

# Timber Growth, Mortality, and Change

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The previous section discussed trends in timber volume. Changes in volume often result from land-use change; that is, land entering or removed from the timber base. On those acres remaining forested, tree growth and mortality are the primary factors for volume change. Annual rates of growth and mortality often differ by species group, ownership, and geographic region. This section of chapter 5 focuses on these two elements of change and their net effect on timber volume at a given point in time.

Net annual growth, commonly used as a measure of timber productivity, is defined as the average annual growth in tree volume less the volume lost through mortality. Mortality is the average annual net volume of timber dying over a given time period due to natural causes. Most often, tree mortality occurs at low and predictable rates due to insects and disease, suppression by overstory trees, or advanced tree age. Occasionally, highly concentrated and localized losses occur due to insect and disease epidemics, wildfire, or severe weather events.

## Mortality

Total mortality for trees in the United States amounted to nearly 7.8 billion cubic feet in 2006 (see appendix C, table 33), marking the highest level of volume loss recorded to date. Although mortality has been increasing steadily over time, the current mortality rate (mortality as a percent of growing-stock volume) averaged just 0.81 percent for the United States as a whole. At the regional level, about 2.9 billion cubic feet (37 percent) of the current mortality occurred in the South region, indicating a 0.95-percent rate of loss from growing stock. In the North region losses amounted to 2.0 billion cubic feet, and in the Pacific Coast region they totaled 1.6 billion. Mortality on private timber lands was almost 4.3 billion cubic feet, or 56 percent of the 2006 estimate. National forest timber land lost 2.4 billion cubic feet to mortality, and other public lands lost about 1.1 billion. Although the volume lost to tree mortality is substantial, the rate of loss remains less than 1 percent of the growing-stock volume for any region or owner group (figs. 5c.1 and 5c.2).

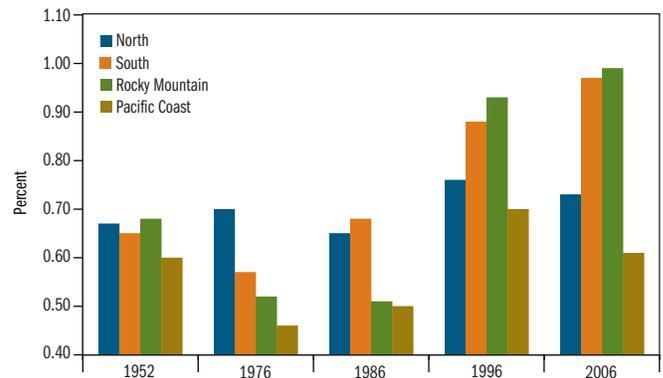


Figure 5c.1. Annual growing-stock mortality as a percent of growing-stock volume by region and inventory year.

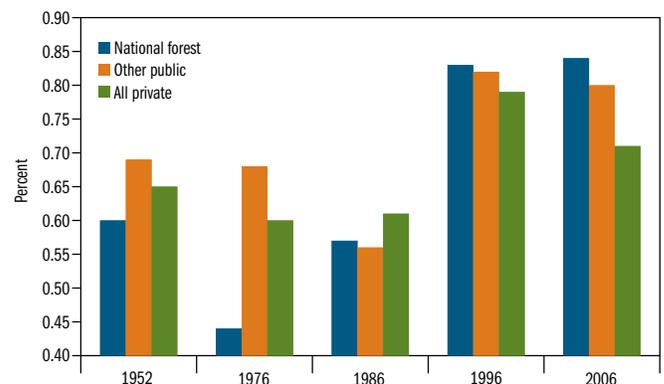


Figure 5c.2. Annual growing-stock mortality as a percent of growing-stock volume by owner group and inventory year.

Nationally, growing-stock mortality averaged less than 15 cubic feet per acre annually as of 2006. Regional per-acre losses remained consistent with the 1996 estimates. Mortality loss was highest in the Pacific Coast region, averaging about 21 cubic feet per acre annually, and lowest in the North region, averaging nearly 12 cubic feet per acre per year. Softwoods accounted for about 4.5 billion cubic feet of the total mortality, and almost 2.1 billion cubic feet of that loss occurred on national forest timber land.

## Net Growth

Net annual growth totaled nearly 26.7 billion cubic feet in 2006, up from the nearly 23.9 billion cubic feet in 1996 (see appendix C, table 34). As with the increase in mortality, growth has been steadily increasing; the 2006 net growth estimate represents the historical high mark for the United States as a whole. Only the Rocky Mountain region showed a decline in net growth since 1996. The annual rate of growth (net growth as a percent of growing-stock volume) averaged about 2.8 percent per year since 1996, which is about three-and-one-half times the rate of mortality. Half of the net growth, or 13.3 billion cubic feet, occurred in the South, meaning that growing-stock volume in southern forests is increasing at a rate of 4.6 percent annually. Net annual growth in northern forests averaged 6.6 billion cubic feet since 1996, a 2.4-percent annual rate of increase, and growth in the forests of the Pacific Coast region was about 5.2 billion cubic feet, increasing 2.0 percent annually. Growth has more than doubled on both national forest and other public timber land since 1952 and has increased 13 percent on private timber land since that year (see appendix C, table 34).

On a per-acre basis, total net growth averaged 52 cubic feet annually for all timber land. At the regional level, the Pacific Coast region had the highest average annual growth, at 69 cubic feet per acre, followed by the South region, at 65 cubic feet per acre (fig. 5c.3). The North and Rocky Mountain regions have the lowest per-acre growth rates of about 40 and 25 cubic feet per acre per year, respectively. Among owner groups, net annual growth on national forest timber land averaged almost 41 cubic feet per acre in 2006, and volume growth on other public timber land occurred at a rate of about 50 cubic feet per acre annually.

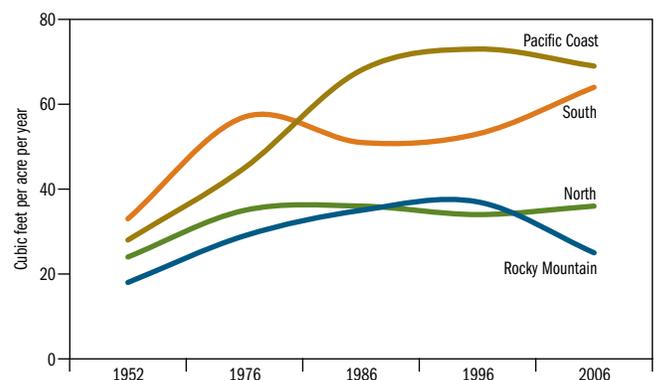
Private timber land has the highest net annual growth per acre, averaging nearly 55 cubic feet in 2006. Historically, millions of intensively managed and highly productive forest industry timberland acres, concentrated in the South, have been the primary reason for the higher average productivity on private timber land. Whether these acres will continue to contribute as much to future growth on private timber land is unknown. The relatively recent divestiture of landholdings by forest industry in the South has resulted in the shift of much of industry land to Timber Investment Management Organizations (TIMOs), Real Estate Investment Trusts (REITs), and nonindustrial-private owners (see chapter 2, Forest Area, Ownership, and Setting). Long-term ownership and management of these acres will be ascertained only by future ownership and timber resource surveys.

## Indicators of Forest Sustainability for State Forest Planning

Sherri Wormstead

Across the 20 States of the Northeast and Midwest, a common set of 18 forest sustainability indicators and associated metrics are monitored at State and regional levels. The indicators provide specific measurements following the framework of the Montreal Process criteria that are tracked at a national level. The Northeastern Area State and Private Forestry, a unit of the Forest Service, has worked collaboratively with the Northeastern Area Association of State Foresters on this effort. They want to use these common measures to reveal trends in forest resources and to convey critical and complex information on forests to decisionmakers and the public.

An online indicator information system tracks trends in the ecological, economic, and social aspects of forests, providing dynamic graphs, maps, and other resources for the 18 indicators and associated metrics. Among the wealth of information compiled from a variety of sources, FIA provides a significant source of data. The Northeastern Area has used the indicators for strategic planning and in various communication products. Several States, including Delaware, Maryland, New Hampshire, and Wisconsin, are using the indicators as a base set, adjusting as needed, to organize State forest assessments, which in turn are used in the State forest planning process.

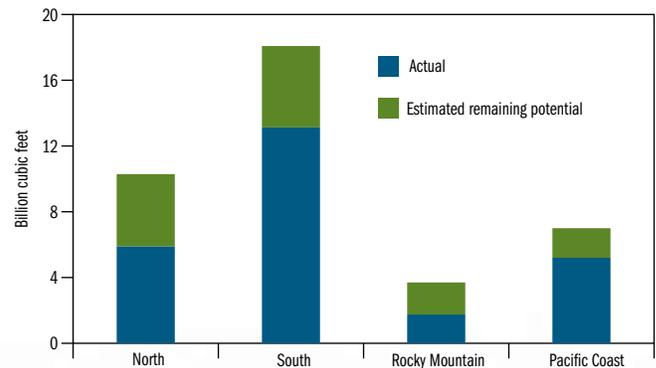


**Figure 5c.3.** Average net annual growing-stock growth per acre by region and inventory year.

Of the net growth reported in 2006, 73 percent (19.7 billion cubic feet) occurred on private timber land, including 67 percent (10.3 billion cubic feet) of the total softwood net growth. The South region accounts for half of the softwood growth, due in large part to the extensive area of highly productive pine plantations in this region (see Planted Forests and Plantations section in chapter 5). In contrast, the Rocky Mountain and Pacific Coast regions combined have 41 percent of all softwood growth despite having 68 percent of all softwood volume. These regions have a higher concentration of older, slower growing softwood stands. Softwood net growth in the North region increased to 1.5 billion cubic feet in 2006, marking the first increase in softwood growth in this region since 1952. The South region had 49 percent of the hardwood net growth in 2006, followed by the North region with 44 percent. Of the hardwood net growth, 82 percent is on private timber land.

Figure 5c.4 illustrates the relationship between potential growth and actual net growth on timber land by region. Potential growth is the maximum mean annual increment of a stand at a given age. It provides a measure of potential productivity or yield of a forest stand. Actual net growth will always be less than potential growth because of site-specific conditions such as soil type, management objectives,

owner objectives, and capability of the site to support tree growth. Overall, the ratio of actual net growth to potential net growth averaged 66 percent for the United States. By region, the Pacific Coast had the highest ratio of 74 percent, the South averaged 73 percent, the North averaged 57 percent, and the Rocky Mountain averaged 47 percent.



**Figure 5c.4.** Comparison of potential net annual growing-stock growth against actual net annual growing-stock growth by region.