

VOLUME AND AVAILABILITY OF EASTERN HARDWOODS

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Abstract. -- In the Eastern United States, some 354 million acres of timberland are classified as a hardwood or pine-hardwood forest type. The inventory of hardwood growing stock totals 275 billion cubic feet, or 90 percent of the hardwood inventory in the United States. Whereas hardwood inventories have increased by 70 percent since 1952, the availability of this resource for use by the wood products industry has probably not increased proportionately. Procedures for discounting total inventory to that which is more likely available from a physical standpoint are demonstrated.

INTRODUCTION

The adequacy of present and future hardwood timber supplies in the Eastern United States is a topic of genuine concern to the hardwood forest products industry. Whereas the hardwood inventory volume has been escalating for several decades, available supplies--especially supplies of high quality material--apparently have not kept pace. This paper describes the current hardwood resource situation in the Eastern United States, examines changes during recent decades, and discusses factors affecting the availability of this resource for wood products.

The basic resource data presented here are taken from the latest national compilation of forest statistics which was completed as part of the 1989 RPA Assessment (Waddell and others 1989). The data were adjusted to a common date of 1987.

TIMBERLAND AREA

Some 354 million acres of land in the Eastern United States are classed as timberland. For the purposes of this analysis, the Eastern United States includes both the North (Northeast, North Central, and Great Plains regions) and the South (Southeast and South Central regions). These regions are depicted in figure 1. In both the North and the South, hardwood forests account for a majority of the timberland (fig. 2). Pine-hardwood stands (oak-pine forest type) are included as a hardwood type in this analysis because hardwood stocking in these stands is greater than that of pine.

Four-fifths of the timberland in the North is in hardwood forest types. The North accounts for almost all the maple-beech-birch stands in the Eastern United States and all the aspen-birch. The most common forest type in the North is oak-hickory, which covers some 47 million acres.

RPA ASSESSMENT REGIONS

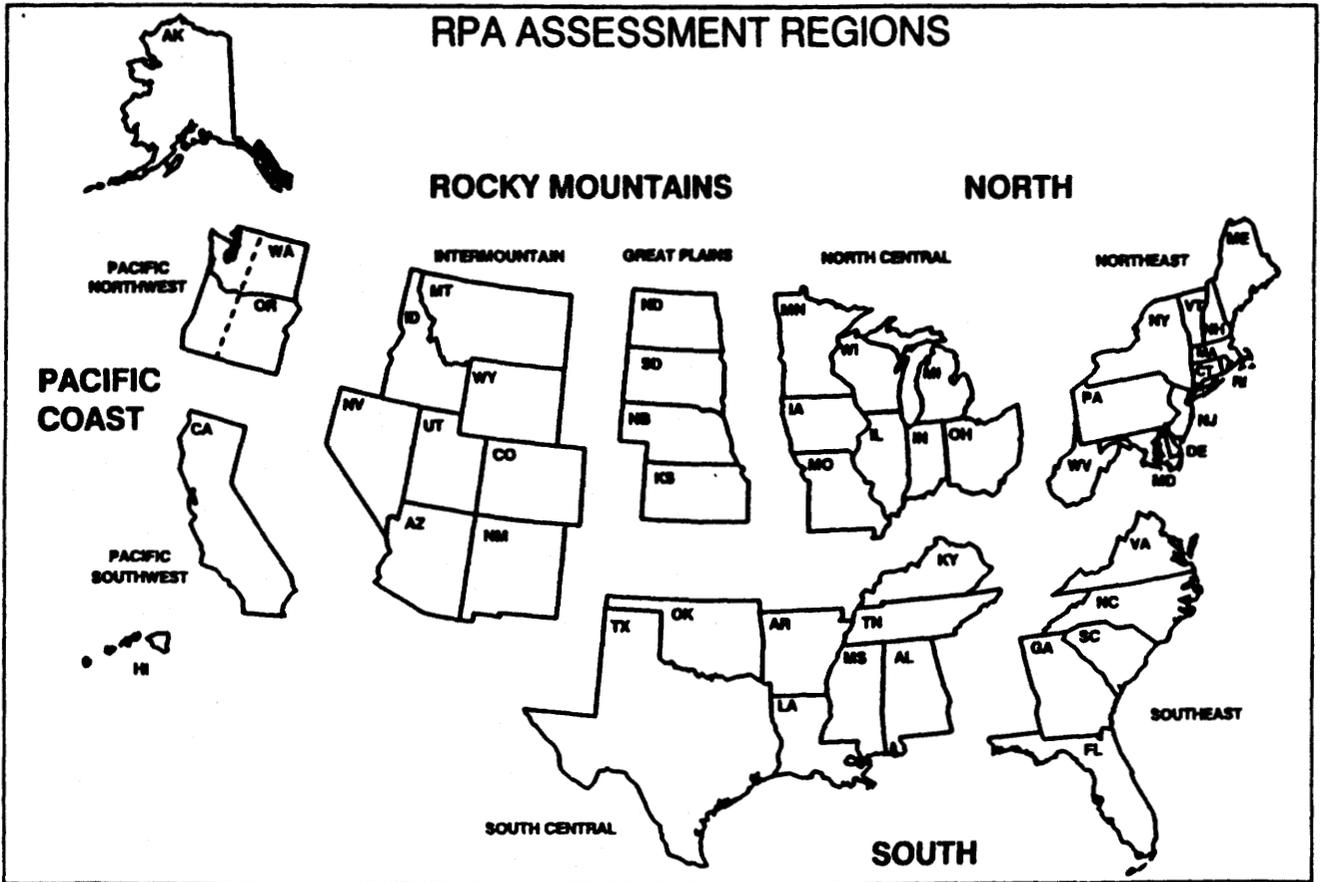


Figure 1.--Delineations of RPA Assessment regions.

In the South, two-thirds of the timberland is occupied by hardwood or pine-hardwood forest types. People who have envisioned the South as the domain of the southern yellow pine are wrong; the South is really hardwood country. Oak-hickory is also the predominant hardwood forest type in this region with 71 million acres. Pine-hardwood stands cover 28 million acres in the South. Oak-gum-cypress stands cover some 27 million acres, almost all of the Eastern total. This type group includes a diverse mixture of swamp, bottomland, and other mesic hardwood species.

Farmers and other private owners that we collectively call nonindustrial private owners (NIPF) hold three-fourths of the hardwood acreage (table 1). This group is extremely diverse. Members range from farmers whose sole livelihood is derived from the land, through professionals and factory workers who get little income from the land to non-forest-industry corporations of many kinds. NIPF owners control approximately three-fourths of the hardwood acreage in both the North and South. Forest industries (excluding leased acres) own 14 percent of the hardwood acreage in the South but only 8 percent in the North. Only 6 percent of the hardwood acreage is on National Forests in the Eastern United States. In the counties where National Forests are located, however, the Federal Government is often the predominant landowner. Other public agencies such as states, counties, and municipalities control 13 percent of the hardwood resource in the North compared with 4 percent in the South. Much of the other public ownership in the North is concentrated in the Lake States of Michigan, Minnesota, and Wisconsin.

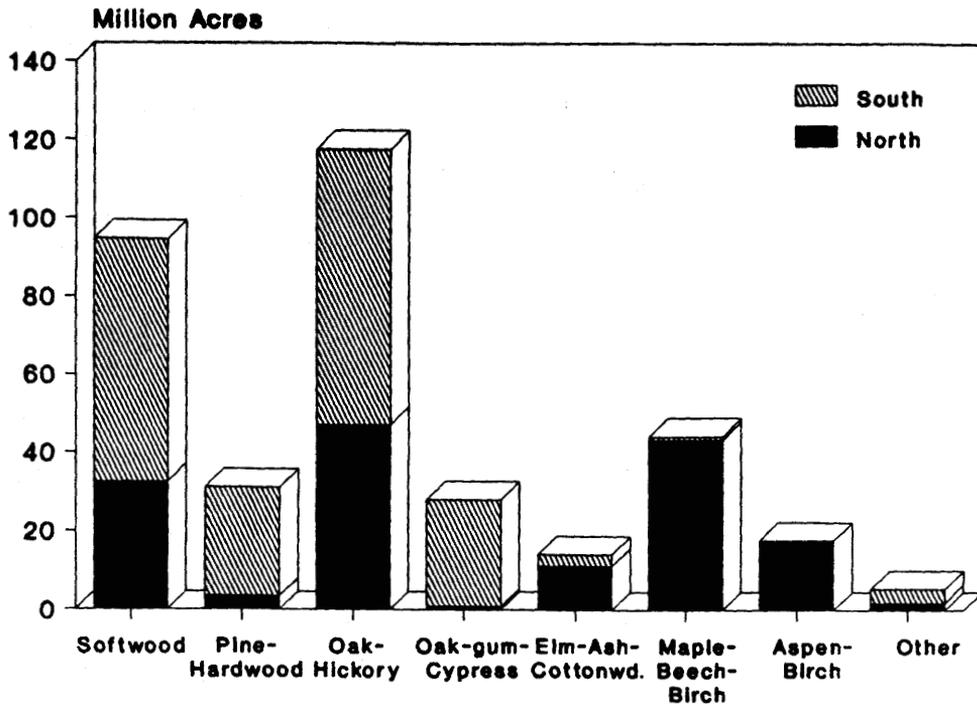


Figure 2.--Area of timberland in the Eastern United States by forest-type group and section, 1987.

Table 1.--Area of timberland classified as a hardwood or pine-hardwood forest type^{1/} in the Eastern United States, by ownership class and section, 1987

Ownership class	Eastern United States		
	North	South	Million acres
National forest	14.2	6.9	7.3
Other public	21.1	15.9	5.2
Forest industry ^{2/}	28.9	10.1	18.8
Farmer and other private	189.2	90.9	98.3
All ownerships	253.4	123.8	129.6

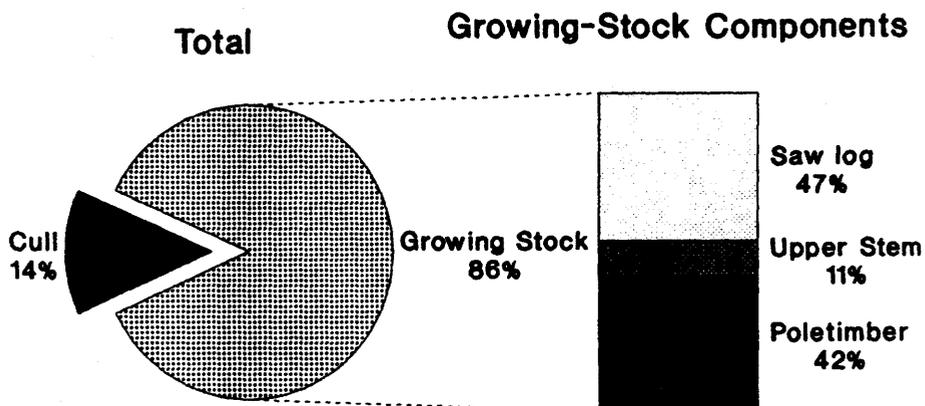
^{1/}Excludes softwood forest types and nonstocked stands.

^{2/}Lands under long-term lease are included with farmer and other private.

HARDWOOD INVENTORY

The inventory of hardwood growing stock in the Eastern United States totals 275 billion cubic feet, about 90 percent of the hardwood inventory in the entire United States. Material that qualifies as sawtimber accounts for almost

one-half of all growing stock, or 129 billion cubic feet (fig. 3). Eleven percent of the volume is in the upper stem of sawtimber trees and 42 percent is in poletimber trees (5.0-10.9 inches d.b.h.). The saw-log component is equivalent to 716 billion board feet (Int.1/4-inch log rule).



Total Inventory = 319 Bil. Cu. Ft.

Figure 3.--Delineation of merchantable hardwood inventory in the Eastern United States into growing stock, cull, and growing-stock components.

An additional 44 billion cubic feet of merchantable hardwood volume exists in trees that fail to qualify as growing stock because of rotten or missing wood or poor form. These trees are not capable of producing saw logs, now or prospectively.

By ownership, the inventory of hardwood growing stock is distributed similarly to hardwood acreage. Nearly three-fourths of the hardwood volume is in NIPF ownership.

The inventory of hardwood growing stock totals 141 billion cubic feet in the North and 134 billion cubic feet in the South. Several dozen hardwood species contain significant volumes--the major species groups are displayed in table 2. Oak species are the dominant species group in the Eastern United States. They make up 28 percent of the growing stock in the North and 44 percent in the South. The select red oaks are concentrated in the North, whereas the select white oaks are more common in the South. "Other" oaks, which do not have sufficient overall quality to be considered "select", include a large number of red and white oak species; 70 percent of this groups' volume is in the South. Both hard and soft maples plus cottonwood and aspen are significant components of the hardwood inventory in the North. In the South, soft-textured species such as blackgum, tupelo, sweetgum, and yellow-poplar are more prevalent than in the North.

Table 2.--Volume of hardwood growing stock in the Eastern United States, by species group and section

Species group	Eastern United States		
	North	South	
	Billion cubic feet		
Select white oaks	24.5	10.4	14.1
Select red oaks	19.4	12.6	6.8
Other oaks	54.5	16.5	38.0
Hickory	16.3	5.7	10.6
Ash	11.1	7.3	3.8
Hard maple	17.5	16.2	1.3
Soft maple	25.2	18.7	6.5
Gums/tupelo	27.9	1.2	26.7
Yellow-poplar	15.5	3.9	11.6
Cottonwood/aspen	14.8	14.1	0.7
Other	48.7	34.6	14.1
All species	275.4	141.2	134.2

The average size of hardwood trees is significantly higher in the South than in the North (fig. 4). In the North, poletimber trees (the 6-, 8-, and 10-inch diameter classes) account for 46 percent of the hardwood inventory compared with 38 percent for the South. The diameter distributions also reveal that across the East almost one-half the volume in sawtimber-size trees exists in the two smallest sawtimber d.b.h. classes--the 12- and 14-inch diameter classes. These tree sizes supply the poorest grade of material for uses where log or lumber quality is important.

HARDWOOD RESOURCE TRENDS AND OUTLOOK

The hardwood inventory that exists today in the Eastern United States is approximately 70 percent greater than that which existed in 1952 (fig. 5). There have been substantial increases in both the North (an 81-percent increase) and South (a 60-percent increase). Hardwood inventories have increased with consistency during the last 3 1/2 decades. Significant increases in volume have occurred for all hardwood tree sizes, both poletimber and sawtimber. The large (15.0 inches d.b.h. and larger) and small (11.0-14.9 inches d.b.h.) sawtimber size groups have increased proportionately. Volume changes for certain species and localities may differ significantly from these trends.

Increasing hardwood inventories in the Eastern United States have resulted from wide gaps between net annual growth and annual removals. Trends for hardwood net annual growth and removals are shown in figure 6 for three years--1970, 1976, and 1986. Hardwood net growth increased substantially during the 1970's but has leveled out in the 1980's. In contrast, removals did not increase during the 1970's but have turned upward more recently. In 1986, the hardwood growth-removal ratio was 1.8:1.

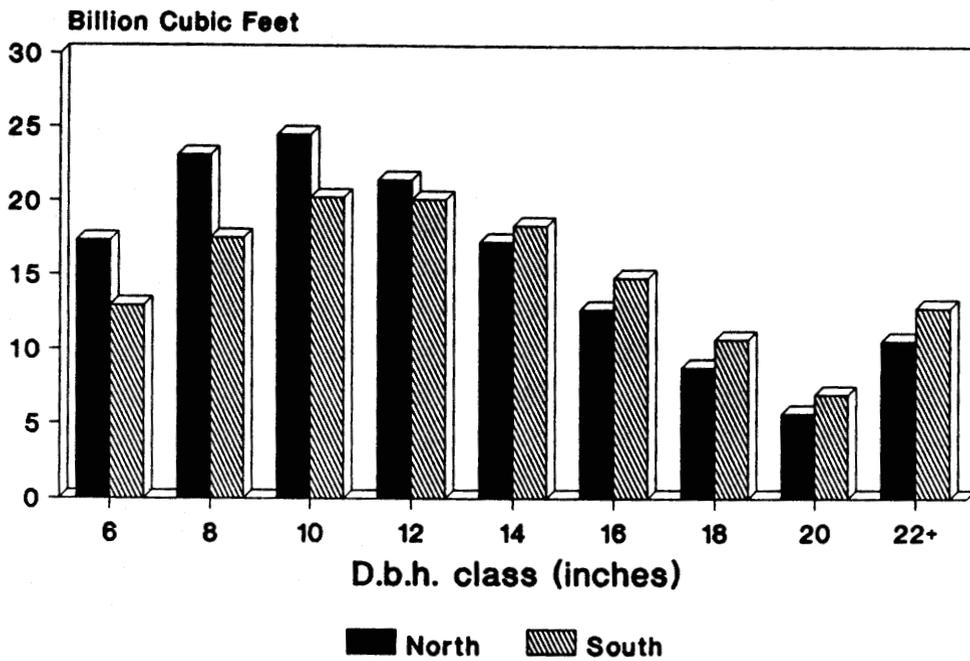


Figure 4.--Volume of hardwood growing stock in the Eastern United States, by d.b.h. class and section.

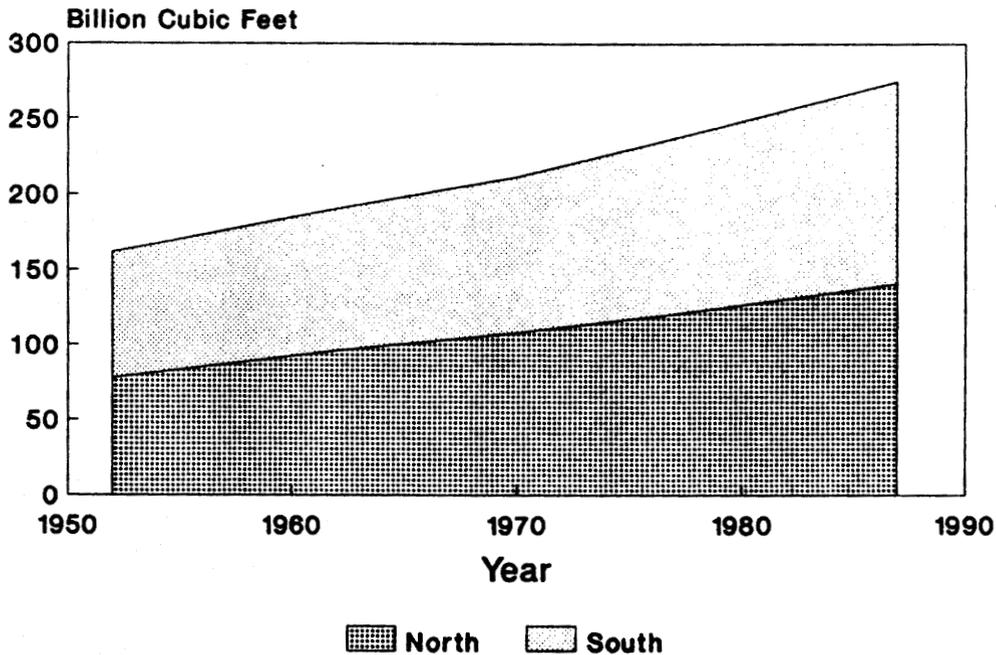


Figure 5.--Volume of hardwood inventory in the Eastern United States, by section, 1952-87.

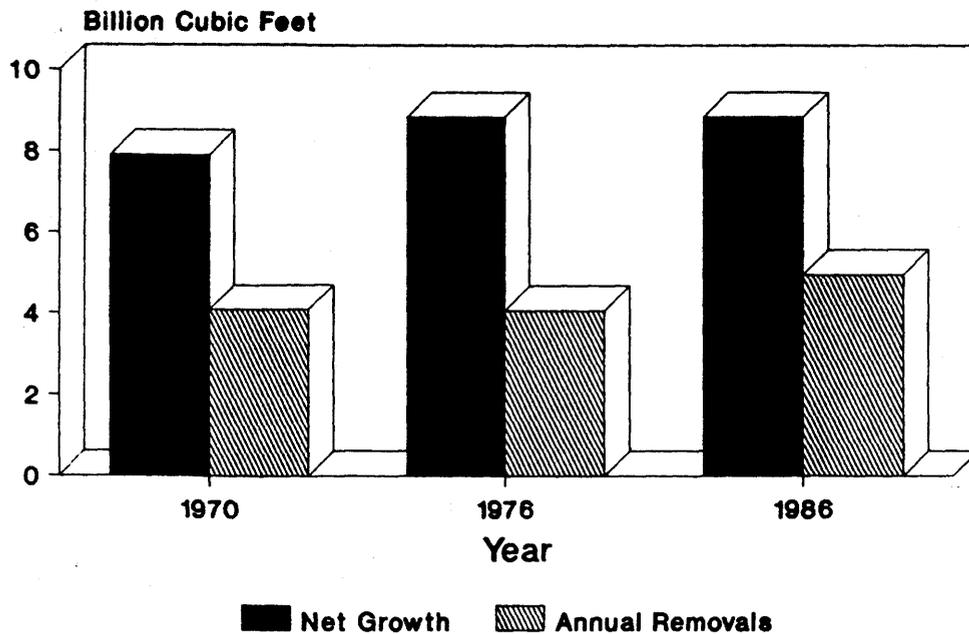


Figure 6.--Net annual growth and removals of hardwood growing stock in the Eastern United States, 1970, 1976, and 1986.

The prognosis is for increases in hardwood inventory to moderate still further as increases in the level of annual removals bring the growth-removal relationship closer to a balance. Recently completed inventories in several Southern States indicate that this trend may be well underway. A 1986 inventory of South Carolina (Tansey and Hutchins 1988) recorded a 27-percent increase in hardwood removals since 1978 and a growth-removal ratio of 1.5:1.0. In 1989, a new inventory of Georgia showed hardwood removals up by 50 percent and a growth-removal ratio of 1.3:1.0 (Thompson 1989). In West-central Alabama, hardwood removals were up by 64 percent since 1982 and the growth-removal ratio was 1.1:1.0 (McWilliams and others 1990). In the Coastal Plain of North Carolina, hardwood removals increased by 58 percent since 1984 and the growth-removal relationship was 1.05:1.0 (Johnson 1990; Thompson [in press]). In most of these regions, the growth-removal ratio was close to 2.0:1.0 in the previous inventory of those areas.

TIMBER AVAILABILITY

From the data presented, we can see that hardwood inventories are substantial and are larger now than several decades ago. Much of this total inventory is not now and may never be available for wood products manufacturing. Factors affecting timber availability are complex and difficult to separate in terms of influence. About all we can do here is to briefly discuss some options for discounting the total inventory to account for portions of the inventory that may not be available for various reasons.

Factors affecting timber availability can be grouped into four major categories: (1) owner attitudes and characteristics, (2) physical constraints,

(3) public policy, and (4) monetary. Public policy would include regulations that affect harvesting and management practices plus cutting limits on public lands. Monetary factors are major ones because economics affects all the other factors to some degree. Only the first two factors of owner attitude and characteristics and physical constraints will be addressed here.

Owner Attitude and Characteristics

Since the owners of timberland ultimately determine whether their timber is harvested, information on characteristics of landowners and their attitudes toward timber harvesting should be important in order to assess timber supply potential. In a typical landowner survey, sample owners are asked questions about their general characteristics such as age, income, educational background, profession, and reasons for owning forest land. In addition, information is sought about their attitudes toward harvesting timber: Did they harvest timber in the past? Do they plan to harvest in the future? Such surveys have been conducted in many Northern States and more sporadically in the South (Birch 1983; Birch and others 1982; Carpenter and Hansen 1985; Carpenter and others 1986; Kingsley and Finley 1975; Rosson and Doolittle 1987; Widmann and Birch 1988).

In general, most surveys have found that the typical owner is well-educated, is older than the average for the general population, and has better-than-average income. People own forest land for a variety of reasons, but the production of timber is usually low on the list. Interestingly, many owners that give timber harvesting a low priority, have harvested timber or are not opposed to harvesting. A fairly low proportion of owners state that they have intentions of harvesting in the future.

Repeat surveys for the same State sometimes show significant shifts in owner intentions or harvest history. For example, in 1972, 53 percent of Vermont's landowners said they never intended to harvest timber from their land. In 1983, only 13 percent had similar intentions (Widmann and Birch 1988). Economics and the increase use of firewood as a fuel apparently swayed the views of these owners. Partly because of the potential for significant shifts in landowner attitudes, it is difficult to transform survey data on landowners into objective measures of timber availability.

Physical Constraints

Reasonably objective measures of timber availability can be provided by quantitative and qualitative descriptions of physical attributes associated with timberland. FIA inventories all include some descriptions of physical parameters that can be used to quantify potentially available timber supplies. The example presented here is taken from the latest inventories conducted in the Southeast--Florida, Georgia, North Carolina, South Carolina, and Virginia. Five factors we often use to estimate potential timber availability are:

- 1-Forest type
- 2-Distance to access road
- 3-Operability and percent slope
- 4-Distance to conflicting land use
- 5-Volume per acre.

We have used a stepwise screening process to discount the total hardwood sawtimber inventory in the Southeast to a volume that would probably be most available before considering whether owners would be willing to sell the timber (fig. 7). In the first step, the hardwood inventory found in pine stands, both planted and natural, were subtracted from the total inventory of 190 billion board feet. These hardwoods are often too scattered to justify their harvest. This step discounted the total by about 4 percent. In the next phase, the hardwood sawtimber in stands that are characterized by poor access or poor operability within the stand were excluded. Poor access includes stands lacking an access road within 1500 feet of the our sample plot. Poor operability was defined as all stands with a year-round excess of soil moisture or slopes of 60 percent or greater. This step removed 29 percent of the remaining hardwood sawtimber. Next, stands oriented in narrow strips and stringers such as along narrow meandering streams were excluded. About 20 percent of the residual hardwood sawtimber in the previous step dropped out. In the fourth step, the recognized conflicting land uses include urban buildup, lakes and seashores, rivers and streams, and major highways. Volume in stands less than 200 feet from these land uses were omitted. This approach simulates the retention of timber in buffer strips around these land uses. An additional 8 percent of the remaining sawtimber was excluded. In the fifth step, the hardwood volume in stands with less than 4000 board feet per acre was excluded. The 4000 board foot criterion is arbitrary, but it leaves stands where logging prospects are economically attractive. More than 17 percent of the remaining inventory was excluded in this step. In the final step, a non-physical parameter--ownership--was used to further discount the inventory to that most likely to be available if one were only interested in the inventory on NIPF ownership. The final discounted figure, 64 billion board feet, represents only one-third of the regional hardwood sawtimber.

With differing assumptions about limiting distances, volume per acre, and other constraints, larger or smaller estimates can be generated. Here we mean to demonstrate primarily that the entire inventory is not equally available for harvest, and that discounting is a promising way to account for differences in physical availability. Perhaps the primary weakness of the demonstrated approach is that it removes entire segments of the inventory rather than proportions of these segments. Steep slopes, for example, do not entirely preclude timber harvests. They make harvests more difficult, less likely, and less frequent.

Repeated inventories provide valuable opportunities to provide a quantitative basis for assessing the factors that affect timber supply. We can provide this needed information by correlating timber removals measured during remeasurements of permanent plots with the classification of potential supply factors made during the previous inventory. Other opportunities exist for improving the types of physical constraint data available. Two such items are presently being tested by the Forest Inventory and Analysis Unit in the Southeast. One is the identification of tract size (the acreage of the tract the sample plot is in) from public records. If this information can be collected in a high proportion of the counties, it will become a standard collection item. Another classification will provide a much-needed characterization of the landscape surrounding each permanent sample location. This effort is aimed toward identifying areas characterized by low-density residential development such as mountain vacation homes.

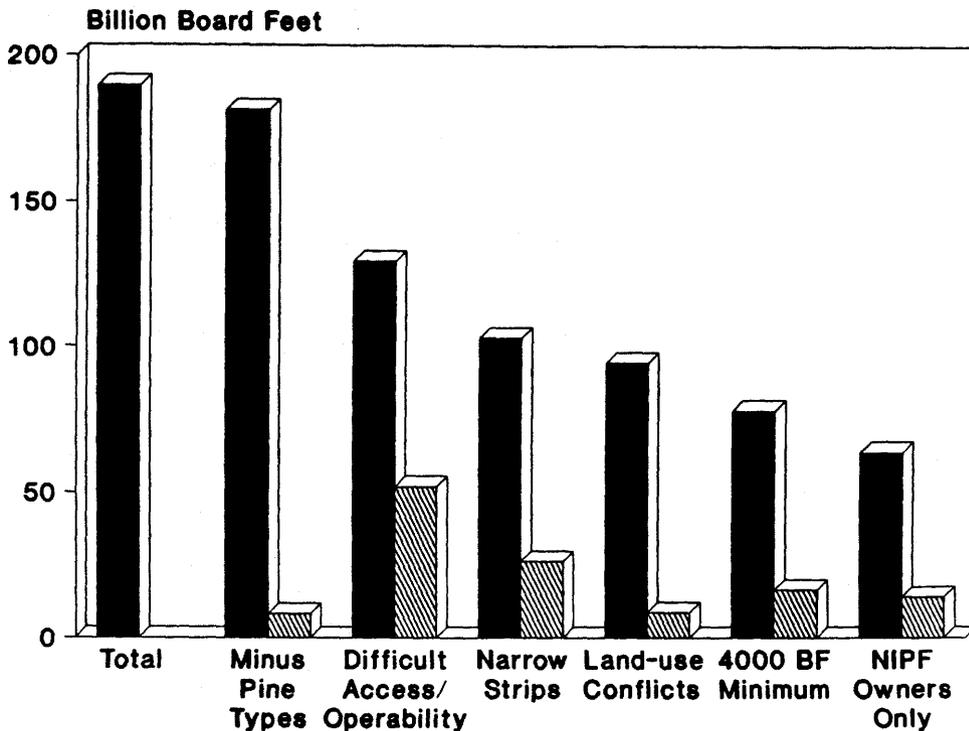


Figure 7.--Example discount of the hardwood sawtimber inventory in the Southeast based on selected physical constraints.

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