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Private Timberlands

Growing Demands, Shrinking Land Base

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ABSTRACT

By 2050, US timberland area is projected to be about 3 percent smaller than today due to increasing demands for urban and related land uses from another 126 million people. An increasing area of southern planted pine will be accompanied by a reduction in the area of upland hardwoods. Hardwoods will continue to dominate the forested landscape in the South. Plantation growth rates will increase by 38 percent, and plantation fiber output will increase by 289 percent to reach 61 percent of private softwood removals volume.

Keywords: economics; industry; inventory; nonindustrial private forestland; timber

In 1997, the United States had 747 million acres of forestland (Smith et al. 2001), covering about one-third of the land area. Two-thirds of this forestland (504 million acres) was timberland—forestland that can produce 20 cubic feet of industrial wood per acre per year and is not withdrawn from timber production or reserved for other uses such as wilderness. An additional 52 million acres of forest, reserved for nontimber purposes, are managed as parks or wilderness areas. In addition, 191 million acres of other forests are not capable of producing 20 cubic feet per acre of industrial wood annually but can be important for watershed protection, wildlife habitat, and other uses and services.

In 1997, 71 percent of US timberland was private, 22 percent was federally owned, and 7 percent was on state and other public ownerships. Slightly more than 80 percent of US private timberland is classified as nonindustrial private forestland (NIPF). Eighty-six percent of the private US total is in the East, with 60 percent of that in the South. US forests in federal ownership are primarily the National Forests and are concentrated in the West.

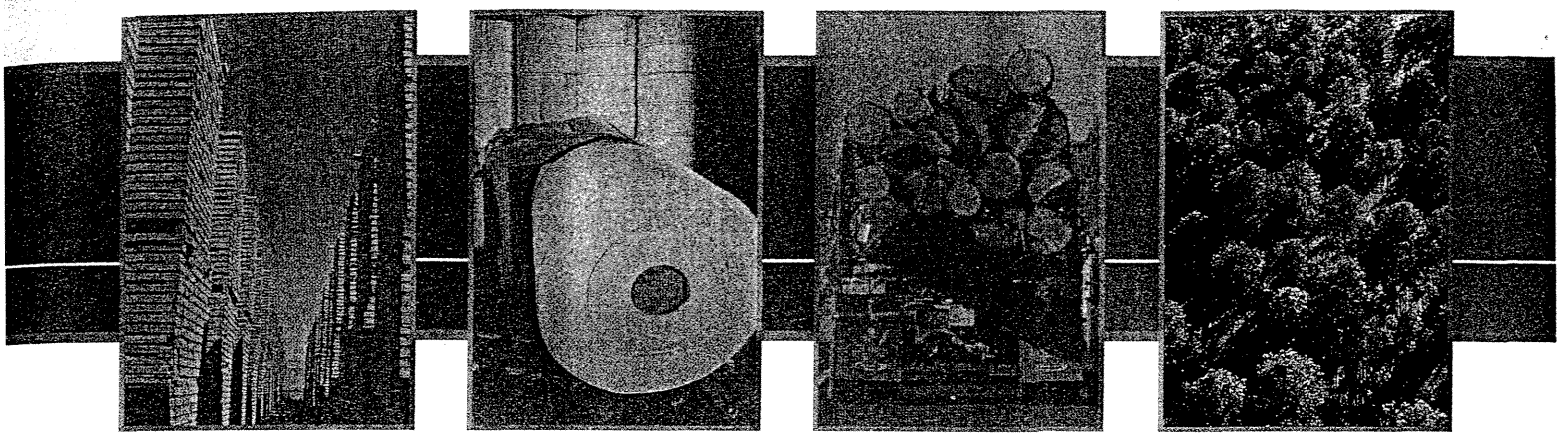
Sixty-four percent of the nation's sawtimber-size stands (average of >9 inches dbh) are also in the East. The percentage of the nation's timber stands in the sawtimber class has increased from 37 percent in 1953 to 51 percent in 1997. The South was one of the regions with an increase over time in percentage of sawtimber stands. The South also contains the largest area of high-productivity forests (92 million acres) when compared to the Pacific Coast region with 44 million acres (Smith et al. 2001).

Between 1952 and 1997, total area of timberland decreased by 1 percent *(fig. 1, p. 34)*, from 509 to 504 million acres. During that period, timberland area peaked in the early 1960s, declined at a decelerating rate to 1987, and then increased slowly. A significant share of the reduction was on public lands, where millions of acres of timberland were reclassified to other forest categories (e.g., wilderness). NIPF owners had the largest loss of timberland—about 4.5 percent. More than half was purchased by forest industry, but the remainder was cleared for agriculture (largely in the South) or development. Unlike the movement between lands in agriculture and forestry, the loss of timberland to development is essentially permanent, and the rate of this loss depends on growth in population and personal incomes.

Land-Use Projections

Over the next 50 years, a US population increase of 126 million is projected along with a moderate rise in per capita incomes, resulting in a projected net loss of US timberland area of about 15 million acres. This would be a 3 percent reduction *(fig. 1)*, primarily conversions to development. Driven largely by this increasing population, the area of timberland per capita is projected to decline from about 1.8 acres per person in 1997 to 1.2 acres by 2050.

During the past 40 years, the largest population growth in the United States has been in the West and South, and those two regions are projected to continue to have above-average population growth in the future. The two states with the largest timberland areas, Georgia and Oregon, were among the 10 fastest-growing states in the 1990s. Further decreases in the av-



erage number of people per US household are projected, so a larger amount of timberland may be converted to urban–developed uses than with historical household numbers. Forestland was the largest source of rural land converted to urban–developed uses in the 1990s (USDA Natural Resources Conservation Service 2001), providing more than one-third of converted land. No large changes are projected in the proportional distribution of timberland among regions over the next 50 years.

Some regional differences in land-use trends are related to interactions with the agriculture sector. In the North, excess capacity and changing profitability in the agriculture sector (e.g., dairy farms) resulted in the natural reversion of some former agricultural land to trees. In contrast, the Conservation Reserve Program (CRP) represented the nation's largest treeplanting program over a five-year period and was concentrated in the South. At the same time, continued urbanization converted several million acres of forestland as cities such as Atlanta grew, leading to net losses in private timberland in states such as Georgia. No massive treeplanting programs are foreseen, while conversion of forestland for urban and developed uses is projected to continue to accommodate population growth. The South is a region with one of the smaller percentage reductions in projected timberland area (1.7 percent by 2050), as the large south-central region is projected to gain a small amount of timberland because of net gains from land exchanges with agriculture (Ahn et al. 2001).

Forest-Cover Dynamics

In 1996, 63 percent of the nation's 16 billion cubic feet of timber harvest was softwoods (Haynes, in press). The South and Pacific Northwest dominated the nation's supply of softwood timber in the 20th century, and the fates of these two regions have been intertwined. In the last quarter of the 20th century, the South and Pacific Northwest collectively accounted for nearly 75 percent of the US timber harvested, but regional proportions have dramatically shifted because of decreased harvest levels on federal forests in the Pacific Northwest.

The largest changes in forest cover are projected for the South, with an increase of 14 million acres in pine plantations.

Distribution of forest-cover types is controlled by a combination of natural and human processes, including succession, natural disturbances, and human disturbances associated with afforestation and reforestation practices. The relative importance of each varies among regions and ownership groups. For example, because industrial timberlands tend to be managed more intensively than NIPF lands, a higher proportion of financially valuable forest-cover types are located on industrial lands.

A majority of the 356 million acres of private timberland support hardwoods (207 million acres), and 149 million acres have softwoods (Smith et al. 2001). The most dynamic forest landscape is the US South, where for the past 45 years the natural pine area decreased by 59 percent, area of planted pine increased 18-fold, upland hardwood area increased, and lowland hardwood area decreased (Butler and Alig, n.d.). Although most of the loss of natural pine has been on NIPF timberlands, the area of upland hardwood

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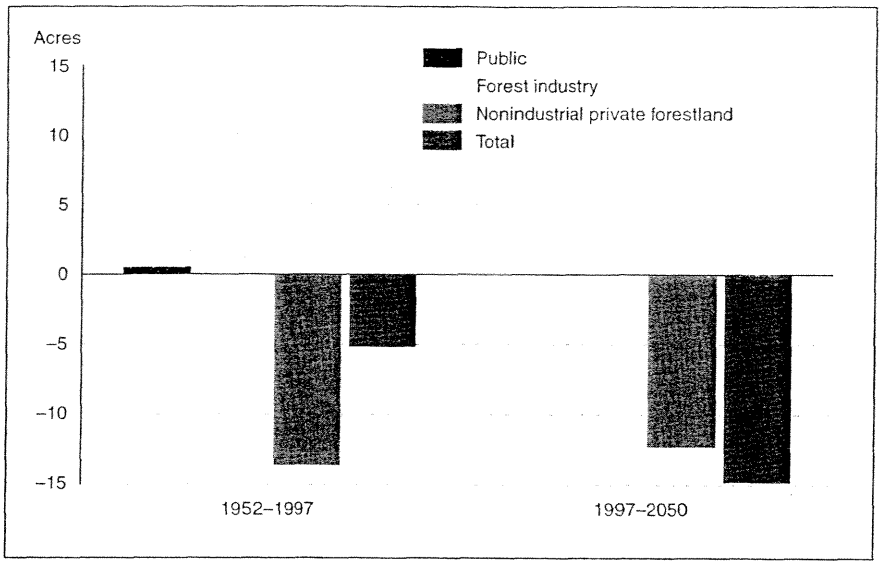

Figure 1. **Net area changes in timberland by ownership between 1952 and 1997, with projections to 2050.** ***Note:*** **No net area change in public timberland is projected for 1997–2050.**

on NIPF ownerships has been steadily increasing and now covers 63 million acres. Area of the mixed type (oak-pine) has been roughly stable; however, the Southeast has had a net gain and the South-Central region a net loss of oak-pine. Although upland hardwood was the dominant forest type on NIPF lands, planted pine is the dominant type on industrial timberlands. For planted pine area, the industrial and NIPF ownerships overall had similar amounts, each with about half of the 27 million acres in the South.

Driven largely by increasing population, area of timberland per capita is projected to decline from about 1.8 acres in 1997 to 1.2 acres by 2050.

The largest changes in forest cover are projected for the South *(fig. 2)*. The largest area change in forest cover is the increase of 14 million acres in pine plantations projected by 2050. Some other general projection trends across private ownership groups and subregions are a 15 percent decrease in area of natural pine and an overall 18 percent loss of upland hardwood across private ownerships. Note that the projected reduction in upland hardwood area represents a change from the historical increase, as upland hardwoods in the future are converted to other forest types or converted to other land uses.

The largest increases in planted pine and decreases in upland hardwood were projected for the South-Central region, with each involving about 10 million acres. Within this region, most of the planted pine will be gained on industrial lands and most of the upland hardwood losses will be on NIPF timberlands. While the South-Central region has a 2 percent loss of natural pine area, the Southeast has a loss of 28 percent (3.9 million acres), mostly on NIPF timberlands. Area of oak-pine in total across the region increases by 0.5 percent, but with a net loss in the Southeast. Total area of lowland hardwood was projected to decrease 4 percent at the regional level, the net result of a 1.7 million acre loss in the Southeast and a 0.5 million acre gain in the South-Central region, the latter on NIPF timberlands.

Management intensification on industry lands in the South artificially regenerates many harvested natural pine, mixed oak-pine, and hardwood stands to higher-productivity planted pine stands. Further, the Conservation Reserve Program led to about 3 million acres of pine planted on erodible cropland in the South between 1985 and 1995. However, harvest of pine stands on NIPF lands leads to exchanges between forest-cover types due to natural succession and management activities that include substantial hardwood encroachment (Butler and Alig, n.d.).

Area change varies notably by region, as does the movement between the softwood and hardwood forest types. As in the South, hardwood types cover the most area in the Northeast and Lake States. The two largest are the maple-beech-birch type (36 million acres) and the oak-hickory type (25 million acres) on private timberland. However, projected area changes in total across the two regions are relatively small compared to those in the South, as the area of maple-beech-birch is projected to decrease by 1 percent by 2050 and the oak-hickory type by 3 percent.

Due in part to more stable land uses (caused by both cultural and physical constraints) and regulatory restrictions on forest practices, the forest cover dynamics in the Pacific Northwest have also been relatively small compared to those in the South. On the private timberlands of the west side of the Pacific Northwest, the projected changes are largely a continuation of past trends. The dominant trends have been an increase in the area of Douglas-fir *(Psuedotsuga menziesii)* and a decrease in the area of red alder *(Alnus rubra)* (Alig et al. 2000; Butler and Alig, n.d.), largely the result of an intensification of forestry practices. This includes a conversion of naturally regenerated forests to artificially regenerated forests with higher financial values. The largest projected area change is that Douglas-fir area is projected to increase from 60 percent of industrial timberlands in 1997 to 66 percent by 2050. A related change is the projected decrease of hardwood area on industrial timberlands.

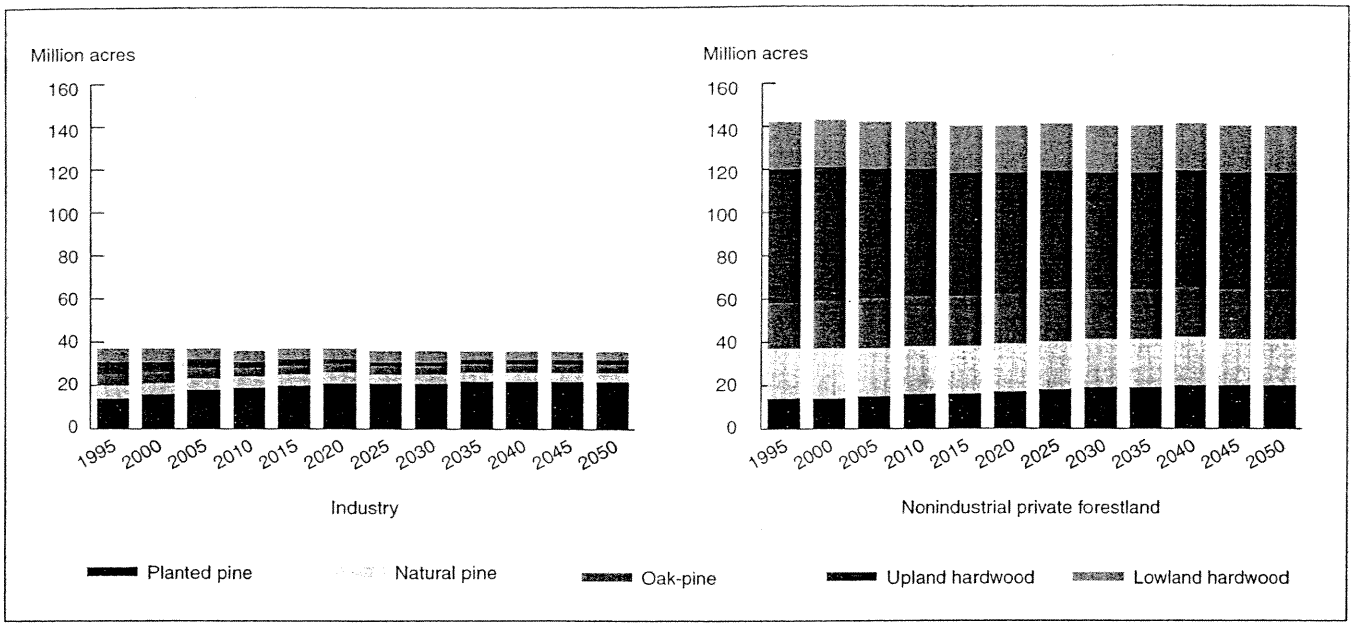

Figure 2. **Projections of areas for southern forest cover types on private timberlands, industrial and nonindustrial.**

Management and Investment Trends

Changes in management practices and rising management investment have contributed to increases in US inventories and harvests in the past and are projected to do so in the future. *Table 1* (p. 36) illustrates that industrial forestland owners in the South will increase their plantation area to more than three-quarters of their softwood timberland base and use more intensive regimes (e.g., substitution of capital for land) on more than 80 percent of the plantation area by 2050. This investment pushes average growth rates up by 63 percent across all industry pine plantations. In natural pine and oak-pine areas, however, management will remain largely nonintensive, actually becoming a smaller proportion of the area as investment focuses on pine plantations. NIPF owners will also add more plantations, but to a much smaller extent than industrial forestland owners (plantations rise from 13 percent to 20 percent of the NIPF timberland base between 1997 and 2050). Similar to industry, but not to the same extent, there will be increases in the application by NIPF owners of more intensive regimes within plantations. Average NIPF plantation growth is projected to be up just 13 percent by 2050. For NIPF owners, management intensity will increase in natural pine and oak-pine types. In addition, NIPF owners are projected to increase the areas unavailable for timber harvesting (Moffat et al. 1998).

Although changes will occur in all regions, key areas for future private supply are the South and the Douglas-fir region of the Pacific Northwest. The South will experience some limitations in softwood harvest over the next decade, but in the long term should see expansion in softwood inventory that supports an increase of softwood harvest of nearly 50 percent (Haynes, in press). One of the few available measures of investment in forestry is the annual area of treeplanting across ownerships, and the vast majority of US treeplanting has been conifers on private lands, and in the South, with an upward trend since the 1950s.

Increasing management intensity will increase growth and sustain harvests in the future. Managed plantations of Douglas-fir are expected to move from roughly 44 percent of the Pacific Northwest industrial softwood timberland base to nearly 69 percent by 2050. The proportion of industrial plantations in more intensive management forms with fertilization, genetically improved stock or enhanced site preparation, and commercial thinning is projected to rise from the current level of 58 percent of plantations to 71 percent by 2050.

Hardwoods are often overlooked in discussions of wood consumption, but they remain a critical part of the US timber supply. In 1996, hardwoods accounted for 37 percent of total roundwood consumption and are expected to remain at that share for the foreseeable future. Private forests, mostly in the eastern states, provide 90 percent of hardwood harvested today, and this fraction is projected to rise to 93 percent by 2050.

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Although there is not a full set of reliable statistics, management invest-

Table 1. Indicators of management intensity on private lands in key supply regions, historical and projected to 2050.

Region, type,* and management class	Measured as percent of	1995	2010	2030	2050
Softwood					
Southern industry					
Plantations	All softwood area	57%	67%	73%	75%
High-intensity plantations	Plantations	21	64	81	82
Actively managed natural and oak-pine (low to medium intensity)	Natural and oak-pine	22	18	14	11
Unavailable for harvest	All softwood area	3	3	3	3
Southern NIPF					
Plantations	All softwood area	24	26	30	31
High-intensity plantations	Plantations	26	37	48	47
Actively managed natural and oak-pine (low to medium intensity)	Natural and oak-pine	17	29	40	43
Unavailable for harvest	All softwood area	5	8	10	12
Douglas-fir industry					
Plantations	All softwood area	48	66	66	66
High-intensity plantations	Plantations	58	67	71	71
Hardwood					
Southern industry					
Some management (low intensity)	All hardwood area	5	6	12	25
Unavailable for harvest	All hardwood area	7	11	14	18
Southern NIPF					
Some management (low intensity)	All hardwood area	9	12	18	23
Unavailable for harvest	All hardwood area	10	12	16	18

*NIPF = nonindustrial private forestland.

ment on private hardwood timberlands is certainly far lower than for softwood types. As indicated in *table 1* for private timberlands in the South, most hardwood timberland has not been planted and is generally treated with the least-intensive methods (partial cutting or clearcutting followed by natural regeneration). More than half of the hardwood timberland is in age classes 45 years and older. A sizable area on both industrial and NIPF ownerships is not available for harvest according to regional surveys (e.g., Moffat et al. 1998), and both groups are projected to shift a significant fraction of their remaining hardwood acres into unavailable status over time. For both owner groups, this class holds roughly 18 percent of their hardwood timberland by 2050, representing assumptions about land set aside for ecological, operational, or aesthetic reasons. These acres are considered part of the inventory, but their unavailable nature puts upward pressure on hardwood prices.

Both industrial and NIPF owners are expected to shift a significant fraction of their remaining hardwood acres into unavailable status over time.

Meanwhile, responding to the demand for hardwood fiber, industrial owners are expected to shift a small portion into more-intensive modes of management, while NIPF owners are projected to shift a larger area into more-intensive forms of hardwood silviculture. These are expected to be low management classes, defined by a combination of silvicultural activities including but not limited to stocking control, commercial thinning, and (perhaps) fertilization.

Summary and Conclusions

Area of the US timberland base in 2050 is projected to be slightly smaller, by about 3 percent, than it is today. Timberland area would decline due to increasing demands for urban and related land uses. Aside from direct conversion to urban uses, timberland is also projected to be converted to agricultural uses to replace developed prime croplands. Major trends in forest-cover types in the South over the past 50 years are, for the most part, projected to continue over the next 50 years. These trends include an increasing area of planted pine; however, one divergence from the past is a projected reduction in the area of upland hardwoods in the South. Even with such projected changes, hardwoods will continue to dominate the forested landscape of the South. Hardwood forests in 2050 are projected to cover about half of the southern private timberland base, twice the amount for planted pine in the region. Further, many pine plantation acres will revert to naturally regenerated forest types, ranging from 70 percent of final harvested plantations on NIPF timber-

lands in the South-Central region to 34 percent on industrial timberlands in the Southeast.

Key findings can be summarized as follows:

- Adding another 126 million people in the United States may lead to a net reduction in the area of private timberland, with conversions to urban and developed uses outweighing timberland area additions from agriculture.
- Changes in total area in the various forest ownerships will be relatively small, as management becomes intensified, particularly on industrial ownerships. This will lead to substantial increases in the area of planted conifers.
- The most significant landscape changes are projected to occur in the South, where the majority of the treeplanting will occur, along with the conversion of many timberland acres to other uses. Even beyond these changes, the South has the potential to add millions of acres of marginal agricultural land to the timberland base, as well as to economically and substantially increase growth on existing timberlands.
- In terms of area changes for broad forest-cover types, planted conifer area will increase notably compared to areas of natural forest types.
- By 2050, the average softwood growth rate will increase 33 percent on private timberlands as the average age of harvest drops from 47 to 36 years. Over all lands, softwood removals will increase 33 percent, while inventories rise by 53 percent. Specifically for managed plantations, growth rates will increase by 38 percent, and plantation fiber output will increase by 289 percent to account for 61 percent of all private softwood removals (53 percent of all US softwood removals volume).
- By 2050, hardwood growth will decline slightly while hardwood inventories will rise by 28 percent, removals will increase by 33 percent, and average harvest age will drop from 62 to 60 years.

The forest landscape of the new millennium has many possible faces. Interactions across sectors of the economy will influence those outcomes. If agriculture and forestry can both continue to increase yields per acre and can harvest products, then more land should be available for nontimber purposes.

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