying that loggers are needing to harvest more tracts per year to meet production levels; facing an increased number of moves per year.

South Carolina’s NIPFs accounts for 74 percent of the state’s 12.3 million acres of timberland (Thompson 1997). Sixteen percent (1.5 million acres) of NIPFs are in tracts greater than 500 acres; 31 percent (2.8 million acres) are in tracts between 101 and 500 acres, and 10 percent (0.9 million acres) are in tracts 10 acres or less. The dominant size category is between 11 and 100 acres, accounting for 43 percent (3.9 million acres) of NIPFs. Figure 1 shows average NIPF size distributions for South Carolina counties based on 1993 forest statistics.

CONCERN FOR PROFITABILITY

Economies of scale are negatively impacted by reduced parcel size. Row (1978) found economies of scale for minimized harvest cost to be effective between 20 and 40 acres. Likewise, Cubbage (1982) found that the economies of scale for a highly mechanized harvesting system in the South to effective at just less than 40 acres. In Georgia, harvesting costs increase rapidly on tracts less than 50 acres, while there is little motivation for harvesting tracts less than 20 acres (Greene et al. 1997). The advantages of larger tract size include, but are not limited to reduced transaction costs, standard or interchangeable parts, more efficient power source or automatic equipment, and specialized workers and equipment (Row 1978).

Parcelization and changing land use implies a reduced number of timber sales, while capital costs for loggers are increasing (fuel, machinery, hauling, and labor). Therefore, timber may be less available (with greater distance between tracts), with loggers incurring greater productivity losses from time spent moving. Depending on the mechanization level of the harvesting system (i.e. semi-mechanized shortwood vs. highly mechanized tree-length) small parcels may be suitable for harvesting. Many harvesting systems in South Carolina are highly mechanized. Comparable to South Carolina, Baker and Greene (2008) found that about 90 percent of Georgia loggers surveyed operate a conventional highly mechanized feller-buncher/skidder system.

According to Cubbage (1982), moving costs should consider costs for transporting equipment between sites, wages paid to unproductive employees, fixed costs for idle equipment, and the value of timber not being actively harvested. Small systems cost less to move, and require less
time to move than highly mechanized systems. A small partially-mechanized system may cost between $400 and $1,100 per move, while a highly mechanized system may cost between $2,200 and $5,400 per move (Cubbage 1982, adjusted to 2008 dollars).

Potential solutions for mitigating the increased costs associated with smaller tract size might consider land-use planning, conservation easements, forest landowner co-operatives, and appropriately-scaled harvesting systems. The first three are consolidatory methods – either planning for, setting aside, or establishing personal relationships that encourage, contiguous networks of timber resources. The last, appropriately-scaled harvesting systems, will be important as the process of parcelization continues, and demand for timber increases.

METHODOLOGY

In response to the potential threats of parcelization, a study has been designed to determine whether logging companies in the state of South Carolina have noticed an overall reduction in tract size harvested. If they have noticed a difference, this study will highlight what modifications they have made to their operation to minimize the effects of reduced parcel size. Members of the South Carolina Timber Producers Association and companies with employees certified as Timber Operations Professionals (TOP) will be contacted.

Employing a survey methodology modeled after Dillman (2000), the companies will be mailed a prenotice letter, a questionnaire with accompanying cover letter, a thank you postcard/reminder, and where additional response is sought, a replacement questionnaire and an additional final contact. Loggers responding to the survey will be informed of its importance in the prenotice letter and the survey cover letter. Dillman (2000) encourages the establishment of trust with the respondent for an increased response rate. This may be accomplished by use of a respondent-friendly questionnaire, first class mail, real first-class stamps, personalized correspondence, and a financial incentive (typically cash) (Dillman 2000). These methods follow Dillman’s Tailored Design Method (Dillman 2000). Some research following his original Total Design Method (1978) yielded response rates as high as 77 percent when all five modes of contact were incorporated (Dillman 2000).

Studies investigating similar topics have also used surveys as a tool for judging loggers’ reactions to population growth and/or NIPF dependency (e.g. Rickenbach and Steele 2006, Baker and Greene 2008). Baker and Greene (2008) assessed changes in production levels, workforce, land ownership patterns, system mechanization, and other important indicators in the Georgia timber production industry. They have developed a time series analysis, surveying loggers every five years for the last 20 years. Using a single survey mailing for a sample population of 878 loggers, their most recent questionnaire had a response rate of 24 percent, or 211 loggers. Similarly, Rickenbach and Steele (2006) surveyed loggers in northern Wisconsin and Michigan to assess their NIPF dependency, as related to production and profitability levels, worker safety, and other issues. They used a “multi-wave” approach with their survey, consisting of a full mailing including a $2 financial incentive, a postcard follow-up, and two additional mailings to nonrespondents. Distributing 1,063 11-page surveys, the authors received
a usable response of 513 out of 921 firms, yielding a response rate of about 56 percent (Rickenbach and Steele 2006).

For this study of South Carolina logging firms, a response rate of 24 percent as in Baker and Greene (2008) would be acceptable. However, implementation of the Dillman (2000) approach intends to produce a response rate closer to 50 percent, approximately that of Rickenbach and Steele (2006). A higher response rate would provide more confident relationships between responses to different survey questions. For example, the questions “What is your average moving distance between tracts?” and “How much time do you usually spend moving between tracts?” may be correlated. Examples of questions included in the survey are:

7. How many loads does each crew average per day?
   ( ) <1 load   ( ) 2-4 loads   ( ) 5-6 loads   ( ) 7-8 loads   ( ) >8 loads

8. What is the minimum number of loads / acre required to make harvesting a tract worthwhile?
   ( ) <1 load   ( ) 1 load   ( ) 2 loads   ( ) 3 loads   ( ) >3 loads

15. How much time do you usually spend moving between tracts?
    ( ) <2 hours   ( ) 2-4 hours   ( ) 4-6 hours   ( ) 6-8 hours   ( ) >8 hours

16. What is your average moving distance between tracts?
    ( ) <20 mi.   ( ) 20-40 mi.   ( ) 40-60 mi.   ( ) 60-80 mi.   ( ) >80 mi.

CONCLUSION

Two issues are presented in the preceding literature review. Generally, NIPF size in the United States is decreasing due to population growth and development, and, changing resident values are influencing the way timber is harvested. To maintain production levels and business viability it can be assumed that logging companies are harvesting a greater number of tracts through increasingly selective measures. Regionally comparable studies have shown that loggers are increasing the mechanization level of their operation. With rising fixed costs and more frequent movement between tracts, harvesting operations will need to modify the scale of their operation to more appropriately address tract size and management restrictions. Soon, harvesting systems may economically suffocate logging companies, as many believe that maximizing productivity by use of highly mechanized, multiple-machine systems is the most efficient method. Conversely, if smaller systems, requiring fewer pieces of equipment, fewer crew members, less moving expense, and less moving time were utilized, the logger may find his or her system to align better with the demands imposed by expanding urban growth and increasing human populations.

This study will be conducted to determine the effects of urban growth and population increase on the logging industry in the state of South Carolina. Firms are largely dependent on their harvesting of NIPFs, and NIPF subdivision may be forcing them to modify their operation. A methodological survey will be mailed to a group of South Carolina logging companies, intending to learn whether parcelization has impacted their harvesting operation, and how or if they have modified their operation to increase efficiency on smaller tracts.
LITERATURE CITED


