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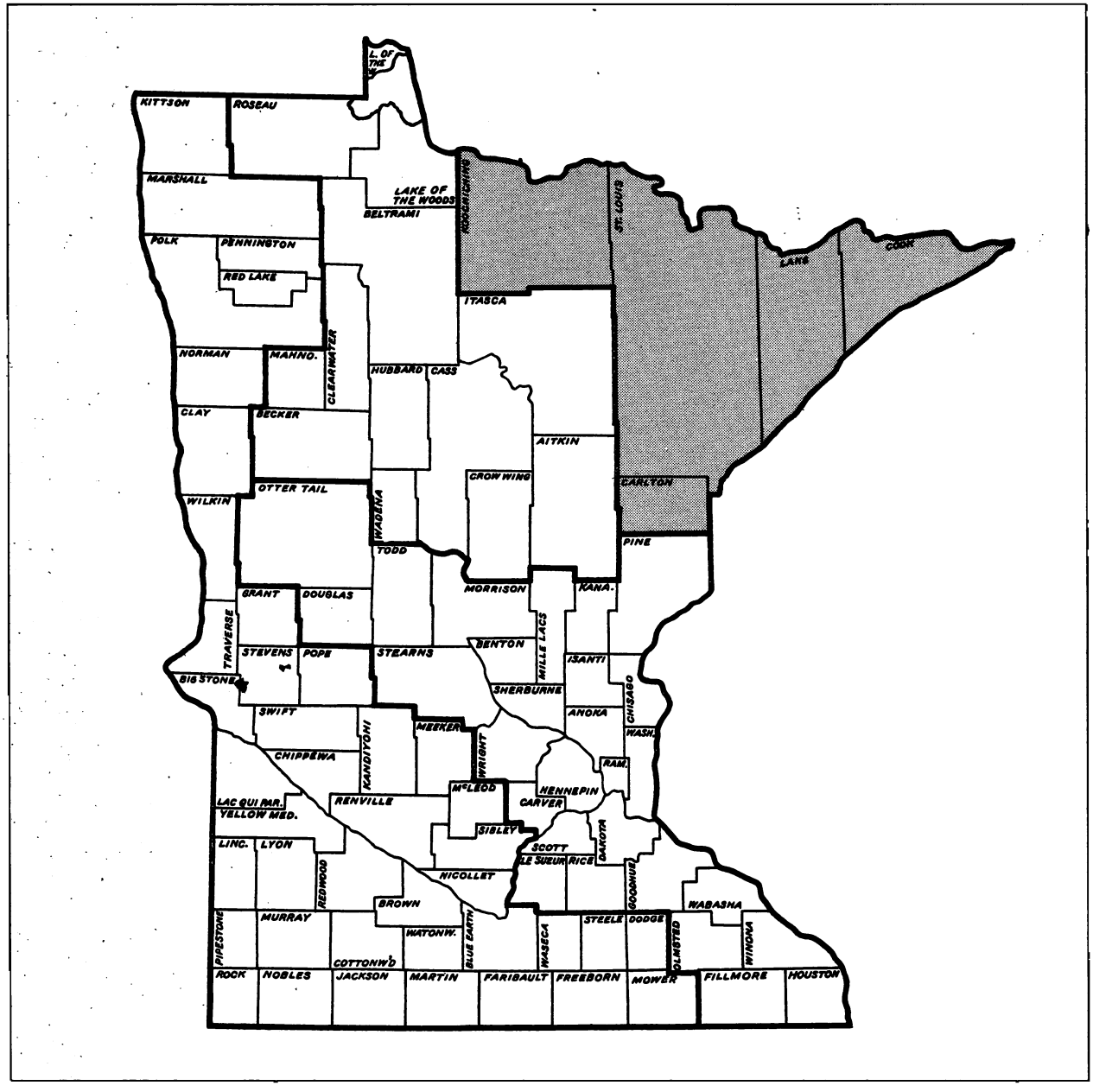
Timber resource of Minnesota's aspen-birch unit, 1977.

John S. Spencer, Jr., and Arnold J. Ostrom



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FOREWORD

Resources Evaluation (formerly called Forest Survey) is a continuing endeavor as mandated by the Forest and Rangeland Renewable Resources Planning Act of 1974, which was preceeded by the McSweeney-McNary Forest Research Act of 1928. Its objective is to periodically inventory the Nation's forest land to determine its extent, condition, and volume of timber, growth, and depletions. This kind of up-to-date information is essential to frame intelligent forest policies and programs. USDA Forest Service regional experiment stations are responsible for conducting these inventories and publishing summary reports for individual States. The North Central Forest Experiment Station is responsible for Resources Evaluation work done in Michigan, Wisconsin, Minnesota, North Dakota, eastern South Dakota (east of 103rd meridian), Nebraska, Iowa, Illinois, Indiana, Missouri, and Kansas.

Fieldwork for the 1977 Minnesota Forest Survey began in July 1974 and was completed in July 1978. Reports on the three previous surveys of Minnesota's timber resource are dated 1936, 1953, and 1962.

The 1977 Minnesota survey data have been adjusted to take into account expansion of the reserved portion of the Boundary Waters Canoe Area (BWCA). The Bill that increased the reserved portion of the BWCA was not passed by Congress until the fall of 1978. The adjustments were made so that the data are as current as possible.

Similar Resource Bulletins containing statistical highlights and detailed tables on the timber resource of the other Survey Units in Minnesota (see cover) are available. These will provide the basis for a comprehensive analysis of the timber resource of the entire State which will be published as a separate report.

More accurate survey information was obtained during the 1977 survey than otherwise would have been feasible because of intensified field sampling made possible by funding and manpower provided the North Central Station by the State Legislature through the Minnesota Department of Natural Resources. The Department also assisted in a canvass of primary wood-using plants in the State, which was used to help estimate the quantity of timber products harvested in Minnesota.

Aerial photos used in the Aspen-Birch Unit survey were furnished by the Superior National Forest, Minnesota Department of Natural Resources, Lake County Land Commissioner's Office, and Boise Cascade Company.

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TIMBER RESOURCE OF MINNESOTA'S ASPEN-BIRCH UNIT, 1977

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HIGHLIGHTS

Forest Area

- Forest land occupies 7.5 million acres in 1977 (87 percent of the Unit's land area) as compared to 7.8 million acres (88 percent) in 1962.[1]

- Commercial forest land accounts for 5.5 million acres (73 percent of the total forest area), a decline of 13 percent from the 6.2 million acres in 1962 (80 percent of total forest area).

- The area of productive-reserved forest increased from 0.4 million acres in 1962 to 1.1 million acres (a 162 percent increase), due largely to the creation of Voyageurs National Park and to the addition of the Portal Zone (former commercial forest) to the completely reserved Boundary Waters Canoe Area on the Superior National Forest.

- St. Louis County contains the Unit's largest area of commercial forest (2.5 million acres) followed by Koochiching County (1.3 million), and Lake County (0.9 million).

- In terms of proportion of forest land to total land, Cook County is the most heavily forested (99 percent), and Carlton County is the least heavily forested (61 percent).

- Sixty-six percent (3.6 million acres) of the commercial forest land in the Unit is in public ownership (fig. 1); the Superior National Forest is the largest owner (1.2 million acres).

- The aspen forest type dominated the commercial forest in 1977 with 1.9 million acres (36 per-

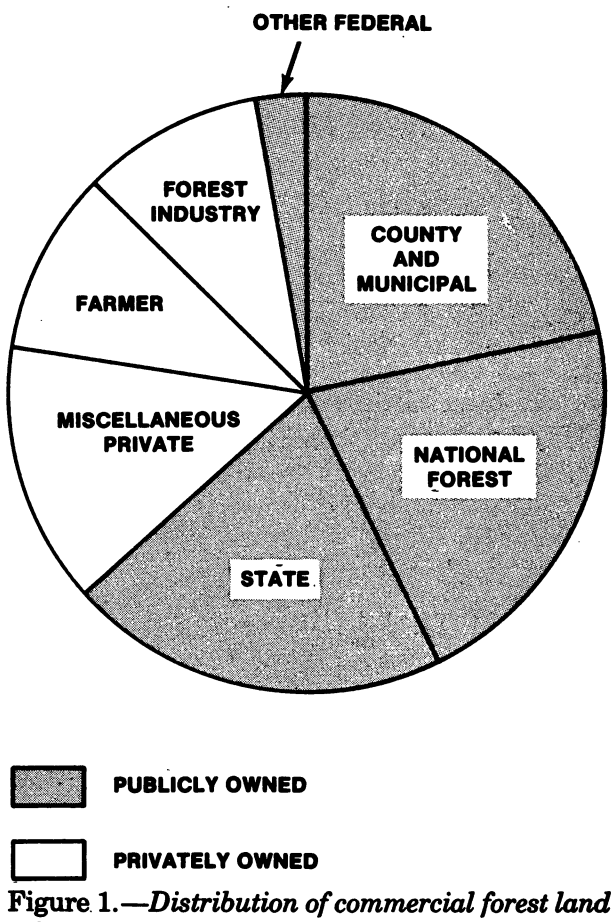

Figure 1.—*Distribution of commercial forest land by ownership class, Aspen-Birch Unit, Minnesota, 1977.*

[1] *1962 statistics have been adjusted from those published after the 1962 survey to conform to 1977 statistics because of changes in survey unit boundaries and in procedures and definitions. (See Comparing Minnesota's Fourth Forest Survey with the Third Survey in Appendix.)*

cent of the commercial forest). In 1962 the aspen type accounted for 2.1 million acres (33 percent).

• Poletimber stands constitute the largest stand-size class, 52 percent of the commercial forest area.

• Thirteen percent (1.0 million acres) of the Unit's forest land is classed as unproductive.

Timber volume

• Although commercial forest area declined between surveys, growing-stock volume increased from 4.2 billion cubic feet in 1962 to 4.5 billion cubic feet in 1977, a 6 percent gain (fig. 2).

• Sawtimber volume increased from 5.7 billion board feet in 1962 to 8.3 billion board feet in 1977 (a 45 percent increase).

• Forty-eight percent of the Unit's growing-stock volume is in St. Louis County (2.2 billion cubic feet).

• Aspen accounts for 1.4 billion cubic feet, 31 percent of the 1977 growing-stock volume. In 1962 aspen accounted for 1.2 billion cubic feet (29 percent).

• Twenty-seven percent of the Unit's growing-stock volume is on Superior National Forest land (1.2 billion cubic feet). County and municipal owners account for the next largest volume (0.9 billion cubic feet).

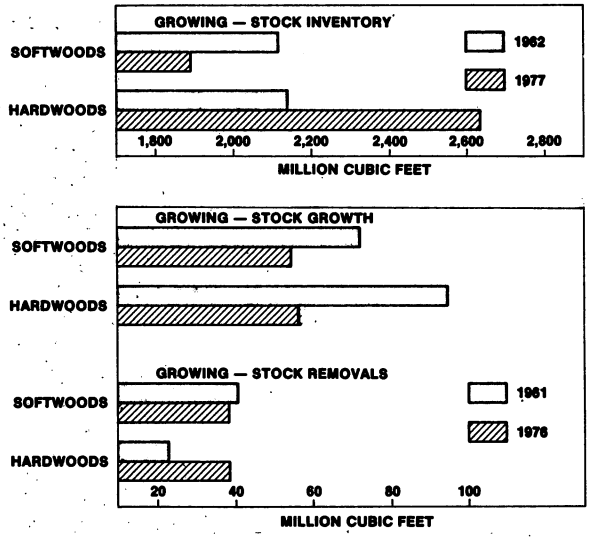

Figure 2.—*Growing-stock inventory, net annual growth, and removals, by softwoods and hardwoods, Aspen-Birch Unit, Minnesota, 1962 to 1977.*

• Forty-eight percent of the growing-stock volume is in stands aged 41 to 60 years.

• The average growing-stock volume per acre in 1977 is 830 cubic feet (10.5 cords per acre),compared to 680 cubic feet (8.6 cords per acre) in 1962, a 22 percent increase.

• The volume of cull trees (rough, rotten, and short-log cull) is 391 million cubic feet; salvable dead trees total 27 million cubic feet.

Stand Conditions

• Net annual growth on growing-stock trees was 115 million cubic feet (1.5 million cords) in 1976, compared with 163 million cubic feet (2.1 million cords) in 1961.

• Net annual growth rate of growing stock was 2.5 percent of inventory. The growth rate for softwoods (3.0 percent) was higher than that for hardwoods (2.2 percent).

• Net growth averaged 21.1 cubic feet per acre in 1976, compared with 26.1 in 1961.

• Average annual mortality of growing-stock trees was 55 million cubic feet in 1976; disease accounted for 59 percent of it.

• Mortality of growing-stock trees averaged 1.2 percent of inventory.

• Fifty-eight percent of the commercial forest area is capable of growing trees 50 feet and taller at age 50, but only 12 percent is capable of growing trees 70 feet and taller at the same age.

• Fifty-seven percent of the commercial forest is in stands 50 years of age or younger.

Timber Use

• Timber removals from growing stock totaled 77 million cubic feet (1.0 million cords) in 1976—39 million cubic feet of softwoods and 38 million of hardwoods.

• Growing-stock removals[2] in 1976 represented a 21 percent increase over removals in 1962 (64 million cubic feet).

[2]*Removals in 1976 are trend level removals. "Other" removals from transfer of commerical forest land to productive-reserved are not included in 1976 removals.*

- Forty-four percent of growing-stock removals came from St. Louis County (34 million cubic feet); 36 percent from Koochiching County (28 million cubic feet).

- Thirty-eight percent of the growing-stock removals came from private, nonindustrial lands.

- Timber products output totaled 79 million cubic feet in 1975; 64 million cubic feet of it in pulpwood alone.

- Primary plant residue totaled 3.6 million cubic feet in 1975, of which 1.0 million cubic feet were not utilized.

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PRINCIPAL TREE SPECIES IN MINNESOTA'S ASPEN-BIRCH UNIT[3]

SOFTWOOD SPECIES

Eastern white pine ..... *Pinus strobus*
Red pine ..... *Pinus resinosa*
Jack pine ..... *Pinus banksiana*
Black spruce ..... *Picea mariana*
White spruce ..... *Picea glauca*
Balsam fir ..... *Abies balsamea*
Tamarack ..... *Larix laricina*
Northern white-cedar ..... *Thuja occidentalis*
Other softwoods:
  Eastern redcedar ..... *Juniperus virginiana*

HARDWOOD SPECIES

White oaks
  White oak ..... *Quercus alba*
  Bur oak ..... *Quercus macrocarpa*
Select red oaks
  Northern red oak ..... *Quercus rubra*
Yellow birch ..... *Betula alleghaniensis*
Hard maples
  Black maple ..... *Acer nigrum*
  Sugar maple ..... *Acer saccharum*

[3]*The common and scientific names are based on: Little, Elbert L., Jr. 1953. Check list of native and naturalized trees of the United States (including Alaska). U.S. Dep. Agric., Agric. Handb. 41, 472 p.*

Soft maples
- Red maple ..... *Acer rubrum*
- Silver maple ..... *Acer saccharinum*

Ashes
- Black ash ..... *Fraxinus nigra*
- Green ash ..... *Fraxinus pennsylvanica*

Balsam poplar ..... *Populus balsamifera*
Paper birch ..... *Betula papyrifera*
Bigtooth aspen ..... *Populus grandidentata*
Quaking aspen ..... *Populus tremuloides*
Basswood ..... *Tilia americana*

Elms
- American elm ..... *Ulmus americana*
- Slippery elm ..... *Ulmus rubra*
- Rock elm ..... *Ulmus thomasii*

Select hardwoods
- Black cherry ..... *Prunus serotina*

Other hardwoods
- Boxelder ..... *Acer negundo*
- Eastern cottonwood ..... *Populus deltoides*
- Black willow ..... *Salix nigra*

APPENDIX

ACCURACY OF SURVEY

Resources Evaluation information is based on a sampling procedure designed to provide reliable statistics at the State and Survey Unit levels. Consequently, the reported figures are only estimates. However, a measure of reliability of these figures is given by sampling errors. These sampling errors may be interpreted as meaning that the chances are two out of three that if a 100-percent inventory had been taken, using the same methods, the results would have been within the limits indicated.

For example, the estimated area of commercial forest land in the Aspen-Birch Unit in 1977, 5,451.4 thousand acres, has a sampling error of ±0.32 percent (±17.4 thousand acres). The chances are two out of three that the commercial forest area from a 100-percent inventory, then, would fall between 5,468.8 and 5,434.0 thousand acres (5,451.4 ±17.4).

Sampling errors were calculated separately for National Forest land and other land, reflecting the higher sampling intensity on other land. For example, the sampling error for growing-stock inventory on National Forest land is ±6.20 percent, but on other land it is ±1.39 percent.

The following sampling errors are a combination of National Forest and other land sampling errors for total estimated volume, net growth, and removals for both growing stock and sawtimber, and for area of commercial forest land during the 1977 Aspen-Birch Unit survey:

Item	Aspen-Birch Unit totals	Sampling error (percent)
Growing stock:		
Volume	4,522.1 MM cubic feet	1.97
Growth	114.9 MM cubic feet	3.05
Removals	77.2 MM cubic feet	4.56
Sawtimber:		
Volume	8,324.6 MM board feet	3.52
Growth	378.1 MM board feet	4.04
Removals	178.0 MM board feet	3.60
Commercial forest land:	5,451.4 M acres	0.32

As survey data are broken down into units smaller than State or Survey Unit totals, the sampling error increases (table 54). The smaller the breakdown, the larger the sampling error. For example, the sampling error for area of commercial forest land in a particular county is higher than that for total commercial forest area in the Survey Unit.

SURVEY PROCEDURES

The major steps in the survey of the Aspen-Birch Unit were as follows:

1. A total of 36,109 1-acre points distributed systematically across aerial photos of the entire area, except the Superior National Forest, were observed. To make a preliminary estimate of forest area these points were classified as either forest land (25,086), unproductive forest land (2,213), nonforest land (7,647), or questionable (1,163). Next, all 25,086 of the forest points, 289 of the unproductive forest points, and all 1,163 questionable points were stereoclassified as to forest type, stand-size class, and density. Then 3,420 points classed as forest, 289 points classed as unproductive, and 157 points classed as questionable were examined on the ground to correct the preliminary area estimate for errors in classification and for actual changes in land use since the photos were taken. At each of the 3,093 commercial forest locations, 10-point variable-radius plots (basal area factor 37.5) were established uniformly over the sample acre. Tree measurements made on these plots were the basis for estimates of timber volume, growth, mortality, number of trees, and other forest classifications.

2. Area statistics for the Superior National Forest were prepared by the Forest Timber Management staff from compartment examination records. Volume data for Superior National Forest lands were prepared by Forest Timber Management staff using permanent sample plots established by Forest personnel. Superior National Forest data, then, were added to data for the rest of the State computed from 10-point variable-radius plot information.

3. Growth, mortality, and cull increment on all commercial forest land except the Superior National Forest were estimated using the Forest Resources Evaluation Program (FREP)[4], which is an individual tree-growth projection system that uses stand characteristics such as tree diameter to estimate tree volumes.

4. Statistics on timber utilization during 1975 were obtained from mill surveys. The Minnesota Department of Natural Resources and the North Central Forest Experiment Station canvassed resident sawmills, veneer mills, and other primary wood-using plants. The North Central Forest Experiment Station canvassed resident pulpmills as well as out-of-State sawmills, pulpmills, and veneer mills to determine their use of timber from Minnesota. Fuelwood and fencepost output was based on a sample of private landowners to determine their production of fuelwood and fenceposts and on a canvass of industrial and public timber owners. Estimates of primary mill residue used for fuelwood were obtained from the canvass of Minnesota primary wood-using plants. Timber cut for products by ownership class was determined by a canvass of all public and industrial timber owners. The portion of timber cut unaccounted for by the latter owners was grouped under "farmer and other owners".

5. To develop wood utilization factors used in converting timber products output to timber removals for saw logs and pulpwood, 1,028 felled trees throughout the State were measured during 1975-1976. Factors for veneer logs were obtained during the 1967-1968 Wisconsin utilization study. Factors for all other products were obtained during the 1960-1961 Minnesota utilization study.

6. Field data were sent to St. Paul, Minnesota, for editing and compilation.

COMPARING MINNESOTA'S FOURTH FOREST SURVEY WITH THE THIRD SURVEY

Data from new forest surveys are often compared with data from earlier forest surveys to determine trends in forest areas and volumes. Changes in procedures and definitions between surveys make it necessary to adjust earlier survey data so they are comparable to data from the new survey.

In Minnesota's Aspen-Birch Unit, published 1962 commercial forest area was adjusted to take into account changes in the Unit boundaries between surveys. Then, a portion of the 1962 commercial forest area was withdrawn and added to unproductive forest (noncommercial) and to nonforest to allow for changes in the method of determining these land uses. The result, an adjusted 1962 commercial forest area, appears in the tables presented in this report.

Original estimates of 1962 inventory, growth, mortality, and removals were based on the original, unadjusted 1962 commercial forest area.

[4]*For more information on FREP, see: U.S. Department of Agriculture, Forest Service. 1979. A generalized forest growth projection system for the Lake States Region. U.S. Dep. Agric. For. Serv., Gen. Tech. Rep. NC-49, 96 p. U.S. Dep. Agric. For. Serv., North Cent. For. Exp. Stn., St. Paul, MN.*

However, because the 1962 commercial forest area was adjusted to take into account changes in survey methods, the estimates of inventory, growth, mortality, and removals for the year must also reflect these changes. Volume adjustments were made by estimating inventory, growth, mortality, and removals on the unproductive forest and nonforest lands originally classed as commercial forest in 1962, and subtracting these volumes from the original State 1962 estimates.

A test was made to ensure that it was possible to move from the adjusted 1962 volumes to the new 1977 volumes by means of Timber Resource Analysis System (TRAS), a Forest Service computer program for updating, backdating, and projecting timber volume, growth, mortality, and removals. In order for the program to work most effectively, the 2 years to be reconciled must have comparable commercial forest land bases so the changes in volumes between surveys reflect actual changes in forest conditions or land use. To achieve this condition it was necessary to make further adjustments in 1962 data so that land transferred from commercial forest to productive-reserved between the two surveys does not appear in the 1962 land base. If this adjustment were not made, removals between 1962 and 1977 would appear artificially high in order to absorb the loss of timber from this change in land status. This adjustment is made for the test only; area and volumes removed for the test are added back into the 1962 reported data.

TRAS recalculated 1962 volumes using 1977 estimates of cubic foot volume per tree and board foot-cubic foot ratios. This volume adjustment was necessary so that differences in volumes between surveys reflected actual change and not merely a change in the volume equations used on each occasion.

When the final adjustments of 1962 data were completed, the resulting 1962 volumes and area were distributed among the four Survey Units. A check was made by hand to ensure that it was possible to move from the adjusted 1962 volumes to the new 1977 volumes in each Unit. This was done using the average periodic difference between growth and removals for the two surveys and applying this difference to the 1962 volume. Next, the same procedure was repeated for each individual species within each Unit to make certain inventory volumes reported for each species were consistent with reported growth and removals volumes.

Removals estimates for 1962 and 1977 are for total removals, including timber cut in addition to "other" removals, and are trend level removals. "Other" removals from transfer of commercial forest land to productive-reserved are not included. Previously published 1962 estimates are of timber cut only, and do not include "other" removals. TRAS generated an estimate of what "other" removals must have been in 1962 to provide the adjusted 1962 total removals.

METRIC EQUIVALENTS OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hectare.

1,000 acres = 405 hectares.

1,000 board feet (International ¼-inch log rule) = 3.48 cubic meters.

Breast height = 1.4 meters above the ground.

1 cubic foot = 0.0283 cubic meter.

1 foot = 30.48 centimeters or 0.3048 meter.

1 inch = 25.4 millimeters or 2.54 centimeters or 0.0254 meter.

DEFINITION OF TERMS

Land-use Classes

Gross area.—The entire area of land and water as determined by the Bureau of Census, 1970.

Land area.—The area of dry land and land temporarily or partially covered by water such as marshes, swamps, flood plains, streams, sloughs, and estuaries. Canals less than 1/8-mile wide, and lakes, reservoirs, and ponds smaller than 40 acres are included as land area. These figures are from the Bureau of Census, 1970.

Forest land.—Land at least 16.7 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Includes afforested areas. The minimum forest area classified was 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas were classed as forest if less than 120 feet wide.

Commercial forest land.—Forest land that is producing or is capable of producing crops of industrial wood and that is not withdrawn from timber utilization by statute or administrative regulation. This includes areas suitable for management to grow crops of industrial wood generally of a site quality capable of producing in excess of 20 cubic feet per acre of annual growth. This includes both inaccessible and inoperable areas.

Noncommercial forest land.—(a) Unproductive—forest land incapable of yielding crops of industrial wood because of adverse site conditions, (b) Productive-reserved—forest land withdrawn from commercial timber use through statute or administrative regulation, or exclusively used for Christmas tree production.

Nonforest land.—Land that has never supported forests, and land formerly forested where forest use is precluded by development for nonforest uses, such as cropland, improved pasture, residential areas, and city parks. Also includes improved roads and adjoining rights-of-way, powerline clearings, and certain areas of water classified by the Bureau of Census as land. Unimproved roads, streams, canals, and nonforest strips in forest areas must be more than 120 feet wide, and clearings in forested areas must be more than 1 acre in size, to qualify as nonforest land.

Ownership Classes

National forest.—Federal land that has been designated by executive order or statute as National Forests or purchase units, and other land under the administration of the USDA Forest Service.

Other Federal.—Federal land other than National Forest.

State, county, and municipal.—Land owned by States, counties, or local public agencies, or land leased by them for more than 50 years.

Forest industry.—Land owned by companies or individuals operating primary wood-using plants.

Farmer-owned.—Land owned by operators of farms. A farm must include 10 or more acres from which the sale of agricultural products totals $50 or more annually, or if less than 10 acres, the yield must be at least $250 annually.

Farmer-owned, leased.—Land owned by an operator of a farm but leased to another party.

Miscellaneous private-corporation.—Land owned by a private corporation not in the business of operating primary wood-using plants.

Miscellaneous private-individual.—Land owned by a private individual.

Miscellaneous private-corporation, leased.—Land owned by a private corporation but leased to another party.

Miscellaneous private-individual, leased.—Land owned by a private individual but leased to another party.

Tree Classes

All live trees.—Growing-stock, rough, and rotten trees 1 inch d.b.h. and larger.

Growing-stock trees.—All live trees of commercial species except rough and rotten trees.

Desirable trees.—Growing-stock trees having no serious defects in quality limiting present or prospective use, and of relatively high vigor and containing no pathogens that may kill or seriously deteriorate them before rotation age. These are trees that would be favored by forest managers in silvicultural operations.

Acceptable trees.—Trees meeting the standards for growing stock but not qualifying as desirable trees.

Sawtimber trees.—Growing-stock trees of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs, each 8 feet or longer. At least 33 percent of the gross volume of the tree must be sound wood. Softwoods must be at least 9.0 inches d.b.h. and hardwoods must be at least 11.0 inches.

Poletimber trees.—Growing-stock trees of commercial species at least 5.0 inches d.b.h. but smaller than sawtimber size and of good form and vigor.

Saplings.—Live trees of commercial species 1.0 to 5.0 inches d.b.h. and of good form and vigor.

Seedlings.—Live trees of commercial species less than 1.0 inch d.b.h. that are expected to survive according to regional standards. (Examples of seedlings not expected to survive are those that are diseased or heavily damaged by logging, browsing, or fire.) Only softwood seedlings more

than 6 inches and hardwood seedlings more than 1 foot tall are counted.

Rotten trees.—Live trees (any size) of commercial species that do not contain a merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of rot (that is, when more than 50 percent of the cull volume of the tree is rotten).

Rough trees.—Live trees that do not contain at least one merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of roughness and poor form, as well as all live noncommercial species.

Short-log (rough trees).—Sawtimber-sized trees of commercial species that contain at least one merchantable 8- to 11-foot saw log but not a 12-foot saw log.

Stocking

The degree of utilization of land by trees as measured in terms of basal area and/or the number of trees in a stand compared to the basal area and/or number of trees required to fully utilized the growth potential of the land.

A stocking percent of 100 indicates full utilization of the site and is equivalent to 80 square feet of basal area per acre in trees 5 inches d.b.h. and larger. In a stand of trees less than 5 inches d.b.h., a stocking percent of 100 would indicate that the present number of trees is sufficient to produce 80 square feet of basal area per acre when the trees reach 5 inches d.b.h.

Stocking of all live trees, growing-stock trees, and desirable trees are recorded separately and stands are grouped into the following stocking classes.

Stocking Classes

Overstocked stands.—Stands in which stocking of trees is 133 percent or more.

Fully-stocked stands.—Stands in which stocking of trees is from 100 to 133 percent.

Medium-stocked stands.—Stands in which stocking of trees is from 60 to 100 percent.

Poorly-stocked stands.—Stands in which stocking of trees is from 16.7 to 60 percent.

Nonstocked areas.—Commercial forest land on which stocking of trees is less than 16.7 percent.

Stand-size Classes

Stand.—A growth of trees on a minimum of 1 acre of forest land that is stocked by forest trees of any size.

Sawtimber stands.—Stands at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber or poletimber trees and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands.—Stands at least 16.7 percent stocked with growing-stock trees, and with half or more of this stocking in sawtimber and/or poletimber trees and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands.—Stands at least 16.7 percent stocked with growing-stock trees and with saplings and/or seedlings comprising more than half of this stocking.

Nonstocked areas.—Commercial forest land on which stocking of growing-stock trees is less than 16.7 percent.

Other Classifications

Site index.—An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Site classes.—A classification of forest land in terms of inherent capacity to grow crops of industrial wood expressed in cubic-foot growth per acre per year.

Stand-age.—Age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Basal area.—The area in square feet of the cross section at breast height of a single tree. When the basal area of all the trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Forest Types

A classification of forest land based upon the species forming a plurality of live-tree stocking. Major forest types in Minnesota are:

Jack pine.—Forests in which jack pine comprises a plurality of the stocking. (Common associates include eastern white pine, red pine, aspen, birch, and maple.)

Red pine.—Forests in which red pine comprises a plurality of the stocking. (Common associates include eastern white pine, jack pine, aspen, birch, and maple.)

White pine.—Forests in which eastern white pine comprises a plurality of the stocking. (Common associates include red pine, jack pine, aspen, birch, and maple.)

Balsam fir.—Forests in which balsam fir comprises a plurality of stocking. (Common associates include white spruce, aspen, maple, birch, northern white-cedar, and tamarack.)

White spruce.—Forests in which white spruce comprises a plurality of the stocking. (Common associates include balsam fir, aspen, maple, birch, northern white-cedar, and tamarack.)

Black spruce.—Forests in which swamp conifers (black spruce, tamarack, and northern white-cedar) comprise a plurality of live-tree stocking, with black spruce the most common.

Northern white-cedar.—Forests in which swamp conifers comprise a plurality of live-tree stocking, with northern white-cedar the most common.

Tamarack.—Forests in which swamp conifers comprise a plurality of live-tree stocking, with tamarack the most common.

Oak.—Forests in which northern red oak, white oak, or bur oak, singly or in combination, comprise a plurality of the stocking. (Common associates include elm, maple, and aspen.)

Elm-ash-cottonwood.—Forests in which lowland elm, ash, cottonwood, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include basswood and balsam poplar.)

Maple-basswood.—Forests in which sugar maple, basswood, yellow birch, upland American elm, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include white pine and elm.)

Aspen.—Forests in which quaking aspen or bigtooth aspen, singly or in combination, comprise a plurality of the stocking. (Common associates include balsam poplar, balsam fir, and paper birch.)

Paper birch.—Forests in which paper birch comprises a plurality of the stocking. (Common associates include maple, aspen, and balsam fir.)

Balsam poplar.—Forests in which balsam poplar comprises a plurality of the stocking. (Common associates include aspen, elm, and ash.)

Timber Volume

Volume of growing stock.—The volume of sound wood in the bole of growing-stock trees 5.0 inches d.b.h. and over, from a 1-foot stump to a minimum of 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs. Growing-stock volumes are shown in cubic feet. Conversion to cords may be accomplished by a factor of 79 cubic feet per solid wood cord.

Volume of sawtimber.—Net volume of the saw log portion of live sawtimber trees in board feet, International ¼-inch rule, from stump to a minimum 7 inches top diameter outside bark for softwoods and 9 inches for hardwoods.

Upper stem portion.—That part of the bole of sawtimber trees above the merchantable sawtimber top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

Growth and Mortality

Net volume growth of growing stock.—Net annual growth of growing stock is the change in volume of sound wood that occurred during 1976 in growing-stock trees that were 5.0 inches d.b.h. or larger at the beginning of the year,

plus

the volume of sound wood in growing-stock trees smaller than 5.0 inches d.b.h. at the beginning of the year that grew sufficiently during the year to be reclassified into the 5.0-inch-or-larger d.b.h. classes (ingrowth),

plus

the volume of sound wood in trees that had been classified either as rough or rotten trees at the beginning of the year but were reclassified during the year as growing-stock trees,

plus

the annual change in volume of sound wood that occurred during the year on growing-stock trees that died during the year,

plus

the annual change in volume of sound wood that occurred in growing-stock trees included among timber removals for the year,

plus

the annual change in volume of sound wood in trees that had been classified as growing stock at the beginning of the year but were reclassified during the year as rotten or rough trees. Only the volume change that occurred during the portion of the year the trees were classified as growing stock was included,

minus

the volume of sound wood in growing-stock trees that died from natural causes during the year,

minus

the volume of sound wood in trees that had been classified as growing stock at the beginning of the year, but were reclassified during the year as rough or rotten trees.

Net annual growth of sawtimber.—Net annual growth of sawtimber is the change in volume of sound wood that occurred during 1976 in trees that were sawtimber size at the beginning of the year,

plus

the volume of sound wood in growing-stock trees smaller than sawtimber size at the beginning of the year that grew sufficiently during the year to be classified as sawtimber trees (ingrowth),

plus

the volume of sound wood in trees that had been classified either as rough or rotten trees at the beginning of the year, but were reclassified during the year as sawtimber trees,

plus

the annual change in volume of sound wood that occurred during the year on sawtimber trees that died during the year.

plus

the annual change in volume of sound wood that occurred in sawtimber trees included among timber removals for the year.

plus

the annual change in volume of sound wood in trees that had been classified as sawtimber trees at the beginning of the year, but were reclassified during the year as rough or rotten trees. Only the volume change that occurred during the portion of the year the trees were classified as sawtimber was included,

minus

the volume of sound wood in trees that had been classified as sawtimber trees that died from natural causes during the year, and

minus

the volume of sound wood in trees that had been classified as sawtimber trees at the beginning of the year, but were reclassified during the year as rough or rotten trees.

Mortality of growing stock.—The volume of sound wood in growing-stock trees dying annually from natural causes. Natural causes include fire, insects, disease, animal damage, weather, and suppression.

Mortality of sawtimber.—The net board-foot volume of sawtimber trees dying annually from natural causes.

Timber Removals

Timber removals from growing stock.—The volume of sound wood in growing-stock trees removed annually for forest products (including roundwood products and logging residues) and for other removals. Roundwood products are logs, bolts, or other round sections cut and used from trees. Logging residues are the unused portions of cut trees plus unused trees killed by logging. Other removals are growing-stock trees removed but not utilized for products or trees left standing but "removed" from the commercial forest land classification by land use change—examples are removals from cultural operations such as timber stand improvement work, land clearing, and changes in land use.

Timber removals from sawtimber.—The net board-foot volume of live sawtimber trees removed for forest products annually (including roundwood products and logging residues) and for other removals.

Timber products output.—All timber products cut from roundwood, and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary manufacturing plants include slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulpmills that are used as pulpwood chips or other products.

Plant byproducts.—Wood products, such as pulpwood chips, obtained incidental to production of other manufactured products.

Plant residues.—Wood materials from manufacturing plants not utilized for some product.

Table 1.—*Area of land by land class, Aspen-Birch Unit, Minnesota, 1962*[1] *and 1977*
(In thousand acres)

Land class	1962	1977
Commercial forest land:		
Jack pine	395.6	165.7
Red pine	117.0	114.4
White pine	85.2	33.8
Balsam fir	669.2	626.0
White spruce	48.8	60.1
Black spruce	824.7	745.7
Northern white-cedar	206.5	317.8
Tamarack	151.9	157.6
Oak	2.3	5.4
Elm-ash-cottonwood	224.6	243.7
Maple-basswood	161.4	214.5
Aspen	2,070.8	1,947.4
Paper birch	496.5	546.3
Balsam poplar	207.2	208.0
Nonstocked	582.3	65.0
Subtotal	6,244.0	5,451.4
Noncommercial forest land:		
Unproductive	1,125.4	969.8
Productive-reserved	400.9	1,050.6
Subtotal	1,526.3	2,020.4
Nonforest land:	1,064.9	1,161.6
Total	8,835.2	8,633.4

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 estimates due to changes in survey procedures and definitions.

Table 2.—*Area of land by land use class and county, Aspen-Birch Unit, Minnesota, 1977*
(In thousand acres)

Land class	All counties	Carlton	Cook	Koochiching	Lake	St. Louis
Forest land:						
Commercial	5,451.4	312.8	538.8	1,278.9	855.3	2,465.6
Productive-reserved	1,050.6	11.1	292.5	12.9	313.0	421.1
Unproductive	969.8	12.2	21.6	502.5	88.8	344.7
Total forest	7,471.8	336.1	852.9	1,794.3	1,257.1	3,231.4
Nonforest land:						
Nonforest with trees:						
Improved pasture with trees	4.8	—	—	1.7	—	3.1
Wooded strips	10.6	2.8	—	1.3	—	6.5
Idle farmland with trees	1.6	—	—	—	—	1.6
Windbreaks	13.5	2.8	—	2.4	—	8.3
Wooded pasture	23.3	4.4	—	2.8	—	16.1
Total nonforest with trees	53.8	10.0	—	8.2	—	35.6
Nonforest without trees:						
Cropland without trees	357.1	92.4	.5	80.3	3.4	180.5
Improved pasture without trees	67.6	11.1	.5	19.5	5.4	31.1
Idle farmland without trees	15.4	2.8	—	2.8	—	9.8
Marsh	350.6	58.6	3.9	62.3	34.4	191.4
Other	33.6	12.6	.9	7.0	1.9	11.2
Urban and other	283.5	28.2	2.7	26.9	17.6	208.1
Total nonforest without trees	1,107.8	205.7	8.5	198.8	62.7	632.1
Total nonforest	1,161.6	215.7	8.5	207.0	62.7	667.7
Total land area[1]	8,633.4	551.8	861.4	2,001.3	1,319.8	3,899.1
Census water	715.1	7.6	129.3	29.4	152.8	396.0
Total gross area	9,348.5	559.4	990.7	2,030.7	1,472.6	4,295.1

[1]U.S. Department of Commerce, Bureau of Census. Area Measurement Reports, GE-20 No. 1, 22p., 1970.

Table 3.—*Area of commercial forest land by county and ownership class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand acres)

	Ownership class													
County	All owners	National forest	Bureau of land mgmt.	Indian	Misc. Federal	State	County and municipal	Forest industry	Farmer	Farmer-owned, leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Carlton	312.8	—	—	6.9	—	45.7	56.5	27.1	121.6	—	5.8	49.2	—	—
Cook	538.8	335.9	—	31.7	2.6	71.4	6.5	37.7	5.2	—	9.6	38.2	—	—
Koochiching	1,278.9	—	2.6	40.7	—	597.3	273.2	227.6	85.1	—	8.0	42.0	1.4	1.0
Lake	855.3	370.6	—	—	8.6	98.2	143.3	97.5	15.5	—	46.5	75.1	—	—
St. Louis	2,465.6	446.3	5.5	18.2	9.5	319.5	706.4	144.8	316.8	—	176.9	319.1	2.6	—
All counties	5,451.4	1,152.8	8.1	97.5	20.7	1,132.1	1,185.9	534.7	544.2	—	246.8	523.6	4.0	1.0

Table 4.—*Area of commercial forest land by county and forest type, Aspen-Birch Unit, Minnesota, 1977*
(In thousand acres)

Forest type	All counties	Carlton	Cook	Koochiching	Lake	St. Louis
Jack pine	165.7	1.4	17.1	17.8	40.8	88.6
Red pine	114.4	4.1	—	13.2	45.9	51.2
White pine	33.8	—	3.9	—	4.8	25.1
Balsam fir	626.0	12.7	108.9	101.6	151.9	250.9
White spruce	60.1	1.4	19.7	11.3	12.3	15.4
Black spruce	745.7	19.8	56.5	279.1	99.7	290.6
Northern white-cedar	317.8	2.7	31.6	159.3	46.6	77.6
Tamarack	157.6	16.2	—	74.2	2.7	64.5
Oak	5.4	4.0	—	—	—	1.4
Elm-ash-cottonwood	243.7	37.5	8.0	88.1	26.3	83.8
Maple-basswood	214.5	21.9	39.8	16.7	63.3	72.8
Aspen	1,947.4	142.1	164.0	377.6	188.4	1,075.3
Paper birch	546.3	28.2	85.3	31.5	150.3	251.0
Balsam poplar	208.0	17.1	—	95.7	14.1	81.1
Nonstocked	65.0	3.7	4.0	12.8	8.2	36.3
All types	5,451.4	312.8	538.8	1,278.9	855.3	2,465.6

Table 5.—*Area of commercial forest land by county and site-index class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand acres)

		Site index class								
County	All classes	91	81-90	71-80	61-70	51-60	41-50	31-40	21-30	11-20
Carlton	312.8	1.4	9.8	39.2	87.7	77.8	55.7	23.2	16.6	1.4
Cook	538.8	—	2.7	24.9	89.1	161.3	158.3	52.2	48.5	1.8
Koochiching	1,278.9	7.1	56.5	109.4	188.2	209.4	210.7	223.3	232.8	41.5
Lake	855.3	1.4	5.0	57.7	143.2	291.3	195.7	89.6	66.1	5.3
St. Louis	2,465.6	15.5	68.1	251.1	582.4	658.3	476.0	256.6	132.8	24.8
All counties	5,451.4	25.4	142.1	482.3	1,090.6	1398.1	1,096.4	644.9	496.8	74.8

Table 6.—*Area of commercial forest land by county and stand-size class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand acres)

	Stand-size class				
County	All classes	Sawtimber	Poletimber	Restocking	Nonstocked
Carlton	312.8	38.4	162.2	108.5	3.7
Cook	538.8	142.5	295.9	96.4	4.0
Koochiching	1,278.9	193.7	589.2	483.2	12.8
Lake	855.3	194.8	429.9	222.4	8.2
St. Louis	2,465.6	373.5	1,369.9	685.9	36.3
All counties	5,451. 4	942.9	2,847.1	1,596.4	65.0

Table 7.—*Area of commercial forest land by site and ownership class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand acres)

Ownership class	All classes	Site class (cubic feet of growth/acre/year) 225+	165-225	120-165	85-120	50-85	20-50
National forest	1,152.8	—	—	—	14.8	519.3	618.7
Bureau of land mgmt.	8.1	—	—	—	1.4	1.4	5.3
Indian	97.5	—	—	2.8	16.5	29.9	48.3
Miscellaneous Federal	20.7	—	—	—	3.1	9.3	8.3
State	1,132.1	—	1.4	18.1	143.0	245.4	724.2
County and municipal	1,185.9	—	1.3	27.9	206.0	423.6	527.1
Forest industry	534.7	—	—	13.6	90.1	163.4	267.6
Farmer	544.2	—	—	5.4	87.4	207.2	244.2
Farmer-owned, leased	—	—	—	—	—	—	—
Misc. private-corp.	246.8	—	—	2.6	38.0	109.3	96.9
Misc. private-individual	523.6	—	—	10.3	82.3	210.7	220.3
Misc. priv.-corp., leased	4.0	—	—	—	1.4	2.6	—
Misc. priv.-ind., leased	1.0	—	—	—	1.0	—	—
All owners	5,451.4	—	2.7	80.7	685.0	1,922.1	2,760.9

Table 8.—*Area of commercial forest land by forest type and ownership class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand acres)

Ownership class	All types	Forest type Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	No. white-cedar	Tamarack	Oak	Elm-ash-cotton-wood	Maple-bass-wood	Aspen	Paper birch	Balsam poplar	Non-stocked
National forest	1,152.8	88.9	73.3	15.0	145.2	24.0	153.0	48.8	—	—	5.8	39.8	391.6	147.2	—	20.2
Bureau of land mgmt.	8.1	—	—	1.4	—	—	3.9	1.4	—	—	—	—	1.4	—	—	—
Indian	97.5	—	2.5	—	14.5	2.4	13.3	11.5	—	—	7.3	2.7	31.0	12.3	—	—
Miscellaneous Federal	20.7	2.9	—	—	2.9	—	2.6	—	—	—	—	1.4	8.1	2.8	—	—
State	1,132.1	29.3	8.5	1.4	133.5	18.2	293.0	126.9	89.9	—	44.3	18.8	257.1	60.6	44.1	6.5
County and municipal	1,185.9	20.5	12.1	3.0	142.6	—	123.6	48.5	29.4	—	71.0	59.7	471.0	125.3	58.8	20.4
Forest industry	534.7	11.4	4.4	5.1	72.1	2.7	60.1	48.4	7.3	1.4	25.5	20.5	210.7	40.1	20.5	4.5
Farmer	544.2	3.1	2.6	2.7	37.7	4.7	40.6	8.3	19.7	2.6	44.4	31.6	255.4	48.3	38.5	4.0
Farmer-owned, leased	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Misc. private-corp.	246.8	5.3	2.8	1.0	31.1	—	23.3	6.6	4.8	—	8.2	8.3	98.9	41.9	10.7	3.9
Misc. private-individual	523.6	4.3	8.2	4.2	46.4	8.1	32.3	17.4	6.5	1.4	37.2	31.7	217.2	67.8	35.4	5.5
Misc. priv.-corp., leased	4.0	—	—	—	—	—	—	—	—	—	—	—	4.0	—	—	—
Misc. priv.-ind., leased	1.0	—	—	—	—	—	—	—	—	—	—	—	1.0	—	—	—
All owners	5,451.4	165.7	114.4	33.8	626.0	60.1	745.7	317.8	157.6	5.4	243.7	214.5	1,947.4	546.3	208.0	65.0

Table 9.—*Area of commercial forest land by forest type and stand-age class, Aspen-Birch Unit, Minnesota, 1977*

(In thousand acres)

Forest type	All ages	Stand-age class(years) 1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	165.7	13.5	1.4	26.3	15.9	28.3	31.3	23.0	1.5	12.2	9.6	2.7	—	—
Red pine	114.4	1.6	33.5	1.1	22.8	9.5	11.5	5.3	8.0	18.6	1.2	1.3	—	—
White pine	33.8	2.1	1.4	—	—	2.1	—	3.8	5.6	2.5	15.0	1.3	—	—
Balsam fir	626.0	30.4	44.4	51.7	83.8	175.4	142.7	51.4	26.2	9.6	9.1	1.3	—	—
White spruce	60.1	12.8	6.1	1.4	8.2	18.8	5.2	1.3	1.2	1.3	2.7	1.1	—	—
Black spruce	745.7	26.9	72.3	112.5	105.6	93.7	96.1	51.6	70.2	39.3	55.2	12.7	9.6	—
Northern white-cedar	317.8	1.4	7.6	16.6	17.6	13.8	22.7	32.3	36.1	39.0	57.1	29.5	44.1	—
Tamarack	157.6	12.5	34.5	21.7	14.1	15.1	14.6	11.9	8.4	6.7	1.4	10.5	5.0	1.2
Oak	5.4	—	—	—	1.2	2.8	1.4	—	—	—	—	—	—	—
Elm-ash-cottonwood	243.7	20.5	20.7	10.0	12.8	29.4	37.4	27.9	18.1	25.8	19.1	12.5	9.5	—
Maple-basswood	214.5	4.0	12.4	6.7	13.9	38.6	40.3	13.8	17.6	11.9	31.4	14.8	9.1	—
Aspen	1,947.4	244.7	177.6	199.6	286.3	409.0	383.2	150.8	60.8	25.7	8.3	1.4	—	—
Paper birch	546.3	25.3	41.1	17.9	56.5	138.4	122.1	59.5	49.7	27.0	7.4	1.4	—	—
Balsam poplar	208.0	21.8	18.1	11.6	34.8	52.7	35.5	15.4	12.5	4.2	1.4	—	—	—
Nonstocked	65.0	65.0	—	—	—	—	—	—	—	—	—	—	—	—
All types	5,451.4	482.5	471.1	477.1	673.5	1,027.6	944.0	448.0	315.9	223.8	218.9	90.5	77.3	1.2

Table 10.—*Area of commercial forest land by forest type, stand-size class, and site class, Aspen-Birch Unit, Minnesota, 1977*

(In thousand acres)

Forest type and stand-size class	All site classes	Site class 165 or more	120-165	85-120	50-85	Less than 50
Jack pine						
Sawtimber	68.3	—	—	—	23.7	44.6
Poletimber	66.3	—	—	1.4	12.3	52.6
Sapling & seedling	31.1	—	—	—	24.5	6.6
All stands	165.7	—	—	1.4	60.5	103.8
Red pine						
Sawtimber	49.2	—	1.4	6.0	25.8	16.0
Poletimber	19.9	—	—	3.8	6.3	9.8
Sapling & seedling	45.3	—	—	—	24.9	20.4
All stands	114.4	—	1.4	9.8	57.0	46.2
White pine						
Sawtimber	32.4	—	1.4	5.8	12.3	12.9
Poletimber	—	—	—	—	—	—
Sapling & seedling	1.4	—	—	1.4	—	—
All stands	33.8	—	1.4	7.2	12.3	12.9
Balsam fir						
Sawtimber	106.1	2.7	14.9	43.2	20.5	24.8
Poletimber	362.9	—	26.8	126.4	100.3	109.4
Sapling & seedling	157.0	—	12.2	38.2	45.0	61.6
All stands	626.0	2.7	53.9	207.8	165.8	195.8
White spruce						
Sawtimber	13.0	—	—	2.7	5.1	5.2
Poletimber	17.1	—	—	1.7	12.2	3.2
Sapling & seedling	30.0	—	—	5.9	12.9	11.2
All stands	60.1	—	—	10.3	30.2	19.6

(Continued on next page)

Table 10, continued

Forest type and stand-size class	Site class					
	All site classes	165 or more	120-165	85-120	50-85	Less than 50
Black spruce						
Sawtimber	24.0	—	—	—	2.6	21.4
Poletimber	304.4	—	—	5.3	18.7	280.4
Sapling & seedling	417.3	—	—	1.3	7.9	408.1
All stands	745.7	—	—	6.6	29.2	709.9
Northern white-cedar						
Sawtimber	110.2	—	—	—	2.8	107.4
Poletimber	153.0	—	—	—	10.7	142.3
Sapling & seedling	54.6	—	—	—	—	54.6
All stands	317.8	—	—	—	13.5	304.3
Tamarack						
Sawtimber	9.8	—	—	—	1.6	8.2
Poletimber	53.6	—	—	—	11.1	42.5
Sapling & seedling	94.2	—	—	—	7.0	87.2
All stands	157.6	—	—	—	19.7	137.9
Oak						
Sawtimber	—	—	—	—	—	—
Poletimber	5.4	—	—	1.4	1.4	2.6
Sapling & seedling	—	—	—	—	—	—
All stands	5.4	—	—	1.4	1.4	2.6
Elm-ash-cottonwood						
Sawtimber	45.0	—	—	—	—	45.0
Poletimber	138.8	—	—	—	4.1	134.7
Sapling & seedling	59.9	—	—	—	1.4	58.5
All stands	243.7	—	—	—	5.5	238.2
Maple-basswood						
Sawtimber	106.0	—	—	1.0	32.4	72.6
Poletimber	79.8	—	—	—	9.7	70.1
Sapling & seedling	28.7	—	—	—	7.1	21.6
All stands	214.5	—	—	1.0	49.2	164.3
Aspen						
Sawtimber	260.5	—	8.6	55.8	173.2	22.9
Poletimber	1,120.5	—	9.8	284.5	643.0	183.2
Sapling & seedling	566.4	—	4.2	61.6	346.9	153.7
All stands	1,947.4	—	22.6	401.9	1,163.1	359.8
Paper birch						
Sawtimber	69.4	—	—	1.5	22.2	45.7
Poletimber	419.2	—	—	—	144.3	274.9
Sapling & seedling	57.7	—	—	—	10.9	46.8
All stands	546.3	—	—	1.5	177.4	367.4
Balsam poplar						
Sawtimber	49.0	—	—	12.2	28.2	8.6
Poletimber	106.2	—	1.4	14.1	63.9	26.8
Sapling & seedling	52.8	—	—	5.5	31.0	16.3
All stands	208.0	—	1.4	31.8	123.1	51.7
Nonstocked	65.0	—	—	4.3	14.2	46.5
All types	5,451.4	2.7	80.7	685.0	1,922.1	2,760.9

Table 11.—*Area of noncommercial forest land by ownership class, Aspen-Birch Unit, Minnesota, 1977*

(In thousand acres)

Ownership class	All areas	Productive-reserved areas	Unproductive areas
National forest	856.1	756.8	99.3
Other federal	175.6	121.6	54.0
State, county and municipal	872.8	165.7	707.1
Forest industry	30.9	—	30.9
Farmer	55.3	—	55.3
Miscellaneous private	29.7	6.5	23.2
All ownerships	2,020.4	1,050.6	969.8

Table 12.—*Area of noncommercial forest land by forest type, Aspen-Birch Unit, Minnesota, 1977*

(In thousand acres)

Forest type	All areas	Productive-reserved areas	Unproductive areas
Jack pine	203.2	202.0	1.2
Red-white pine	65.0	59.2	5.8
Spruce-fir	149.6	100.2	49.4
Black spruce	709.2	62.9	646.3
Northern white-cedar	104.8	12.4	92.4
Tamarack	104.2	3.0	101.2
Oak	2.7	.2	2.5
Elm-ash-cottonwood	44.9	8.9	36.0
Maple-basswood	13.8	9.5	4.3
Aspen-birch	609.1	589.7	19.4
Nonstocked	13.9	2.6	11.3
All forest types	2,020.4	1,050.6	969.8

Table 13.—*Number of all live trees on commercial forest land by species and diameter class, Aspen-Birch Unit, Minnesota, 1977*

(In thousand trees)

Species	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:															
White pine	14,118	2,846	4,286	1,841	1,169	1,292	826	623	487	337	161	110	114	26	—
Red pine	33,273	13,881	4,622	5,124	3,817	2,687	1,514	841	371	178	170	54	14	—	—
Jack pine	39,027	2,479	5,939	10,367	9,793	6,079	3,079	864	378	33	14	—	2	—	—
White spruce	39,294	14,763	7,702	7,502	3,897	2,360	1,440	797	481	202	98	38	14	—	—
Black spruce	596,244	259,233	213,559	90,698	25,028	6,360	1,007	283	51	18	5	2	—	—	—
Balsam fir	760,272	390,303	213,303	101,516	38,356	12,739	3,185	755	95	15	5	—	—	—	—
Tamarack	95,761	38,546	34,407	15,072	5,590	1,366	628	116	27	9	—	—	—	—	—
Northern white-cedar	193,278	64,424	53,821	35,290	20,153	10,116	5,388	2,420	942	455	183	50	34	2	—
Other softwoods	455	135	270	30	15	—	—	5	—	—	—	—	—	—	—
Total softwoods	1,771,722	786,610	537,909	267,440	107,818	42,999	17,067	6,704	2,832	1,247	636	254	178	28	—
Hardwoods:															
Select white oaks	3,000	1,245	770	480	230	120	97	15	25	6	3	2	6	1	—
Select red oaks	2,540	538	269	716	360	318	182	96	42	12	7	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	2,894	712	705	267	334	209	249	144	70	85	31	38	44	6	—
Hard maple	93,280	51,407	24,008	10,076	3,666	2,091	809	502	387	204	64	36	30	—	—
Soft maple	125,966	67,422	37,030	14,273	4,902	1,330	653	222	72	53	7	2	—	—	—
Ash	217,082	120,577	50,127	26,362	11,185	5,660	1,808	879	375	76	19	6	8	—	—
Balsam poplar	112,306	46,786	25,464	15,789	11,462	7,070	3,431	1,326	559	286	82	38	13	—	—
Paper birch	385,022	138,222	110,543	68,401	40,664	17,216	6,476	1,938	886	407	167	36	66	—	—
Bigtooth aspen	5,390	853	926	1,318	1,193	663	244	115	47	18	9	4	—	—	—
Quaking aspen	699,079	354,455	124,136	82,212	67,911	39,151	19,612	7,388	2,583	1,070	387	103	70	1	—
Basswood	11,167	2,191	2,860	2,425	1,950	1,002	354	141	117	68	32	20	7	—	—
Elm	16,308	5,990	3,985	2,073	1,556	906	738	404	259	193	63	59	66	12	4
Select hardwoods	631	544	—	87	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	1,880	1,066	420	211	113	41	17	—	4	6	2	—	—	—	—
Noncommercial species	17,930	14,210	2,690	908	101	21	—	—	—	—	—	—	—	—	—
Total hardwoods	1,694,475	806,218	383,933	225,598	145,627	75,798	34,670	13,170	5,426	2,484	873	344	310	20	4
All species	3,466,197	1,592,828	921,842	493,038	253,445	118,797	51,737	19,874	8,258	3,731	1,509	598	488	48	4

Table 14.—*Number of growing-stock trees on commercial forest land by species and diameter class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand trees)

Species	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:															
White pine	12,368	2,722	3,585	1,532	1,043	978	716	611	453	325	156	108	113	26	—
Red pine	31,991	13,257	4,214	5,020	3,737	2,657	1,490	832	371	175	170	54	14	—	—
Jack pine	35,364	1,473	4,836	10,040	9,094	5,717	2,970	833	363	27	9	—	2	—	—
White spruce	36,230	12,714	7,145	7,421	3,625	2,319	1,407	786	477	189	95	38	14	—	—
Black spruce	550,365	228,024	202,780	87,855	24,241	6,147	965	277	51	18	5	2	—	—	—
Balsam fir	668,902	322,399	198,814	96,061	36,260	11,697	2,882	695	80	9	5	—	—	—	—
Tamarack	84,419	33,142	31,316	13,203	4,969	1,157	510	96	20	6	—	—	—	—	—
Northern white-cedar	154,502	51,432	46,802	27,185	15,344	7,329	3,542	1,705	689	283	131	32	27	1	—
Other softwoods	315	—	270	30	15	—	—	—	—	—	—	—	—	—	—
Total softwoods	1,574,456	665,163	499,762	248,347	98,328	38,001	14,482	5,835	2,504	1,032	571	234	170	27	—
Hardwoods:															
Select white oaks	2,529	834	770	480	200	101	97	15	17	6	3	—	5	1	—
Select red oaks	1,855	262	269	473	312	287	134	72	35	9	2	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	1,819	712	570	134	100	45	112	48	37	30	15	6	10	—	—
Hard maple	65,281	36,408	18,227	6,890	2,136	1,003	240	197	129	30	13	4	4	—	—
Soft maple	85,414	46,794	25,905	9,020	2,509	604	394	162	20	6	—	—	—	—	—
Ash	191,103	103,259	46,169	23,903	9,910	5,018	1,601	822	340	56	17	2	6	—	—
Balsam poplar	97,790	41,769	21,269	13,356	10,148	6,405	3,069	1,148	434	139	40	7	6	—	—
Paper birch	328,755	113,599	96,588	60,059	36,606	14,709	5,236	1,286	448	116	94	8	6	—	—
Bigtooth aspen	4,433	567	656	1,200	1,072	586	198	91	40	12	9	2	—	—	—
Quaking aspen	584,299	299,235	101,012	68,808	58,448	33,027	15,790	5,552	1,689	496	162	43	37	—	—
Basswood	9,063	1,359	2,455	1,935	1,798	910	285	127	106	50	26	10	2	—	—
Elm	12,720	4,885	2,985	1,598	1,141	724	605	282	198	142	48	41	60	8	3
Select hardwoods	312	284	—	28	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	1,130	858	136	102	15	10	6	—	—	3	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	1,386,503	650,825	317,011	187,986	124,395	63,429	27,767	9,802	3,493	1,095	429	123	136	9	3
All species	2,960,959	1,315,988	816,773	436,333	222,723	101,430	42,249	15,637	5,997	2,127	1,000	357	306	36	3

Table 15.—*Number of short-log trees on commercial forest land by species and diameter class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand trees)

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:											
White pine	74	37	8	8	17	3	—	—	1	—	—
Red pine	23	—	18	5	—	—	—	—	—	—	—
Jack pine	194	113	61	14	3	3	—	—	—	—	—
White spruce	9	—	5	—	4	—	—	—	—	—	—
Black spruce	100	92	8	—	—	—	—	—	—	—	—
Balsam fir	266	223	35	—	8	—	—	—	—	—	—
Tamarack	69	51	12	—	3	3	—	—	—	—	—
Northern white-cedar	1,325	553	458	178	51	72	11	2	—	—	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	2,060	1,069	605	205	86	81	11	2	1	—	—
Hardwoods:											
Select white oaks	4	—	—	—	4	—	—	—	—	—	—
Select red oaks	27	—	15	9	3	—	—	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	49	—	6	20	—	10	—	—	13	—	—
Hard maple	66	—	13	23	10	—	5	2	13	—	—
Soft maple	28	—	—	16	7	3	2	—	—	—	—
Ash	47	—	32	12	3	—	—	—	—	—	—
Balsam poplar	277	—	102	40	—	87	26	19	3	—	—
Paper birch	1,017	—	381	179	255	119	35	8	40	—	—
Bigtooth aspen	27	—	12	5	7	3	—	—	—	—	—
Quaking aspen	1,413	—	669	341	209	122	71	—	—	1	—
Basswood	7	—	—	—	3	3	—	—	1	—	—
Elm	108	—	37	35	18	9	2	2	4	—	1
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—
Noncommericial species	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	3,070	—	1,267	680	519	356	141	31	74	1	1
All species	5,130	1,069	1,872	885	605	437	152	33	75	1	1

Table 16.—*Net volume of growing stock and sawtimber on commercial forest land by species, Aspen-Birch Unit, Minnesota, 1962 and 1977*

Species	Growing stock		Sawtimber	
	1962[1]	1977	1962[1]	1977
	Thousand cubic feet		*Thousand board feet*[2]	
Softwoods:				
White pine	110,870	91,561	520,291	515,487
Red pine	128,207	147,197	603,099	596,918
Jack pine	419,188	212,572	801,907	589,587
Spruce	664,352	556,456	694,049	842,555
Balsam fir	498,522	559,387	515,571	741,009
Tamarack	130,428	75,063	121,350	86,831
Northern white-cedar	161,294	246,561	241,328	768,841
Other softwoods	—	138	—	—
Total softwoods	2,112,861	1,888,935	3,497,595	4,141,228
Hardwoods:				
White oak	3,584	5,277	10,509	13,774
Red oak	7,794	9,347	18,472	23,285
Yellow birch	9,722	6,861	44,638	27,091
Hard maple	36,426	43,352	123,036	56,909
Soft maple	26,389	38,495	65,083	30,931
Ash	152,374	196,644	271,058	312,399
Paper birch	436,083	620,775	254,367	591,221
Aspen	1,241,021	1,386,738	981,896	2,404,266
Basswood	20,945	35,262	62,747	64,530
Elm	40,599	45,431	149,441	176,959
Other hardwoods	158,765	244,958	242,942	482,003
Total hardwoods	2,133,702	2,633,140	2,224,189	4,183,368
All species	4,246,563	4,522,075	5,721,784	8,324,596

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 estimates due to changes in survey definitions and procedures.

[2]International ¼-inch rule.

Table 17.— *Cubic foot volume in all live trees on commercial forest land by species and diameter class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:													
White pine	95,990	2,863	4,417	9,849	9,569	10,866	13,763	12,383	8,646	6,850	12,003	4,781	—
Red pine	148,398	11,031	23,230	30,379	27,830	21,600	12,441	7,631	8,968	3,821	1,467	—	—
Jack pine	219,973	24,343	53,120	60,278	50,116	18,506	11,867	1,115	530	—	98	—	—
White spruce	138,372	18,462	20,377	23,957	23,774	18,399	15,896	8,330	5,469	2,543	1,165	—	—
Black spruce	428,442	205,257	131,174	63,453	17,671	7,566	1,985	954	330	52	—	—	—
Balsam fir	586,038	223,677	190,382	111,671	42,338	14,968	2,425	340	237	—	—	—	—
Tamarack	84,729	33,889	27,331	12,192	8,197	2,112	687	321	—	—	—	—	—
Northern white-cedar	284,598	48,300	62,683	61,780	45,031	30,133	18,116	9,931	5,637	1,446	1,434	107	—
Other softwoods	207	65	73	—	—	69	—	—	—	—	—	—	—
Total softwoods	1,986,747	567,887	512,787	373,559	224,526	124,219	77,180	41,005	29,817	14,712	16,167	4,888	—
Hardwoods:													
Select white oaks	5,632	879	905	882	1,033	340	648	237	104	—	497	107	—
Select red oaks	10,475	1,247	1,455	2,341	2,293	1,570	1,048	311	210	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	11,071	424	804	852	2,003	1,375	1,177	1,356	721	659	1,669	31	—
Hard maple	61,453	18,305	13,392	11,276	4,731	5,319	4,035	1,688	1,465	673	569	—	—
Soft maple	54,100	19,899	15,155	7,703	5,884	3,373	1,303	526	150	107	—	—	—
Ash	207,620	56,765	50,715	46,339	24,217	15,845	10,223	1,974	797	193	552	—	—
Balsam poplar	264,278	37,041	62,700	65,497	48,940	26,402	13,933	6,554	1,984	762	465	—	—
Paper birch	679,373	169,380	221,000	152,847	80,996	28,890	15,260	5,364	4,349	840	447	—	—
Bigtooth aspen	23,229	3,339	6,129	5,996	3,263	2,111	1,193	533	395	270	—	—	—
Quaking aspen	1,517,824	221,479	391,522	377,592	287,421	138,756	59,581	25,543	10,437	2,982	2,507	4	—
Basswood	37,297	4,996	10,547	8,200	3,873	2,708	2,908	1,919	1,155	658	333	—	—
Elm	51,819	3,547	5,568	6,406	7,737	6,479	5,695	5,630	2,401	2,464	4,413	984	495
Select hardwoods	78	78	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	890	196	226	195	152	—	13	104	4	—	—	—	—
Noncommercial species	972	631	200	141	—	—	—	—	—	—	—	—	—
Total hardwoods	2,926,111	538,206	780,318	686,267	472,543	233,168	117,017	51,739	24,172	9,608	11,452	1,126	495
All species	4,912,858	1,106,093	1,293,105	1,059,826	697,069	357,387	194,197	92,744	53,989	24,320	27,619	6,014	495

Table 18.—*Net volume of timber on commercial forest land by class of timber and softwoods and hardwoods, Aspen-Birch Unit, Minnesota, 1977*
(In thousand cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Growing stock trees:			
Saw log trees:			
Saw log portion	1,212,135	621,522	590,613
Upper stem portion	446,139	236,504	209,635
Total sawtimber	1,658,274	858,026	800,248
Poletimber trees:	2,863,801	1,030,909	1,832,892
Total growing stock	4,522,075	1,888,935	2,633,140
Cull trees:			
Rough and rotten cull trees:			
Sawtimber	121,419	33,195	88,224
Poletimber	221,664	49,765	171,899
Total rough and rotten cull	343,083	82,960	260,123
Short-log cull trees:			
Sawtimber	47,700	14,852	32,848
Poletimber	—	—	—
Total short log	47,700	14,852	32,848
Total cull	390,783	97,812	292,971
Salvable dead trees:	27,448	16,717	10,731
All classes	4,940,306	2,003,464	2,936,842

Table 19.—*Net volume of growing stock on commercial forest land by species and county, Aspen-Birch Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All counties	Carlton	Cook	Koochiching	Lake	St. Louis
Softwoods:						
White pine	91,561	2,494	11,256	7,323	13,809	56,679
Red pine	147,197	14,588	357	15,430	19,651	97,171
Jack pine	212,572	1,767	21,913	20,709	26,106	142,077
White spruce	136,485	2,702	33,164	17,337	26,492	56,790
Black spruce	419,971	5,998	49,521	153,137	53,376	157,939
Balsam fir	559,387	17,047	97,165	100,736	85,162	259,277
Tamarack	75,063	5,999	787	34,458	5,401	28,418
Northern white-cedar	246,561	2,118	30,957	100,972	48,711	63,803
Other softwoods	138	—	—	—	—	138
Total softwoods	1,888,935	52,713	245,120	450,102	278,708	862,292
Hardwoods:						
Select white oaks	5,277	2,120	—	1,673	—	1,484
Select red oaks	9,347	6,690	—	—	325	2,332
Other red oaks	—	—	—	—	—	—
Hickory	—	—	—	—	—	—
Yellow birch	6,861	—	162	91	4,521	2,087
Hard maple	43,352	6,936	6,181	1,250	20,407	8,578
Soft maple	38,495	4,509	2,682	2,122	4,321	24,861
Ash	196,644	23,854	3,640	50,649	21,115	97,386
Balsam poplar	244,477	10,724	4,789	81,560	28,460	118,944
Paper birch	620,775	33,721	96,544	47,414	172,099	270,997
Bigtooth aspen	21,001	1,117	—	790	431	18,663
Quaking aspen	1,365,737	56,205	171,395	262,098	158,010	718,029
Basswood	35,262	6,953	3,451	5,618	5,500	13,740
Elm	45,431	4,563	—	25,523	132	15,213
Select hardwoods	53	—	53	—	—	—
Other hardwoods	428	271	—	33	—	124
Noncommercial species	—	—	—	—	—	—
Total hardwoods	2,633,140	157,663	288,897	478,821	415,321	1,292,438
All species	4,522,075	210,376	534,017	928,923	694,029	2,154,730

Table 20.—*Net volume of sawtimber on commercial forest land by species and county, Aspen-Birch Unit, Minnesota, 1977*
(In thousand board feet[1])

Species	All counties	Carlton	Cook	Koochiching	Lake	St. Louis
Softwoods:						
White pine	515,487	15,826	65,334	44,097	72,580	317,650
Red pine	596,918	69,532	1,910	62,419	95,221	367,836
Jack pine	589,587	6,638	69,301	38,513	86,183	388,952
White spruce	471,316	11,572	115,955	56,365	103,042	184,382
Black spruce	371,239	377	71,871	114,828	42,325	141,838
Balsam fir	741,009	25,580	125,687	137,389	101,260	351,093
Tamarack	86,831	6,403	1,430	44,136	13,006	21,856
Northern white-cedar	768,841	3,701	114,968	286,040	186,391	177,741
Other softwoods	—	—	—	—	—	—
Total softwoods	4,141,228	139,629	566,456	783,787	700,008	1,951,348
Hardwoods:						
Select white oaks	13,774	4,419	—	6,333	—	3,022
Select red oaks	23,285	15,905	—	—	1,211	6,169
Other red oaks	—	—	—	—	—	—
Hickory	—	—	—	—	—	—
Yellow birch	27,091	—	—	428	19,344	7,319
Hard maple	56,909	7,810	10,501	3,044	32,392	3,162
Soft maple	30,931	6,375	3,741	5,900	6,696	8,219
Ash	312,399	29,112	2,385	81,988	48,182	150,732
Balsam poplar	481,135	21,619	14,480	139,553	65,583	239,900
Paper birch	591,221	36,848	85,630	64,632	218,221	185,890
Bigtooth aspen	32,683	2,597	—	720	639	28,727
Quaking aspen	2,371,583	59,715	400,505	387,200	365,396	1,158,767
Basswood	64,530	11,280	—	15,248	8,824	29,178
Elm	176,959	12,147	—	105,611	356	58,845
Select hardwoods	—	—	—	—	—	—
Other hardwoods	868	502	—	—	—	366
Noncommercial species	—	—	—	—	—	—
Total hardwoods	4,183,368	208,329	517,242	810,657	766,844	1,880,296
All species	8,324,596	347,958	1,083,698	1,594,444	1,466,852	3,831,644

[1]International ¼-inch rule.

Table 21.—*Net volume of growing stock, sawtimber, short-log, and rough and rotten trees on commercial forest land by individual species, Aspen-Birch Unit, Minnesota, 1977*

Species	Total all live	Growing stock	Short log	Rough and rotten	Sawtimber
	Thousand cubic feet				*Thousand board feet*[1]
Softwoods:					
White pine	95,990	91,561	1,080	3,349	515,487
Red pine	148,398	147,197	339	862	596,918
Jack pine	219,973	212,572	1,878	5,523	589,587
White spruce	138,372	136,485	147	1,740	471,316
Black spruce	428,442	419,971	787	7,684	371,239
Balsam fir	586,038	559,387	2,253	24,398	741,009
Tamarack	84,729	75,063	625	9,041	86,831
Northern white-cedar	284,598	246,561	7,743	30,294	768,841
Eastern redcedar	207	138	—	69	—
Total softwoods	1,986,747	1,888,935	14,852	82,960	4,141,228
Hardwoods:					
White oak	230	230	—	—	402
Burr oak	5,402	5,047	73	282	13,372
Swamp white oak	—	—	—	—	—
Northern red oak	10,475	9,347	380	748	23,285
Black oak	—	—	—	—	—
Northern pin oak	—	—	—	—	—
Bitternut hickory	—	—	—	—	—
Shagbark hickory	—	—	—	—	—
Yellow birch	11,071	6,861	1,482	2,728	27,091
Sugar maple	61,361	43,260	798	17,303	56,909
Black maple	92	92	—	—	—
Red maple	52,778	37,483	467	14,828	28,606
Silver maple	1,322	1,012	—	310	2,325
White ash	—	—	—	—	—
Black ash	199,086	188,695	440	9,951	301,531
Green ash	8,534	7,949	66	519	10,868
Balsam poplar	264,278	244,477	2,314	17,487	481,135
Paper birch	679,373	620,775	5,785	52,813	591,221
Bigtooth aspen	23,229	21,001	455	1,773	32,683
Quaking aspen	1,517,824	1,365,737	18,203	133,884	2,371,583
Basswood	37,297	35,262	279	1,756	64,530
American elm	50,943	44,716	2,106	4,121	175,349
Slippery elm	485	436	—	49	1,140
Rock elm	391	279	—	112	470
Butternut	—	—	—	—	—
Black walnut	—	—	—	—	—
Black cherry	78	53	—	25	—
Boxelder	331	71	—	260	—
River birch	—	—	—	—	—
Hackberry	—	—	—	—	—
Cottonwood	437	357	—	80	868
Black willow	122	—	—	122	—
Noncommercial	972	—	—	972	—
Total hardwoods	2,926,111	2,633,140	32,848	260,123	4,183,368
All species	4,912,858	4,522,075	47,700	343,083	8,324,596

[1]International ¼-inch rule.

Table 22.— *Net volume of growing stock on commercial forest land by species and diameter class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All classes	Diameter class (Inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:													
White pine	91,561	2,207	4,009	8,464	9,039	10,671	13,167	12,087	8,499	6,754	11,883	4,781	—
Red pine	147,197	10,859	22,930	30,188	27,503	21,457	12,441	7,563	8,968	3,821	1,467	—	—
Jack pine	212,572	23,776	51,157	57,710	48,894	18,069	11,510	984	374	—	98	—	—
White spruce	136,485	18,348	19,596	23,650	23,498	18,287	15,815	8,166	5,418	2,542	1,165	—	—
Black spruce	419,971	201,035	128,580	62,169	17,341	7,525	1,985	954	330	52	—	—	—
Balsam fir	559,387	213,602	183,157	105,535	40,004	14,410	2,162	280	237	—	—	—	—
Tamarack	75,063	29,838	24,168	10,917	7,377	1,921	609	233	—	—	—	—	—
Northern white-cedar	246,561	41,585	55,924	52,331	38,334	26,489	16,089	8,298	4,800	1,289	1,331	91	—
Other softwoods	138	65	73	—	—	—	—	—	—	—	—	—	—
Total softwoods	1,888,935	541,315	489,594	350,964	211,990	118,829	73,778	38,565	28,626	14,458	15,944	4,872	—
Hardwoods:													
Select white oaks	5,277	879	805	742	1,033	340	561	237	104	—	469	107	—
Select red oaks	9,347	1,061	1,450	2,308	1,860	1,288	922	311	147	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	6,861	372	440	351	1,309	924	918	945	696	339	567	—	—
Hard maple	43,352	15,622	9,799	7,831	2,680	3,080	2,681	772	495	183	209	—	—
Soft maple	38,495	15,831	10,127	4,548	4,346	2,792	644	207	—	—	—	—	—
Ash	196,644	54,256	47,731	43,596	22,716	15,281	9,805	1,913	797	97	452	—	—
Balsam poplar	244,477	33,731	57,951	62,273	46,428	24,151	12,487	5,117	1,591	413	335	—	—
Paper birch	620,775	157,071	206,068	139,564	73,240	25,104	11,756	3,909	3,350	429	284	—	—
Bigtooth aspen	21,001	3,024	5,779	5,545	2,785	1,826	1,062	446	395	139	—	—	—
Quaking aspen	1,365,737	201,908	359,433	345,507	258,004	121,250	49,696	18,353	7,525	2,152	1,909	—	—
Basswood	35,262	4,673	10,335	7,939	3,541	2,610	2,709	1,647	1,102	520	186	—	—
Elm	45,431	3,317	4,956	5,761	6,774	5,347	4,838	4,815	2,170	2,184	3,943	960	366
Select hardwoods	53	53	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	428	118	63	74	87	—	—	86	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	2,633,140	491,916	714,937	626,039	424,803	203,993	98,079	38,758	18,372	6,456	8,354	1,067	366
All species	4,522,075	1,033,231	1,204,531	977,003	636,793	322,822	171,857	77,323	46,998	20,914	24,298	5,939	366

Table 23.—*Net volume of sawtimber on commercial forest land by species and diameter class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand board feet[1])

Species	Diameter class (inches at breast height)										
	All classes	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:											
White pine	515,487	44,453	59,859	67,161	79,556	72,328	51,855	40,964	70,668	28,643	—
Red pine	596,918	133,646	148,700	116,962	71,507	43,824	51,205	22,146	8,928	—	—
Jack pine	589,587	223,002	211,005	85,459	63,075	4,737	1,825	—	484	—	—
White spruce	471,316	92,052	103,389	92,871	83,935	44,967	31,893	14,498	7,711	—	—
Black spruce	371,239	244,431	75,485	34,570	9,477	4,991	1,693	592	—	—	—
Balsam fir	741,009	472,810	188,652	67,243	9,988	1,268	1,048	—	—	—	—
Tamarack	86,831	44,114	31,642	7,457	2,623	995	—	—	—	—	—
Northern white-cedar	768,841	269,771	197,575	135,850	79,568	42,234	26,649	8,020	8,317	857	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	4,141,228	1,524,279	1,016,307	607,573	399,729	215,344	166,168	86,220	96,108	29,500	—
Hardwoods:											
Select white oaks	13,774	—	6,033	1,847	2,588	1,013	422	—	1,545	326	—
Select red oaks	23,285	—	10,165	6,856	4,365	1,312	587	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	27,091	—	6,356	5,047	4,706	4,203	3,281	1,366	2,132	—	—
Hard maple	56,909	—	16,782	17,650	13,480	4,376	2,654	944	1,023	—	—
Soft maple	30,931	—	14,044	13,186	2,789	912	—	—	—	—	—
Ash	312,399	—	149,056	90,720	55,630	10,352	4,012	548	2,081	—	—
Balsam poplar	481,135	—	238,924	131,589	69,985	28,338	8,502	2,096	1,701	—	—
Paper birch	591,221	—	367,071	131,617	56,420	19,567	13,479	1,895	1,172	—	—
Bigtooth aspen	32,683	—	13,631	9,026	4,980	2,371	1,921	754	—	—	—
Quaking aspen	2,371,583	—	1,297,446	635,764	271,806	100,486	42,653	11,869	11,559	—	—
Basswood	64,530	—	17,862	14,149	14,642	8,701	5,478	2,739	959	—	—
Elm	176,959	—	35,783	29,146	27,054	27,464	12,574	12,830	23,891	5,898	2,319
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	868	—	502	—	—	366	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	4,183,368	—	2,173,655	1,086,597	528,445	209,461	95,563	35,041	46,063	6,224	2,319
All species	8,324,596	1,524,279	3,189,962	1,694,170	928,174	424,805	261,731	121,261	142,171	35,724	2,319

[1]International ¼-inch rule.

Table 24.—*Net volume of growing stock on commercial forest land by species and forest type, Aspen-Birch Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	Forest type															
	All types	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	No. white-cedar	Tamarack	Oak	Elm-ash cotton-wood	Maple-bass-wood	Aspen	Paper birch	Balsam poplar	Non-stocked
Softwoods:																
White pine	91,561	1,628	14,561	25,430	9,916	437	2,616	2,540	422	—	972	2,901	24,304	5,728	106	—
Red pine	147,197	3,753	95,780	3,340	9,388	706	1,839	3,477	—	—	252	105	18,185	10,286	86	—
Jack pine	212,572	145,499	8,204	3,891	4,867	257	14,750	1,764	210	—	301	1,556	28,088	1,019	73	2,093
White spruce	136,485	1,007	3,462	6,209	29,222	15,130	8,280	1,863	77	—	3,699	4,868	44,700	14,642	3,326	—
Black spruce	419,971	12,381	1,083	554	39,978	920	281,064	26,549	8,652	—	1,735	794	40,981	3,282	1,697	301
Balsam fir	559,387	3,947	3,119	2,529	222,789	3,262	25,360	24,917	1,460	64	16,715	13,587	163,168	54,999	23,325	146
Tamarack	75,063	—	—	—	5,071	347	22,995	3,921	39,327	—	373	96	1,955	489	278	211
Northern white-cedar	246,561	—	312	211	31,528	1,194	6,634	153,146	1,877	—	9,771	10,112	20,956	6,657	3,939	224
Other softwoods	138	—	—	—	—	—	—	—	—	—	—	—	—	138	—	—
Total softwoods	1,888,935	168,215	126,521	42,164	352,759	22,253	363,538	218,177	52,025	64	33,818	34,019	342,337	97,240	32,830	2,975
Hardwoods:																
Select white oaks	5,277	—	—	—	—	—	—	—	—	446	712	607	2,968	328	216	—
Select red oaks	9,347	—	—	—	90	—	—	—	—	3,938	—	2,884	923	1,102	410	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	6,861	—	—	—	308	—	—	715	—	—	989	3,703	81	836	229	—
Hard maple	43,352	—	—	—	607	—	—	—	—	224	387	32,695	4,384	4,247	704	104
Soft maple	38,495	1,268	—	763	1,880	—	107	57	56	35	1,565	5,442	14,588	12,485	249	—
Ash	196,644	—	—	78	4,371	—	1,690	6,021	65	215	108,763	9,846	43,709	11,370	10,290	226
Balsam poplar	244,477	—	—	—	13,091	100	992	4,475	176	226	7,225	5,253	103,113	11,783	97,904	139
Paper birch	620,775	4,271	3,942	1,110	76,271	8,203	6,612	19,019	1,218	103	11,771	18,531	195,857	260,469	13,222	176
Bigtooth aspen	21,001	—	101	37	723	—	48	516	—	—	129	558	17,971	681	237	—
Quaking aspen	1,365,737	23,563	8,024	8,625	62,808	5,415	29,258	6,375	630	385	8,773	22,078	1,082,456	80,233	25,752	1,362
Basswood	35,262	—	—	—	416	—	—	—	—	—	1,222	21,318	7,701	4,086	519	—
Elm	45,431	—	—	—	515	—	—	118	—	90	14,673	10,191	12,873	1,602	5,225	144
Select hardwoods	53	—	—	—	—	—	—	—	—	—	—	—	53	—	—	—
Other hardwoods	428	—	—	—	—	—	—	—	—	—	71	—	357	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	2,633,140	29,102	12,067	10,613	161,080	13,718	38,707	37,296	2,145	5,662	156,280	133,106	1,487,034	389,222	154,957	2,151
All species	4,522,075	197,317	138,588	52,777	513,839	35,971	402,245	255,473	54,170	5,726	190,098	167,125	1,829,371	486,462	187,787	5,126

Table 25.— *Net volume of sawtimber on commercial forest land by species and forest type, Aspen-Birch Unit, Minnesota, 1977*
(In thousand board feet[1])

Species	Forest type															
	All types	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	No. white-cedar	Tamarack	Oak	Elm-ash cotton-wood	Maple-bass-wood	Aspen	Paper birch	Balsam poplar	Non-stocked
Softwoods:																
White pine	515,487	5,506	67,563	148,331	61,154	3,296	15,369	15,558	2,713	—	7,419	17,801	141,106	28,970	701	—
Red pine	596,918	11,178	326,506	19,451	50,075	2,918	9,963	18,696	—	—	1,128	563	100,096	55,811	533	—
Jack pine	589,587	370,381	16,496	23,402	18,113	1,245	41,683	6,050	336	—	1,214	6,705	94,432	3,882	—	5,648
White spruce	471,316	2,146	12,356	27,605	104,565	47,705	25,590	7,335	—	—	14,441	21,690	132,078	63,889	11,916	—
Black spruce	371,239	7,688	998	645	59,527	—	152,034	51,107	5,791	—	3,260	1,720	74,652	8,252	4,970	595
Balsam fir	741,009	1,580	5,556	6,006	272,777	3,657	20,842	23,105	1,957	—	29,596	26,945	231,369	82,024	35,595	—
Tamarack	86,831	—	—	—	13,197	1,214	22,149	8,643	33,573	—	617	485	4,905	1,047	1,001	—
Northern white-cedar	768,841	—	1,101	428	100,271	5,160	10,411	442,963	5,694	—	33,352	45,689	83,077	26,369	13,617	709
Other softwoods	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	4,141,228	398,479	430,576	225,868	679,679	65,195	298,041	573,457	50,064	—	91,027	121,598	861,715	270,244	68,333	6,952
Hardwoods:																
Select white oaks	13,774	—	—	—	—	—	—	—	—	718	2,314	2,578	7,762	402	—	—
Select red oaks	23,285	—	—	—	438	—	—	—	—	6,508	—	10,757	1,103	2,573	1,906	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	27,091	—	—	—	646	—	—	2,236	—	—	4,322	15,102	—	3,890	895	—
Hard maple	56,909	—	—	—	—	—	—	—	—	1,070	699	49,526	2,124	3,490	—	—
Soft maple	30,931	—	—	—	6,696	—	—	—	—	—	3,334	8,817	11,313	771	—	—
Ash	312,399	—	—	—	10,088	—	6,719	12,377	—	—	170,439	18,354	63,108	17,567	13,747	—
Balsam poplar	481,135	—	—	—	10,873	—	1,048	10,753	509	395	18,124	17,938	210,774	22,868	187,853	—
Paper birch	591,221	381	690	792	117,811	10,555	3,637	35,251	756	—	14,568	34,785	147,170	208,745	15,836	244
Bigtooth aspen	32,683	—	—	—	2,475	—	—	1,176	—	—	—	856	27,189	987	—	—
Quaking aspen	2,371,583	48,501	11,018	34,742	97,697	10,272	30,116	12,415	2,278	—	20,882	45,502	1,804,246	191,536	61,292	1,086
Basswood	64,530	—	—	—	1,293	—	—	—	—	—	4,657	41,027	9,557	6,933	1,063	—
Elm	176,959	—	—	—	1,064	—	—	506	—	424	61,642	49,418	37,636	7,190	18,367	712
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	868	—	—	—	—	—	—	—	—	—	—	—	868	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	4,183,368	48,882	11,708	35,534	249,081	20,827	41,520	74,714	3,543	9,115	300,981	294,660	2,322,850	466,952	300,959	2,042
All species	8,324,596	447,361	442,284	261,402	928,760	86,022	339,561	648,171	53,607	9,115	392,008	416,258	3,184,565	737,196	369,292	8,994

[1]International ¼-inch rule.

Table 26.—*Net volume of growing stock on commercial forest land by species and ownership class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	Ownership class													
	All owners	National forest	Bureau of land mgmt.	Indian	Misc. Federal	State	County and municipal	Forest industry	Farmer	Farmer-owned, leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Softwoods:														
White pine	91,561	39,695	448	1,789	679	8,314	14,270	9,745	4,816	—	3,976	7,829	—	—
Red pine	147,197	62,268	—	4,279	—	17,704	19,009	9,062	10,149	—	3,657	21,069	—	—
Jack pine	212,572	116,794	77	114	2,450	32,281	23,962	13,114	5,405	—	6,688	11,421	266	—
White spruce	136,485	45,610	—	3,119	814	22,047	24,681	13,164	6,792	—	4,776	15,358	124	—
Black spruce	419,971	97,327	744	9,417	1,574	169,641	48,438	39,237	18,593	—	14,550	20,097	353	—
Balsam fir	559,387	134,772	186	12,059	1,914	98,520	128,787	62,951	40,212	—	31,744	48,242	—	—
Tamarack	75,063	5,654	82	457	127	39,384	13,433	4,461	5,085	—	1,646	4,734	—	—
Northern white-cedar	246,561	38,452	307	11,193	461	86,387	39,021	42,445	6,459	—	7,474	14,362	—	—
Other softwoods	138	—	—	—	—	—	138	—	—	—	—	—	—	—
Total softwoods	1,888,935	540,572	1,844	42,427	8,019	474,278	311,739	194,179	97,511	—	74,511	143,112	743	—
Hardwoods:														
Select white oaks	5,277	—	—	—	—	619	1,114	281	2,620	—	—	643	—	—
Select red oaks	9,347	—	—	314	52	265	1,446	2,437	1,965	—	168	2,700	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	6,861	461	—	—	—	609	4,595	218	181	—	589	208	—	—
Hard maple	43,352	4,684	—	304	297	5,360	14,866	4,516	5,008	—	1,316	6,931	70	—
Soft maple	38,495	15,460	—	321	498	2,632	7,002	3,440	5,684	—	1,173	2,285	—	—
Ash	196,644	39,324	—	2,777	—	32,226	45,190	15,850	34,875	—	5,953	20,449	—	—
Balsam poplar	244,477	49,400	—	3,019	462	41,423	64,218	27,134	25,124	—	9,169	24,528	—	—
Paper birch	620,775	168,291	1,127	11,302	1,330	79,998	135,111	46,125	55,051	—	42,431	79,399	88	522
Bigtooth aspen	21,001	—	—	—	—	6,254	4,484	2,291	3,962	—	447	3,563	—	—
Quaking aspen	1,365,737	407,508	432	17,708	7,933	178,412	326,821	126,446	136,724	—	48,627	112,017	2,683	426
Basswood	35,262	3,451	—	299	—	2,261	9,616	4,015	7,087	—	785	7,748	—	—
Elm	45,431	1,417	—	697	—	9,866	13,067	5,763	8,311	—	751	5,559	—	—
Select hardwoods	53	—	—	—	—	53	—	—	—	—	—	—	—	—
Other hardwoods	428	—	—	—	—	—	—	—	428	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	2,633,140	689,996	1,559	36,741	10,572	359,978	627,530	238,516	287,020	—	111,409	266,030	2,841	948
All species	4,522,075	1,230,568	3,403	79,168	18,591	834,256	939,269	432,695	384,531	—	185,920	409,142	3,584	948

Table 27.—*Net volume of sawtimber on commercial forest land by species and ownership class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand board feet[1])

Species	Ownership class													
	All owners	National forest	Bureau of land mgmt.	Indian	Misc. Federal	State	County and municipal	Forest industry	Farmer	Farmer-owned, leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Softwoods:														
White pine	515,487	192,115	1,625	9,575	4,061	51,192	82,538	65,496	32,679	—	24,138	52,068	—	—
Red pine	596,918	194,461	—	18,836	—	88,706	86,356	38,508	49,394	—	17,236	103,421	—	—
Jack pine	589,587	303,033	402	551	9,740	96,127	69,644	34,245	18,575	—	24,654	31,737	879	—
White spruce	471,316	166,475	—	13,327	1,759	64,447	87,114	43,693	26,004	—	17,102	50,927	468	—
Black spruce	371,239	129,882	—	4,157	457	128,448	33,142	38,495	8,935	—	10,444	17,279	—	—
Balsam fir	741,009	145,895	354	19,412	2,790	126,633	193,860	81,518	60,557	—	38,513	71,477	—	—
Tamarack	86,831	10,279	—	1,301	—	45,849	8,521	5,094	6,109	—	767	8,911	—	—
Northern white-cedar	768,841	129,165	772	22,130	2,682	258,921	130,229	139,810	13,213	—	28,493	43,426	—	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	4,141,228	1,271,305	3,153	89,289	21,489	860,323	691,404	446,859	215,466	—	161,347	379,246	1,347	—
Hardwoods:														
Select white oaks	13,774	—	—	—	—	2,165	4,359	753	5,359	—	—	1,138	—	—
Select red oaks	23,285	—	—	1,581	—	312	4,932	2,335	7,224	—	—	6,901	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	27,091	1,606	—	—	—	1,944	18,598	1,213	575	—	3,155	—	—	—
Hard maple	56,909	6,668	—	457	416	8,344	21,546	2,780	6,268	—	424	10,006	—	—
Soft maple	30,931	10,437	—	622	476	3,150	3,657	3,545	6,372	—	1,271	1,401	—	—
Ash	312,399	70,742	—	4,689	—	49,842	71,389	28,362	53,028	—	7,979	26,368	—	—
Balsam poplar	481,135	107,536	—	8,126	458	78,224	132,341	48,125	42,965	—	18,070	45,290	—	—
Paper birch	591,221	190,570	—	13,899	1,527	78,309	97,345	55,887	46,166	—	24,639	82,569	—	310
Bigtooth aspen	32,683	—	—	—	—	3,860	10,105	5,826	7,349	—	544	4,999	—	—
Quaking aspen	2,371,583	770,336	1,057	28,997	17,932	324,409	514,440	234,598	204,185	—	104,287	168,838	2,168	336
Basswood	64,530	—	—	430	—	5,168	19,149	5,278	15,377	—	787	18,341	—	—
Elm	176,959	8,614	—	1,268	—	36,783	53,710	24,218	30,775	—	2,512	19,079	—	—
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	868	—	—	—	—	—	—	—	868	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	4,183,368	1,166,509	1,057	60,069	20,809	592,510	951,571	412,920	426,511	—	163,668	384,930	2,168	646
All species	8,324,596	2,437,814	4,210	149,358	42,298	1,452,833	1,642,975	859,779	641,977	—	325,015	764,176	3,515	646

[1]International ¼-inch rule.

Table 28.—*Net volume of growing stock on commercial forest land by forest type and stand-age class, Aspen-Birch Unit, Minnesota, 1977*

(In thousand cubic feet)

Forest type	All ages	Stand-age class(years) 1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	197,317	338	208	2,741	17,678	38,880	63,381	48,443	1,993	12,811	8,299	2,545	—	—
Red pine	138,588	1,497	2,684	1,247	31,306	17,004	24,517	5,218	23,377	28,126	2,222	1,390	—	—
White pine	52,777	—	491	—	—	413	—	7,326	18,954	1,710	22,683	1,200	—	—
Balsam fir	513,839	10,183	14,834	17,926	55,289	168,353	160,164	48,417	12,683	10,025	13,682	2,283	—	—
White spruce	35,971	304	240	717	4,189	15,454	3,820	1,465	1,530	2,087	5,173	992	—	—
Black spruce	402,245	1,829	14,765	22,929	30,488	50,623	82,648	47,238	68,283	30,080	35,722	6,944	10,696	—
Northern white-cedar	255,473	193	1,335	2,810	7,340	7,869	14,137	28,035	24,109	40,187	44,176	31,325	53,957	—
Tamarack	54,170	1,570	6,016	4,665	2,409	5,961	5,826	7,235	3,799	3,856	685	8,440	3,202	506
Oak	5,726	—	—	—	603	3,199	1,924	—	—	—	—	—	—	—
Elm-ash-cottonwood	190,098	3,697	5,988	2,078	3,789	19,145	27,889	32,943	15,680	40,360	17,779	9,111	11,639	—
Maple-basswood	167,125	961	4,401	2,173	7,470	27,788	25,836	14,136	18,164	14,284	30,199	12,607	9,106	—
Aspen	1,829,371	56,339	57,303	88,067	229,456	488,537	534,057	253,495	71,564	38,619	11,076	858	—	—
Paper birch	486,462	3,836	10,335	9,162	39,665	141,005	131,037	52,297	59,517	29,739	7,911	1,958	—	—
Balsam poplar	187,787	6,003	3,876	4,288	32,826	63,008	33,734	20,167	15,975	6,422	1,488	—	—	—
Nonstocked	5,126	5,126	—	—	—	—	—	—	—	—	—	—	—	—
All types	4,522,075	91,876	122,476	158,803	462,508	1,047,239	1,108,970	566,415	335,628	258,306	201,095	79,653	88,600	506

Table 29.—*Net volume of sawtimber on commercial forest land by forest type and stand-age class, Aspen-Birch Unit, Minnesota, 1977*

(In thousand board feet[1])

Forest type	All ages	Stand-age class(years) 1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	447,361	287	402	1,586	22,735	76,112	177,968	97,961	8,424	32,780	21,804	7,302	—	—
Red pine	442,284	6,764	10,466	1,423	47,782	48,626	82,341	21,833	88,726	117,570	10,746	6,007	—	—
White pine	261,402	—	3,736	—	—	2,711	—	31,771	98,507	6,579	109,870	8,228	—	—
Balsam fir	928,760	21,833	36,307	32,386	65,832	227,545	306,874	110,666	38,026	29,952	52,692	6,647	—	—
White spruce	86,022	—	—	2,987	6,443	18,527	5,162	3,684	5,938	10,315	28,260	4,706	—	—
Black spruce	339,561	1,546	7,197	7,564	16,513	40,114	76,316	30,047	93,239	30,070	22,870	5,002	9,083	—
Northern white-cedar	648,171	533	2,078	2,603	9,472	16,724	20,617	57,563	45,506	112,824	89,690	91,661	198,900	—
Tamarack	53,607	1,749	7,765	1,579	2,910	2,764	3,836	7,213	5,973	2,415	—	12,140	5,263	—
Oak	9,115	—	—	—	1,437	3,391	4,287	—	—	—	—	—	—	—
Elm-ash-cottonwood	392,008	3,000	12,365	1,839	8,880	24,127	45,119	54,155	34,473	91,512	51,196	23,313	42,029	—
Maple-basswood	416,258	2,030	8,147	2,011	8,066	45,355	45,337	38,283	65,281	52,794	64,797	46,194	37,963	—
Aspen	3,184,565	86,134	72,668	104,402	250,915	662,870	987,692	633,930	203,659	148,720	30,806	2,769	—	—
Paper birch	737,196	2,562	13,202	19,029	39,971	142,367	145,763	87,561	149,223	107,895	25,055	4,568	—	—
Balsam poplar	369,292	11,151	3,487	4,918	48,454	104,350	59,147	57,859	51,810	23,233	4,883	—	—	—
Nonstocked	8,994	8,994	—	—	—	—	—	—	—	—	—	—	—	—
All types	8,324,596	146,583	177,820	182,327	529,410	1,415,583	1,960,459	1,232,526	888,785	766,659	512,669	218,537	293,238	—

[1]International 1/4-inch rule.

Table 30.—*Net volume of short-log trees on commercial forest land by species and diameter class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:											
White pine	1,080	311	85	134	341	89	--	—	120	—	—
Red pine	339	—	265	74	—	—	—	—	—	—	—
Jack pine	1,878	797	681	216	112	72	—	—	—	—	—
White spruce	147	—	66	—	81	—	—	—	—	—	—
Black spruce	787	696	91	—	—	—	—	—	—	—	—
Balsam fir	2,253	1,753	329	—	171	—	—	—	—	—	—
Tamarack	625	309	167	—	61	88	—	—	—	—	—
Northern white-cedar	7,743	2,991	2,161	890	731	753	175	42	—	—	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	14,852	6,857	3,845	1,314	1,497	1,002	175	42	120	—	—
Hardwoods:											
Select white oaks	73	—	—	—	73	—	—	—	—	—	—
Select red oaks	380	—	162	137	81	—	—	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	1,482	—	80	267	—	211	—	—	924	—	—
Hard maple	798	—	109	251	233	—	136	60	9	—	—
Soft maple	467	—	—	186	146	60	75	—	—	—	—
Ash	506	—	256	164	86	—	—	—	—	—	—
Balsam poplar	2,314	—	271	570	—	887	254	225	107	—	—
Paper birch	5,785	—	2,093	1,218	1,494	166	661	134	19	—	—
Bigtooth aspen	455	—	160	105	131	59	—	—	—	—	—
Quaking aspen	18,203	—	7,209	4,195	3,404	2,499	892	—	—	4	—
Basswood	279	—	—	—	62	91	—	—	126	—	—
Elm	2,106	—	324	422	366	268	52	98	447	—	129
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—
Noncommercial species	—	—	—	—	-	—	—	—	—	—	—
Total hardwoods	32,848	—	10,664	7,515	6,076	4,241	2,070	517	1,632	4	129
All species	47,700	6,857	14,509	8,829	7,573	5,243	2,245	559	1,752	4	129

Table 31.—*Net volume of short-log trees on commercial forest land by species and diameter class, Aspen-Birch Unit, Minnesota, 1977*

(In thousand board feet[1])

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:											
White pine	4,653	1,181	387	690	1,613	411	—	—	371	—	—
Red pine	1,593	—	1,246	347	—	—	—	—	—	—	—
Jack pine	7,854	3,463	2,893	657	522	319	—	—	—	—	—
White spruce	759	—	332	—	427	—	—	—	—	—	—
Black spruce	2,957	2,589	368	—	—	—	—	—	—	—	—
Balsam fir	9,095	6,412	1,540	—	1,143	—	—	—	—	—	—
Tamarack	2,701	1,135	655	—	455	456	—	—	—	—	—
Northern white-cedar	29,491	12,649	8,666	3,060	2,300	2,219	485	112	—	—	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	59,103	27,429	16,087	4,754	6,460	3,405	485	112	371	—	—
Hardwoods:											
Select white oaks	274	—	—	—	274	—	—	—	—	—	—
Select red oaks	1,455	—	653	474	328	—	—	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	2,856	—	226	929	—	838	—	—	863	—	—
Hard maple	3,179	—	321	862	922	—	674	358	42	—	—
Soft maple	1,923	—	—	814	645	273	191	—	—	—	—
Ash	1,792	—	1,032	493	267	—	—	—	—	—	—
Balsam poplar	11,573	—	798	1,906	—	5,345	1,518	1,489	517	—	—
Paper birch	19,401	—	6,338	4,268	2,612	739	4,300	1,024	120	—	—
Bigtooth aspen	1,497	—	403	347	525	222	—	—	—	—	—
Quaking aspen	69,351	—	25,062	14,437	15,644	9,545	4,660	—	—	3	—
Basswood	862	—	—	—	134	337	—	—	391	—	—
Elm	8,158	—	1,508	1,983	1,414	1,024	157	329	1,391	—	352
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	122,321	—	36,341	26,513	22,765	18,323	11,500	3,200	3,324	3	352
All species	181,424	27,429	52,428	31,267	29,225	21,728	11,985	3,312	3,695	3	352

[1]International ¼-inch rule.

Table 32.—*Net annual growth of growing stock on commercial forest land by softwoods and hardwoods, Aspen-Birch Unit, Minnesota, 1961*[1] *and 1976*

(In thousand cubic feet)

Species	1961	1976
Softwoods	68,124	56,982
Hardwoods	94,826	57,917
All species	162,950	114,899

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 estimates due to changes in survey procedures and definitions.

Table 33.—*Net annual growth of growing stock on commercial forest land by species and county, Aspen-Birch Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	All counties	Carlton	Cook	Koochiching	Lake	St. Louis
Softwoods:						
White pine	2,367	77	194	250	191	1,655
Red pine	5,811	540	6	536	497	4,232
Jack pine	5,799	64	471	630	835	3,799
White spruce	7,328	158	1,413	1,381	1,210	3,166
Black spruce	11,358	99	923	3,847	1,861	4,628
Balsam fir	17,912	603	1,564	5,013	−671	11,403
Tamarack	−343	−176	20	−132	222	−277
Northern white-cedar	6,747	31	752	3,259	405	2,300
Other softwoods	3	—	—	—	—	3
Total softwoods	56,982	1,396	5,343	14,784	4,550	30,909
Hardwoods:						
Select white oaks	140	63	—	40	—	37
Select red oaks	191	135	—	—	8	48
Other red oaks	—	—	—	—	—	—
Hickory	—	—	—	—	—	—
Yellow birch	30	—	−13	1	−4	46
Hard maple	1,298	477	163	28	368	262
Soft maple	1,574	95	249	38	132	1,060
Ash	3,996	365	99	387	468	2,677
Balsam poplar	6,229	28	208	3,371	594	2,028
Paper birch	10,619	769	2,358	752	3,031	3,709
Bigtooth aspen	409	21	—	20	8	360
Quaking aspen	31,322	−830	2,497	9,998	840	18,817
Basswood	891	169	133	123	120	346
Elm	1,248	167	—	674	5	402
Select hardwoods	4	—	4	—	—	—
Other hardwoods	−34	−21	—	−6	—	−7
Noncommercial species	—	—	—	—	—	—
Total hardwoods	57,917	1,438	5,698	15,426	5,570	29,785
All species	114,899	2,834	11,041	30,210	10,120	60,694

Table 34.—*Net annual growth of sawtimber on commercial forest land by species and county, Aspen-Birch Unit, Minnesota, 1976*
(In thousand board feet[1])

Species	All counties	Carlton	Cook	Koochiching	Lake	St. Louis
Softwoods:						
White pine	15,969	380	1,650	1,643	2,300	9,996
Red pine	25,414	3,796	35	1,191	4,131	16,261
Jack pine	30,665	214	5,935	3,426	3,215	17,875
White spruce	23,581	1,224	4,578	2,738	5,740	9,301
Black spruce	14,758	−382	2,362	2,036	1,662	9,080
Balsam fir	48,647	2,057	8,611	10,772	590	26,617
Tamarack	6	181	35	784	615	−1,609
Northern white-cedar	19,486	656	3,941	7,328	871	6,690
Other softwoods	—	—	—	—	—	—
Total softwoods	178,526	8,126	27,147	29,918	19,124	94,211
Hardwoods:						
Select white oaks	199	76	—	86	—	37
Select red oaks	658	578	—	—	14	66
Other red oaks	—	—	—	—	—	—
Hickory	—	—	—	—	—	—
Yellow birch	428	—	—	4	339	85
Hard maple	2,639	102	686	393	1,415	43
Soft maple	1,574	57	423	49	743	302
Ash	6,377	775	29	766	1,681	3,126
Balsam poplar	22,274	−656	418	6,440	2,604	13,468
Paper birch	23,611	1,396	3,554	1,309	5,920	11,432
Bigtooth aspen	1,130	30	—	11	9	1,080
Quaking aspen	132,104	2,970	18,251	24,019	14,922	71,942
Basswood	2,452	553	—	645	131	1,123
Elm	6,113	187	—	3,529	16	2,381
Select hardwoods	—	—	—	—	—	—
Other hardwoods	−19	−15	—	—	—	−4
Noncommercial species	—	—	—	—	—	—
Total hardwoods	199,540	6,053	23,361	37,251	27,794	105,081
All species	378,066	14,179	50,508	67,169	46,918	199,292

[1]International ¼-inch rule.

Table 35.—*Net annual growth of growing stock on commercial forest land by species and ownership class, Aspen-Birch Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	Ownership class													
	All owners	National forest	Bureau of land mgmt.	Indian	Misc. Federal	State	County and municipal	Forest industry	Farmer	Farmer-owned, leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Softwoods:														
White pine	2,367	530	27	68	21	241	566	388	133	—	132	261	—	—
Red pine	5,811	2,683	—	131	—	486	645	335	261	—	116	1,154	—	—
Jack pine	5,799	2,974	1	1	80	800	1,022	395	66	—	123	327	10	—
White spruce	7,328	1,777	—	117	45	2,394	1,321	411	356	—	243	651	13	—
Black spruce	11,358	2,386	29	178	18	3,910	2,127	1,102	545	—	490	557	16	—
Balsam fir	17,912	1,816	5	945	102	3,533	7,186	819	1,676	—	802	1,028	—	—
Tamarack	−343	326	2	−295	6	−646	−258	145	181	—	59	137	—	—
Northern white-cedar	6,747	653	8	423	9	2,649	985	1,008	283	—	230	499	—	—
Other softwoods	3	—	—	—	—	—	3	—	—	—	—	—	—	—
Total softwoods	56,982	13,145	72	1,568	281	13,367	13,597	4,603	3,501	—	2,195	4,614	39	—
Hardwoods:														
Select white oaks	140	—	—	—	—	18	19	5	81	—	—	17	—	—
Select red oaks	191	—	—	6	1	9	24	50	33	—	5	63	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	30	−84	—	—	—	13	75	4	4	—	8	10	—	—
Hard maple	1,298	125	—	7	9	133	188	−140	419	—	39	515	3	—
Soft maple	1,574	1,028	—	8	10	58	207	72	118	—	25	48	—	—
Ash	3,996	2,030	—	61	—	179	158	143	822	—	137	466	—	—
Balsam poplar	6,229	2,020	—	101	14	209	1,480	708	1,403	—	472	−178	—	—
Paper birch	10,619	948	22	166	28	1,607	3,446	901	1,426	—	840	1,214	1	20
Bigtooth aspen	409	—	—	—	—	140	73	39	65	—	14	78	—	—
Quaking aspen	31,322	10,124	19	1,403	358	5,299	7,145	3,704	1,263	—	−788	2,843	−72	24
Basswood	891	133	—	8	—	55	229	105	171	—	19	171	—	—
Elm	1,248	−35	—	31	—	211	368	199	226	—	27	221	—	—
Select hardwoods	4	—	—	—	—	4	—	—	—	—	—	—	—	—
Other hardwoods	−34	—	—	—	—	—	—	—	−34	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	57,917	16,289	41	1,791	420	7,935	13,412	5,790	5,997	—	798	5,468	−68	44
All species	114,899	29,434	113	3,359	701	21,302	27,009	10,393	9,498	—	2,993	10,082	−29	44

Table 36.— *Net annual growth of sawtimber on commercial forest land by species and ownership class, Aspen-Birch Unit, Minnesota, 1976*
(In thousand board feet[1])

Species	Ownership class													
	All owners	National forest	Bureau of land mgmt.	Indian	Misc. Federal	State	County and municipal	Forest industry	Farmer	Farmer-owned, leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Softwoods:														
White pine	15,969	6,418	64	301	92	1,198	2,522	2,663	697	—	572	1,442	—	—
Red pine	25,414	11,362	—	329	—	1,977	3,581	2,243	957	—	424	4,541	—	—
Jack pine	30,665	18,951	6	5	312	2,714	2,234	3,807	809	—	489	1,311	27	—
White spruce	23,581	6,305	—	847	105	4,133	5,081	1,016	1,834	—	996	3,203	61	—
Black spruce	14,758	8,326	—	44	15	2,693	1,437	1,372	266	—	298	307	—	—
Balsam fir	48,647	8,032	9	1,245	108	9,804	16,495	5,036	4,199	—	3	3,716	—	—
Tamarack	6	538	—	19	—	−1,992	521	140	162	—	22	596	—	—
Northern white-cedar	19,486	4,353	14	1,069	55	6,360	3,231	1,528	346	—	1,212	1,318	—	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	178,526	64,285	93	3,859	687	26,887	35,102	17,805	9,270	—	4,016	16,434	88	—
Hardwoods:														
Select white oaks	199	—	—	—	—	36	50	7	89	—	—	17	—	—
Select red oaks	658	—	—	20	—	5	48	407	85	—	—	93	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	428	154	—	—	—	23	187	18	10	—	36	—	—	—
Hard maple	2,639	626	—	6	6	404	1,011	33	80	—	6	467	—	—
Soft maple	1,574	1,166	—	5	3	30	32	33	286	—	10	9	—	—
Ash	6,377	1,569	—	44	—	−280	1,236	1,305	1,222	—	100	1,181	—	—
Balsam poplar	22,274	4,184	—	169	5	3,775	6,839	2,936	3,430	—	436	500	—	—
Paper birch	23,611	10,935	—	126	15	741	3,187	1,550	3,463	—	574	3,014	—	6
Bigtooth aspen	1,130	—	—	—	—	269	306	60	87	—	6	402	—	—
Quaking aspen	132,104	40,997	36	1,183	551	19,310	39,497	13,345	8,831	—	−2,438	10,709	64	19
Basswood	2,452	—	—	8	—	78	1,011	817	255	—	13	270	—	—
Elm	6,113	245	—	46	—	602	1,943	745	1,411	—	70	1,051	—	—
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	−19	—	—	—	—	—	—	—	−19	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	199,540	59,876	36	1,607	580	24,993	55,347	21,256	19,230	—	−1,187	17,713	64	25
All species	378,066	124,161	129	5,466	1,267	51,880	90,449	39,061	28,500	—	2,829	34,147	152	25

[1]International ¼-inch rule.

Table 37.—*Net annual growth of growing stock on commercial forest land by species and forest type, Aspen-Birch Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	Forest type															
	All types	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	No. white-cedar	Tamarack	Oak	Elm-ash cotton-wood	Maple-bass-wood	Aspen	Paper birch	Balsam poplar	Non-stocked
Softwoods:																
White pine	2,367	54	276	379	264	18	81	36	19	—	33	119	891	196	1	—
Red pine	5,811	109	3,804	40	256	20	48	59	—	—	8	1	1,119	344	3	—
Jack pine	5,799	4,162	258	29	129	3	394	85	10	—	11	−4	645	29	−34	82
White spruce	7,328	78	175	222	1,216	844	429	7	7	—	67	196	3,291	630	166	—
Black spruce	11,358	223	36	−80	1,433	42	8,431	−3	264	—	37	−22	985	−49	51	10
Balsam fir	17,912	257	110	−581	5,197	112	844	136	30	5	376	−95	7,676	3,156	681	8
Tamarack	−343	—	—	—	169	−822	490	−124	−164	—	7	3	60	19	8	11
Northern white-cedar	6,747	—	11	8	915	24	211	4,149	85	—	243	80	732	128	153	8
Other softwoods	3	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—
Total softwoods	56,982	4,883	4,670	17	9,579	241	10,928	4,345	251	5	782	278	15,399	4,456	1,029	119
Hardwoods:																
Select white oaks	140	—	—	—	—	—	—	—	—	14	10	14	86	10	6	—
Select red oaks	191	—	—	—	1	—	—	—	—	85	—	51	23	25	6	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	30	—	—	—	7	—	—	15	—	—	18	−31	2	17	2	—
Hard maple	1,298	—	—	—	19	—	—	—	—	5	8	810	320	112	22	2
Soft maple	1,574	142	—	37	25	—	3	1	1	1	29	115	585	626	9	—
Ash	3,996	—	—	2	123	−310	41	−95	2	7	2,021	4	1,632	287	274	8
Balsam poplar	6,229	—	—	—	−926	5	29	113	4	9	223	−115	3,876	399	2,606	6
Paper birch	10,619	83	28	−107	2,100	288	204	37	22	1	85	311	2,016	5,251	297	3
Bigtooth aspen	409	—	2	1	12	—	1	10	—	—	4	8	348	17	6	—
Quaking aspen	31,322	975	−369	162	1,919	400	983	165	−145	15	54	395	26,235	101	362	70
Basswood	891	—	—	—	8	—	—	—	—	—	21	529	214	107	12	—
Elm	1,248	—	—	—	23	−129	—	4	—	2	381	216	478	56	213	4
Select hardwoods	4	—	—	—	—	—	—	—	—	—	—	—	4	—	—	—
Other hardwoods	−34	—	—	—	—	—	—	—	—	—	−12	—	−22	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	57,917	1,200	−339	95	3,311	254	1,261	250	−116	139	2,842	2,307	35,797	7,008	3,815	93
All species	114,899	6,083	4,331	112	12,890	495	12,189	4,595	135	144	3,624	2,585	51,196	11,464	4,844	212

Table 38.— *Net annual growth of sawtimber on commercial forest land by species and forest type, Aspen-Birch Unit, 1976*
(In thousand board feet[1])

Species	Forest type															
	All types	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	No. white-cedar	Tamarack	Oak	Elm-ash cotton-wood	Maple-bass-wood	Aspen	Paper birch	Balsam poplar	Non-stocked
Softwoods:																
White pine	15,969	148	2,871	4,236	1,349	119	471	243	97	—	196	612	4,608	1,011	8	—
Red pine	25,414	323	15,052	642	1,080	52	204	636	—	—	24	7	5,862	1,516	16	—
Jack pine	30,665	20,019	1,046	108	407	12	3,197	373	12	—	38	−26	5,290	97	−184	276
White spruce	23,581	208	976	1,981	4,672	2,771	856	−87	—	—	138	972	7,125	3,274	645	—
Black spruce	14,758	568	16	4	3,068	—	4,111	−94	190	—	25	715	5,878	181	85	11
Balsam fir	48,647	58	683	157	13,027	−117	1,507	120	86	—	60	1,395	20,804	8,365	2,502	—
Tamarack	6	—	—	—	913	−2,814	418	130	772	—	11	16	492	37	31	—
Northern white-cedar	19,486	—	36	8	2,191	115	840	7,879	532	—	924	969	5,414	158	401	19
Other softwoods	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	178,526	21,324	20,680	7,136	26,707	138	11,604	9,250	1,689	—	1,416	4,660	55,473	14,639	3,504	306
Hardwoods:																
Select white oaks	199	—	—	—	—	—	—	—	—	12	21	35	127	4	—	—
Select red oaks	658	—	—	—	5	—	—	—	—	466	—	118	15	32	22	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	428	—	—	—	6	—	—	24	—	—	54	285	—	53	6	—
Hard maple	2,639	—	—	—	—	—	—	—	—	13	9	2,538	30	49	—	—
Soft maple	1,574	—	—	—	751	—	—	—	—	—	24	301	491	7	—	—
Ash	6,377	—	—	—	273	−1,516	114	90	—	—	2,493	215	3,001	774	933	—
Balsam poplar	22,274	—	—	—	263	—	22	856	11	11	340	326	10,122	1,005	9,318	—
Paper birch	23,611	4	10	9	4,091	392	22	74	7	—	118	1,152	9,633	7,886	211	2
Bigtooth aspen	1,130	—	—	—	24	—	—	10	—	—	—	8	1,074	14	—	—
Quaking aspen	132,104	3,433	1,134	788	4,830	243	2,399	234	51	—	865	892	105,245	6,990	4,955	45
Basswood	2,452	—	—	—	20	—	—	—	—	—	451	1,277	574	110	20	—
Elm	6,113	—	—	—	37	−520	—	18	—	12	2,493	1,062	1,677	227	1,086	21
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	−19	—	—	—	—	—	—	—	—	—	—	—	−19	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	199,540	3,437	1,144	797	10,300	−1,401	2,557	1,306	69	514	6,868	8,209	131,970	17,151	16,551	68
All species	378,066	24,761	21,824	7,933	37,007	−1,263	14,161	10,556	1,758	514	8,284	12,869	187,443	31,790	20,055	374

[1]International ¼-inch rule.

Table 39.—*Net annual growth of growing stock on commercial forest land by forest type and stand-age class, Aspen-Birch Unit, Minnesota, 1976*

(In thousand cubic feet)

Forest type	Stand-age class(years)													
	All ages	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	6,083	18	6	470	1,299	1,702	1,666	995	53	−86	−89	49	—	—
Red pine	4,331	43	119	93	1,893	416	884	170	119	491	68	35	—	—
White pine	112	−29	20	—	—	3	—	202	79	71	−247	13	—	—
Balsam fir	12,890	327	81	565	2,465	6,041	2,227	1,773	−386	−446	173	70	—	—
White spruce	495	−395	14	40	217	−94	445	67	30	50	101	20	—	—
Black spruce	12,189	15	628	742	857	1,888	2,765	1,420	2,014	610	912	54	284	—
Northern white−cedar	4,595	8	46	24	125	35	492	648	574	918	567	328	830	—
Tamarack	135	53	5	−13	99	−156	214	241	123	−696	19	196	38	12
Oak	144	—	—	—	15	78	51	—	—	—	—	—	—	—
Elm−ash−cottonwood	3,624	−554	170	70	114	574	705	946	386	596	190	298	129	—
Maple−basswood	2,585	30	16	19	237	604	737	380	−305	350	703	−380	194	—
Aspen	51,196	1,424	2,061	3,717	9,100	11,926	16,164	5,466	602	343	413	−20	—	—
Paper birch	11,464	52	517	345	1,344	3,988	2,796	813	993	710	−132	38	—	—
Balsam poplar	4,844	−441	189	193	1,186	2,134	567	321	482	173	40	—	—	—
Nonstocked	212	212	—	—	—	—	—	—	—	—	—	—	—	—
All types	114,899	763	3,872	6,265	18,951	29,139	29,713	13,442	4,764	3,084	2,718	701	1,475	12

Table 40.—*Net annual growth of sawtimber on commercial forest land by forest type and stand-age, Aspen-Birch Unit, Minnesota, 1976*

(In thousand board feet[1])

Forest type	Stand-age class(years)													
	All ages	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	24,761	5	19	72	1,272	4,602	11,096	5,340	187	986	1,059	123	—	—
Red pine	21,824	141	1,138	76	5,869	2,877	3,958	496	1,983	4,472	255	559	—	—
White pine	7,933	—	131	—	—	−13	—	1,899	1,920	213	3,730	53	—	—
Balsam fir	37,007	1,344	359	801	3,925	13,177	14,517	3,343	−424	−705	509	161	—	—
White spruce	−1,263	−2,036	—	213	198	−1,866	285	521	117	217	988	100	—	—
Black spruce	14,161	44	734	190	1,179	2,063	3,991	1,038	2,540	563	1,590	91	138	—
Northern white−cedar	10,556	9	48	68	212	−687	291	1,610	1,733	3,849	1,496	−37	1,964	—
Tamarack	1,758	41	250	48	83	97	115	195	178	45	—	617	89	—
Oak	514	—	—	—	18	436	60	—	—	—	—	—	—	—
Elm−ash−cottonwood	8,284	475	268	40	227	580	1,363	1,669	828	1,330	−193	1,179	518	—
Maple−basswood	12,869	47	1,583	−190	−233	1,536	1,325	1,460	473	1,071	3,381	1,007	1,409	—
Aspen	187,443	5,015	2,858	10,725	24,275	44,727	52,783	33,307	7,296	4,839	1,270	348	—	—
Paper birch	31,790	99	399	1,275	4,392	9,045	4,460	3,462	3,309	4,306	985	58	—	—
Balsam poplar	20,055	−1,786	135	180	4,448	8,388	2,892	2,474	1,816	979	529	—	—	—
Nonstocked	374	374	—	—	—	—	—	—	—	—	—	—	—	—
All types	378,066	3,772	7,922	13,498	45,865	84,962	97,136	56,814	21,956	22,165	15,599	4,259	4,118	—

[1]International 1/4-inch rule

Table 41.—*Timber removals from growing stock and sawtimber on commericial forest land by species, Aspen-Birch Unit, Minnesota, 1962[1] and 1976*

Species	Growing stock		Sawtimber	
	1962	1976	1962	1976
	Thousand cubic feet		*Thousand board feet[2]*	
Softwoods:				
White pine	1,975	1,711	11,785	7,641
Red pine	1,018	1,485	5,013	4,210
Jack pine	11,993	10,718	24,723	27,678
Spruce	15,617	13,163	34,645	28,225
Balsam fir	7,656	7,728	12,239	15,329
Tamarack	941	2,503	1,999	5,237
Northern white-cedar	1,452	1,495	3,318	4,948
Other softwoods	—	—	—	—
Total softwoods	40,652	38,803	93,722	93,268
Hardwoods:				
White oak	12	10	42	10
Red oak	14	113	72	160
Yellow birch	315	3	1,350	14
Hard maple	82	28	163	39
Soft maple	26	77	28	69
Ash	237	302	723	683
Paper birch	1,200	3,253	4,259	6,582
Aspen	20,141	33,351	36,438	75,259
Basswood	56	48	305	152
Elm	51	207	231	618
Other hardwoods	807	1,053	980	1,172
Total hardwoods	22,941	38,445	44,591	84,758
All species	63,593	77,248	138,313	178,026

[1] Figures have been adjusted from those published after the 1962 survey to conform to 1977 estimates due to changes in survey procedures and definitions.

[2] International ¼-inch rule.

Table 42.—*Timber removals from growing stock on commercial forest land by species and county, Aspen-Birch Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	All counties	Carlton	Cook	Koochiching	Lake	St. Louis
Softwoods:						
White pine	1,711	10	411	277	387	626
Red pine	1,485	64	107	490	160	664
Jack Pine	10,718	227	332	1,532	2,262	6,365
White spruce	2,888	11	344	705	853	975
Black spruce	10,275	22	412	5,683	1,283	2,875
Balsam fir	7,728	86	397	3,730	1,002	2,513
Tamarack	2,503	22	1	1,930	6	544
Northern white-cedar	1,495	48	57	1,076	88	226
Other softwoods	—	—	—	—	—	—
Total softwoods	38,803	,490	2,061	15,423	6,041	14,788
Hardwoods:						
Select white oak	10	—	—	2	—	8
Select red oak	113	47	8	53	—	5
Other red oak	—	—	—	—	—	—
Hickory	—	—	—	—	—	—
Yellow birch	3	—	—	—	—	3
Hard maple	28	4	2	6	1	15
Soft maple	77	—	—	9	1	67
Ash	302	16	19	105	26	136
Balsam poplar	1,044	3	1	638	3	399
Paper birch	3,253	302	243	482	947	1,279
Bigtooth aspen	665	29	1	45	9	581
Quaking aspen	32,686	1,446	1,802	10,988	1,598	16,852
Basswood	48	—	—	32	1	15
Elm	207	3	6	167	1	30
Other hardwoods	9	—	—	1	—	8
Total hardwoods	38,445	1,850	2,082	12,528	2,587	19,398
All species	77,248	2,340	4,143	27,951	8,628	34,186

Table 43.—*Timber removals from sawtimber on commercial forest land by species and county, Aspen-Birch Unit, Minnesota, 1976*
(In thousand board feet[1])

Species	All counties	Carlton	Cook	Koochiching	Lake	St. Louis
Softwoods:						
White pine	7,641	54	2,293	773	2,157	2,364
Red pine	4,210	217	255	925	557	2,256
Jack pine	27,678	672	788	3,269	6,430	16,519
White spruce	6,368	23	867	1,524	1,819	2,135
Black spruce	21,857	38	1,008	12,032	2,746	6,033
Balsam fir	15,329	170	806	7,630	2,177	4,546
Tamarack	5,237	45	1	4,016	12	1,163
Northern white-cedar	4,948	44	222	3,880	324	478
Other softwoods	—	—	—	—	—	—
Total softwoods	93,268	1,263	6,240	34,049	16,222	35,494
Hardwoods:						
Select white oak	10	1	1	2	—	6
Select red oak	160	112	6	33	1	8
Other red oak	—	—	—	—	—	—
Hickory	—	—	—	—	—	—
Yellow birch	14	—	—	—	—	14
Hard maple	39	8	3	5	2	21
Soft maple	69	3	—	7	1	58
Ash	683	27	54	348	88	166
Balsam poplar	1,165	2	1	903	2	257
Paper birch	6,582	281	542	643	3,864	1,252
Bigtooth aspen	1,472	69	1	85	22	1,295
Quaking aspen	73,787	3,448	4,653	25,140	3,882	36,664
Basswood	152	—	—	136	1	15
Elm	618	12	4	559	1	42
Other hardwoods	7	—	—	1	—	6
Total hardwoods	84,758	3,963	5,265	27,862	7,864	39,804
All species	178,026	5,226	11,505	61,911	24,086	75,298

[1]International ¼-inch rule.

Table 44.—*Timber removals from growing stock and sawtimber on commercial forest land by item and species group, Aspen-Birch Unit, Minnesota, 1976*

Item	Growing stock						Sawtimber					
	All species	Jack pine	Spruce	Other softwoods	Aspen	Other hardwoods	All species	Jack pine	Spruce	Other softwoods	Aspen	Other hardwoods
	Thousand cubic feet						Thousand board feet[1]					
Roundwood products:												
Pulpwood	54,803	7,620	11,495	9,008	24,710	1,970	119,715	15,352	25,711	19,940	57,496	1,216
Sawlogs	7,940	2,339	315	2,428	2,384	474	38,649	11,663	1,571	13,140	9,742	2,533
Fuelwood	1,115	22	2	39	607	445	1,555	30	6	54	842	623
Posts	843	358	—	485	(2)	—	362	154	—	207	1	—
Veneer logs	80	—	—	—	63	17	526	—	—	—	406	120
Poles	238	79	—	159	—	—	683	227	—	456	—	—
Other[3]	1,461	2	—	97	737	625	7,210	9	—	537	3,154	3,510
All products	66,480	10,420	11,812	12,216	28,501	3,531	168,700	27,435	27,288	34,334	71,641	8,002
Logging residue:	2,026	202	208	253	1,156	207	1,636	103	7	244	815	467
Other removals:	8,742	96	1,143	2,453	3,694	1,356	7,690	140	930	2,787	2,803	1,030
Total removals:	77,248	10,718	13,163	14,922	33,351	5,094	178,026	27,678	28,225	37,365	75,259	9,499

[1]International ¼-inch rule.
[2]Less than 500 cubic feet.
[3]Includes match bolts, particleboard bolts, shavings bolts, pilings, lath bolts, etc.

Table 45.—*Timber removals from growing stock by ownership class and softwoods and hardwoods, Aspen-Birch Unit, Minnesota, 1976*
(In thousand cubic feet)

Ownership class	All species	Softwoods	Hardwoods
Federal:			
National Forest	10,633	6,063	4,570
Other	960	435	525
State	16,927	10,195	6,732
County	8,924	2,549	6,375
Private:			
Forest industry	10,616	5,104	5,512
Farm and other	29,188	14,457	14,731
All owners	77,248	38,803	38,445

Table 46.—*Timber removals from sawtimber by ownership class and softwoods and hardwoods, Aspen-Birch Unit, Minnesota, 1976*
(In thousand board feet[1])

Ownership class	All species	Softwoods	Hardwoods
Federal:			
National forest	26,767	15,899	10,868
Other	2,707	1,237	1,470
State	43,933	27,421	16,512
County	20,867	5,916	14,951
Private:			
Forest industry	23,580	11,552	12,028
Farmer and other	60,172	31,243	28,929
All owners	178,026	93,268	84,758

[1]International ¼-inch rule.

Table 47.—*Annual mortality of growing stock on commercial forest land by species and cause, Aspen-Birch Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	Cause											
	All causes	Insects	Disease	Fire	Animals	Weather	Suppression	Unknown and other	Logging	Timber stand improvement	Land clearing	Conversion
Softwoods:												
White pine	634	—	545	—	27	27	—	35	—	—	—	—
Red pine	—	—	—	—	—	—	—	—	—	—	—	—
Jack pine	1,563	—	1,285	—	31	222	—	25	—	—	—	—
White spruce	953	101	696	—	—	156	—	—	—	—	—	—
Black spruce	3,438	173	2,246	—	56	515	—	448	—	—	—	—
Balsam fir	12,429	4,887	5,490	—	—	719	—	1,333	—	—	—	—
Tamarack	2,736	322	519	—	—	—	—	1,895	—	—	—	—
Northern white-cedar	1,176	—	251	—	—	557	—	312	56	—	—	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	22,929	5,483	11,032	—	114	2,196	—	4,048	56	—	—	—
Hardwoods:												
Select white oaks	—	—	—	—	—	—	—	—	—	—	—	—
Select red oaks	—	—	—	—	—	—	—	—	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	87	—	87	—	—	—	—	—	—	—	—	—
Hard maple	626	—	362	—	—	—	—	—	—	264	—	—
Soft maple	6	—	6	—	—	—	—	—	—	—	—	—
Ash	1,576	—	455	—	—	408	—	403	—	310	—	—
Balsam poplar	4,545	—	1,456	—	784	1,333	—	972	—	—	—	—
Paper birch	2,562	—	1,931	120	—	77	—	434	—	—	—	—
Bigtooth aspen	—	—	—	—	—	—	—	—	—	—	—	—
Quaking aspen	22,852	—	17,328	—	1,148	2,329	—	1,770	277	—	—	—
Basswood	—	—	—	—	—	—	—	—	—	—	—	—
Elm	313	—	184	—	—	—	—	—	—	129	—	—
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	32,567	—	21,809	120	1,932	4,147	—	3,579	277	703	—	—
All species	55,496	5,483	32,841	120	2,046	6,343	—	7,627	333	703	—	—

Table 48.—*Annual mortality of sawtimber on commercial forest land by species and cause, Aspen-Birch Unit, Minnesota, 1976*
(In thousand board feet[1])

Species	Cause											
	All causes	Insects	Disease	Fire	Animals	Weather	Suppression	Unknown and other	Logging	Timber stand improvement	Land clearing	Conversion
Softwoods:												
White pine	1,263	—	737	—	193	171	—	162	—	—	—	—
Red pine	—	—	—	—	—	—	—	—	—	—	—	—
Jack pine	1,306	—	944	—	—	362	—	—	—	—	—	—
White spruce	2,867	237	1,710	—	—	920	—	—	—	—	—	—
Black spruce	1,304	—	670	—	228	406	—	—	—	—	—	—
Balsam fir	12,787	6,482	3,377	—	—	1,117	—	1,811	—	—	—	—
Tamarack	2,835	—	—	—	—	—	—	2,835	—	—	—	—
Northern white-cedar	4,616	—	717	—	—	2,229	—	1,294	376	—	—	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	26,978	6,719	8,155	—	421	5,205	—	6,102	376	—	—	—
Hardwoods:												
Select white oaks	—	—	—	—	—	—	—	—	—	—	—	—
Select red oaks	—	—	—	—	—	—	—	—	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	27	—	27	—	—	—	—	—	—	—	—	—
Hard maple	—	—	—	—	—	—	—	—	—	—	—	—
Soft maple	8	—	8	—	—	—	—	—	—	—	—	—
Ash	2,985	—	1,469	—	—	—	—	—	—	1,516	—	—
Balsam poplar	1,999	—	10	—	—	1,989	—	—	—	—	—	—
Paper birch	2,397	—	1,200	—	—	—	—	1,197	—	—	—	—
Bigtooth aspen	—	—	—	—	—	—	—	—	—	—	—	—
Quaking aspen	30,113	—	19,687	—	1,322	4,402	—	3,531	1,171	—	—	—
Basswood	—	—	—	—	—	—	—	—	—	—	—	—
Elm	1,349	—	829	—	—	—	—	—	—	520	—	—
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	38,878	—	23,230	—	1,322	6,391	—	4,728	1,171	2,036	—	—
All species	65,856	6,719	31,385	—	1,743	11,596	—	10,830	1,547	2,036	—	—

[1]International ¼-inch rule.

Table 49.—*Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods, Aspen-Birch Unit, Minnesota, 1976*

Ownership class	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet			*Thousand board feet*[1]		
National forest	9,649	6,885	2,764	1,556	928	628
Bureau of land mgmt.	—	—	—	—	—	—
Indian	686	456	230	—	—	—
Miscellaneous Federal	276	53	223	—	—	—
State	10,341	5,992	4,349	12,564	8,457	4,107
County and municipal	11,099	2,570	8,529	15,339	3,911	11,428
Forest industry	7,797	3,114	4,683	10,503	5,883	4,620
Farmer	5,544	742	4,802	7,428	1,486	5,942
Farmer-owned leased	—	—	—	—	—	—
Misc. private-corp.	4,256	1,341	2,915	10,891	3,441	7,450
Misc. private-individual	5,654	1,776	3,878	7,575	2,872	4,703
Misc. priv.-corp., leased	194	—	194	—	—	—
Misc. priv.-ind., leased	—	—	—	—	—	—
All owners	55,496	22,929	32,567	65,856	26,978	38,878

[1]International ¼-inch rule.

Table 50.— *Output of timber products by source of material and softwoods and hardwoods, Aspen-Birch Unit, Minnesota, 1975*

Product and species group	Standard unit	Total		Roundwood products				Plant byproducts	
				Growing stock		Nongrowing stock			
		No. of units	Thousand cubic feet	No. of units	Thousand cubic feet	No. of units	Thousand cubic feet	No. of units	Thousand cubic feet
Pulpwood:	Std. cords								
Softwood		411,935	32,540	356,019	28,123	20,445	1,615	35,471	2,802
Hardwood		395,215	31,216	337,785	26,680	46,806	3,697	10,624	839
Total		807,150	63,756	693,804	54,803	67,251	5,312	46,095	3,641
Fuelwood:	Std. cords								
Softwood		21,476	1,492	973	63	1,190	77	19,313	1,352
Hardwood		37,309	2,598	15,114	1,052	19,826	1,380	2,369	166
Total		58,785	4,090	16,087	1,115	21,016	1,457	21,682	1,518
Posts:	Thousand pcs.								
Softwood		1,291	1,039	1,047	843	244	196	—	—
Hardwood		1	(1)	1	(1)	—	(1)	—	—
Total		1,292	1,039	1,048	843	244	196	—	—
Veneer logs	Thousand bd. ft.[2]								
Softwood		—	—	—	—	—	—	—	—
Hardwood		553	88	503	80	50	8	—	—
Total		553	88	503	80	50	8	—	—
Poles:	Pieces								
Softwood		40,193	241	39,693	238	500	3	—	—
Hardwood		—	—	—	—	—	—	—	—
Total		40,193	241	39,693	238	500	3	—	—
Saw logs:	Thousand bd. ft.[2]								
Softwood		28,192	5,247	27,305	5,082	887	165	—	—
Hardwood		15,939	2,921	15,595	2,858	344	63	—	—
Total		44,131	8,168	42,900	7,940	1,231	228	—	—
Other[3]	Thousand cu. ft.								
Softwood		177	177	99	99	2	2	76	76
Hardwood		1,434	1,434	1,362	1,362	63	63	9	9
Total		1,611	1,611	1,461	1,461	65	65	85	85
All products:	Thousand cu. ft.								
Softwood		40,736	40,736	34,448	34,448	2,058	2,058	4,230	4,230
Hardwood		38,257	38,257	32,032	32,032	5,211	5,211	1,014	1,014
Total		78,993	78,993	66,480	66,480	7,269	7,269	5,244	5,244

[1]Less than 500 cubic feet.
[2]International ¼-inch rule.
[3]Other (industrial production) includes match bolts, shaving bolts, particleboard bolts, lath bolts, piling, etc.

Table 51.—*Forest products harvested by ownership class and product, Aspen-Birch Unit, Minnesota, 1975*

Ownership class	Pulpwood	Saw logs	Fuelwood	Posts	Poles	Other
	Cords[1]	*Thousand board feet*[2]	*Cords*[1]	*Thousand pieces*	*Pieces*	*Thousand cubic feet*
Federal:						
National Forest:						
Softwoods	64,954	5,526	288	—	—	13
Hardwoods	44,390	1,981	1,580	—	—	399
Other Federal:						
Softwoods	3,329	678	—	9	—	1
Hardwoods	3,786	1,046	960	—	—	—
Total	116,459	9,231	2,828	9	—	413
State:						
Softwoods	97,163	11,515	—	375	16,677	10
Hardwoods	66,299	6,408	1,253	—	—	152
Total	163,462	17,923	1,253	375	16,677	162
County:						
Softwoods	29,705	1,064	—	48	485	3
Hardwoods	77,220	1,897	3,318	—	—	272
Total	106,925	2,961	3,318	48	485	275
Private:						
Forest industry:						
Softwoods	58,983	1,917	82	225	—	—
Hardwoods	65,300	522	72	—	—	241
Farm and other:						
Softwoods	122,330	7,492	1,793	634	23,031	74
Hardwoods	127,596	4,085	27,757	1	—	449
Total	374,209	14,016	29,704	860	23,031	764
All owners:						
Softwoods	376,464	28,192	2,163	1,291	40,193	101
Hardwoods	384,591	15,939	34,940	1	—	1,513
Total	761,055	44,131	37,103	1,292	40,193	1,614

[1]Standard cords, rough wood basis.
[2]International ¼-inch rule.

Table 52.—*Volume of primary plant residue by kind of material and type of use, Aspen-Birch Unit, Minnesota, 1975*

(In thousand cubic feet)

Type of use	Kind of wood residue							
	Total		Coarse[1]		Fine[2]		Bark[3]	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Fiber products[4]	651.1	413.9	595.1	406.9	56.0	7.0	—	4.2
Industrial fuel	1,292.9	62.0	800.7	19.8	492.2	42.2	547.3	297.0
Domestic fuel	59.0	103.8	57.1	98.4	1.9	5.4	27.7	62.2
Miscellaneous[5]	75.5	8.8	62.5	—	13.0	8.8	1.3	.2
Not used[6]	478.4	471.8	99.7	144.5	378.7	327.3	507.9	364.8
Total	2,556.9	1,060.3	1,615.1	669.6	941.8	390.7	1,084.2	728.4

[1]Suitable for chipping such as slabs, edging, veneer cores etc.
[2]Not suitable for chipping such as sawdust, veneer clippings, etc.
[3]Does not include bark disposal at pulpmills.
[4]For manufacture of pulp, hardboard or roofing felt.
[5]Lifestock bedding, mulch, small dimension, and specialty items.
[6]Includes residue burned as waste.

Table 53.—*Timber products output from roundwood by species and product, Aspen-Birch Unit, Minnesota, 1975*

Species	Saw logs		Veneer logs		Pulpwood		Fuelwood		Poles		Posts		Other Products	All Products
	Thousand board feet[1]	Thousand cubic feet[2]	Thousand board feet[1]	Thousand cubic feet[2]	Cords	Thousand cubic feet[2]	Cords	Thousand cubic feet[2]	Pieces	Thousand cubic feet[2]	Thousand pieces	Thousand cubic feet[2]	Thousand cubic feet[2]	Thousand cubic feet[2]
Softwoods:														
White pine	6,512	1,124	—	—	6,228	492	34	—	—	—	—	—	—	1,616
Red pine	2,065	357	—	—	6,776	534	183	10	26,812	161	332	267	5	1,334
Jack pine	12,673	2,434	—	—	103,519	8,178	735	48	13,381	80	551	442	2	11,184
Spruce	1,707	328	—	—	152,863	12,075	125	5	—	—	—	—	—	12,408
Balsam fir	1,123	215	—	—	76,451	6,040	1,086	77	—	—	—	—	—	6,332
Tamarack	3	—	—	—	30,627	2,419	—	—	—	—	3	3	—	2,422
Northern white-cedar	4,109	789	—	—	—	—	—	—	—	—	405	327	94	1,210
Total softwoods	28,192	5,247	—	—	376,464	29,738	2,163	140	40,193	241	1,291	1,039	101	36,506
Hardwoods:														
White oak	—	—	—	—	—	—	101	3	—	—	—	—	—	3
Red oak	97	16	1	—	1,069	85	220	12	—	—	—	—	—	113
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	—	—	14	2	—	—	—	—	—	—	—	—	—	2
Hard maple	4	1	7	1	41	2	403	26	—	—	—	—	—	30
Soft maple	—	—	11	1	60	3	—	—	—	—	—	—	—	4
Ash	484	83	—	—	—	—	2,302	161	—	—	—	—	—	244
Balsam poplar	583	103	—	—	9,808	775	—	—	—	—	—	—	—	878
Paper birch	988	172	85	13	15,798	1,248	11,790	824	—	—	—	—	637	2,894
Aspen	13,104	2,428	428	70	357,123	28,209	20,022	1,404	—	—	1	—	788	32,899
Basswood	133	23	1	—	—	—	34	—	—	—	—	—	—	23
Elm	546	95	6	1	692	55	51	2	—	—	—	—	—	153
Other hardwoods	—	—	—	—	—	—	17	—	—	—	—	—	—	17
Total hardwoods	15,939	2,921	553	88	384,591	30,377	34,940	2,432	—	—	1	—	1,425	37,243
All species	44,131	8,168	553	88	761,055	60,115	37,103	2,572	40,193	241	1,292	1,039	1,526	73,749

[1]International ¼-inch rule.
[2]Small quantities may round off to less than 500 cubic feet and will be shown as a dash in columns showing thousand cubic feet.

Table 54.—*Sampling errors[1] for estimates smaller than unit totals of volume, net growth, removals, and area of commercial forest land, Aspen-Birch Unit, Minnesota, 1977*

Sampling error	Commercial forest area	Growing stock			Sawtimber		
		Inventory	Growth	Removals	Inventory	Growth	Removals
Percent	Thousand acres	Million cubic feet			Million board feet[2]		
1	569.7	17,501.7	1,071.6	1,605.3	103,144.3	6,179.7	2,306.9
2	142.4	4,375.4	267.9	401.3	25,786.1	1,545.0	576.7
3	63.3	1,944.6	119.1	178.4	11,460.5	686.6	256.3
4	35.6	1,093.9	67.0	100.3	6,446.5	386.3	144.2
5	22.8	700.1	42.8	64.2	4,125.8	247.2	92.3
10	5.7	175.0	10.7	16.1	1,031.4	61.8	23.1
15	2.5	77.8	4.8	7.1	458.4	27.5	10.3
20	1.4	43.8	2.7	4.0	257.9	15.5	5.8
25	0.9	28.0	1.7	2.6	165.0	9.9	3.7
50	0.2	7.0	0.4	0.6	41.3	2.5	0.9
100	0.1	1.8	0.1	0.2	10.3	0.6	0.2

[1]At the 67 percent probability level.
[2]International ¼-inch rule.

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1979. Timber resource of Minnesota's Aspen-Birch Unit, 1977. U.S. Dep. Agric. For. Serv., Resour. Bull. NC-43, 52 p. U.S. Dep. Agric. For. Serv., North Cent. For. Exp. Stn., St. Paul, MN.

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OXFORD: 905(776). KEY WORDS: timber volume, growth, utilization, forest area.

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Plant a tree...trees give oxygen.