Removals, Timber Products, and Residues

Todd A. Morgan, Tony Johnson, and Ron Piva

Our Nation's forests are an essential source of raw materials for goods and services used every day by the country's 300 million residents. Forest products is a multibillion dollar industry that makes important contributions to the environment and economy by sequestering carbon, managing vegetation, and supplying wood products, employment, income, and tax revenue. This section examines the forest inventory impacts of harvesting and manufacturing timber products; it also discusses volume and uses of wood residue generated by the forest products industry.

To place this section in perspective, we first look at the overall pattern of timber use in the United States. This pattern of use is reflected in overall timber products consumption, which is supplied by domestic timber production and imports and offset by exports (fig. 6a.1). In general, domestic timber production has been declining since the early 1990s, while consumption has been relatively stable. The gap between production and consumption has been filled with rising imports. The remaining discussion focuses on timber removals for domestic production and exports.

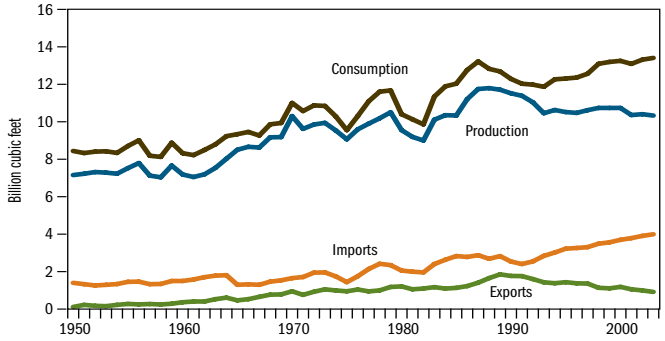

Figure 6a.1. Total roundwood consumption, production, imports, and exports, 1950–2005.

Volume removed from forest inventory during timber harvesting or other cultural treatments is known as "removals." Removals are an important indicator of timber harvest sustainability. Removals that exceed net growth could indicate over-harvesting and declining forest inventory, while growth greatly exceeding removals could signal the need for vegetation management to regulate density and species mix, inhibit insect and disease outbreaks, or reduce wildfire risk.

Removals can come from two sources: (1) growing stock (i.e., portions of live trees of commercial species meeting specified standards of quality or vigor) and (2) nongrowing stock (i.e., rough, rotten, or dead trees and tops and stumps of growing stock trees) (fig. 6a.2). The three general types of removals in order of magnitude are timber products harvested for processing by mills, logging residue (i.e., volume cut or killed but not utilized), and other removals (e.g., precommercial thinning and land-use conversion).

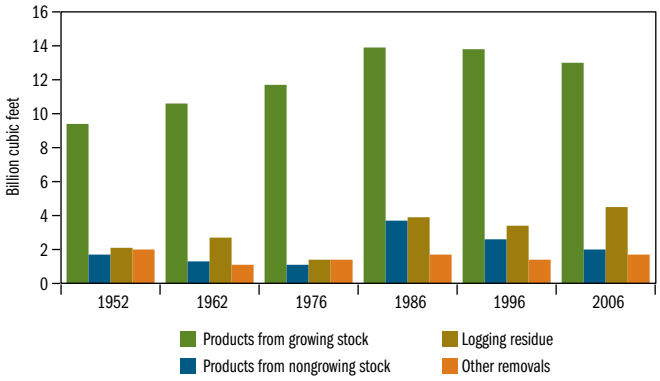

Figure 6a.2. Forest products by source, logging residues, and other removals, 1952–2006.

Growing-Stock Removals

At the national level, growing-stock removals have been fairly stable over the past two decades (fig. 6a.3). During 2006, they totaled 15.5 billion cubic feet (see appendix C, table 35). This amount represents a decline of nearly 3 percent from 1996 and 1986 but a 9-percent increase from 1976. Softwoods accounted for 63 percent, or 9.9 billion cubic feet, of growing-stock removals in 2006, and hardwoods accounted for 5.7 billion cubic feet, or 37 percent. Both species groups showed declines in removals from 1996, with hardwoods down by 5 percent and softwoods down by 2 percent.

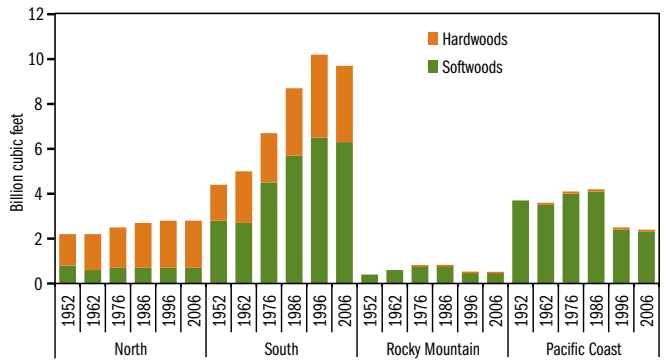

Figure 6a.3. Growing-stock removals by species group, region, and year, 1952–2006.

The South region led growing-stock removals in 2006, with 9.7 billion cubic feet, accounting for 62 percent of the Nation's total growing-stock removals. The North and Pacific Coast regions had 2.8 and 2.5 billion cubic feet of removals, respectively, but the Rocky Mountain region had just 0.5 billion cubic feet of growing-stock removals. The South region experienced the greatest change in growing-stock removals, with 2006 removals 5 percent below 1996 levels. The Pacific Coast region experienced a 2-percent decline in removals, but the North and Rocky Mountain regions showed 2-percent increases from 1996 to 2006. By ownership category, private owners, which includes nonindustrial private forest and forest industry owners, accounted for 14.2 billion cubic feet, or 92 percent, of growing-stock removals. These figures were essentially unchanged from 1996 to 2006. National forests, however, experienced a 54-percent (450 million cubic feet) drop over the period, while other public timber lands showed only a 1-percent decline in growing-stock removals. Combined, public owners accounted for 8 percent of growing-stock removals.

It is important for the reader to keep in mind that, although 15.5 billion cubic feet of growing-stock removals is a substantial volume, nationwide this volume amounts to only 1 percent of total growing-stock inventory. Softwood removal rates amounted to 1.9 percent of the total inventory, but hardwood removal rates were just 0.6 percent of hardwood inventory. Even in the heavily harvested South region, softwood growing-stock removals amounted to 5.5 percent of softwood inventory, and hardwood growing-stock removals were only 1.2 percent of the hardwood growing-stock inventory. The North, Pacific Coast, and Rocky Mountain regions had removal rates as a percent of inventory of 0.9, 0.5, and 0.2 percent, respectively.

Net Growth and Removals Balance

As mentioned earlier, the balance between net growth and removals is important because it provides an estimate of sustainability of timber harvest volume. The growth-to-removals ratio (G:R = net growth ÷ growing-stock removals) quantifies the balance between net growth and removals. During 2006, net growth was about 26.7 billion cubic feet and growing-stock removals were about 15.5 billion cubic feet (see appendix C, table 36). Thus, G:R in the United States was 1.72, indicating that growth exceeded removals by 72 percent during 2006. In 1996, G:R was 1.49 and, in 2002, G:R was 1.50 (Smith et al. 2004, table 36). This trend of increasing growth relative to removals suggests that, at the national level, our forests are producing increasingly more wood each year than is being harvested.

The national level trend of increasing net growth relative to growing-stock removals does not necessarily reflect the trend for each geographic region, species group, or ownership class, as illustrated in the following examples:

- The Rocky Mountain region has experienced a 24-percent decline in the growth-to-removals ratio since 1996. Although growth relative to removals has remained very high (G:R ≥ 3.2) in the Rocky Mountain region between 1996 and 2006, growing-stock removals have increased slightly (2 percent), but net growth has declined 23 percent during the period—due in large part to increasing mortality in the region. Mortality in the Rocky Mountain region increased 16 percent between 1996 and 2006.
- The South region's growth-to-removal ratio has experienced a substantial increase, rising 21 percent from 1.12 in 1996 to 1.35 in 2006. Net growth in the South region increased 15 percent over the period, but removals from growing stock declined 5 percent. This trend suggests that forest inventory volume in the South region has begun to respond to increased management and harvesting during the 1990s, when more of the harvest shifted to private lands in the South region from public lands in the Rocky Mountain and Pacific Coast regions.

In 2006, hardwood G:R (2.00) was 29 percent higher than softwood (1.56) nationwide (fig. 6a.4). Since 1996 both species groups have undergone increases in growth relative to removals; however, hardwood net growth increased by 10 percent but growing-stock removals declined by 5 percent; softwood growth increased 8 percent and removals were down just 2 percent over the 1996-to-2006 period. Sizeable

declines in hardwood pulpwood and fuelwood harvests in the North and South regions contributed to the more pronounced decline in hardwood growing-stock removals over the period.

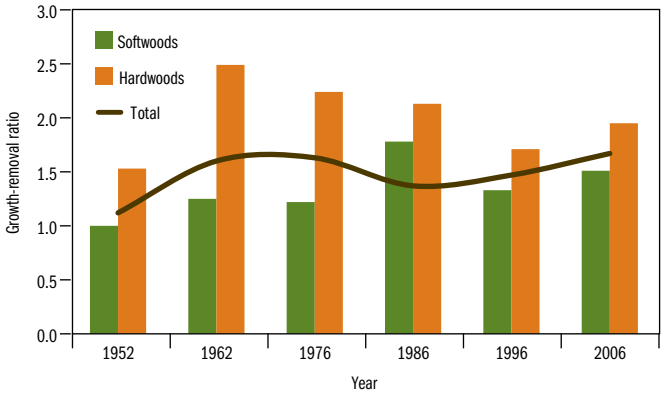

Figure 6a.4. Growth-removal ratios by softwoods and hardwoods, 1952–2006.

G:R increased for each ownership class between 1996 and 2006 (fig. 6a.5). National forest timber lands experienced the largest increase (127 percent) in growth relative to removals, with G:R rising to 11.23 in 2006 versus 4.96 in 1996. Other public owners witnessed a 30-percent increase, with G:R rising from 2.27 to 2.94. Private timberlands experienced the smallest increase, with G:R rising just 7 percent, from 1.24 in 1996 to 1.33 in 2006. The substantial change in national forest G:R was due to the 54-percent decline in removals, because net growth increased just 3 percent.

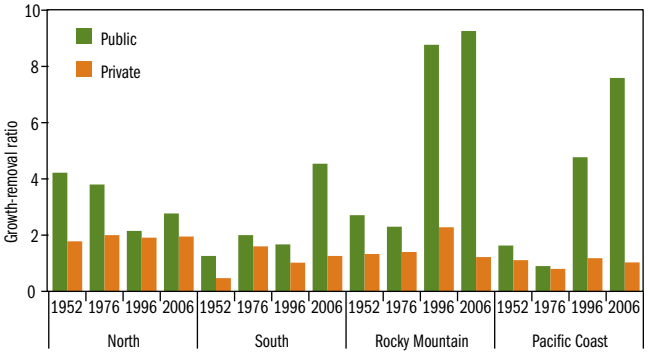

Figure 6a.5. Growth-removal ratio by owner and region, 1952–2006.

Timber Products

Timber harvested for industrial products and domestic fuelwood totaled 15 billion cubic feet in 2006 (see appendix C, table 39). More than 13 billion cubic feet came from growing-stock sources, and 2 billion cubic feet came from nongrowing-stock sources. At 13.7 billion cubic feet, private lands supplied the majority (91 percent) of timber product output (TPO). National forests supplied 0.4 billion cubic feet (3 percent) and other public owners provided 0.9 billion cubic feet (6 percent) of removals during 2006.

Since 1996, total TPO has declined nearly 9 percent at the national level, with the largest declines in the North and South regions at 13 and 9 percent, respectively. The Rocky Mountain region had a 1-percent decline in product output, while the Pacific Coast region was the only region to realize a slight increase of 2 percent in product output. Each ownership class experienced declines in TPO. National forests had the largest proportional decline, with a 57-percent reduction in TPO between 1996 and 2006. Total TPO from other public owners declined by 13 percent, and the private ownership category declined by 5 percent over the period. Rapidly declining TPO is the major factor contributing to the increasingly high growth-to-removals ratio on national forest timber lands.

Hardwood TPO declined 21 percent between 1996 and 2006, and softwood output was down by 1 percent over the period. A major cause of hardwood product output decline was regional reduction in harvesting hardwoods for fuelwood in the South and North regions. Over the period, product output declined for all products except saw logs and composite products. At 7.7 billion cubic feet, saw log production was up 1 percent and accounted for 48 percent of the Nation's total TPO (fig. 6a.6). Pulpwood output declined 13 percent to 4.4 billion cubic feet but still accounted for 29 percent of total TPO. Both softwood and hardwood pulpwood production was down, 8 and 13 percent, respectively. Veneer production, at 1.2 billion cubic feet, ranked third among industrial products, accounting for 8 percent of product output for the Nation. Composite panel production experienced the most dramatic increase for industrial products, up 50 percent to 543 million cubic feet, and accounted for 4 percent of total TPO. Volume used for other industrial products such as poles, posts, mulch, and other miscellaneous products totaled 254 million cubic feet, down more than 25 percent from the volume in 1996. Domestic fuelwood dropped from 2.3 to 1.4 billion cubic feet, or 38 percent. Hardwood fuelwood declined by 230 million cubic feet (30 percent) in the North region and by 506 million cubic feet (60 percent) in the South region.

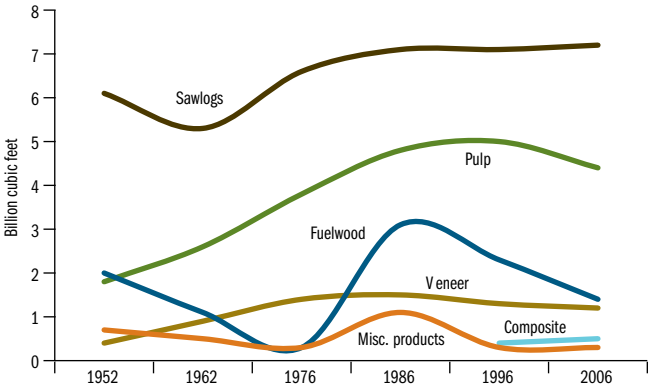

Figure 6a.6. Trends in production by primary product, 1952–2006.

Logging Residue

Nationwide in 2006, more than 4.5 billion cubic feet of logging residue was created and left in the forest as "slash" in the process of harvesting timber (see appendix C, table 40). About 28 percent, or 1.3 billion cubic feet, of this logging residue came from growing-stock sources, and 72 percent, or 3.3 billion cubic feet, came from tree tops, limbs, stumps, and other nongrowing-stock sources.

Softwood volume accounted for 2.2 billion cubic feet, or 50 percent, of the logging residue, even though softwood harvest accounted for 78 percent of total product output and 60 percent of total removal volume. The uniformity of softwood trees and less volume in tops and forks allow for greater utilization of the main stem portion of the trees for products. At 552 million cubic feet, softwood growing-stock logging residue accounted for 5.6 percent of total growing-stock removals in 2006 compared with 6.1 percent in 1996 and 9.2 percent in 1986, suggesting increases in softwood harvesting efficiency and utilization of sotwood stems. Hardwoods accounted for the remaining 2.3 billion cubic feet of logging residues. Of this volume, 31 percent, or 701 million cubic feet, came from the growing-stock portion of trees. This volume accounted for 12 percent of total hardwood growing-stock removals. Hardwood utilization is not as complete as with softwoods due to the variability in hardwood stems and fewer markets for hardwood volume.

Other Removals

(Note: Due to the implementation of the annual inventory, the Pacific Coast region and Intermountain subregion do not have sufficient remeasurement data available to calculate other removals. The data presented here include the North and South regions and the Great Plains subregion.)

Other removals include volume removed from forest inventory by precommercial thinning, land clearing, and changes in land use from a forest use to a nonforest or developed use. When timber land is converted to nonforest use, some wood may be processed as timber products; this volume is captured in the timber products section. Approximately 1.7 billion cubic feet of other removals were generated in 2006. About 77 percent, or 1.3 billion cubic feet, of other removals came from growing-stock sources, and the remaining 23 percent, or 0.4 billion cubic feet, came from nongrowing-stock sources. Hardwoods accounted for 1.2 billion cubic feet of other removal volume, and softwood accounted for 0.5 billion cubic feet.

Mill Residue Volume and Use

Timber-processing facilities generate substantial quantities of wood residue when manufacturing wood products such as lumber, plywood, oriented strandboard (OSB), and log homes. Most of this residue volume is utilized to produce other products. These "reconstituted" wood products include fiber products, such as pulp, paper, particle board, and medium density fiberboard (MDF); biomass energy, including steam and electricity; energy products, such as fuel pellets and firewood; and other miscellaneous products, such as animal bedding, mulch, and decorative bark.

During 2006, timber-processing facilities in the United States produced nearly 86.8 million dry tons of wood residues, with just 1.3 million tons (1.5 percent) of that residue not utilized for a product (see appendix C, table 42). About 36.7 million tons (42.3 percent) of wood residue were used for fuel, 35.4 million tons (40.8 percent) for fiber products, and 13.3 million tons (15.3 percent) for other products. The South region produced 61 percent of the wood residue, the Pacific Coast region produced 19 percent, the North region produced 15 percent, and the Rocky Mountain region produced just 5 percent. Softwoods accounted for 72 percent of mill residue.

Since 1996, mill residue production declined 5 percent from about 91.6 million dry tons. The decline in mill residue production can be attributed to two causes: (1) less timber being processed by mills and (2) increased efficiency and recovery of products from the volume of timber processed. The volume of mill residue going to fiber and energy uses declined between 1996 and 2006, as did the volume of residue not used for products. Other uses of mill residue (e.g., animal bedding, mulch, and decorative bark) experienced a 5-percent increase in volume.