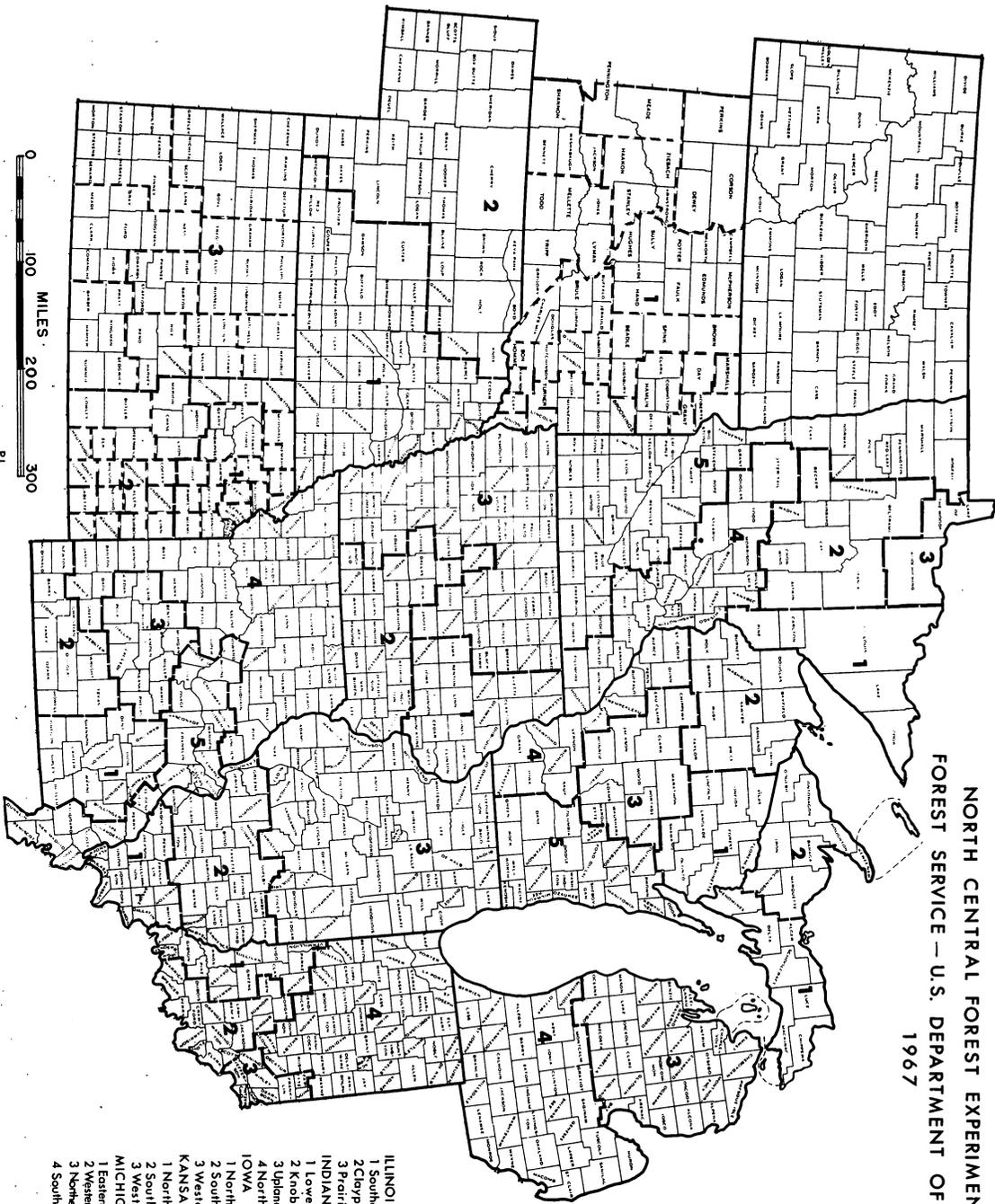


NORTH CENTRAL  
FOREST SURVEY FIELD INSTRUCTIONS



NORTH CENTRAL FOREST EXPERIMENT STATION  
FOREST SERVICE  
U.S. DEPARTMENT OF AGRICULTURE

**FOREST SURVEY UNITS**  
**NORTH CENTRAL FOREST EXPERIMENT STATION**  
**FOREST SERVICE — U.S. DEPARTMENT OF AGRICULTURE**  
**1967**



**UNIT NAME**

- |  |  |   |   |  |  |   |  |   |  |
|--|--|---|---|--|--|---|--|---|--|
| <ul style="list-style-type: none"> <li>ILLINOIS</li> <li>1 Southern</li> <li>2 Cloyden</li> <li>3 Prairie</li> </ul> | <ul style="list-style-type: none"> <li>INDIANA</li> <li>1 Lower Wabash</li> <li>2 Knobs</li> <li>3 Upland Flats</li> <li>4 Northern</li> </ul> | <ul style="list-style-type: none"> <li>IOWA</li> <li>1 Northeastern</li> <li>2 Southeastern</li> <li>3 Western</li> </ul> | <ul style="list-style-type: none"> <li>KANSAS</li> <li>1 Northeastern</li> <li>2 Southeastern</li> <li>3 Western</li> </ul> | <ul style="list-style-type: none"> <li>MICHIGAN</li> <li>1 Eastern Upper Peninsula</li> <li>2 Western Upper Peninsula</li> <li>3 Northern Lower Peninsula</li> <li>4 Southern Lower Peninsula</li> </ul> | <ul style="list-style-type: none"> <li>MINNESOTA</li> <li>1 Lake Superior</li> <li>2 Central Pine</li> <li>3 Rainy River</li> <li>4 Southeastern</li> <li>5 Western</li> </ul> | <ul style="list-style-type: none"> <li>MISSOURI</li> <li>1 Eastern Ozark</li> <li>2 Southwestern Ozark</li> <li>3 Northwestern Ozark</li> <li>4 Prairie</li> <li>5 Riverborder</li> </ul> | <ul style="list-style-type: none"> <li>NEBRASKA</li> <li>1 Eastern</li> <li>2 Western</li> </ul> | <ul style="list-style-type: none"> <li>NORTH DAKOTA</li> <li>1 Eastern</li> </ul> | <ul style="list-style-type: none"> <li>SOUTH DAKOTA</li> <li>1 Eastern</li> <li>2 Northern</li> <li>3 Central</li> <li>4 Southwestern</li> <li>5 Southeastern</li> </ul> |
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**NORTH CENTRAL FOREST SURVEY FIELD INSTRUCTIONS**

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by

**Burton L. Essex, Arnold J. Ostrom,  
and Robert N. Stone**

**June 1967**

**Supplement to Forest Survey Handbook FSH 4813.1**

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## 001 - INTRODUCTION

This manual provides Forest Survey field instructions for the North Central Forest Experiment Station, Wisconsin Conservation Department and other cooperating organizations in establishing and measuring field sample plots for the Third Forest Survey of Wisconsin.

It contains procedures as given in the Forest Service Handbook FSH 4810, March 1967 with local supplements and abridged codes for convenience and efficiency in field work.

## 002 - FIELD EQUIPMENT LIST

The following equipment will be needed to measure required items at field locations. Each field man should check to make sure he has this equipment and it is in good working order.

Pocket Stereoscope  
37.5 Factor Prism or Angle Gauge  
Hand Axe  
Compass (Silva Ranger)  
Increment Borer  
Diameter Tape  
Plot Tape (75 Ft. Metallic Woven Tape)  
Relaskop or Abney Level  
Plot Bag  
Photo Holder  
Clip Board (With Cover)  
Telescopic Fish Pole (18' or 33")  
Mirror Calipers

01 - DEFINITION OF TERMS. Terms used in this handbook are defined below.

1. Acceptable Trees. Growing-stock trees of commercial species that meet specified standards of size and quality, but not qualifying as desirable trees.

2. Afforested Areas. Lands formerly not in tree cover, but converted to forests by planting.

3. Allowable Cut. The volume of timber that would be cut on commercial forest land during a given period under specified management plans aimed at sustained production of timber products.

✓ 4. Area Condition Class. A classification of commercial forest land based upon stocking of desirable trees and other conditions affecting current and prospective timber growth.

5. Available Cut. The volume of timber that would be available for cutting on commercial forest land during a given period under specified assumptions concerning growth, cut, mortality, and forest management practices.

6. Bureau of Land Management Lands. Federal land administered by the Bureau of Land Management.

7. Clear Panel. A section of the tree surface one-fourth the circumference of the tree and at least 2 feet long free of limbs, knots, bumps and other indications of defect which preclude clear cuttings.

8. Commercial Forest Land. Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization. (Note: Areas qualifying as commercial forest land have the capability of producing in excess of 20 cubic feet per acre per year of industrial wood under management. Currently inaccessible and inoperable areas are included, except when the areas involved are small and unlikely to become suitable for production of industrial wood in the foreseeable future.)

✓ 9. Commercial Species. Tree species presently or prospectively suitable for industrial wood products. (Note: Excludes species of typically small size, poor form, or inferior quality, such as hawthorn and sumac.)

✓ 10. Cull. Portions of a tree that are unusable for industrial wood products, because of rot, form, or other defect.

✓ 11. Crown Class. A classification of trees based on dominance in relation to adjacent trees in the stand as indicated by crown development and amount of light received from above and the sides. Crown classes recognized by the Forest Survey include:

✓ a. Open Crown. Trees with crowns which have received full light from above and from all sides throughout all or most of the life of the trees, particularly during early development.

✓ b. Dominant Trees. Trees with well-developed crowns extending above the general level of the crown cover and receiving full light from above and part light from the sides.

✓ c. Codominant Trees. Trees with crowns forming the general level of the crown cover and receiving full light from above, but comparatively little from the sides; usually with medium-sized crowns more or less crowded on the sides.

✓ d. Intermediate Trees. Trees with crowns either below or extending into the crown cover formed by codominant and dominant trees, receiving little direct light from above, and none from the sides; usually with small crowns considerably crowded on the sides.

✓ e. Overtopped Trees. Trees with crowns entirely below the general level of the crown cover, receiving no direct light either from above or from the sides.

✓ 12. Desirable Trees. Growing-stock trees of commercial species (a) having no serious defects in quality limiting present or prospective use for timber products, (b) of relatively high vigor, and (c) containing no pathogens that may result in death or serious deterioration before rotation age. (Note: These are the types of trees forest managers try to grow; that is, the trees favored in cultural operations. In over-rotation age stands, desirable trees are low-risk trees.)

13. Diameter Classes. A classification of trees based on diameter outside bark, measured at breast height (4-1/2 feet above the ground). (Note: D.b.h. is the common abbreviation for diameter at breast height. Two-inch diameter classes are commonly used in Forest Survey, with the even inch the approximate mid-point for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h., inclusive.)

✓ 14. Face. A section of the tree surface one-fourth the circumference of the tree extending the full length of the log.

15. Farm. Either a place operated as a unit of 10 or more acres from which the sale of agricultural products totals \$50 or more annually or a place operated as a unit of less than 10 acres from which the sale of agricultural products for a year amounts to at least \$250. Places having less than the \$50 or \$250 minimum estimated sales in a given year are also counted as farms if they can normally be expected to produce products in sufficient quantity to meet the requirement of the definition.

16. Farm Operator. A person who operates a farm, either doing the work himself or directly supervising the work.

17. Farmer-Owned Lands. Lands owned by farm operators. (Note: These exclude land leased by farm operators from nonfarm owners, such as railroad companies and States.)

18. Farmer-Owned Leased. Lands owned by farm operators, but leased to forest industry.

19. Forest Industry Lands. Lands owned by companies or individuals operating wood-using plants.

20. Forest Land. Land at least 10 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use. (Note: Stocking is measured by comparison of basal area and/or number of trees, by age or size and spacing with specified standards. The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelter-belt strips of timber must have a crown width at least 120 feet wide to qualify as forest land. Unimproved roads and trails, streams, or other bodies of water or clearings in forest areas shall be classed as forest if less than 120 feet in width.) Also see definitions for land area, commercial forest land, noncommercial forest land, productive-reserved forest land, stocking, unproductive forest land, and water.

21. Forest Trees. Woody plants having a well-developed stem and usually more than 12 feet in height at maturity.

22. Forest Types. A classification of forest land based upon the species forming a plurality of live-tree stocking. (Note: Types shall be determined on the basis of species plurality of all live trees that contribute to stocking; that is, up to a maximum of 16 percent at each plot point.)

23. Gross Growth. Annual increase in net volume of trees in the absence of cutting and mortality.

24. Growing-Stock Trees. Live trees of commercial species qualifying as desirable or acceptable trees. (Note: Excludes rough, rotten, and dead trees.)

25. Growing-Stock Volume. Net volume in cubic feet of growing stock trees 5.0 inches d.b.h. and over from a 1-foot stump to a minimum 4.0 inch top diameter outside bark of the central stem or to the point where the central stem breaks into limbs.

26. Growth. (See definitions for net growth, gross growth, and ingrowth.)

27. Hardwoods. Dicotyledonous trees, usually broad-leaved and deciduous.

28. Idle Farmland. Includes former croplands, orchards, improved pastures and farm sites not tended within the past 2 years and presently less than 10 percent stocked with trees.

29. Improved Pasture. Land currently improved for grazing by cultivation, seeding, irrigation, or clearing of trees or brush.

30. Indian Lands. Tribal lands held in fee by the Federal Government, but administered for Indian tribal groups, and Indian trust allotments.

31. Industrial Wood. All roundwood products, except fuelwood.

32. Ingrowth. The number or net volume of trees that grow large enough during a specified year to qualify as saplings, pole-timber, or sawtimber.

33. Land Area

a. Bureau of the Census. The area of dry land and land temporarily or partly covered by water, such as marshes, swamps, and river flood plains (omitting tidal flats below mean high tide); streams, sloughs, estuaries, and canals less than 1/8 of a statute mile in width; and lakes, reservoirs, and ponds less than 40 acres in area.

b. Forest Survey. The same as the Bureau of the Census, except minimum width of streams, etc. is 120 feet and minimum size of lakes, etc. is 1 acre.

34. Limb. That part of the tree above the stump which does not meet the requirement for saw logs and upper-stem portions, including all live, sound branches to a minimum of 4 inches d.o.b.

35. Log Grades. A classification of logs based on external characteristics as indicators of quality or value.

36. Logging Residues. The unused portions of trees cut or killed by logging.

37. Miscellaneous Federal Lands. Federal lands other than National Forests, lands administered by the Bureau of Land Management, and Indian lands.

38. Miscellaneous Private Lands. Privately owned lands other than forest-industry and farmer-owned lands.

39. Mortality. Number or sound-wood volume of live trees dying from natural causes during a specified period.

40. National Forest Land. Federal lands which have been legally designated as National Forests or purchase units, and other lands under the administration of the Forest Service, including experimental areas and Bankhead-Jones Title III lands.

41. Net Annual Growth. The increase in volume of a specified size class for a specific year. (Note: Components of net annual growth include the increment in net volume of trees at the beginning of the specific year surviving to its end plus volume of trees reaching the size class during the year minus the volume of trees that died during the year minus the net volume of trees that became rough or rotten trees during the year.)

42. Net Volume. Gross volume less deductions for rot, sweep, or other defect affecting use for timber products.

43. Noncommercial Forest Land. (a) Unproductive forest land incapable of yielding crops of industrial wood, because of adverse site conditions and (b) productive-reserved forest land.

44. Noncommercial Species. Tree species of typically small size, poor form, or inferior quality which normally do not develop into trees suitable for industrial wood products.

45. Nonforest Land. Land that has never supported forests and lands formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width, and 1-to-40-acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide, and clearings, etc., more than 1 acre in size, to qualify as nonforest land.)

46. Nonstockable. Areas of forest land not capable of supporting seedlings of commercial species, because of the presence of rock, water, etc.

47. Nonstocked Land. Commercial forest land less than 16.7 percent stocked with growing-stock trees.

48. Old-Growth Sawtimber Stands. Sawtimber stands in which 50 percent or more of the area is occupied by old-growth sawtimber trees.

49. Old-Growth Sawtimber Trees. Trees that are at least 100 years old.

50. Other Federal Lands. Federal lands other than National Forests, including lands administered by the Bureau of Land Management, Bureau of Indian Affairs, and other Federal agencies.

51. Other Removals. The net volume of growing-stock trees removed from the inventory by cultural operations, such as timber-stand improvements, land clearing, and changes in land use.

52. Overgrown Knot. The scar left in the bark by a limb completely overgrown, but still outlined by the circular configuration in the bark.

53. Overstocked Areas. Areas where growth of trees is significantly reduced by excessive numbers of trees. (Note: Stands will be considered overstocked if stocking is 133 percent or more, when 100 percent represents the minimum level of stocking required to make full use of the site.)

54. Ownership. Property owned by one owner, regardless of the number of parcels in a specified area.

55. Plant Byproducts. Wood products, such as pulp chips, obtained incidental to production of other manufactured products.

56. Plant Residues. Wood materials from manufacturing plants not utilized for some product. (Note: Includes slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and pulp screenings.)

57. Poletimber Stands. (See stand-size class.)

58. Poletimber Trees. Growing-stock trees of commercial species at least 5.0 inches in d.b.h., but smaller than sawtimber size.

59. Productive-Reserved Forest Land. Forest land sufficiently productive to qualify as commercial forest land, but withdrawn from timber utilization through statute, administrative designation, or exclusive use for Christmas-tree production as indicated by annual shearing.

60. Quality Classes. A classification of sawtimber volumes by log or tree grades.

61. Rangeland. Land on which the natural plant cover is composed principally of native grasses, forbs, or shrubs valuable for forage.

62. Rotation. The period of years between establishment of a stand of timber and the time when it is considered ready for cutting and regeneration.

63. Rotten Trees. Live trees of commercial species that do not contain at least one 12-foot saw log now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

64. Rough Trees. (a) Live trees of commercial species that do not contain at least one 12-foot saw log now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees of noncommercial species.

65. Roundwood Products. Logs, bolts, or other round sections cut from trees for industrial or consumer uses. (Note: Include saw logs; veneer logs and bolts; cooperage logs and bolts; pulpwood; fuelwood; piling; poles; posts; hewn ties; mine timbers; and various other round, split, or hewn products.)

66. Salvable Dead Trees. Standing or down dead trees that are considered merchantable by Regional standards.

67. Saplings. Live trees 1.0 inch to 5.0 inches in diameter at breast height.

68. Sapling-Seedling Stands. (See stand-size class.)

69. Saw Log. A log meeting minimum standards of diameter, length, and defect, including logs at least 8 feet long, sound and straight and with a minimum diameter inside bark for softwoods of 6 inches (8 inches for hardwoods) or other combinations of size and defect specified by Regional standards.

70. Saw Log Portion. That part of the bole of sawtimber trees between the stump and the saw log top.

71. Saw Log Top. The point on the bole of sawtimber trees above which a saw log cannot be produced. The minimum saw log top is 7.0 inches d.o.b. for softwoods and 9.0 inches d.o.b. for hardwoods.

72. Sawtimber Stands. (See stand-size class.)

73. Sawtimber Trees. Live trees of commercial species containing at least a 12-foot saw log and meeting Regional specifications for freedom from defect. Softwoods must be at least 9.0 inches in diameter breast height. Hardwoods must be at least 11.0 inches in diameter.

74. Sawtimber Volume. Net volume of the saw log portion of live sawtimber in board feet International 1/4-inch rule.

75. Seedlings. Live trees less than 1.0 inch in diameter at breast height that are expected to survive.

76. Site Classes. A classification of forest land in terms of inherent capacity to grow crops of industrial wood based on fully stocked natural stands.

77. Softwoods. Coniferous trees, usually evergreen having needles or scalelike leaves.

78. Sound Knot or Limb. Knots or limbs intergrown or encased with the surrounding wood and with no indication of decay. Bark may or may not be present on the limbs.

79. Stand-Size Class. A classification of forest land based on the size class of growing stock trees on the area; that is, sawtimber, poletimber, or seedlings and saplings. (Note: Only those trees that contribute to no more than 16 percent stocking at a plot point will be considered in determining stand-size class.)

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

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

c. Sapling-Seedling Stands. Stands at least 16.7 percent stocked with growing stock trees of which more than half of the stocking is saplings and/or seedlings.

80. State, County, and Municipal Lands. Lands owned by States, counties, and local public agencies or municipalities, or lands leased to these governmental units for 50 years or more.

81. Stocking. The degree of occupancy of land by trees, measured by basal area and/or the number of trees in a stand by size or age and spacing, compared to the basal area and/or number of trees required to fully utilize the growth potential of the land; that is, the stocking standard. (Note: Also see stocking explanation in section 21.5 of Forest Survey Handbook.)

82. Timber Removals. The net volume of growing stock trees removed from the inventory by harvesting; cultural operations, such as timber-stand improvement; land clearing; or changes in land use.

83. Timber Products. Roundwood products and plant byproducts. (Note: Timber products output includes roundwood products cut from growing stock on commercial forest land; from other sources, such as cull trees, salvable dead trees, limbs, and saplings; from trees on noncommercial and nonforest lands, and from plant byproducts.)

84. Tree Size Class. A classification of trees based on diameter at breast height, including sawtimber trees, poletimber trees, saplings and seedlings.

85. Unproductive Forest Land. Forest land incapable of producing 20 cubic feet per acre of industrial wood under natural conditions, because of adverse site conditions. (Note: Adverse conditions include sterile soils, dry climate, poor drainage, high elevation, steepness, and rockiness.)

86. Upper Stem Portion. That part of the bole of sawtimber trees above the saw log top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

87. Urban and Other Areas. Areas within the legal boundaries of cities and towns; suburban areas developed for residential, industrial, or recreational purposes; schoolyards; cemeteries; roads; railroads; airports; beaches; powerlines and other rights-of-way; or other nonforest land not included in any other specified land use class.

88. Water

a. Bureau of the Census. Streams, sloughs, estuaries, and canals more than 1/8 of a statute mile in width; and lakes, reservoirs, and ponds more than 40 acres in area.

b. Forest Survey. The same as the Bureau of the Census, except minimum width of streams, etc. is 120 feet and minimum size of lakes, etc. is 1 acre.

89. Young-Growth Sawtimber Stands. Sawtimber stands in which 50 percent or more of the stand is occupied by young-growth sawtimber trees.

90. Young-Growth Sawtimber Trees. Sawtimber trees less than 100 years old.

#### 40 - INVENTORY FIELD PROCEDURES

Uniform measuring and recording methods are provided to ensure comparability of the resource data compiled by different units and efficiency in the collection of timber resource statistics.

Forest Survey is faced with the problem of remeasuring and recovering information from plot systems other than the standard 10-point cluster plot specified in this chapter. No attempt will be made in this handbook to outline remeasurement procedures. Appropriate supplements to this handbook will be prepared covering remeasurement procedures for Wisconsin.

Precise measurements and classifications are essential to keep field-technique errors to a minimum. Errors in area classification of tree measurements will be expanded several hundred times in the processing phase of the Forest Survey, and an accumulation of even small errors may lead to erroneous inventory results.

Item captions and numbers mentioned in this handbook refer to items on the Forest inventory sample record in exhibit 1.

## 41 - DETERMINING SAMPLE LOCATION

41.1 - Planning Travel. Supply field crews with road maps and aerial photographs with sample locations marked, along with a list of field sample locations to be visited. Field crews should select the field sample locations to be visited each day from this list and plan travel to field sample locations using the maps, photographs, and other information on local travel conditions.

41.2 - Establishment of Reference Line. The first step in locating the forest sample location is to draw a straight reference line between two features visible on the photograph and easily located on the ground. Select such features as straight road sections, drainage ditches, or field edges. Avoid using railroads or powerlines, since they influence the compass reading. A line drawn between two well-spaced buildings or other easily identifiable landmarks may also serve as a reference line.

Next draw the reference line on the photograph with an arrow at one end of the line to indicate the azimuth direction. Measure the azimuth with a compass to the nearest degree and record it on the back of the photograph. Disregard magnetic declination.

41.3 - Starting Point. Select a landmark readily identifiable on the ground and on the photograph and as close to the sample location as possible. Select landmarks which can be readily identified on resurveys, such as intersections or sharp bends in roads, streams or drainage ditches, field corners and prominent trees.

Pinprick the starting point on the aerial photograph on which the sample location is pinpricked. Label the pinprick "SP" on the back of the photograph.

In the field mark the starting point with paint. Paint "SP" facing direction of normal approach in letters about 4" high located at D.B.H. and a 3" high "X" near ground level.

Describe the starting point on the back of the sample record under item 73.

41.4 - Photograph Azimuth. Draw a straight line on the photograph through the starting point and center of the sample location. Extend this line to intersect the reference line or an extension of it.

41.5 - Photograph Distance. Measure on the photograph the distance from the starting point to the plot center to the nearest 20 feet (or 3/10 chain) by using a transparent scale.

41.6 - Photograph Scale. Instructions for determining photograph scale and locating the sample location center from aerial photographs will be prepared by the Stations and Regions to best fit local or regional conditions.

The following is an example of detailed procedures description that should be included in local supplements to this Handbook.

Photograph scale may be determined as follows:

1. Select two landmarks which are at least 1,000 feet apart, at approximately the same elevation, and readily identifiable on the photograph.

2. Determine the horizontal distance in feet between the landmarks by ground traverse. A speedometer reading interpolated in hundredths of a mile may be satisfactory for landmarks adjoining a road; otherwise the distance should be chained.

3. Scale the distance between images of landmarks on the photograph to the nearest thousandth of a foot.

4. Use the following formula to solve to the nearest 100 for photograph scale reciprocal (PSR):

$$PSR = \frac{GD}{PD} \text{ where } GS = \text{ground distance and}$$

$$PD = \text{photograph distance between landmarks and photo-} \\ \text{graph scale or RF, } = \frac{1}{PSR}$$

5. Where a reference map is detailed enough to show suitable landmarks in the vicinity of the sample location, map measurements may be substituted for ground measurements. In this case:

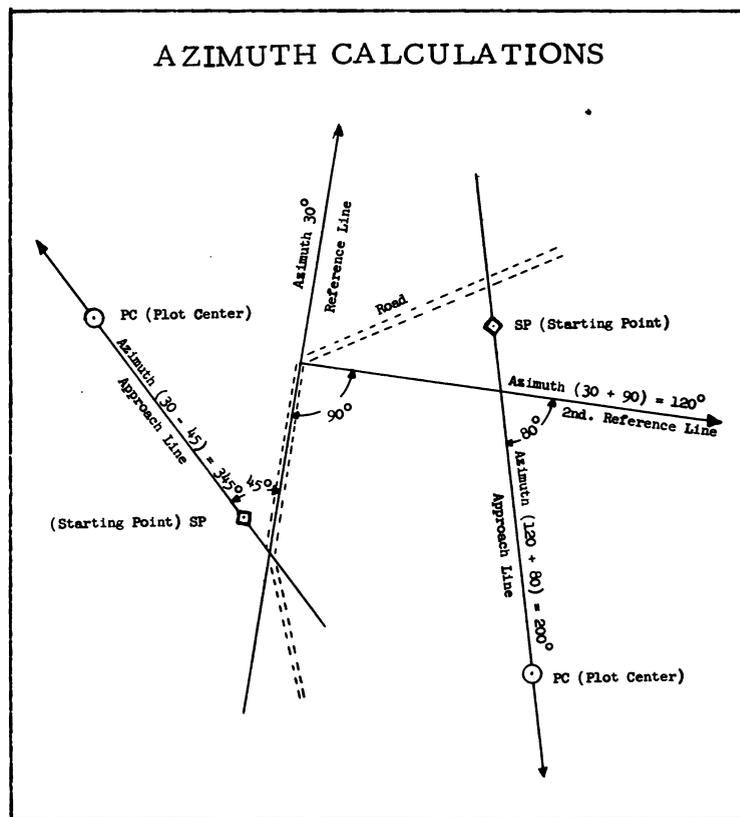
$$PSR = \frac{(\text{Map scale reciprocal})(\text{map distance})}{\text{Photograph distance}}$$

41.61 - Conversion Scale. As an alternative to the above methods, the representative fraction (RF) may be determined by laying a transparent conversion scale over a known distance on the photograph. Orient the scale over the images of the landmarks so that the ground distance between landmarks is represented on the scale and read the RF directly.

If the reference line and the line to the sample location, or extensions of those lines, do not intersect on the photograph, draw a line perpendicular to the reference line, making it cross the line to the sample location. Use this as the new reference line after adding or subtracting 90 degrees. Indicate the directions of the sample location line and the reference line by putting an arrow at the end of each line.

Measure the angle between these lines, starting from the reference line. Obtain the azimuth of the sample location line by adding or subtracting this angle from the azimuth of the reference line. Add the angle if it is measured counterclockwise from the reference line (exhibit 2).

Exhibit 2



41.7 - Travel to Location. Using compass and tape, run a course on the computed azimuth for the scaled distance from starting point to sample location. Record this information on the back of the Forest inventory sample record under item 74 (exhibit 1).

## 42 - ESTABLISHMENT OF SAMPLE LOCATION

42.1 - Establishing Center of New Location. If the sample location is being established for the first time, place a pin or stake at the end of the computed course. Check to make sure that photograph location agrees with ground location.

42.2 - Location Correction. If the ground location is clearly not the point pinpricked on the photograph, and the correct location can be determined on the site, place a second pin at the correct location. Note the azimuth and distance from the initial pin to the relocated pin and record these items on the back of the Forest inventory sample record under item 80 and remove the first pin. This second pin becomes the location of point one of the 10-point cluster.

42.3 - Reestablishing Center of Remeasured Locations. If the sample is one established in a previous survey, search for the old center pin or other identification. If located, measure the direction and distance from the current approach line to the old center of the sample location and record on the back of the Forest inventory sample record under item 80 (exhibit 1). A current sample should be taken at the old location. A supplement will be prepared outlining procedures for remeasuring the fixed plots in Wisconsin.

If the old center cannot be located, establish a new sample center at the end of the approach line.

42.4 - Nonforest Locations. A certain number of locations interpreted as nonforest on aerial photographs will require a field check in accordance with an improved sampling design. In addition, a certain number of locations interpreted as forest on aerial photographs, upon field examination will turn out to be nonforest.

If point one of the location falls on nonforest land, record data for items 1-9 inclusive on the forest inventory sample record.

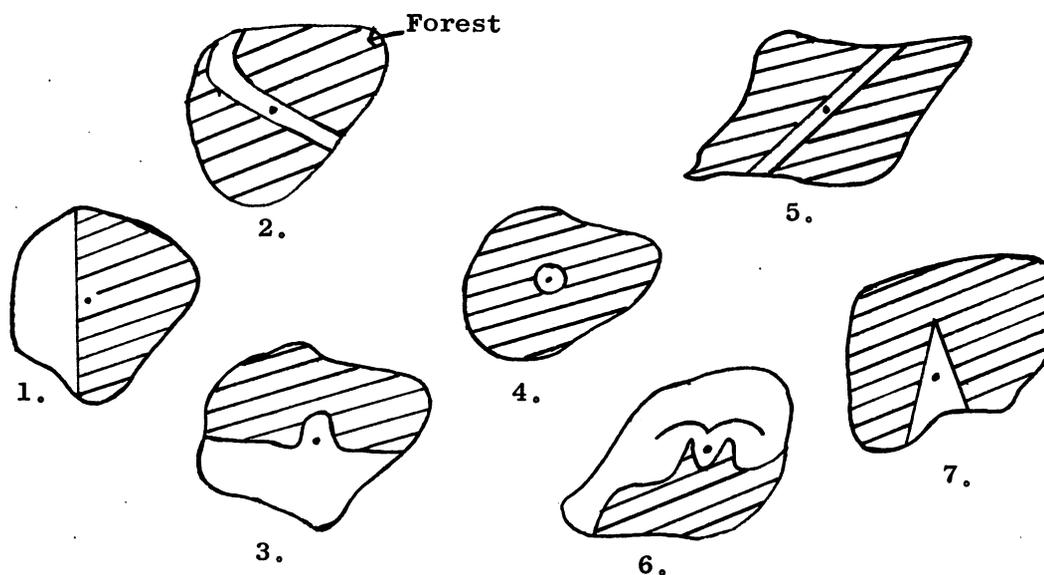
42.5 - Noncommercial Forest Locations. If point one of the location falls on noncommercial forest land, record only items 1 through 12 and item 56 on the Forest inventory sample record.

This category of land includes both unproductive forest land and productive forest land withdrawn from commercial timber use, including land used for Christmas tree production (item 8).

42.6 - Commercial Forest Locations. If point one of the sample location falls on land that qualifies as commercial forest land, establish the sample location and record information for all items on the Forest inventory sample record.

In this and the following sections dealing with plot location, it should be remembered that the location center (as defined by the pin prick on the photo) determines the land class, provided the area surrounding the pin prick is a least 1 acre or 120 feet in width.

In the following examples hatched areas represent forest lands.



1. Forest--dot falls on forest land larger than 1 acre in size.
2. & 3. Forest--dot falls on strip of nonforest land (less than 120' in width) that is bounded by forest land on at least 2 sides.
4. Forest--dot falls on nonforest land (less than 1 acre in size) that is surrounded by forest land.
5. Nonforest--dot falls in improved road less than 120' wide. Improved roads and powerline clearings of any width are nonforest.
6. Forest--dot falls in area of more than two adjacent strips of clearly defined forest and nonforest land (each strip less than 120' in width). As the band of strips in the acre is comprised of more forest than nonforest, the classification is forest.



72. LOCATION:

COUNTY \_\_\_\_\_ T. \_\_\_\_\_ R. \_\_\_\_\_

SECTION # \_\_\_\_\_ SUBDIVISION \_\_\_\_\_

FLIGHT # \_\_\_\_\_ PHOTO # \_\_\_\_\_

73. OWNER'S NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

74. STARTING POINT DESCRIPTION:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

75. COURSE TO SAMPLE LOCATION:

DIRECTION \_\_\_\_\_

DISTANCE \_\_\_\_\_

TO \_\_\_\_\_

77. WITNESS TREES:

SPECIES	D.B.H. (Inches)	AZIMUTH (Degrees)	DISTANCE (Feet)

79. GROWTH TREES:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

76. SKETCH OF SAMPLE LOCATION AREA



78. FIELD CREW:

CRUISER \_\_\_\_\_

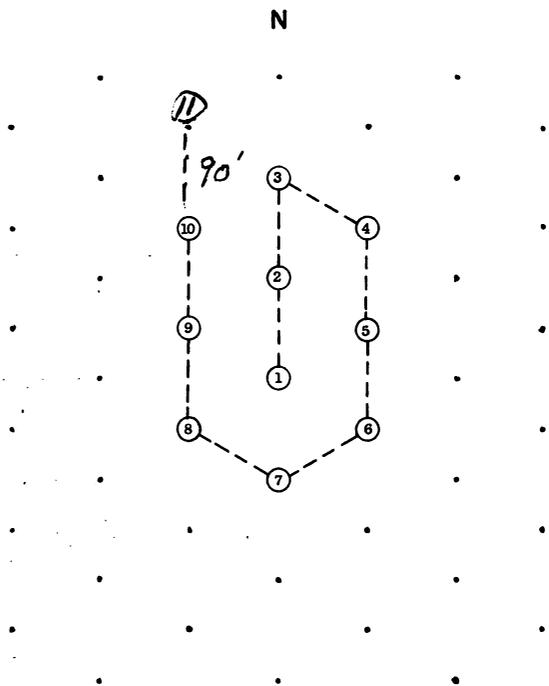
TALLYMAN\* \_\_\_\_\_

DATE \_\_\_\_\_

FIELD EDIT:

OFFICE EDIT:

80. 10-POINT CLUSTER LAYOUT:



81. NOTES:

7. Forest--dot falls on nonforest land (less than 120' in width). If point had fallen in area 120+ feet wide the classification would be nonforest.

The above rules apply equally but in reverse manner if the location of forest and nonforest land is reversed.

42.7 Witness Trees. Reference point one with at least two witness trees if possible. They should preferably be (1) close to the pin and spaced approximately at right angles from the pin, (2) not likely to die or be cut within 10 years, (3) species easily located in the stand, and (4) at least 5 inches in diameter at d.b.h. (at least 2 inches in diameter if no trees 5 inches and over are available). Record the following witness tree data on the back of the sample record under item 76: (1) species, (2) d.b.h. to the nearest 1/10th inch, (3) azimuth from pin to center of the tree, and (4) slope distance to the nearest 1/10th foot, from pin to face of the tree at its base. Mark the base of each witness tree with a painted "X," on the side of the tree facing plot center.

42.8 - Ten-Point Cluster. After point one has been established, and providing it falls on commercial forest land, the other nine points should be located and marked with wire pins, metal stakes or treated-wood stakes. The entire 10 points should be restricted to commercial forest land as shown in the following tabulation.

The grid pattern of sample points is designed to obtain a uniform distribution of points over approximately 1 acre. Use spacing and orientation as follows:

### 10-point cluster design

#### Azimuth and Distance from Point to Point

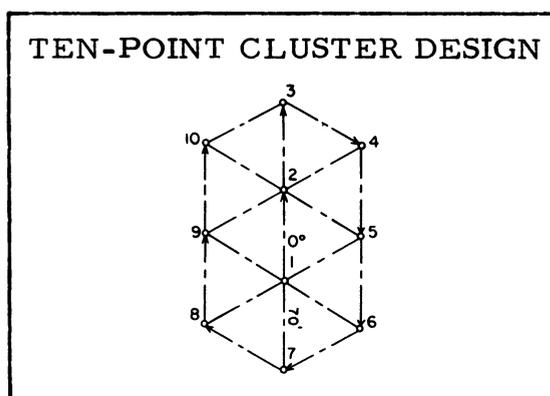
0°	70 feet	1	2
0°	70 feet	2	3
120°	70 feet	3	4
180°	70 feet	4	5
180°	70 feet	5	6
240°	70 feet	6	7
300°	70 feet	7	8
0°	70 feet	8	9
0°	70 feet	9	10

The above spacing and orientation results in 10 equilateral triangles with sides 70 feet in length between points (exhibit 3). Modifications of this standard cluster design should be made only with Washington Office approval except for selection of substitute points as described below.

If point one or any other of the 10 points at a sample location falls within a tree trunk, shift the point location back along the approach line a distance of 2 feet from the edge of the tree trunk and mark with a pin or stake. Measure distance to the next point from the pin or stake.

42.9 - Substitute Points. If point 1 falls on commercial forest land, and any of the points 2 through 10 fall on nonforest or noncommercial forest land area more than 1 acre in size or more than 120 feet in width, locate a substitute point on commercial forest land and mark with pins or stakes.

Exhibit 3



(Points falling on noncommercial forest or nonforest land smaller than 1 acre in size or less than 120 feet in width, will be considered commercial forest land and no substitute points will be required.)

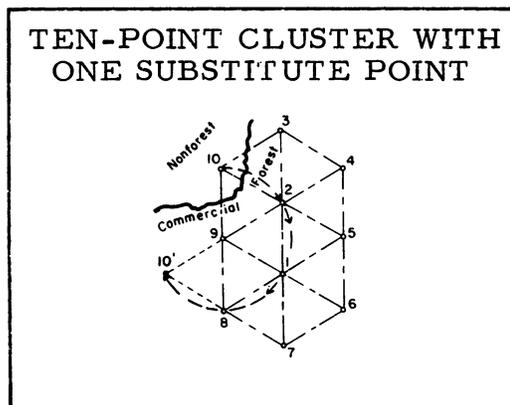
Also locate substitute points when any of points 2 through 10 fall on improved roads, railroads, and adjoining clearings. Such clearings will be considered nonforest land regardless of width.

A substitute point should be located by starting at zero azimuth from the highest-numbered regular point qualifying for tally and rotating clockwise to locate the first qualifying point forming additional equilateral triangle of points. When more than one substitute point is required, continue this rotation, selecting in turn other qualifying points forming additional triangles. If necessary, repeat this procedure at next highest-numbered regular points in turn and then at each previously selected substitute point in turn.

Where substitute points are selected, show their location on the back of the sample record on the diagram provided in item 79. Also show a number with a prime superscript for each substitute point as indicated in exhibits 4 and 5.

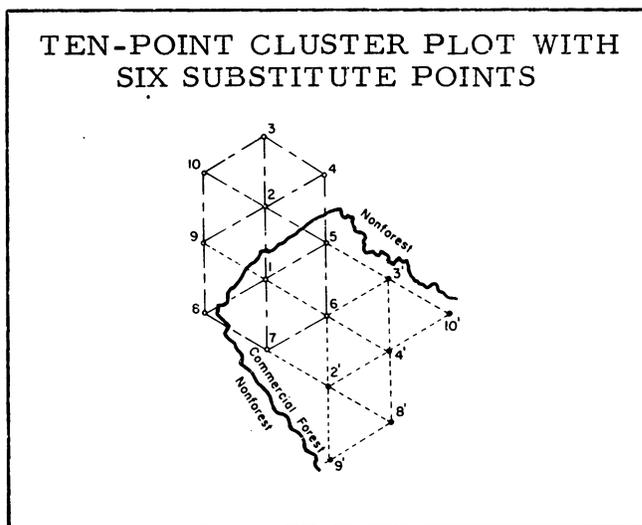
In exhibit 4 a substitute for point 10 is located at 10' by rotating around point 9 (the highest numbered regular point qualifying for tally) to locate the first possible additional equilateral triangle of points.

#### Exhibit 4



In exhibit 5 substitutes must be located in turn for points 2, 3, 4, 8, 9, and 10. The first substitute point 2', is located by rotating from zero azimuth around point 7 (the highest-numbered regular point qualifying for tally in commercial forest) to form the first possible additional equilateral triangle of points. Further rotation around point 7 yields no more qualifying substitute points; this rotation procedure is repeated around point 6 (the next highest-numbered regular point below 7 qualifying in commercial forest). This yields substitute points 3' and 4'. Rotation around the next highest-numbered regular point qualifying, 5, yields no additional substitutes; thus rotation around the first-selected substitute point, 2', is used to select two more substitutes, 8' and 9'. Rotation around the second-selected substitute, 3', must be used to locate the last required substitute, point 10'.

Exhibit 5



43 - LOCATION IDENTIFICATION. Field measurements and observations should be recorded on the Forest inventory sample record (exhibit 1). Data are recorded to facilitate preparation of punchcards and items are numbered in the sequence in which normally recorded.

43.2 - State, Item 1. Record the appropriate two-digit code from the list of standard codes. The state code for Wisconsin is 48.

43.3 - Survey Unit, Item 2. Record appropriate one-digit code from code list of survey units.

State Code = 48

- Unit 1 Northeastern
- Unit 2 Northwestern
- Unit 3 Central
- Unit 4 Southwestern
- Unit 5 Southeastern

43.4 - County, Item 3. Record appropriate two-digit code from code list of counties.

<u>Unit Code</u>	<u>County Code</u>	<u>County Name</u>	<u>Unit Code</u>	<u>County Code</u>	<u>County Name</u>
3	01	Adams	3	07	Marathon
2	01	Ashland	1	06	Marinette
2	02	Barron	3	08	Marquette
2	03	Bayfield	1	05	Menominee
5	01	Brown	5	14	Milwaukee
4	01	Buffalo	3	09	Monroe
2	04	Burnett	1	07	Oconto
5	02	Calumet	1	08	Oneida
3	02	Chippewa	5	15	Outagamie
3	03	Clark	5	16	Ozaukee
5	03	Columbia	4	08	Pepin
4	02	Crawford	4	09	Pierce
5	04	Dane	2	07	Polk
5	05	Dodge	3	10	Portage
5	06	Door	2	08	Price
2	05	Douglas	5	17	Racine
4	03	Dunn	4	10	Richland
3	04	Eau Claire	5	18	Rock
1	01	Florence	2	09	Rusk
5	07	Fond du Lac	4	11	St. Croix
1	02	Forest	4	12	Sauk
4	04	Grant	2	10	Sawyer
5	03	Green	1	09	Shawano
5	09	Green Lake	5	19	Sheboygan
4	05	Iowa	2	11	Taylor
2	06	Iron	4	13	Trempealeau
3	05	Jackson	4	14	Vernon
5	10	Jefferson	1	10	Vilas
3	06	Juneau	5	20	Walworth
5	11	Kenosha	2	12	Washburn
5	12	Kewaunee	5	21	Washington
4	06	La Crosse	5	22	Waukesha
4	07	La Fayette	3	11	Waupaca
1	03	Langlade	3	12	Waushara
1	04	Lincoln	5	23	Winnebago
5	13	Manitowoc	3	13	Wood

43.5 - Sample Number, Item 4. Record appropriate three-digit code to identify separate series of sample location numbers within each county, starting with 001 in each county.

All plots, both forest and nonforest, permanent and partial permanent will be numbered consecutively across each county.

43.6 - Sample Kind, Item 5. Record a one-digit code from the following list of standard codes:

Code

- 1      New 10-point cluster. A new 10-point cluster established without reference to any previous inventory.
  
- 2      New 10-point cluster established at the same location as another type of plot or point cluster. The center point of the initial plot or cluster is taken as point one of the 10-point cluster.
  
- 3      New 10-point cluster established in the immediate vicinity of a sample location that cannot be reestablished.
  
- 7      New 10-point partial permanent cluster where heights are not measured.

43.7 - Date of Survey, Item 6. Record a four-digit code to show the month by the first two digits, followed by a code showing the year in which the sample location is measured, using the following standard codes:

<u>Code</u>	<u>Month</u>	<u>Code</u>	<u>Year</u>
01	January	64	1964
02	February	65	1965
03	March	66	1966
04	April	67	1967
05	May	68	1968
06	June	69	1969
07	July	70	1970
08	August	71	1971
09	September	72	1972
10	October	73	1973
11	November	74	1974
12	December	75	1975

For example, January 1964 would be coded 0164.

44 - AREA CLASSIFICATION

44.1 - Land Use

44.11 - Land Use, Dot and PI, Item 7. Enter a two-digit land-use code as estimated by photo interpretation. Record one of the following codes:

<u>Code</u>	
00	Indicates nonforest dot (record in PI column only)
10	Forest land
60	Nonforest land
91	Census water
92	Noncensus water

44.12 - Land Use, Ground, Item 8. Record present land classification as determined from ground examination. Use one of the following two-digit codes:

<u>Code</u>	
20	Commercial forest land
21	Pastured commercial forest land more than 25 percent stocked with growing stock trees
40	Unproductive forest land
50	Productive forest land withdrawn from commercial use
51	Productive forest land withdrawn for Christmas tree production
61	Cropland
62	Improved pasture and natural range land (less than 10 percent stocked with all trees)
64	Idle farmland (not tended within the last 2 years and less than 10 percent stocked with all trees).
65	Marsh
66	Other farmland, including farmsteads
67	Urban and other
69	Wooded pasture (improved pasture with 10 percent or more stocking in all trees, but less than 25 percent stocking in growing stock trees)
90	Water
91	Census water
92	Noncensus water

44.13 - Land Use Trend, Item 9. On remeasured locations record change in land use since the previous survey using the following two-digit codes. On new sample locations record change in land use since the photo date.

Code

- 01 No change in land use
- 02 Changed from forest to cropland, improved pasture,  
or other farmland
- 03 Changed from forest to idle farmland
- 04 Changed from forest to urban and other
- 05 Changed from forest to water or marsh
- 06 Changed from cropland, improved pasture,  
or other farmland to forest
- 07 Changed from idle farmland to forest
- 08 Changed from urban and other, or from water  
or marsh to forest
- 09 Changed from noncommercial to commercial forest land
- 10 Changed from commercial to noncommercial

44.2 - Owner Class, Item 10.

Ownership class should be obtained from county tax and ownership records for private land. Current ownership maps or ownership records are generally available for Federal land and most public lands at local offices. Fieldmen will visit county offices to obtain ownership of field locations falling on private land. The photo interpreters will complete ownership for public land or specifically refer this task to the fieldmen for particular field locations. Owner, size of ownership, and address will be determined from county courthouse records and recorded later on the Forest Inventory Sample Record, except in situations where ownership can be determined easily in the field. Record ownership using the following two-digit codes:

Code

- 11 National Forest
- 12 Bureau of Land Management
- 13 Indian
- 14 Miscellaneous
- 15 State
- 16 County and municipal
- 20 Forest industry
- 40 Farmer
- 50 Farmer-owned leased
- 60 Miscellaneous private-corporate
- 70 Miscellaneous private-individual
- 80 Miscellaneous private-corporate leased
- 90 Miscellaneous private-individual leased

In ownership codes 20 through 90, use the second digit to indicate size of ownership in the United States by the following codes:

<u>Code</u>	
1	0 to 50 acres
2	50 to 100 acres
3	100 to 500 acres
4	500 to 2,500 acres
5	2,500 to 5,000 acres
6	5,000 acres or more

For example, a location falling on land owned by a farmer having a total commercial forest land holding of 75 acres in the United States would be coded as 42.

44.3 - National Forest, Item 11. On National Forest lands record a three-digit code for this item. The first digit indicates National Forest Region and the last two digits the National Forest. Dash this item for sample locations on private or other public land.

44.4 - Working Circle, Item 12. On National Forest lands record a one-digit code for the National Forest working circle. Dash this item for sample locations on other lands.

45 - TREE IDENTIFICATION. Space is provided on the forest inventory sample record for recording complete information on each tree found on sample plots. On forest locations designated as partial plots, the following data will not be recorded: Items 13, 14, 20 through 30, 37 through 38. Partial plots will be witnessed so they can be remeasured at the next survey in the same manner as regular permanent plots.

45.1 - New Plots

45.11 - Fixed-Plot Tally for Trees 1.0 to 5.0 Inches Diameter Breast High (Plot Radius 6.8 Feet Encompassing 1/300 Acre)

45.11a - Plot Points 1, 2, and 3. Record data for all live saplings; that is, trees of commercial species from 1.0 to 5.0 inches d.b.h., within the fixed plot for items 13-19 and 31-35 on forest inventory sample record. See Appendix Tatum Guide 4 for checklist of items to collect. Record items 13-19 and 34-35 for trees of noncommercial species 1.0 to 5.0 inches in diameter.

45.11b - Plot Points 4 Through 10. Record data for the first four most dominant live trees 1.0 to 5.0 inches in diameter for items 15 through 19 and 31-35 on the forest inventory sample record.

45.12 - Variable-Plot Tally for Trees 5.0 Inches Diameter Breast High and Larger. At each plot point 1 through 10, record data on all live trees 5.0 inches d.b.h. and larger that fall within the limiting distance of the basal factor designated for the area.

Exhibit 6 summarizes items required for (1) live trees of commercial species, (2) live trees of noncommercial species, and (3) dead trees.

Exhibit 7 summarizes the basal area factors used by Stations and Regions for various types or species.

Exhibit 8 summarizes limiting distances.

Limiting distance for various basal factors is the horizontal distance from the pin to the center of a tree at d.b.h. For example, the limiting distance for a tree with a d.b.h. of 14.6 inches, using a basal area factor of 37.5, is 19.88 plus .85, or 20.73 feet.

45.13 - Fixed-Plot Tally for Seedlings or Other Cover (Plot Radius 6.8 Feet Encompassing 1/300 Acre). If no live trees 1.0 inch d.b.h. and larger; that is, sapling, poletimber, or sawtimber-sized trees, are recorded at a point, on the forest inventory sample record, record items 15 through 19 and item 33-35 for the four seedling-sized trees on the fixed plot with the largest stem diameters.

Softwoods must be 1/2 foot tall and hardwoods one foot tall.

If no live trees of any size are recorded at a point, record data on other cover for items 15 and 34.

45.14 - Fixed-Plot Tally for Stumps (Plot Radius 16.6 Feet Encompassing 1/50 Acre). At each point record items 15 through 19 on the forest inventory sample record for all stumps plus item 21 for stumps of poletimber - or sawtimber-sized trees (exhibit 6).

45.2 - Remeasured Plots. For remeasurement of sample locations field crews will be provided a separate supplement with specific instructions concerning remeasurement.

45.3 - Azimuth, Item 13. On forest inventory sample record, record azimuth from the point to the center of all tally trees 1.0 inch d.b.h. and larger on points 1, 2, and 3. On all other points record azimuth for trees 5.0 inches d.b.h. and larger only.

45.4 - Distance, Item 14. Record slope distance to the nearest foot from the point center to the face of each tree at its base. Record distance for each tree for which an azimuth is recorded.

Exhibit 7

VARIABLE PLOT BASAL AREA FACTORS BY AREA	
Area	Basal area factor
Eastern United States	37.5
Rocky Mountains	40.0
Pacific Northwest	
Ponderosa pine subregion	40.0
Douglas-fir subregion	80.0
Pacific Southwest	
Eastside Sierra	40.0
Old-growth redwood	250.0
All other areas	80.0
Alaska:	
Coastal	40.0
Interior	75.0

45.5 - Point Number, Item 15. Record point number 1 through 10, recording 0 for point 10. For each point there will be at least one line of entries. If no trees are tallied at a point, check the fixed-radius plot for stockability and non-tree cover, and record cover class code in item 34.

45.6 - Tree Number, Item 16. Record a two-digit code for each live or dead tree tallied. On new locations proceed from 0 degree azimuth in a clockwise direction. Begin with number 01 at each point

On all new sample locations, also record a number for each stump estimated to have been cut within the past 3 years or other specified period on a 1/50-acre plot (radius of 16.6 feet) centered on each point, using the same consecutive numbering system used for trees.

45.7 - Tree History, Item 17. Record a two-digit tree history code on both new and remeasured sample locations, using the following standard codes:

<u>Code</u>	<u>New sample locations</u>
01	Live trees

04 Dead tree qualifying as salvable dead.  
(Note: No tally needed for nonsalvable dead trees dying prior to mortality period, but all dead trees should be blazed so they can be readily identified at future remeasurements).

05 Dead tree qualifying as mortality tree.  
(Note: If a dead tree qualifies both as salvable dead and mortality, complete separate entries for each tree history).

08 Stump of live tree cut within past 3 years or other specified period (To be recorded on 1/50-acre fixed-radius plot at each point).

10 Stump of dead tree cut within past 3 years or other specified period (Qualifies as salvaged mortality. To be recorded on 1/50-acre fixed-radius plot at each point).

99 Site tree not on plot

Exhibit 8

VARIABLE PLOT LIMITING DISTANCE RADII, BY D.B.H. AND BASAL AREA FACTOR, USING ZERO SLOPE.					
D.B.H. (INCHES)	----- BASAL AREA FACTOR -----				
	37.5	40	75	80	250
	----- LIMITING DISTANCE IN FEET -----				
0.1	0.14	0.14	0.10	0.10	0.05
0.2	0.28	0.27	0.20	0.19	0.11
0.3	0.43	0.41	0.30	0.29	0.16
0.4	0.57	0.55	0.40	0.39	0.22
0.5	0.71	0.69	0.50	0.49	0.27
0.6	0.85	0.82	0.60	0.58	0.33
0.7	0.99	0.96	0.70	0.68	0.38
0.8	1.14	1.10	0.80	0.78	0.44
0.9	1.28	1.24	0.90	0.88	0.49
5.0	7.10	6.88	5.02	4.86	2.75
6.0	8.52	8.25	6.02	5.83	3.30
7.0	9.94	9.63	7.03	6.81	3.85
8.0	11.36	11.00	8.03	7.78	4.40
9.0	12.78	12.38	9.04	8.75	4.95
10.0	14.20	13.75	10.04	9.72	5.50
11.0	15.62	15.13	11.05	10.69	6.05
12.0	17.04	16.50	12.05	11.67	6.60
13.0	18.46	17.88	13.05	12.64	7.15
14.0	19.88	19.25	14.06	13.61	7.70
15.0	21.30	20.63	15.06	14.58	8.25
16.0	22.72	22.00	16.07	15.56	8.80
17.0	24.14	23.38	17.07	16.53	9.35
18.0	25.56	24.75	18.07	17.50	9.90
19.0	26.98	26.13	19.08	18.47	10.45
20.0	28.40	27.50	20.08	19.45	11.00
21.0	29.82	28.88	21.09	20.42	11.55
22.0	31.24	30.25	22.09	21.39	12.10
23.0	32.66	31.63	23.10	22.36	12.65
24.0	34.08	33.00	24.10	23.33	13.20
25.0	35.50	34.38	25.10	24.31	13.75
26.0	36.92	35.75	26.11	25.28	14.30
27.0	38.34	37.13	27.11	26.25	14.85
28.0	39.76	38.50	28.12	27.22	15.40
29.0	41.18	39.88	29.12	28.20	15.95
30.0	42.60	41.25	30.12	29.17	16.50
31.0	44.02	42.63	31.13	30.14	17.05
32.0	45.44	44.00	32.13	31.11	17.60
33.0	46.86	45.38	33.14	32.08	18.15
34.0	48.28	46.75	34.14	33.06	18.70
35.0	49.70	48.13	35.15	34.03	19.25
36.0	51.12	49.50	36.15	35.00	19.80
37.0	52.54	50.88	37.15	35.97	20.35
38.0	53.96	52.25	38.16	36.95	20.90
39.0	55.38	53.63	39.16	37.92	21.45
40.0	56.80	55.00	40.17	38.89	22.00
41.0	58.22	56.38	41.17	39.86	22.55
42.0	59.64	57.75	42.17	40.84	23.10
43.0	61.06	59.13	43.18	41.81	23.65
44.0	62.48	60.50	44.18	42.78	24.20
45.0	63.90	61.88	45.19	43.75	24.75
46.0	65.32	63.25	46.19	44.72	25.30
47.0	66.74	64.63	47.20	45.70	25.85
48.0	68.16	66.00	48.20	46.67	26.40
49.0	69.58	67.38	49.20	47.64	26.95
50.0	71.00	68.75	50.21	48.61	27.50

Exhibit 8--Continued

D.B.H. (INCHES)	----- BASAL AREA FACTOR -----				
	37.5	40	75	80	250
	----- LIMITING DISTANCE IN FEET -----				
51.0	72.42	70.13	51.21	49.59	28.05
52.0	73.84	71.50	52.22	50.56	28.60
53.0	75.26	72.88	53.22	51.53	29.15
54.0	76.69	74.25	54.22	52.50	29.70
55.0	78.11	75.63	55.23	53.47	30.25
56.0	79.53	77.00	56.23	54.45	30.80
57.0	80.95	78.38	57.24	55.42	31.35
58.0	82.37	79.75	58.24	56.39	31.90
59.0	83.79	81.13	59.25	57.36	32.45
60.0	85.21	82.50	60.25	58.34	33.00
61.0			61.25	59.31	33.55
62.0			62.26	60.28	34.10
63.0			63.26	61.25	34.65
64.0			64.27	62.23	35.20
65.0			65.27	63.20	35.75
66.0			66.27	64.17	36.30
67.0			67.28	65.14	36.85
68.0			68.28	66.11	37.40
69.0			69.29	67.09	37.95
70.0			70.29	68.06	38.50
71.0			71.30	69.03	39.05
72.0			72.30	70.00	39.60
73.0			73.30	70.98	40.15
74.0			74.31	71.95	40.70
75.0			75.31	72.92	41.25
76.0			76.32	73.89	41.80
77.0			77.32	74.86	42.35
78.0			78.32	75.84	42.90
79.0			79.33	76.81	43.45
80.0			80.33	77.78	44.00
81.0			81.34	78.75	44.55
82.0			82.34	79.73	45.10
83.0			83.35	80.70	45.65
84.0			84.35	81.67	46.20
85.0			85.35	82.64	46.75
86.0			86.36	83.62	47.30
87.0			87.36	84.59	47.85
88.0			88.37	85.56	48.40
89.0			89.37	86.53	48.95
90.0			90.37	87.50	49.50
91.0			91.38	88.48	50.05
92.0			92.38	89.45	50.60
93.0			93.39	90.42	51.15
94.0			94.39	91.39	51.70
95.0			95.40	92.37	52.25
96.0			96.40	93.34	52.80
97.0			97.40	94.31	53.35
98.0			98.41	95.28	53.90
99.0			99.41	96.25	54.45
100.0			100.42	97.23	55.00

45.8 - Species, Item 18. Record a three-digit species code for all live trees, dead trees, and stumps recorded in item 16. Use standard species codes shown in Appendix. ALL NONCOMMERCIAL SPECIES ARE CODED 999.

46 - TREE MEASUREMENTS. Measurements and observations recorded are those required to compute volume, growth, and quality.

46.1 - Tree Diameter Breast High, Item 19. For each tree listed in item 16 record a four-digit code for diameter at breast height, to the last 0.1 inch. The 6.1-inch diameter class coded as 0061, for example, should include trees 6.10 inches in diameter up to but not including trees 6.20 inches in diameter. Record code 0000 for tree with DBH less than 1.0 inch.

Since trees will be determined as in or out of the tally, depending on their d.b.h. and distance from the point center, and since identical trees should be remeasured on resurveys, it is highly important that d.b.h. be accurately determined. Proper measuring procedures are illustrated in exhibits 10 and 11.

In case of irregularities at d.b.h. such as swellings, bumps, depressions, and branches, measure diameter immediately above the irregularity at the place where it ceases to affect the normal stem form. Naturally swell-butted trees, such as cypress and tupelo, should be measured at a point 1.5 feet above the end of the pronounced swell or bottleneck if the bottleneck is more than 3 feet high.

If the stem forks immediately above d.b.h., measure diameter below the swell at the place where the fork ceases to affect the normal stem form. When the stem forks below d.b.h., consider the tree as two trees and measure or estimate diameter at a point as near to 3-1/2 feet above the fork as possible.

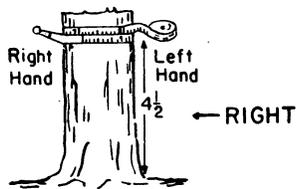
On salvable dead trees that have had their bark slough off, etc. estimate the diameter outside bark at time of death.

Place a 2-inch horizontal paint mark just above the upper tape at the point where DBH is measured on the side facing plot center. Place another 2-inch vertical paint mark at the base of the tree. Dead trees tallied may be marked additionally so they can be easily identified at future remeasurements.

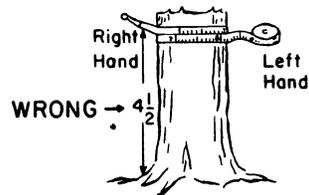
46.11 - Stump Diameter at New Locations. For each stump of sawtimber - or poletimber-sized trees recorded in item 16, record average diameter outside bark to the last 0.1 inch at the top of the stump in item 19. Estimate and record the d.b.h. at the time of cutting for each stump of sapling-sized trees recorded in item 16.

Exhibit 10

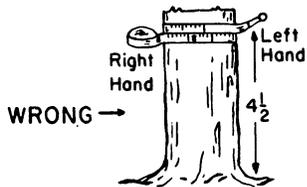
USING THE DIAMETER TAPE



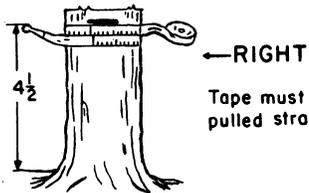
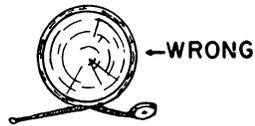
LEFT HANDED - Right hand crossed under.



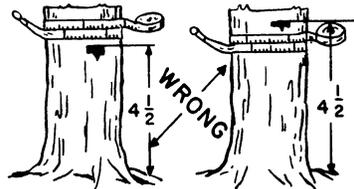
LEFT HANDED - Right hand crossed over.



RIGHT HANDED - Left hand crossed over.

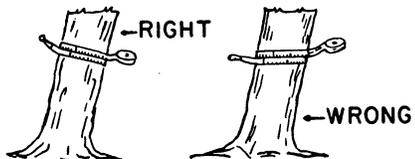


Tape must be pulled straight.



Always assume that the 4 1/2 ft. D.B.H. point is at the top of lower tape at this point.

The tape must be at right angles to the lean of the tree.



Don't place tape at abnormal place on the bole.

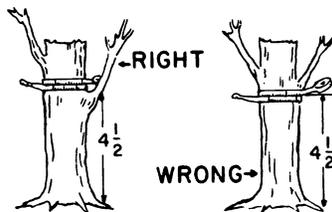
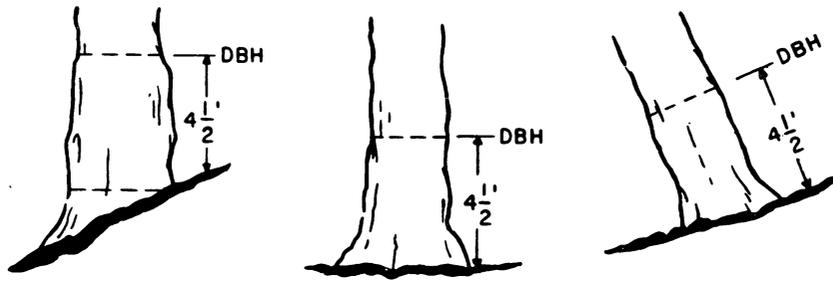


Exhibit 11

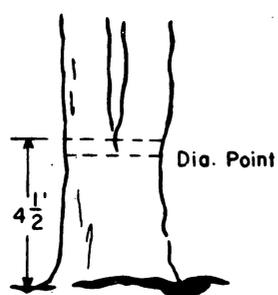
DIAMETER BREAST HIGH MEASUREMENT  
IN A VARIETY OF SITUATIONS



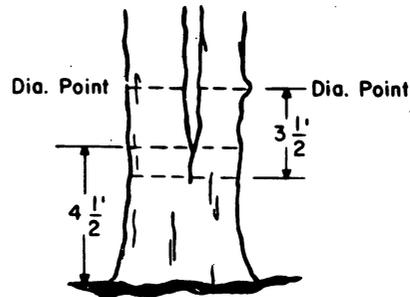
1. Tree on slope

2. Tree on level ground

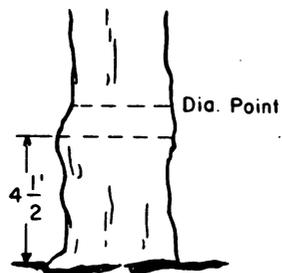
3. Leaning tree



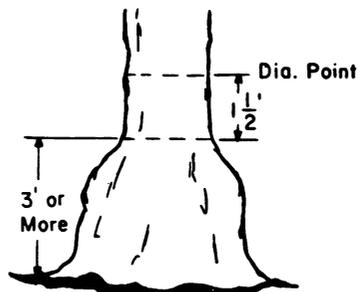
4. Tree forking at or above 4 1/2 feet



5. Tree forking below 4 1/2 feet



6. Tree deformed at 4 1/2



7. Bottleneck tree

46.3 - Bole Length, Item 21. Bole length of all live and dead trees 5.0 inches d.b.h. and larger should be determined between the top of a 1-foot stump and 4.0-inch diameter outside bark, or the point where the central stem is terminated before reaching 4.0 inches d.b.h. Record length to the last whole foot using a three-digit code. For example, a bole length of 23 feet would include lengths of 23.0 feet up to, but not including, 24.0 feet and would be coded 023. See exhibit 12.

46.31 - Stump Height. On new locations for all stumps of sawtimber- or poletimber-sized trees shown in item 17 record height of stump to the last tenth foot using a three-digit code. For example, a stump height of 1.86 feet should be coded 018.

46.4 - Cubic-Foot Cull, Item 22. Cubic-foot cull is the volume of decayed or missing wood in live or dead trees.

For growing stock and dead trees, cubic-foot cull includes the volumes of sections of the bole that are too rough to be utilized for products, such as pulpwood, including short sections with extreme crook, large forks, or numerous limbs including:

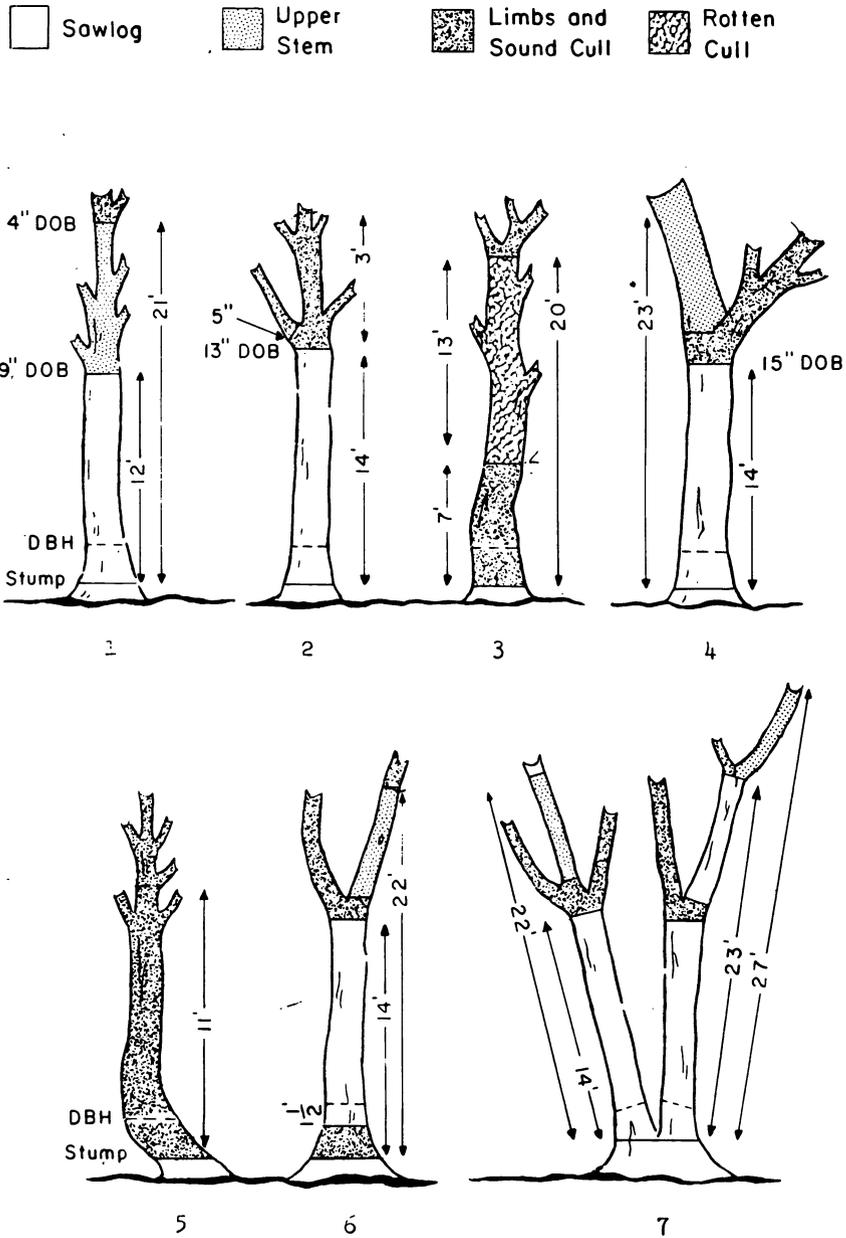
1. Any section less than 4 feet long above a limb with a knot collar greater than the stem diameter at that point, or several limbs over 2-inches d.o.b. within a 1-foot span with an aggregate knot collar diameter greater than the stem d.o.b. of the section.
2. Any 4-foot section of bole so crooked that a line drawn between the center of the ends falls outside the bark at any point.
3. Any rotten section unusable for industrial products.

For cull trees record only the volume of rotten wood.

Cubic foot cull may be computed by determining the length of the section affected, and the midpoint d.i.b. The volume of the section can then be looked up in the Tatum Guide "Cubic Foot Volumes of Short Logs" found in the Appendix. Using a four-digit code, estimate and record cull to the last one-tenth cubic foot (0.1 cubic feet would be recorded as 0001).

Exhibit 12

BOLE MEASUREMENTS  
FOR A VARIETY OF SITUATIONS



46.3

46.5

Exhibit 12 -- Continued

Explanation

1. A hardwood sawtimber tree. Saw log length terminates at 9-inch top d.o.b. and saw log meets minimum 12-foot qualification. Upper stem portion contains no cull and terminates a 4 inches d.o.b. Saw log length is recorded as 12 feet; bole length as 21 feet.
2. A sawtimber tree. Saw log portion is terminated by limbs at 13-inches d.o.b. The saw log contains no cull and meets minimum grade specifications. Both bole length and saw log length are 14 feet. The portion between whorls of limbs is large enough in diameter but not in length to qualify as upper stem volume (i.e., is less than 4 feet long).
3. A rotten tree. The saw log portion is 20 feet long, but a 13-foot rotten section along with a 7-foot sound cull section prevents the log from meeting minimum specifications. Because more than half the volume loss is due to rot, the tree is classed as a rotten tree.
4. A sawtimber tree. Saw log portion terminating because of branching at 15-inch top d.o.b. meets minimum specifications. Seven feet of left-hand fork qualifies as upper stem.
5. A rough tree. Saw log top terminated by branches 11 feet above crooked butt. No saw log meeting minimum qualifications present.
6. A sawtimber tree. Despite rotten cull in the saw log portion due to butt rot, a 14-foot saw log is present with the butt 2 feet cull. Seven feet of right-hand fork qualifies as upper stem.
7. Two sawtimber "trees". Since lowest fork is below d.b.h., each fork is appraised and recorded as a separate tree. The lower 14-foot section of the left-hand fork meets requirements for a sawtimber tree. A 6-foot portion of the largest stem in upper fork qualifies as upper stem material. In the main right-hand fork, a 13-foot saw log plus a 9-foot saw log (with an intervening 1-foot section of sound cull) is recorded as 23 feet of saw log length. A 4-foot section of the right-hand fork qualifies as upper stem.

46.5 - Saw Log Length, Item 23. Record saw log length to the last whole foot of the bole of sawtimber-sized trees, using a three-digit code. For example, a saw log length of 14.5 feet should be recorded as 014. Measure saw log length from a 1-foot stump to a minimum top of 7.0 inches diameter outside bark (d.o.b.) for softwoods and 9.0 inches d.o.b. for hardwood, or to the point where the central stem terminates before reaching 7.0 or 9.0 inches.

Record saw log length for softwood trees 9.0 inches d.b.h. and larger in the Eastern United States and Rocky Mountain sections and hardwood trees 11.0 inches d.b.h. and larger in all sections. Several examples of saw log sections are shown in exhibit 12.

12-foot

To qualify as a saw log section, a tree must contain one/sawlog or more than one shorter log over 8 foot long and meet minimum saw log grade specifications as shown in the Appendix. Short trees.--Trees containing less than a 12-foot saw log but more than an 8-foot saw log is tree class of 31. The tree must contain 33 percent or more of gross board-foot volume (International 1/4-inch rule) in sound material.

46.6 - Saw Log Top Diameter Outside Bark, Item 24. For each tree with an entry in item 23, record saw log top d.o.b. to the last 0.1 inch, using a three-digit code. For example, record 7.0 inches as 070. If the tree has a central stem the top d.o.b. recorded for softwoods will be 7.0 inches and 9.0 inches for hardwoods. For trees with saw log length terminating before reaching minimum top d.o.b., record d.o.b. at the point where saw log length terminates.

46.7 - Board-Foot Cull, Item 25. Board-foot cull is the volume within the saw log portion of growing stock and dead trees of commercial species which cannot be recovered for use as lumber because of rot, sweep, crook or other defect. Cull volume includes the entire volume of tree sections which do not meet minimum log grade requirements plus cull volume within saw logs and for hardwoods, any section less than 8 feet long above a limb or group of limbs with a diameter or sum of diameters greater than 1/3 the stem d.o.b. at that point. And for softwoods any section less than 8 feet long above a group of 2.0 inch or larger limbs whose sum exceeds d.o.b. at that point.

Determine the board foot cull volume in logs and/or cull sections by estimating the length and scaling diameter and looking up the board foot volume in the "Board-foot Volume of Short Logs" table in the Appendix. In determining cull due to sweep and crook, minimize the defect by logical log-making aimed at obtaining maximum high-grade material. Sweep and crook tables along with guides for determining the proportion of cull are also found in the Appendix.

Use a three-digit code to record cull volume, to the last board foot.

46.8 - Log Grade, Item 26. Grade the first saw log in each live saw-timber tree according to log grade rules in the Appendix. Record a one-digit code corresponding to the log grade numbers. Grade hardwood trees by either the best 12 feet of the first 16-foot section or the best 12-foot upper section if the butt log does not meet minimum log grade standards. Grade the first merchantable 16-foot log in softwood trees, or shorter lengths down to 12 feet if a 16-foot log is not present.

Grade tree class 31's to an 8-foot log.

47 - TREE CLASSIFICATION. Items 27 through 33, on the forest inventory sample record, provide the basis for systematically classifying trees into classes that reflect their vigor and suitability for timber products, now or prospectively. These tree classes permit relating inventories and growth to area condition, which in turn provides a basis for rating harvesting and management opportunities. See Appendix, Tatum Guide 4 for items to be recorded.

For live trees of commercial species record items 27 through 33 for all trees 5.0 inches d.b.h. and larger at all points at all sample locations. For live trees of commercial species less than 5.0 inches d.b.h. record data for items 31-33 only. Classification of trees under 5.0 inches d.b.h. will be based on species and vigor as shown by the damage classification.

For dead trees 5.0 inches d.b.h. and larger at new locations that qualify as mortality record cause of death in item 33 and former tree class in item 34.

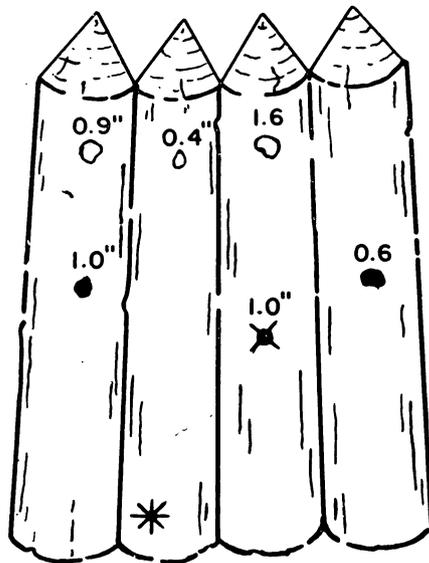
47.1 - Surface Defect, Item 27. Surface defect observations provide a measure of the number and size of limbs, knots, and other defects that affect quality of lumber, veneer, and other products.

47.11 - Softwoods for Eastern United States. Surface defect for eastern softwoods is based on knot count ; that is, the number of overgrown knots more than one-half inch in diameter, plus the sum of diameters of sound knots or limbs, plus twice the sum of the diameter of unsound knots (exhibit 13).

46.7 - Board-Foot Cull, Item 25. Board-foot cull is the volume within

Exhibit 13

**TREE CLASSIFICATION, SOFTWOODS,  
KNOT COUNT FOR EASTERN UNITED STATES**



**LEGEND**

- Live Limb
- Sound Knot
- ✕ Unsound Knot
- \* Overgrown Knot

Source of knot count

Knot count

Live limbs:

Number	Diameter	
1	0.9"	1
1	0.4"	0
1	1.6"	2
	Live limb total	$\frac{3}{3}$

Sound knots:

1	0.6"	1
	1.0"	1
	Sound knot total	$\frac{2}{2}$

Unsound knots:

1	1.0"	2
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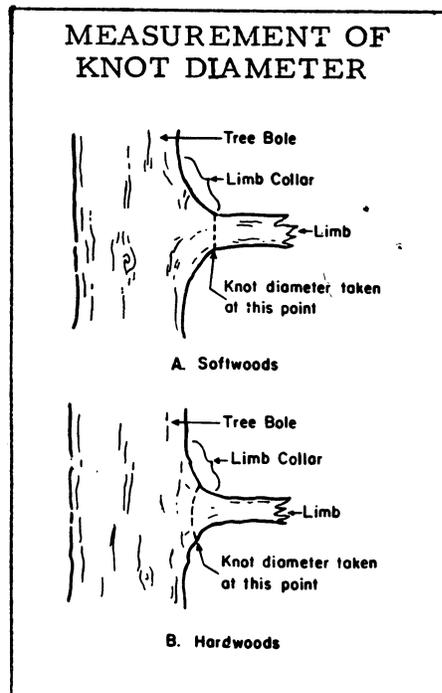
Overgrown knots:

	Total knot count	$\frac{1}{8}$
--	------------------	---------------

Average diameter of knots should be measured to the nearest whole inch at a point where the limb would be removed in pruning (exhibit 14). All limbs and knots less than one-half inch in diameter should be ignored.

For softwoods measure knot diameters at right angles to the axis of the limb at the outer edge of the limb collar. For hardwoods measure diameter at a point where the limb collar flares out almost parallel with the axis of the bole (exhibit 14).

Exhibit 14



Record knot count code for the first:

8-foot section of trees 5.0 to 7.0 inches d.b.h.

12-foot section of trees 7.0 to 9.0 inches d.b.h.

16-foot section of trees 9.0 inches d.b.h. and larger.

The reduction in length of bole examined as specified above serves to relax knot count specifications with decrease in tree size to allow for natural pruning and overgrowth of knots and defects as trees become larger.

Record knot count index codes as follows:

<u>Knot count</u>	<u>Code</u>
0	0
1-2	1
3-4	2
5-6	3
7-8	4
9-10	5
11-12	6
13-14	7
15-16	8
17+	9

47.13 - Hardwoods for Entire United States. Surface defect in hardwoods is based on length of clear panels in the tree face toward point center.

A clear panel is a section of the tree surface one fourth the circumference of the tree and at least 2 feet long, free of limbs, knots, bumps, and other indications of defect which preclude clear cuttings in boards and veneer (exhibit 15).

Record the cumulative clear panel length to the last whole foot in the first:

8-foot section of trees 5.0 to 7.0 inches d.b.h.

12-foot section of trees 7.0 to 11.0 inches d.b.h.

16-foot section of trees 11.0 inches d.b.h. and larger, using the following codes:

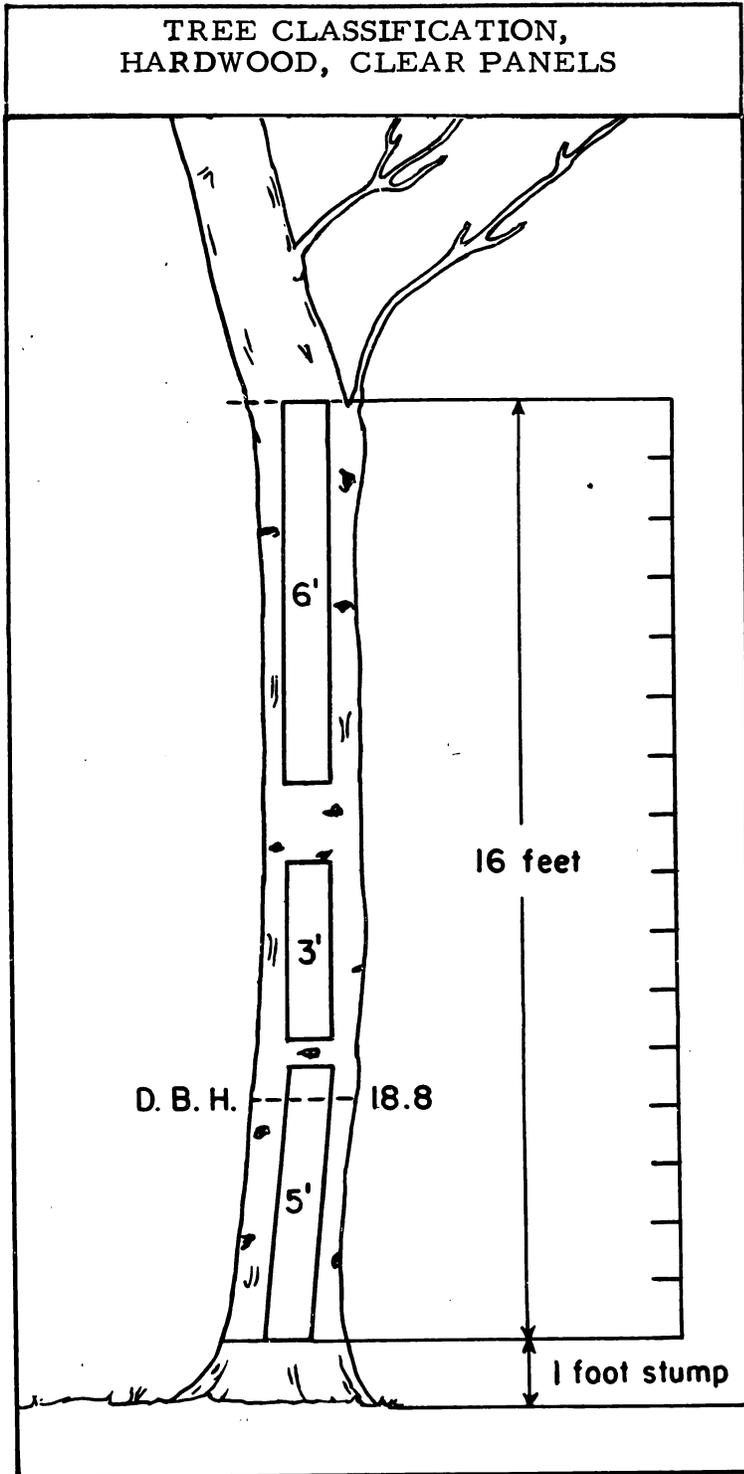
<u>Code</u>	<u>Cumulative clear panel length (feet)</u>
0	0
1	2 or 3
2	4 or 5
3	6 or 7
4	8 or 9
5	10 or 11
6	12 or 13
7	14 or 15
8	16

In judging clear-panel length include as defects:

1. Bark distortions consisting of breaks across and along the normal bark pattern which indicate overgrown knots or defects in the underlying wood.

Exhibit 15

TREE CLASSIFICATION,  
HARDWOOD, CLEAR PANELS



46.7 - Bo  
the saw 1

cull is the volume within  
trees of commercial

2. All adventitious twig growth on trees less than 15.0 inches in d.b.h.

3. All overgrown and adventitious twigs over 3/8 inch in diameter on trees 15.0 inches d.b.h. and larger.

4. All bird pecks, grub holes, or other insect holes, recent or overgrown on trees less than 15 inches in d.b.h.

5. All overgrown bird pecks, grub holes, or other insect holes on trees 15.0 inches d.b.h. or larger.

Ignore as defects:

1. Slight bark distortions, consisting of a simple horizontal break across the normal bark pattern.

2. Shallow fire and other scars, seams, and frost cracks where minimum depth appears to be less than one-fifth of the tree diameter at that point. These shallow defects are expected to be cut out in slabbing for lumber and rounding for veneer.

Defect definitions are adapted from "Hardwood Log Grades for Standard Lumber and How to Apply Them," U.S. Department of Agriculture, Forest Service, Forest Products Laboratory Publication D173A, May 1956.

47.2 - Internal Defect, Item 28. Internal defect includes decay or missing sections of trees. The unusable part of the board-foot volume in the saw log portion of sawtimber trees, or the prospectively unusable portion of board-foot volume of poletimber trees, should be estimated and recorded by the following codes:

<u>Code</u>	<u>Percentage defect</u>
0	0
1	1 through 10
2	11 through 20
3	21 through 30
4	31 through 40
5	41 through 50
6	51 through 60
7	61 through 67
8	68 through 75
9	76+

47.3 Total Volume Loss, Item 29. Total volume loss is the sum of volume losses due to internal defect (from item 28) plus volume losses due to sweep, crook, deep splits and cracks as described later under this item. The percentage of gross board-foot volume of the saw log portion of sawtimber trees unusable because of these losses or in the case of poletimber trees prospectively unusable at the time trees reach saw log size, should be recorded by percentage classes as follows:

<u>Code</u>	<u>Percentage of total volume lost</u>
0	0
1	1 through 10
2	11 through 20
3	21 through 30
4	31 through 40
5	41 through 50
6	51 through 60
7	61 through 67
8	68 through 75
9	76+

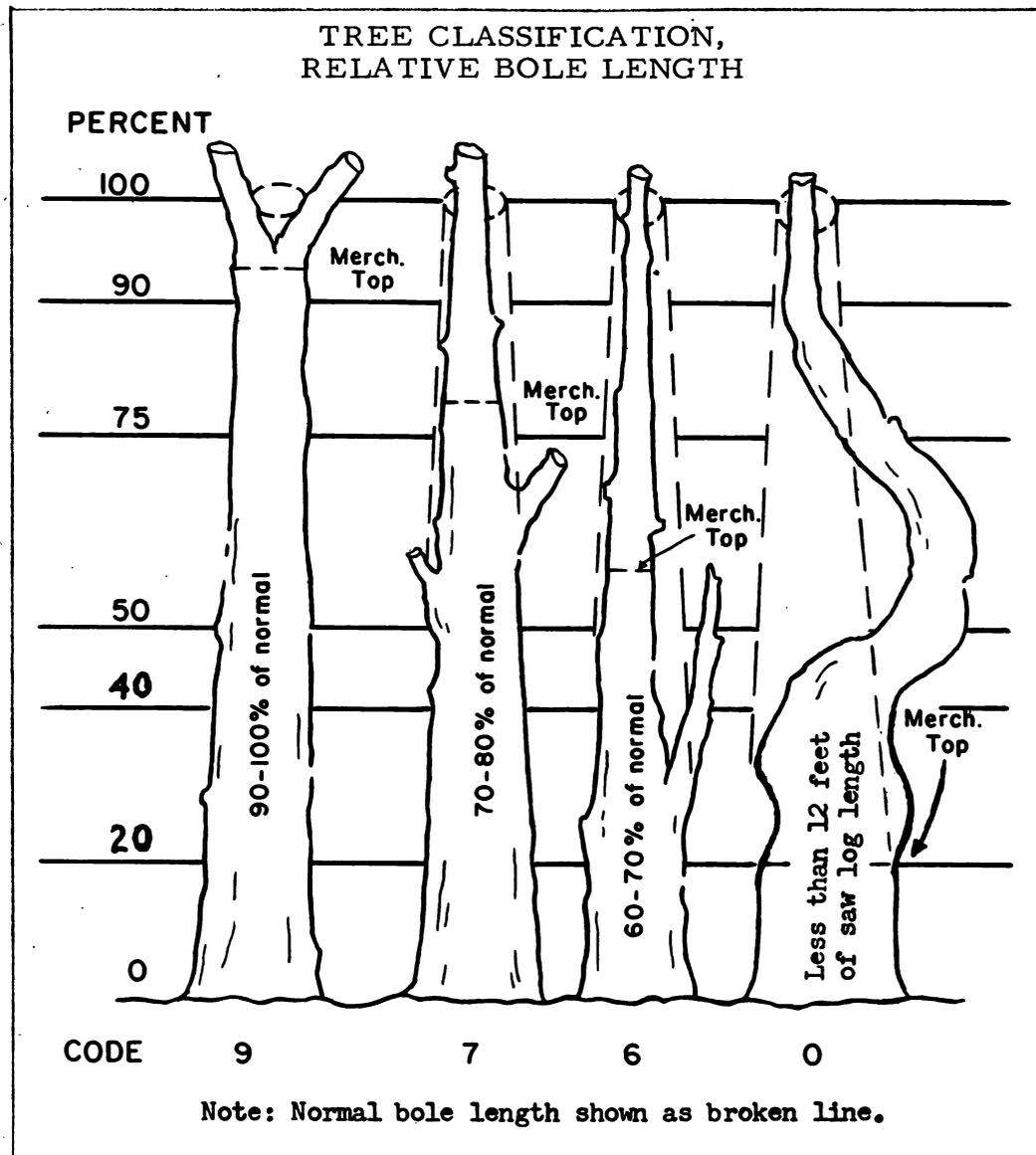
47.31 - Sweep and Crook. Estimate the percent of gross board foot volume loss due to sweep and crook.

47.4 - Relative Bole Length, Item 30. Relative bole length is the length of the saw log portion of a tree expressed as a percentage of saw log length for trees of that diameter, species, and site in the absence of deformities, such as forks, crooks, excessive taper, excessive branching, or broken tops. Estimation of relative bole tends to separate effects of site from effects of stand condition, logging practices, and management. Examples of bole length are shown in exhibit 21.

Record relative bole length in 10-percent classes as follows:

<u>Code</u>	<u>Percentage of normal</u>
9	90 to 100
8	80 to 90
7	70 to 80
6	60 to 70
5	50 to 60
4	40 to 50
3	30 to 40
2	20 to 30
1	Under 20, but at least one 12-foot merchantable log
0	Less than 12 feet of potential saw log length

Exhibit 21



47.5 - Crown Ratio, Item 31. Crown ratio is the percentage of total tree height that supports a full, live, green crown. For trees that have uneven length crowns, ocularly transfer branches to fill holes in the upper portion of the crown, until a full even crown is visualized. For example, a tree might have scattered green branches extending over 60 percent of its total height, but by ocularly transferring branches to produce a full crown the crown ratio might be 40 percent.

Record crown ratio using the following one-digit codes:

<u>Code</u>	<u>Crown ratio</u>
1	1 through 10 percent
2	11 through 20 percent
3	21 through 30 percent
4	31 through 40 percent
5	41 through 50 percent
6	51 through 60 percent
7	61 through 70 percent
8	71 through 80 percent
9	81 through 90 percent
0	91 through 100 percent

47.6 - Crown Class, Item 32. Record a one-digit code to show crown class of all live trees of commercial species 3.0 inches d.b.h. and larger, as follows:

<u>Code</u>	
1	<u>Open grown.</u> Trees with crowns which have received full light from above and from all sides throughout most of the life of the tree, particularly during its early developmental period.
2	<u>Dominant.</u> Trees with crowns extending above the general level of the crown cover and receiving full light from above and partly from the sides; larger than the average trees in the stand, and with crowns well-developed, but possibly somewhat crowded on the sides.
3	<u>Codominant.</u> Trees with crowns forming part of the general level of the crown cover and receiving full light from above, but comparatively little from the sides--usually with medium-sized crowns more or less crowded on the sides. (In stagnated stands, includes trees with small-sized crowns crowded on the sides).
4	<u>Intermediate.</u> Trees shorter than those in the two preceding classes, but with crowns either below or extending into the crown cover formed by codominant and dominant trees, receiving little direct light from above, and none from the sides; usually with small crowns considerably crowded on the sides.

Code

- 5 Overtopped. Trees with crowns entirely below the general level of the crown cover, receiving no direct light either from above or from the sides.

In multiple-age stands with understory trees of younger age classes, crown classification is often difficult. As a general rule, the crown class for each tree should be judged in the context of its immediate environment; that is, those trees affecting it or being affected by it in terms of crown competition. For example, the intermediate and suppressed crown classes are intended to include only trees seriously affected by direct competition from adjacent trees.

47.7 - Damage, Cause of Death, Item 33

47.71 - Damage. For live trees record presence of damage or pathogen activity if serious enough to reduce the quality by one tree classification code (items 27 thorough 32). For example, damage would be considered serious, if a tree has 25 percent total volume loss (coded 3) due to butt rot and this rot is expected to increase until the tree falls into the next class (code 4).

Record presence of pathogens or damage using the following two-digit codes:

Code

- |    |  |
|----|--|
| 10 | Insect damage  |
| 20 | Disease damage   |
| 30 | Fire damage  |
| 40 | Animal damage  |
| 50 | Weather damage   |
| 60 | Suppression  |
| 70 | Unknown and other damage   |
| 80 | Logging and related damage   |
| 90 | Off-site trees not capable of producing a 12-foot log now or prospectively, etc. This code is not intended to indicate damage, but rather to provide data for classifying certain trees as nongrowing stock that are not covered in other items. |
| 00 | No serious damage.   |

When a tree is damaged by more than one agent, code the most severe one.

47.72 - Cause of Death. Record cause of death of dead trees qualifying as mortality, using the following two-digit codes:

<u>Code</u>	<u>Cause of death</u>
10	Insects
20	Disease
30	Fire
40	Animals
50	Weather
60	Suppression
70	Unknown
80	Logging and related activity
81	Logging
82	Timber stand improvement
83	Turpentine
84	Land clearing
85	Conversion to nonforest or noncommercial forest land use. (Note: Includes all growing trees removed from inventory by changes in land use whether trees are killed or not).

Where there is only one cause of death evident, use 0 for the second digit. When there are multiple causes of mortality, use the first digit to indicate the most important subsequent cause of death and the second digit to indicate the initial cause. Thus a tree killed by windthrow, but showing evidence of root rot, would be coded 52. A tree killed by disease only would be coded 20.

Codes 80 and 81 indicate dead trees classed as logging residues. Codes 82, 83, 84, and 85 indicate trees classed as other removals.

47.8 - Tree or Cover Class, Item 34

47.81 - Tree Class, Tree class of live trees will be based on entries in items 27 through 33 and using the following tree class codes:

<u>Code</u>	<u>Tree class</u>
10	Desirable tree
20	Acceptable tree
30	Rough tree
31	Short sawtimber tree
40	Rotten tree

Criteria for these classes are outline in exhibit 22. Standards may be redefined in future manual revisions if analysis of initial classifications indicate a need for revised classes.

Field men should enter tree class for dead trees that qualify as mortality at new locations; that is, trees coded 05 in item 17. Estimate tree class at the time the tree died and record as a two-digit code, using the codes shown in exhibit 22.

**Exhibit 22 STANDARDS FOR COMMERCIAL SPECIES BY TREE CLASS**  
**Desirable tree (Code 10)**

<u>Surface defect</u>		<u>East</u>	
Softwood	<u>D.B.H.</u> <u>(inches)</u>	<u>Log length</u> <u>(feet)</u>	<u>Maximum</u> <u>knot count</u>
	5.0-6.9	8	8
	7.0-8.9	12	8
	9.0-14.9	16	6
	15.0+	16	4
Hardwood	<u>D.B.H.</u>	<u>Log length</u> <u>(feet)</u>	<u>Minimum cumulative clear</u> <u>panel length (feet)</u>
	5.0-6.9	8	4
	7.0-10.9	12	6
	11.0-14.9	16	8
	15.0+	16	10
<u>Internal defect</u>		<u>Maximum allowable percentage</u>	
Poletimber			0
Small sawtimber			10
Large sawtimber (15" +)			20
<u>Total volume loss</u>			
Poletimber			0
Small sawtimber			10
Large sawtimber (15" +)			20
Relative bole length	80 percent or more of normal		
Crown ratio	31 percentage or over		
Crown class	Open grown, dominant and codominant		
Damage class	No serious damage		

Tree less than 3 inches DBH must also be suitable for the stand type and site. See list of desirable species in the Appendix.

Exhibit 22 (Continued)

Acceptable tree (Code 20)

Surface defect

Softwoods (All tree sizes and areas) No limit to knot count or size of knot or limb

Hardwoods (All tree sizes and areas) No minimum cumulative clear panel length

---

Internal defect or total volume loss	Maximum allowable defect Percentage
--------------------------------------	--

---

All East except Southern Station hardwoods	67
---	----

---

Relative bole length	Any except code 0
Crown ratio	No limit
Crown class	No limit

---

Damage class	Any except damage class codes 60 or 90
--------------	---

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Rough tree (Code 30)

1. All live trees of noncommercial species.
2. Live trees of commercial species that do not have at least a 12-foot saw log now or prospectively that fails to meet minimum log grade standards primarily because of roughness, poor form, splits, and cracks, and with percentage of gross tree volume in sound material less than the following Regional standards:

Eastern United States, Rocky Mountains, and Alaska      33 percent

Short sawtimber tree (Code 31)

Live trees of commercial species that do not qualify as desirable or acceptable because they do not contain a 12-foot saw log now. They must contain at least an 8-foot saw log.

Rotten tree (Code 40)

Live trees of commercial species not having at least a 12-foot saw log now or prospectively that fails to meet minimum log grade standards primarily because of rot or missing sections and with percentage of gross tree volume in sound material less than the Regional standards specified under rough tree.

47.82 - Cover Class. If no live trees are recorded at a point, examine the fixed-radius plot for cover class and record, using the codes given below.

Code

- 50      Inhibiting vegetation. Cover sufficiently dense to prevent establishment of tree seedlings.
- 60      Nonstocked not overtopped. Area sufficiently clear to permit establishment and development of one or more tree seedlings by natural or artificial methods.
- 70      Nonstocked overtopped. Area clear enough to permit establishment of seedlings, but sufficiently overtopped by tree crowns to prevent survival of tree seedlings.
- 80      Nonstockable. Not capable of supporting trees of commercial species, because of the presence of rocks, water, etc.

48 - AREA DESCRIPTION

48.1 - Stand Origin, Item 50. Record apparent stand origin on the area being sampled, using the following one-digit codes. Consider only trees in the predominant size class of the area.

Code

- 1      Natural stand with no evidence of artificial regeneration.
- 2      More than 40 percent of the sample location occupied by trees originating from artificial planting or seeding.
- 3      Less than 40 percent of the sample location estimated to be occupied by trees originating from artificial planting or seeding.

48.2 - Site Class, Item 51. Site class will be left blank in the field, since this item will be determined as part of data processing. Site class codes to be used are as follows:

<u>Code</u>	<u>Potential yield, mean annual increment</u>
1	225 or more cubic feet per acre
2	165 to 225 cubic feet per acre
3	120 to 165 cubic feet per acre
4	85 to 120 cubic feet per acre
5	50 to 85 cubic feet per acre
6	20 to 50 cubic feet per acre
7	Less than 20 cubic feet per acre

48.3 - Site Index, Item 52. Site index will be determined in the field.

48.31 - Site Tree Selection. Select three site trees from the commercial species which predominate on the plot area. All site trees should have been dominant and codominant throughout their lives. Do not use trees that were suppressed during early years and then released. These can be identified by increment cores, which show growth rings close together in early years followed by a sudden and marked widening of growth rings. Site trees should be well distributed over the area. If there are no suitable site trees on the plot, select nearby trees from the same general aspect and elevation.

Do not select permanent tally trees if at all possible. The following table gives the species that should be selected for site measurements by stand type:

<u>Type</u>	<u>Preferred Species</u>	<u>Alternate species</u>
01	Jack pine (105)	Red pine (125)
02	Red pine (125)	White pine (129)
03	White pine (129)	Red pine (125)
06	Scotch pine (130)	Jack pine (105)
11	Balsam fir (012)	W. spruce (094)
12	Black spruce (095)	Tamarack (071)
14	N.W. cedar (241)	Black spruce (095)
15	Tamarack (071)	Black spruce (095)
50	N. red oak (833)	Sugar maple (318)
70	A. elm (972)	Black ash (543)
80	Sugar maple (318)	Beech (531), yellow birch (371), Basswood (751)
91	Aspen (746)	-
92	Paper birch (375)	-

10

Site curves are provided in the appendix for most of the above species.

Site index cannot be measured in the regular way for trees below about 15 feet. If larger nearby trees suitable for measuring site are not present, the following guides may be used. For softwood stands estimate site index on the 5-year intercept method using the following table:

<u>Height growth</u> <u>during last 5 years</u>	<u>Estimated</u> <u>Site index</u>
3 feet . . . . .	33
4 feet . . . . .	42
5 feet . . . . .	50
6 feet . . . . .	57
7 feet . . . . .	62
8 feet . . . . .	67
9 feet . . . . .	71
10 feet . . . . .	74
11 feet . . . . .	75
12 feet . . . . .	76

Jack pine, tamarack, and cedar tend to have site index slightly (use 3 feet) below the average in the table; white pine will be slightly above the table. For hardwood stands below 15 feet the site index must be estimated based on ocular appraisal of soil, drainage, vegetation, etc.

Any location in a black spruce, white cedar or tamarack type with site index less than 20 will be considered unproductive. The minimum site index for all other types is 35.

48.32 - Site Tree Data. Information is required on species, d.b.h. total height, and total age.

If the site tree is a plot-tally tree, enter point and tree number, species, total age, and total height at the top of the field record.

If the site tree is not a plot-tally tree, record code 99 in item 17, species in item 18, d.b.h. in item 19, total height in item 21, and total age in item 22.

48.4 - Physiographic Class, Item 53. Record physiographic class for the location based upon specified soil and water conditions that determine forest cover type and site.

Code

Item

- 3 Xeric sites. Very dry droughty sites where excessive drainage seriously limits both growth and species occurrence. Examples are the sandhills of the southeastern pine forest, the thin soiled ridge tops of the Appalachians, and the jack-pine plains of the northeastern coniferous forest.
- 4 Xeromesic sites. Moderately dry sites where excessive drainage limits growth and species occurrence to some extent. These include the flatwoods in southeastern forests, the drier oak ridges in the Ozark-piedmont forests, and the red pine--jack pine associations on the sandy and gravelly soils in the northeastern coniferous forest.
- 5 Mesic sites. Soil-water relationships favorable to tree growth, with growth and species occurrence limited only by climate. These are the deep, well drained soils, usually well suited to agriculture, in all Regions. Those sites offer the most favorable management opportunities.
- 6 Hydromesic sites. Poor drainage or frequent flooding limits species occurrence. These include the better drained bottomland hardwood sites, the heavy, poorly drained, truncated soils of the Ozark-piedmont forest, and the hardpan soils of the northeastern coniferous forest.
- 7 Hydric sites. Growth and species occurrence seriously limited by excess water. These are the pocosins, swamps, and bays of the southeastern pine forest; the wet, frequently flooded river bottoms; and the spruce bogs of the northeastern coniferous forest.

48.5 - Stand Age, Item 54. Determine age of the main stand from three or more borings of representative trees; that is, dominant or codominant trees on or near the sample location. In stands having more than one age class, classify by the age of the predominant stand size class.

Record appropriate age class by the following two-digit codes:

<u>Code</u>	<u>Age class</u> <u>years</u>	<u>Code</u>	<u>Age class</u> <u>years</u>
01	1 to 10	10	90 to 100
02	10 to 20	12	100 to 120
03	20 to 30	14	120 to 140
04	30 to 40	16	140 to 160
05	40 to 50	18	160 to 180
06	50 to 60	20	180 to 200
07	60 to 70	30	200 to 300
08	70 to 80	40	300 and over
09	80 to 90		

48.6 - Seed Source, Item 55. Seed source is adequate when there is a codominant or better tree of commercial species 9.0" d.b.h. and larger within a distance of point #1 not exceeding total height of the tree.

Seed source is also adequate if seedlings are present.

Record prospects for natural seeding by the following one-digit codes:

<u>Code</u>	
1	Adequate softwoods
2	Inadequate softwoods but adequate hardwoods
3	Adequate softwoods and hardwoods
4	Inadequate all species

48.7 - Forest Type, Items 56 and 56a. Forest type will normally be computed in the office as part of data processing. If ten or less tree are recorded, enter the estimated type. Forest type codes are listed in the appendix.

16  
40  
640

#### 49 - SAMPLE LOCATION IDENTIFICATION AND OPTIONAL ITEMS

49.1 - Sample Location Identification Data, Items 71 through 80. Items on the back of the forest inventory sample record (exhibit 1) provide information on the location of the field sample, the size of the plots, and the layout of the 10-point cluster.

49.21 - Stand-size class, Item 57. Normally this item will be computed in the office. If ten or less trees are recorded, enter the estimated size class.

<u>Code</u>	
10	Sawtimber stands
20	Poletimber stands
30	Sapling and seedling stands
40	Nonstocked stands

49.22 - Basal Area Per Acre, Item 69. Using a 3 digit code record the basal area per acre for the plot. BA/A is determined by:

1. Counting the number of live trees 1" d.b.h. and larger at each point that occur within the radius of the 37.5 factor plot. This count may be recorded in the right hand margin of the field form.
2. Then multiplying the total number of trees counted by 3.75. Total BA/A may be determined directly from the "Basal Area Table" in the Appendix.

49.23 - Stand Treatment, Item 70. Stand treatment is a classification of the most important activity by man to improve the timber production on the sample acre. It provides a measure of the areas in need of timber harvest, stand improvement, and reforestation. It contributes to the computation of desirable cut. 20 sq. ft. B.A. to be cut before recommending an improvement cut.

The primary stand treatment needed on each sample acre will be indicated by a two digit code. The first digit will specify kind of activity needed. The second will give area of the type-size-density class of the stand or area represented by the acre.

The following codes and classes will be used:  
First digit - Treatment needed.

<u>Code</u>	<u>Treatment</u>
<u>0</u>	<u>No treatment:</u> Stands needing little or no harvest cutting, stand improvement or regeneration.
<u>1</u>	<u>Emergency cut:</u> A commercial cut of overmature trees or a commercial cut to salvage trees of any age which should be made within 5 years, if possible.
<u>2</u>	<u>Harvest cut:</u> A commercial cut of mature or of near mature trees. May include cut of younger, low quality trees not wanted as residual growing stock and cut or kill of cull and noncommercial trees.

- 3     Commercial stand improvement: A commercial cut in an immature stand designed to improve the composition and character of the stand by removing or killing trees of less desirable species, form and condition. A commercial cut is one that yields more than 3 cords or 1500 board feet per acre.
- 4     Noncommercial stand improvement: An improvement operation which will yield less than 3 cords or 1500 board feet per acre. The primary job here is improvement of the existing stand.
- 5     Reforest only: Seeding or planting in areas which do not have adequate seed sources, but which do have favorable seed beds.
- 6     Site preparation and reforest: Preparation of site and reforestation in areas which have neither adequate seed source nor seed beds favorable to natural regeneration. Includes noncommercial clear cutting. The primary job here is to obtain regeneration.
- 7     Site preparation only: Preparation of site in stands with adequate seed sources but with seed beds unfavorable to natural regeneration. Includes noncommercial clear cutting; ground scarification; or removal of sod, brush or competing vegetation. The primary job here is to obtain regeneration.

Second digit - Size of area to be treated.

Code

- |   |                     |
|---|---------------------|
| 0 | No treatment needed |
| 1 | 1 acre              |
| 2 | 2 acres             |
| 3 | 3-10 acres          |
| 4 | 10-20 acres         |
| 5 | 20-40 acres         |
| 6 | Over 40 acres       |

Stand treatment will be determined by the cruiser after completing the plot tally using the following aids.

1. Rotation ages and desirable growing stock levels. This Tatum Guide gives rotation ages by local types and general site classes for maintaining good growth rates. It also indicates the growing stock levels (by types in square feet per acre of trees 1" d.b.h. and larger) to which stands should be reduced at 15-year intervals to maintain a good growth level.

Approximately 10 square feet less of basal area is required in patchy stands than in stands where trees are evenly spaced. Trees in uneven-aged types (northern and lowland hardwoods) will be considered mature when reaching ages shown in parenthesis. For these basal area is given for the sawtimber, poletimber and sapling components of the stand.

Cutting will be recommended if needed within 10 years following the survey.

While the rotation ages and stocking levels on the guide are considered survey standard the following Timber Management Guides for the National Forests of the North Central States and marking guides for northern hardwoods may be used for more specific recommendations, if desired:

- White pine type
- Red pine type (1964 revision)
- Jack pine type
- Upland spruce fir type
- Black spruce type
- Mixed conifer swamp and northern white cedar type
- Aspen-paper birch type
- Central mixed hardwood type

2. Site class, stand age, seed source, forest survey type, area condition, and basal area per acre from the top of the tally sheet may provide significant information.
3. On the ground judgement may be helpful.
4. If a cut is recommended enough trees should be marked "cut" to reduce the stand to the recommended basal area for even spacing. In marking trees cut and leave mark those trees over 5" d.b.h. which are cull first; the poorest acceptable (20) trees second; undesirable species for the site third; the better acceptable (20) trees fourth; and desirable (10) trees last. If "clear cutting" is recommended, all trees over 5" d.b.h. will be marked cut unless certain trees are left for seed production.

10

49.24 - Start and Dot Number, Items 71 and 72. These items will be recorded in the office before field work.

49.25 - Point Occupancy, Item 35. If one or more live trees are recorded, show order of occupancy based on crown class and d.b.h. Record occupancy using the following 1 digit codes:

Code

- 1 Most controlling tree
- 2 Second most controlling tree
- 3 Third " " "
- 4 Fourth " " "
- 5 Fifth " " "
- 6 Sixth " " "
- 7 Seventh or more most controlling tree

If no trees are recorded leave this item blank.

49.26 - Stocking Percent, Item 36. Normally stocking percent will be computed in the office. However, when it is necessary to determine stocking percent for field application the following percents may be recorded. Using a 3 digit code enter stocking percent to the nearest 1/10 percent for all live trees. Record no more than 16.0% per point.

<u>Point</u>	<u>Tree Size</u>	<u>Percent</u>
One or more 5.0" d.b.h. trees	5.0"+	4.7
	4.0-4.9	4.0
	3.0-3.9	2.4
	2.0-2.9	1.2
	1.0-1.9	.4
No trees 5.0" d.b.h. or larger	4.0-4.9	4.0
	3.0-3.9	3.5
	2.0-2.9	3.0
	1.0-1.9	2.5
No trees 1.0" d.b.h. or larger	seedling	4.0

49.27 - Bole Length Top D.O.B., Item 37. Using a 3 digit code record bole top to the last 1/10 inch for all trees with an entry in item 21 except stumps. Bole length top is measured at the point where bole length terminates.

49.28 - Cut or Leave, Item 38. The instructions in item 70 and "Rotation Ages and Desirable Growing Stock Levels by Forest Type and Site" in the Appendix may be used in determining cut and leave trees.

At least 3 cords or 1500 board feet per acre must be removed from a stand before a cut tally is made.

<u>Code</u>	
1	Cut
2	Leave

APPENDIX

TREE SPECIES. Codes from 010 to 299 are for softwoods, and from 300 to 998 are for hardwoods. Within those groups numbers are listed in sequence alphabetically by scientific names of genera, species, and varieties. Each genus has been assigned a code ending in zero to record either an unidentified species or a genus as a group. Vacant codes may be assigned for important exotics as needed. Codes are primarily for use in recording trees tallied on field plots taken on Forest Survey and timber management inventories and for subsequent automatic data processing. Codes marked # are for use, as needed to supplement species codes, only in quarterly reports of timber cut and sold (specified in FSM 2493.43). Tree species within a designated area which do not develop into trees suitable for industrial products may be classed as noncommercial species in Regional or Station supplements to this section. The code 999 will be used to indicate noncommercial species. Noncommercial species are indicated by an asterisk in the following list.

Softwoods

<u>Code</u>	<u>Common name</u>	<u>Species</u>	<u>Genus</u>
			<u>Abies</u>
011	Pacific silver fir	amabilis	
012	balsam fir	balsamea var balsamea	
013	bracted balsam fir	balsamea var. phanerolepsis	
015	white fir	concolor	
			<u>Juniperus</u>
068	eastern redcedar	virginiana	
			<u>Larix</u>
071	Tamarack	laricina	
			<u>Picea</u>
091	Norway spruce	abies	
093	Engelmann spruce	engelmannii	
094	white spruce	glauca	
095	black spruce	mariana	
096	blue spruce	pungens	
097	red spruce	rubens	
			<u>Pinus</u>
105	jack pine	banksiana	
108	lodgepole pine	contorta	
110	shortleaf pine	echinata	
122	ponderosa pine	ponderosa	

<u>Code</u>	<u>Common name</u>	<u>Species</u>	<u>Genus</u>
125	red pine	resinosa	
126	pitch pine	rigida	
129	eastern white pine	strobis	
130	Scotch pine	sylvestris	
132	Virginia pine	virginiana	
133	Austrian pine		
			<u>Pseudotsuga</u>
201	bigcone Douglas-fir	macrocarpa	
202	Douglas-fir	menziesii	
			<u>Taxodium</u>
221	Baldcypress	distichum var. distichum	
			<u>Thuja</u>
241	northern white-cedar	occidentalia	
			<u>Tsuga</u>
261	eastern hemlock	canadensis	
			<u>Hardwoods</u>
			<u>Acer</u>
313	boxelder	negundo	
314	black maple	nigrum	
315	striped maple*	pensylvanicum	
316	red maple	rubrum var. rubrum	
317	silver maple	saccharinum	
318	sugar maple	saccharum	
319	mountain maple*	spicatum	
			<u>Aesculus</u>
331	Ohio buckeye	glabra	
332	yellow buckeye	octandra	
			<u>Ailanthus</u>
341	ailanthus*	altissima	

<u>Code</u>	<u>Common name</u>	<u>Species</u>	<u>Betula</u>
371	yellow birch	alleghaniensis	
372	sweet birch	lenta	
373	river birch	nigra	
374	water birch*	occidentalia	
375	paper birch	papyrifera var. papyrifera	
379	gray birch	populifolia	
			<u>Carpinus</u>
391	American hornbeam	caroliniana	
			<u>Carya</u>
402	bitternut hickory	cordiformis .	
403	pignut hickory	glabra	
404	pecan	illinoensis	
407	shagbark hickory	ovata	
408	black hickory	texana	
			<u>Castanea</u>
421	American chestnut	dentata	
			<u>Catalpa</u>
452	northern catalpa	speciosa	
			<u>Celtis</u>
461	sugarberry	laevigata	
462	hackberry	occidentalis	
			<u>Cercis</u>
471	eastern redbud*	canadensis	
			<u>Cladrastis</u>
481	yellowwood*	lutea	
			<u>Cornus</u>
491	flowering dogwood	florida	

<u>Code</u>	<u>Common name</u>	<u>Species</u>	<u>Crataegus</u>
500	hawthorn*	sp.	
			<u>Diospyros</u>
521	Common persimmon	virginiana	
			<u>Fagus</u>
531	American beech	grandifolia	
			<u>Fraxinus</u>
541	white ash	americana	
543	black ash	nigra	
544	green ash	pennsylvanica	
545	pumpkin ash	profunda	
546	blue ash	quadrangulata	
			<u>Gleditsia</u>
552	honeylocust	triacanthus	
			<u>Gymnocladus</u>
571	Kentucky coffeetree	dioicus	
			<u>Juglans</u>
601	butternut	cinerea	
602	black walnut	nigra	
			<u>Liquidambar</u>
611	sweetgum	styraciflua	
			<u>Liriodendron</u>
621	yellow-poplar	tulipifera	
			<u>Maclura</u>
641	Osage-orange	pomifera	
			<u>Malus</u>
660	apple*	sp.	

<u>Code</u>	<u>Common name</u>	<u>Species</u>	<u>Morus</u>
681	white mulberry	alba	
682	red mulberry	rubra	
			<u>Nyssa</u>
693	black tupelo	sylvatica var. sylvatica	
694	swamp tupelo, blackgum	sylvatica var. biflora	
			<u>Ostrya</u>
701	eastern hophornbeam*	virginiana	
			<u>Platanus</u>
731	American sycamore	occidentalis	
			<u>Populus</u>
741	balsam poplar	balsamifera	
742	eastern cottonwood	deltoides	
743	bigtooth aspen	grandidentata	
745	plains cottonwood	sargentii	
746	quaking aspen	tremuloides	
			<u>Prunus</u>
760	cherry; peach; plum	sp.	
761	pin cherry*	pensylvanica	
762	black cherry	serotina	
763	common choke cherry*	virginiana	
			<u>Quercus</u>
800	oak	sp.	
802	white oak	alba	
804	swamp white oak	bicolor	
808	Durand oak	durandii	
809	northern-pin oak	ellipsoidalis	
817	shingle oak	imbricaria	
822	overcup oak	lyrata	
823	bur oak	macrocarpa	
824	blackjack oak*	marilandica	
826	chinkapin oak	muehlenbergii	
833	northern red oak	rubra	
837	black oak	velutina	

<u>Code</u>	<u>Common name</u>	<u>Species</u>	<u>Robinia</u>
901	black locust	pseudoacacia	
			<u>Salix</u>
922	black willow	nigra	
			<u>Sassafras</u>
931	sassafras	albidum	
			<u>Tilia</u>
951	Americian basswood	americana	
952	white basswood	heterophylla	
			<u>Ulmus</u>
971	winged elm	alata	
972	American elm	americana	
974	Siberian elm	pumila	
975	Slippery elm	rubra	
977	rock elm	thomassii	
999	Noncommercial, not coded in other more specific codes.		<u>Noncommercial species</u>

Classification of desirable species less than 3.0 inches DBH by forest type and site group <sup>1/</sup>

Type and Site	White pine	Red pine	Jack pine	Balsam fir	White spruce	Hemlock <sup>2/</sup>	Black spruce	Tamarack	White cedar	Beech	Sugar maple <sup>2/</sup>	Red maple	Black cherry	yellow birch	Basswood	Rock elm	White ash	White oak	Bur oak	N. red oak	American elm	Slippery elm	Cottonwood	Black ash	Aspen	Paper birch	Black walnut
<b>Red &amp; white pine</b>																											
SI below 65	D	D	D		D																						
SI 65+	D	D																									
<b>Jack pine</b>																											
SI below 50			D	D																							
SI 50+	D	D	D		D																						
<b>Spruce-fir &amp; cedar</b>																											
Upland	D	D			D	D	D	D	D	D	D	D	D	D													D
Swamp	D				D	D	D	D	D	D	D	D	D	D													
<b>Black spruce &amp; Tamarack</b>																											
<b>Northern Hardwoods</b>																											
Upland	D				D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Lowland	D				D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
<b>Oak</b>																											
SI below 60			D	D																							
SI 60+																											
<b>Lowland Hardwoods</b>																											
Aspen-paper birch																											
SI below 45			D	D																							
SI 45-59			D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
SI 60+			D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D

<sup>1/</sup> Largely taken from Appendix, Table 91, Timber Resources for America's Future, Forest Resource Report No. 14.  
<sup>2/</sup> Not considered desirable in Minnesota.  
<sup>3/</sup> Considered desirable only in tamarack stands.

FOREST SURVEY TATUM GUIDE

NCFPS AUGUST 1966

GROSS BOARD FOOT TREE VOLUME <sup>1/</sup>

DBH (inches)	Length of sawlog portion (feet)															
	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	
Board feet																
10	21	30	38	46	54	61	68	74	79	85	89	93	97	100	102	
11	25	36	47	56	65	74	82	89	96	103	109	115	119	124	127	
12	31	44	56	67	78	88	96	107	116	124	131	138	145	151	156	
13	36	52	66	79	92	104	115	127	137	147	156	165	173	180	187	
14	43	62	78	93	107	121	135	148	161	172	184	194	204	213	222	
15	50	72	90	108	124	141	156	172	186	200	214	226	238	249	259	
16	58	83	104	124	143	162	180	197	214	230	246	261	275	288	300	
17	66	95	119	141	163	184	205	225	244	263	280	298	314	329	344	
18	75	108	135	160	184	208	231	254	276	297	318	337	356	374	391	
19	84	122	152	180	207	234	260	285	310	334	357	379	401	421	440	
20	95	136	170	201	232	261	290	318	346	373	399	424	448	471	493	
21	105	152	189	224	257	290	322	354	384	414	443	471	498	524	549	
22	117	168	209	247	284	321	356	391	425	458	490	521	551	580	607	
23	128	186	230	272	313	353	392	430	467	503	539	573	606	638	669	
24	141	204	253	299	343	386	429	470	511	551	590	628	664	700	733	
25	154	223	276	326	374	421	468	513	558	601	644	685	725	763	800	
26	167	242	301	355	407	458	508	558	606	653	700	745	788	830	870	
27	181	263	326	385	441	496	551	604	656	708	758	806	854	899	943	
28	196	285	353	416	476	538	595	652	709	764	816	871	922	971	1,018	
29	211	307	380	448	513	577	640	702	763	822	881	937	992	1,046	1,097	
30	227	330	409	481	551	620	687	754	819	883	945	1,006	1,065	1,123	1,177	
31	243	354	438	516	591	664	736	807	877	945	1,012	1,078	1,141	1,202	1,261	
32	259	379	469	551	631	710	787	863	937	1,010	1,081	1,151	1,219	1,284	1,347	
33	276	404	500	588	673	757	839	919	999	1,077	1,153	1,227	1,299	1,369	1,436	
34	294	430	532	626	717	805	892	978	1,062	1,145	1,226	1,305	1,381	1,456	1,527	
35	312	457	566	665	761	855	948	1,038	1,128	1,216	1,301	1,385	1,466	1,545	1,621	
36	330	485	600	706	807	907	1,004	1,101	1,195	1,288	1,379	1,467	1,554	1,637	1,717	
37	349	514	635	747	854	959	1,063	1,164	1,264	1,362	1,458	1,552	1,643	1,731	1,816	
38	368	543	672	789	903	1,013	1,122	1,230	1,335	1,438	1,540	1,639	1,735	1,828	1,917	
39	388	573	709	833	952	1,069	1,184	1,296	1,408	1,517	1,623	1,727	1,828	1,926	2,021	
40	408	604	747	877	1,003	1,126	1,246	1,365	1,482	1,596	1,709	1,818	1,924	2,027	2,127	

<sup>1/</sup> Source "Look-up Volume Table International", T.A. Jones, CFI Newsletter 129, December 1964.

GROSS CUBIC FOOT TREE VOLUME <sup>1/</sup>

DBH (inches)	Bole Length (feet)															
	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	
5	.9	1.2	1.5	1.8	2.1	2.4	2.6	2.8	3.1	3.2	3.5	3.6	3.7	3.9	4.0	
6	1.3	1.7	2.2	2.6	3.1	3.5	3.8	4.1	4.4	4.7	5.0	5.2	5.5	5.6	5.8	
7	1.8	2.4	3.0	3.6	4.2	4.7	5.2	5.7	6.1	6.5	6.8	7.1	7.4	7.7	7.8	
8	2.4	3.2	4.0	4.7	5.5	6.2	6.8	7.4	8.0	8.5	8.9	9.4	9.7	10.0	10.3	
9	3.0	4.0	5.1	6.0	7.0	7.8	8.7	9.5	10.2	10.8	11.4	11.9	12.4	12.8	13.1	
10	3.8	5.0	6.2	7.5	8.6	9.7	10.7	11.8	12.6	13.4	14.1	14.8	15.3	15.9	16.3	
11	4.6	6.1	7.6	9.1	10.5	11.8	13.1	14.3	15.3	16.4	17.2	18.0	18.7	19.3	19.8	
12	5.5	7.3	9.1	10.9	12.6	14.2	15.6	17.1	18.3	19.5	20.5	21.5	22.4	23.1	23.7	
13	6.5	8.5	10.5	12.8	14.9	16.1	18.5	20.1	21.6	23.0	24.3	25.4	26.4	27.2	27.9	
14	7.5	10.0	12.5	14.9	17.3	19.5	21.6	23.5	25.2	26.9	28.3	29.5	30.7	31.7	32.5	
15	8.7	11.5	14.5	17.2	20.0	22.5	24.9	27.1	29.1	31.0	32.6	34.1	35.5	36.6	37.5	
16	10.0	13.2	16.5	19.8	22.8	25.7	28.4	31.0	33.3	35.4	37.3	39.0	40.5	41.8	42.9	
17	11.2	14.9	18.7	22.4	25.9	29.2	32.2	35.1	37.8	40.1	42.3	44.2	46.0	47.4	48.7	
18	12.6	16.8	21.1	25.2	29.2	32.9	36.3	39.6	42.5	45.2	47.6	49.8	51.7	53.4	54.8	
19	14.2	18.9	23.6	28.2	32.6	36.8	40.7	44.2	47.6	50.6	53.3	55.8	58.0	59.8	61.4	
20	15.8	21.0	26.3	31.4	36.3	40.9	45.3	49.3	53.0	56.3	59.4	62.2	64.5	66.6	68.3	
21	17.5	23.2	29.2	34.8	40.2	45.3	50.2	54.6	58.7	62.4	65.8	68.8	71.5	73.8	75.7	
22	19.3	25.6	32.1	38.4	44.4	50.0	55.3	60.2	64.7	68.8	72.6	75.9	78.8	81.4	83.5	
23	21.2	28.1	35.2	42.2	48.7	54.9	60.8	66.1	71.1	75.6	79.7	83.3	86.6	89.3	91.7	
24	23.1	30.8	38.6	46.1	53.3	60.1	66.4	72.3	77.7	82.5	87.2	91.5	94.7	97.7	100.3	
25	25.3	33.6	42.0	50.2	58.1	65.5	72.4	78.8	84.8	90.1	95.0	99.4	103.3	106.6	109.3	
26	27.5	36.5	45.7	54.7	63.1	71.2	78.7	85.6	92.1	98.0	103.3	108.0	112.2	115.8	118.6	
27	29.8	39.5	49.5	59.2	68.4	77.1	85.2	92.8	99.8	106.1	111.9	117.0	121.5	125.5	128.7	
28	32.2	42.7	53.5	63.9	73.9	83.3	92.1	100.3	107.8	114.6	120.9	126.4	131.3	135.6	139.0	
29	34.8	46.0	57.6	68.8	79.6	89.8	99.3	108.1	116.1	123.6	130.3	136.3	141.5	146.1	149.9	
30	37.2	49.5	61.9	74.1	85.6	96.5	106.7	116.2	124.9	132.9	140.1	146.5	152.2	157.0	161.1	

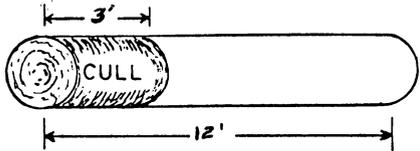
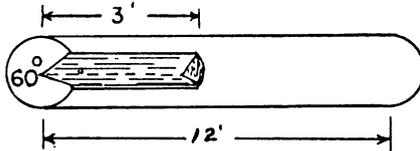
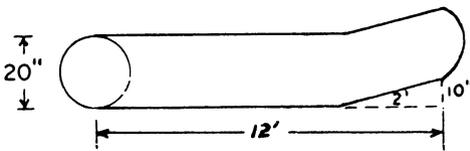
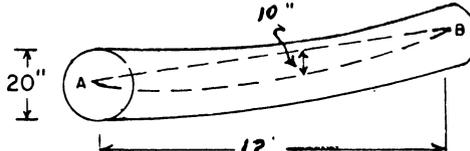
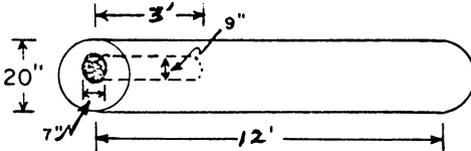
<sup>1/</sup> "Look-up Volume Table, Cordwood", R.M. Stone, CFI Newsletter No. 131, Feb. 1965.

BOARD-FOOT VOLUME OF SHORT LOGS

DBH ea. end	Length of log or section (feet)															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
6	1	2	2	3	4	5	5	8	9	10	11	13	14	16	17	19
7	1	3	4	5	7	8	10	12	13	15	18	19	20	24	26	28
8	2	4	6	8	10	12	14	17	20	22	25	27	30	33	36	39
9	3	5	8	10	13	16	19	22	25	29	32	36	39	43	44	51
10	3	7	10	13	17	21	25	29	33	37	42	46	51	55	61	65
11	4	9	13	17	22	26	32	36	41	46	52	57	63	68	73	80
12	5	10	16	21	27	32	37	44	50	57	63	69	76	83	89	97
13	6	13	19	25	32	39	45	53	61	68	76	83	91	99	107	115
14	8	15	23	30	38	46	54	63	72	80	89	98	108	117	126	138
15	9	18	26	35	45	54	63	73	83	93	104	114	124	135	144	155
16	10	20	31	41	51	62	71	84	96	107	119	131	143	158	168	181
17	12	23	35	46	59	72	84	96	109	122	136	149	163	177	190	203
18	13	26	40	53	67	81	94	109	124	139	154	169	185	200	214	228
19	15	29	45	60	76	92	105	121	138	154	171	188	205	223	239	256
20	17	33	50	67	84	102	117	137	156	174	193	212	231	251	268	290
21	19	37	56	74	94	113	131	150	171	191	212	232	253	275	294	316
22	21	41	62	82	103	125	144	169	191	214	236	259	283	306	328	354
23	22	45	67	90	114	137	159	182	207	232	256	281	307	333	358	383
24	25	50	74	99	125	151	176	203	230	257	284	311	338	368	391	424
25	27	53	81	108	135	161	188	216	245	275	304	334	363	395	422	454
26	29	59	88	118	147	179	206	238	270	304	334	368	398	435	462	501
27	32	64	96	128	160	192	224	256	291	325	360	394	429	466	501	535
28	35	69	104	138	173	210	245	281	319	356	393	430	467	507	542	584
29	38	74	112	149	186	223	261	297	337	377	417	457	497	543	578	620
30																

### ESTIMATING CULL LOSS

This section divides logs into three uses.  
The following are suggestions for estimating cull in logs.

<p>If section of log is affected, deduct length of log length affected.</p> <p>Example: <math>\frac{3}{12} \times 100 = 25</math> percent board foot cull.</p>	
<p>If sector is affected, multiply percent of circle times percent of length.</p> <p>Example: <math>\frac{60}{360} \times \frac{3}{12} \times 100 = 4</math> percent board foot cull.</p>	
<p>For a crook, multiply proportion of diameter displaced times proportion of log length affected by crook.</p> <p>Example: <math>\frac{10}{20} \times \frac{2}{12} \times 100 = 8</math> percent board foot cull.</p>	
<p>For sweep, determine sweep departure and subtract 2 inches. Divide this by minimum log diameter.</p> <p>Example: <math>\frac{10-2}{20} \times 100 = 40</math> percent board foot cull.</p>	
<p>For interior defect, determine the defective material as percent of total volume of the log. Add 1 inch to width and thickness of defect, and divide by one less than average scaling diameter of the log.</p> <p>Example: <math>\frac{8 \times 10}{20-1} \times \frac{3}{12} \times 100 = 11</math> percent board foot cull.</p>	

Grade 1 Hardwood Logs

Minimum log length	Minimum clear length	Possible combinations of clear-cuttings
10	8.3	8 - 0 5 - 3 4 - 4
12	10.0	10 - 0 5 - 5 7 - 3 6 - 4 5 - 5
14	11.7	12 - 0 7 - 5 9 - 3 6 - 6 8 - 4 7 - 5 6 - 6
16	13.3	13 - 0 7 - 7 8 - 5 7 - 6 10 - 3 9 - 4 8 - 5 7 - 6

Grade 2 Hardwood Logs

Minimum log length	Minimum clear length	Possible combinations of clear cuttings
8	-	6.0 6 - 0* 3 - 3*
10	8.3	8 - 0 6.7 7 - 0 4 - 3
12	10.0	10 - 0 8.0 8 - 0 5 - 3 4 - 4 3 - 3 - 3*
14	12.0	12 - 0 9.3 9 - 0 6 - 3 5 - 4 3 - 3 - 3*
16	13.3	13 - 0 7 - 7 11 - 0 8 - 3 7 - 4 6 - 5 3 - 3 - 5* 3 - 4 - 4*

Grade 3 Hardwood Logs

Minimum log length	Minimum clear length	Possible combinations of clear cuttings
8	4	8 4 - 0 4 - 2
10	5	8 5 - 0 3 - 2 2 - 2 - 2
12	6	8 6 - 0 4 - 2 3 - 3 2 - 2 - 2
14	7	8 7 - 0 5 - 2 4 - 3 3 - 2 - 2
16	8	8 8 - 0 6 - 2 5 - 3 4 - 4 3 - 3 - 2 2 - 2 - 2 - 2

1/ Any number in a combination may be increased but not decreased.

2/ Ash and basswood Grade 1 butt logs may be 12" d.i.b.

\* Limited to 12" d.i.b.  
1/ Any number in a combination may be increased but not decreased.

1/ Any number in a combination may be increased but not decreased.

HARDWOOD

LOG GRADE NO. 4

TIE AND TIMBER LOGS

Position in tree	Butt and upper
D.I.B., small end, inches	8"
Length without trim, feet	8'
Clear cuttings	No requirements. Not graded on cutting basis.
Sweep allowance, maximum	1/4 d.i.b. of small end for half logs and 1/2 d.i.b. for logs 16' long.
Sound surface defects permitted:	
Single knots	Any number, if none has an average collar diameter in excess of 1/3 of log diameter at point of occurrence. 1/
Whorled knots	Any number provided the sum of the collar diameter does not exceed 1/3 of the log diameter at point of occurrence.
Holes	Any number not exceeding knot specifications if they do not extend over 3 inches into contained tie or timber.
Unsound defects permitted:	
Surface	Any number and size if they do not extend into contained tie or timber. If they extend into contained tie and timber they shall not exceed size, number, and depth or limits of sound knots.
Interior	None permitted except one shake not more than 1/3 the width of contained tie or timber and one split not over 5 inches long.

1/ Knot collar is the average of the vertical and horizontal diameter of the limb or knot swelling as measured flush with the surface of the log.

LOG GRADES FOR SOFTWOOD LOGS

Grade I

- Logs must be 16" or larger, 10' or longer, and with deduction for defect not over 30 percent of gross scale.
- Logs must be at least 75 percent clear on each of three faces.
- All knots outside clear cutting must be sound and not over 2 1/2" in size.

Grade II

- Logs must be 12" or larger, 10' or longer, and with a net scale after deduction for defect of at least 50 percent of the gross contents of the log.
- Logs must be at least 50 percent clear on each of three faces or 75 percent clear on two faces.

Grade III

- Logs must be 8" or larger, 8' or longer, and a net scale after deduction for defect of at least 50 percent of the gross contents of the log.

From Specifications for Log Grades of Hardwoods and Softwoods, Northern Hemlock and Hardwood Association, 1947.

4.36 (Item 28)--TRIAL LOG GRADES FOR EASTERN WHITE PINE

Log grade	Minimum size Diameter	Sweep or crook allowance	Total cull allowance including sweep	Maximum weevil injury	Allowable knot size (inches) on 3 best faces or minimum clearness on 4 faces	
No. 1 (Select)	12 & 13	8-16	20	50	0	4 faces clear full length
No. 2 (Finish)	6+	8-16	30	50	0	2 faces clear full length, or 4 faces clear 50% length (6 minimum length) or 3/4
No. 3 (Premium)	6+	8-16	40	50	8' logs-- 1 weevil ) and 5" ) 10' logs-- 2 weevils )	Sound red knots = 1/4 D/3 Black knots = D/12 and D/10 < 1 1/4"
No. 4 (Standard)	6+	8-16	50	50	No limit	No limit

1/ Plus trim.

2/ Disregard all knots less than 1/2 inch in diameter in all grades.

3/ If the sum of the diameters of sound red knots plus 2 X (sum of the diameters of dead or black knots) in inches is 1/2 the diameter of the log (in inches).  
4/ < means equal to or less than.

4.36 (Item 28)--INTERIM SOUTHERN PINE LOG GRADES-1/

1. Yard Lumber Logs

Used for red pine also

Log grade	Minimum diameter and maximum aggregate knot criteria
No. 1	D ≥ 17 and 5K ≤ D D ≥ 17 and 7K ≤ D D ≥ 17 and 10K ≤ D
No. 2	D ≥ 10 and 2K ≤ D < 5K D ≥ 10 and 3K ≤ D < 7K D ≥ 10 and 4K ≤ D < 10K
No. 3	D ≥ 5 and D < 2K D ≥ 5 and D < 3K D ≥ 5 and D < 4K
No. 4	D ≥ 5, but not qualified for higher grade after compliance with following degrade rules:

- Degrade any log one grade if D equals or is less than 3 times sweep of at least 3 inches.
- Then degrade any non-Grade No. 4 log one grade if massed heart-rot hyphae visible on circumferential log surface suggest that fruiting has occurred or is imminent.
- Then degrade any Grade No. 3 log to Grade No. 4 if "bad knots" are too dispersed for containment in a 90-degree radial sector extending 1/4 of log length.

1/ From Forest Service, "1953 Interim Log Grades for Southern Pine," Oct. 1953. (Definition of terms on following page)

2. Definition of Terms.

- Log.** Any approximately cylindrical tree section. Common usage excludes pieces with length less than 8 feet or with average scaling diameter inside bark at small end smaller than 4-1/2 inches. Logs longer than 20 feet are beyond the scope of this table unless graded as several shorter logs.
- Face.** Any quarter-cylindrical surface running full log length.
- Overgrown knot.** Any invisible branch or stub buried beneath the log surface but indicated by a surface bump or disturbance of bark pattern.
- Sound knot.** Any visible branch, stub, or socket which contains neither advance decay extending to log heart nor any hole larger than 1/4 inch penetrating more than 2 inches (excludes defects defined in 1948 SPIB Rules, paragraph 12d and 12e).
- Unsound knot.** Any visible branch, stub, or socket not conforming to definition of sound knot.
- D.** Average diameter of log inside bark at small end to nearest whole inch.
- K.** Number of overgrown knots plus sum of diameters of sound knots plus twice sum of diameters of unsound knots. Average diameter of knots should be measured to nearest whole inch at point where limb would normally be trimmed.
- Sweep.** Greatest deviation of longitudinal log axis from straight line connecting centers of each end of log measured to nearest whole inch.
- Bad knot.** Any visible knot which is so large that D is less than 6 times knot diameter, or any unsound knot.

Item 8. Ground Land Use

Code	Description
20	Commercial forest land.
21	Pastured comm. forest land.
40	Unproductive forest land.
50	Productive reserved forest land.
51	Productive forest land withdrawn for Christmas tree production.
61	Cropland.
62	Improved pasture.
64	Idle farmland.
65	Marsh.
66	Other farmland, including farmsteads.
67	Urban and other.
69	Wooded pasture.
91	Census water.
92	Noncensus water.

FOREST SURVEY TATUM GUIDE No. 3

North Central Forest Experiment Station - May 1967

Plot Tally

Number of years to reach D.B.H. by species and site class (to be used for stand age and site index trees)

Species	Good site	Poor site
Aspen	1	2
Ash	8	15
Balsam poplar	1	2
Balsam fir	10	15
Basswood	2	4
Birch (yellow)	8	15
Birch (paper)	2	4
Cedar (white)	10	20
Elm	4	8
Hemlock	10	20
Maple (hard)	8	15
Maple (soft)	2	4
Oak	3	6
Pine (jack)	5	8
Pine (red)	6	10
Pine (white)	8	12
Spruce (black)	10	20
Spruce (white)	10	15
Tamarack	5	10

Item 9. Land Use Trend

Code	Description
01	No change in land use.
02	Changed from forest to cropland, improved pasture, or other farmland.
03	Changed from forest to idle farmland.
04	Changed from forest to urban and other.
05	Changed from forest to water or marsh.
06	Changed from cropland, improved pasture, or other farmland to forest.
07	Changed from idle farmland to forest.
08	Changed from urban and other or from water or marsh to forest.
09	Changed from noncommercial to commercial forest land.
10	Changed from commercial to noncommercial.

Item 38. Cut or Leave Tally

Code	Description
1	Cut.
2	Leave.

Item 50. Stand Origin

Code	Description
1	Natural stand with no evidence of artificial regeneration.
2	More than 40 percent of the sample location occupied by trees originating from artificial planting or seeding.
3	Less than 40 percent of the sample location estimated to be occupied by trees originating from artificial planting or seeding.

Item 57. Stand-size Class

Code	Description
10	Sawtimber stands.
20	Poletimber stands.
30	Sapling-seedling stands.
40	Nonstocked stands.

Item 52. Site Index

The following table gives the species that should be selected for site index measurements by forest type:

Type Code	Preferred species	Alternate species
01	Jack pine	Red pine
02	Red pine	White pine
03	White pine	Red pine
06	Scotch pine	Jack pine
11	Balsam fir	White spruce
12	Black spruce	Tamarack
14	N.W. cedar	Black spruce
15	Tamarack	Black spruce
50	N. red oak	Sugar maple
70	Am. elm	Black ash
80	Sugar maple	Beech
91	Aspen	Paper birch
92	Paper birch	Aspen

Item 70. Stand Treatment

Code	Description
00	No treatment.
10	Emergency cut (within 5 years).
20	Harvest cut.
30	Commercial stand improvement.
40	Noncommercial stand improvement.
50	Reforestation only.
60	Site preparation and reforest.
70	Site preparation only.
2nd Digit - Size of Area Needing Treatment	
01	1 acre.
02	2 acres.
03	3 to 10 acres.
04	10 to 20 acres.
05	20 to 40 acres.
06	40 + acres.

Item 53. Physiographic Class

Code	Description
3	Xeric sites.--Very dry droughty sites where excessive drainage seriously limits both growth and species occurrence. Example--Jack pine plains.
4	Xeromesic sites.--Moderately dry sites where excessive drainage limits growth and species occurrence to some extent. These include the red-pine--jack pine associations on sandy and gravelly soils.
5	Mesic sites.--Soil-water relationships favorable to tree growth, with growth and species occurrence limited only by climate. These are the deep, well drained soils, usually well suited to agriculture.
6	Hydromesic sites.--Poor drainage or frequent flooding limits species occurrence. These include the better drained bottomland hardwood sites, and the hardpan soils of a coniferous forest.
7	Hydric sites.--Growth and species occurrence seriously limited by excess water. These are the frequently flooded riverbottoms and spruce bog.

Item 54. Stand Age

Code	Age class (years)
01	1 to 10
02	10 to 20
03	20 to 30
04	30 to 40
05	40 to 50
06	50 to 60
07	60 to 70
08	70 to 80
09	80 to 90
10	90 to 100
12	100 to 120
14	120 to 140

Item 55. Seed Source

Code	Description
1	Adequate softwoods.
2	Inadequate softwoods but adequate hardwoods.
3	Adequate softwoods and hardwoods.
4	Inadequate all species.

Item 69. Basal Area per Acre (Square Feet per Acre)

Basal Area Table

B.A. = # Trees x 3.75 (3/4 Factor Prism)

# Trees	B.A.	# Trees	B.A.	# Trees	B.A.
01	004	21	079	41	154
02	008	22	082	42	158
03	011	23	086	43	161
04	015	24	090	44	165
05	019	25	094	45	169
06	023	26	098	46	172
07	026	27	101	47	176
08	030	28	105	48	180
09	034	29	109	49	184
10	038	30	112	50	188
11	041	31	116	51	191
12	045	32	120	52	195
13	049	33	124	53	199
14	052	34	128	54	202
15	056	35	131	55	206
16	060	36	135	56	210
17	064	37	139	57	214
18	068	38	142	58	218
19	071	39	146	59	221
20	075	40	150	60	225

Item 56. Forest Types (Wisconsin)

Code	Description
01	Jack pine.--A stand in which pine species predominate with jack pine the most common. (Common associates include hemlock, aspen, birch and maple).
02	Red pine.--A stand in which pine species predominate, with red pine the most common. (Common associates include hemlock, aspen, birch and maple).
03	White pine.--A stand in which pine species predominate, with white pine the most common. (Common associates include hemlock, aspen, birch and maple).
06	Scotch pine.--A stand in which pine species predominate with Scotch pine the most common.
11	Balsam fir-White spruce.--A mixed hardwood - coniferous stand, with white spruce and balsam fir predominating. (Common associates include white cedar, black spruce, tamarack, maple, birch, and hemlock).
12	Black spruce.--A stand in which swamp conifers (black spruce, tamarack, and cedar) predominate with black spruce the most common.
14	Northern white-cedar.--A stand in which swamp conifers predominate with white-cedar the most common.
15	Tamarack.--A stand in which swamp conifers predominate, with tamarack the most common.
50	Oak-hickory.--Forests in which upland oaks or hickory, singly or in combination, comprises a plurality of the stocking. (Common associates include pine, yellow poplar, elm, maple, and black walnut).
70	Elm-Ash-Cottonwood.--Forests in which elm, ash, or cottonwood, singly or in combination, comprises a plurality of the stocking. (Common associates include willow, sycamore, beech and maple).
80	Maple-Beech-Birch.--Forests in which maple, beech, or yellow birch singly or in combination, comprises a plurality of the stocking. (Common associates include hemlock, elm, basswood and white pine).
91	Aspen.--A stand in which a mixture of quaking or bigtooth aspen, balsam poplar, singly or in combination, comprises a plurality of the stocking. (Common associates include maple, birch and balsam fir).
92	Paper birch.--Stands in which paper birch comprises a plurality of the stocking. (Common associates include aspen, maple and balsam fir).

RADII FOR BASAL AREA FACTOR 37.5 ANGLE GAUGE PLOT

(1.421 feet per inch DBH)

DBH Inches	Tenths of inches									
	0	1	2	3	4	5	6	7	8	9
1	1.4	1.6	1.7	1.9	2.0	2.1	2.3	2.4	2.6	2.7
2	2.8	3.0	3.1	3.3	3.4	3.6	3.7	3.8	4.0	4.1
3	4.3	4.4	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.5
4	5.7	5.8	6.0	6.1	6.2	6.4	6.5	6.7	6.8	7.0
5	7.1	7.2	7.4	7.5	7.7	7.8	8.0	8.1	8.2	8.4
6	8.5	8.7	8.8	9.0	9.1	9.2	9.4	9.5	9.7	9.8
7	9.9	10.1	10.2	10.4	10.5	10.7	10.8	10.9	11.1	11.2
8	11.4	11.5	11.7	11.8	11.9	12.1	12.2	12.4	12.5	12.6
9	12.8	12.9	13.1	13.2	13.4	13.5	13.6	13.8	13.9	14.1
10	14.2	14.4	14.5	14.6	14.8	14.9	15.1	15.2	15.3	15.5
11	15.6	15.8	15.9	16.1	16.2	16.3	16.5	16.6	16.8	16.9
12	17.1	17.2	17.3	17.5	17.6	17.8	17.9	18.0	18.2	18.3
13	18.5	18.6	18.8	18.9	19.0	19.2	19.3	19.5	19.6	19.8
14	19.9	20.0	20.2	20.3	20.5	20.6	20.7	20.9	21.0	21.2
15	21.3	21.5	21.6	21.7	21.9	22.0	22.2	22.3	22.5	22.6
16	22.7	22.9	23.0	23.2	23.3	23.4	23.6	23.7	23.9	24.0
17	24.2	24.3	24.5	24.6	24.7	24.9	25.0	25.2	25.3	25.4
18	25.6	25.7	25.9	26.0	26.1	26.3	26.4	26.6	26.7	26.9
19	27.0	27.1	27.3	27.4	27.6	27.7	27.9	28.0	28.1	28.3
20	28.4	28.6	28.7	28.8	29.0	29.1	29.3	29.4	29.6	29.7
21	29.8	30.0	30.1	30.3	30.4	30.6	30.7	30.8	31.0	31.1
22	31.3	31.4	31.5	31.7	31.8	32.0	32.1	32.3	32.4	32.5
23	32.7	32.8	33.0	33.1	33.3	33.4	33.5	33.7	33.8	34.0
24	34.1	34.2	34.4	34.5	34.7	34.8	35.0	35.1	35.2	35.4
25	35.5	35.7	35.8	36.0	36.1	36.2	36.4	36.5	36.7	36.8
26	36.9	37.1	37.2	37.4	37.5	37.7	37.8	37.9	38.1	38.2
27	38.4	38.5	38.7	38.8	38.9	39.1	39.2	39.4	39.5	39.6
28	39.8	39.9	40.1	40.2	40.4	40.5	40.6	40.8	40.9	41.1
29	41.2	41.4	41.5	41.6	41.8	41.9	42.1	42.2	42.3	42.5
30	42.6	42.8	42.9	43.1	43.2	43.3	43.5	43.6	43.8	43.9

FOREST SURVEY TATUM GUIDE No. 4  
NORTH CENTRAL FOREST EXPERIMENT STATION  
MAY 1967-TREE TALLY

Item 17. Tree History

Code	Description
01	Live tree
04	Salvable dead tree
05	Dead tree qualifying as a mortality tree
08	Stump of live tree
10	Stump of dead tree

Item 18. Species (Wisconsin)

Code	Species	Code	Species
012	Balsam fir	544	Green ash
068	Eastern redcedar	552	Honey locust
071	Tamarack	601	Butternut
094	White spruce	602	Black walnut
095	Black spruce	694	Black gum
105	Jack pine	731	Sycamore
125	Red pine	741	Balsam poplar
129	White pine	742	Cottonwood
130	Scotch pine	743	Bigtooth aspen
241	N. White-cedar	746	Quaking aspen
261	Hemlock	762	Black cherry
313	Boxelder	802	White oak
314	Black maple	804	Swamp white oak
316	Red maple	809	Northern-pine oak
317	Silver maple	823	Bur oak
318	Sugar maple	826	Chinkapin oak
371	Yellow birch	833	Northern red oak
373	River birch	837	River oak
375	Paper birch	922	Black willow
402	Bitternut hickory	951	Am. Basswood
407	Shagbark hickory	972	Am. Elm
462	Hackberry	975	Slippery elm
531	Am. Beech	977	Rock elm
541	White ash	999	Noncommercial
543	Black ash		

Item 34. Tree Class Key to Kind of Tree

Item 27. Surface defect	Desirable	Acceptable	Rough cull	Rotten cull
SFWDs: DBH	Code 10	Code 20	Code 30	Code 40
5.0- 8.9	0 to 1	any	any	any
9.0-14.9	0 to 1	any	any	any
15.0+	0 to 2	any	any	any
HDWDS:				
5.0- 6.9	2 to 4	any	any	any
7.0-10.9	3 to 6	any	any	any
11.0-14.9	4 to 8	any	any	any
15.0+	5 to 10	any	any	any

Item 28. Internal defect

SFWDs:				
5.0- 8.9	0	0 to 7	0 to 5	4 to 9
9.0-14.9	0, 1	0 to 7	0 to 5	4 to 9
15.0+	0 to 2	0 to 7	0 to 5	4 to 9
HDWDS:				
5.0-10.9	0	0 to 7	0 to 5	4 to 9
11.0-14.9	0, 1	0 to 7	0 to 5	4 to 9
15.0+	0 to 2	0 to 7	0 to 5	4 to 9

Item 29. Total vol. loss

SFWDs:				
5.0- 8.9	0	0 to 7	8, 9*	8, 9**
9.0-14.9	0, 1	0 to 7	8, 9*	8, 9**
15.0+	0 to 2	0 to 7	8, 9*	8, 9**
HDWDS:				
5.0-10.9	0	0 to 7	8, 9*	8, 9**
11.0-14.9	0, 1	0 to 7	8, 9*	8, 9**
15.0+	0 to 2	0 to 7	8, 9*	8, 9**

Item 30. Rel. bole length

Rel. bole length	8, 9	1 to 9	any	any
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Item 31. Crown ratio

Crown ratio	3 to 9	any	any	any
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Item 32. Crown class

Crown class	1 to 3	any	any	any
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Item 33. Damage or Cause of Death

Damage or Cause of Death	00	60, 90	any	any
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\* Item 28 makes less than half of total vol. loss.  
\*\* Item 28 makes half or more of total vol. loss.

(34) COVER CLASS (No trees present and Items 27 to 33 are all blank)

- 50 Inhibiting vegetation
- 60 Nonstocked, not overtopped
- 70 Nonstocked overtopped
- 80 Nonstockable

Item 30. Relative Bole Length

Code	Percent of Normal
9	90+
8	80-89
7	70-79
6	60-69
5	50-59
4	40-49
3	30-39
2	20-29
1	Under 20% but at least one 12' march. log.
0	Less than 12 feet of potential saw log length.

Item 36. Stocking Percent

Tree size	(Percent)
(5.0' +	4.7
(4.0-4.9	4.0
(3.0-3.9	2.4
(2.0-2.9	1.2
(1.0-1.9	.4

At least one 5.0' + tree

No trees 5.0' or larger

No trees 1.0' or larger (Seedling)

\* Each point on a plot can receive a maximum of 16% stocking.

Item 31. Crown Ratio

Code	Crown Ratio (percent)
1	1-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60
7	61-70
8	71-80
9	81-90
0	91-100

Item 35. Point Occupancy

Code	Class
1	Most controlling tree
2	Second most controlling tree
3	Third most controlling tree
4	Fourth most controlling tree
5	Fifth most controlling tree
6	Sixth most controlling tree
7	Seventh or more most controlling tree

(Leave this item blank when no trees are tallied)

Item 33. Damage or Cause of Death Codes

Damage	Code	Cause of Death
No damage	00	---
Insects	10	Insects
Disease	20	Disease
Fire	30	Fire
Animals	40	Animals
Weather	50	Weather
Suppression	60	Suppression
Unknown & other	70	Unknown & other
Logging	80	---
---	81	Logging
---	82	T.S.I.
---	84	Land clearing
---	85	Conversion to nonfor. or noncomm. P.L.
Off-site trees	90	---

Item 27. Surface Defect Codes

Code	Knot Count	Code	Knot Count
0	0	5	9-10
1	1-2	6	11-12
2	3-4	7	13-14
3	5-6	8	15-16
4	7-8	9	17+

Record knot count code for the first:  
8"section-trees 5.0" to 6.9"d.b.h.  
12"section-trees 7.0" to 8.9"d.b.h.  
16"section-trees 9.0" + d.b.h.

\*Softwoods--Knot count on all faces where knot count equals the number of overgrown knots more than 0.5" in diameter plus the sum of sound knot diameters and limbs, plus 2X (X equals the sum of diameters of unsound knots).

Code	Clear Lgth. (Ft.)	Code	Clear Lgth. (Ft.)
0	0	5	10 or 11
1	2 or 3	6	12 or 13
2	4 or 5	7	14 or 15
3	6 or 7	8	16 +
4	8 or 9		

Record cumulative clear panel length to last whole foot:  
8"section-trees 5.0" to 6.9"d.b.h.  
12"section-trees 7.0" to 10.9"d.b.h.  
16"section-trees 11.0" +

\*Hardwoods--Length of clear panels in first tree face toward point center where clearpanels are sections of tree surface one-fourth tree circumference, at least 2 feet long, and free of knots, limbs and bumps.

Required Tally Items

Type of Plot and Tree Size	Arzimuth	Distance	Point number	Tree number	Tree history	Species	DBH	DBH increment	Bole length	Cubic-foot cull	Saw log length	Saw log top DOB	Board-foot cull	Log grade	Surface defect	Internal defect	Total defect	Relative bole length	Crown ratio	Crown class	Damage-causes of death	Tree or cover class	Point occupancy	Stocking percent	Bole length top D.O.B.	Cut or leave
Fixed plot (1/300 acre):																										
Saplings (Points 1, 2 and 3)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Saplings (4 through 10)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Seedlings 1/	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Other Cover 2/	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Noncommercial Species:																										
Sapling-sized trees:	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Points 1, 2, and 3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Points 4 through 10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Seedling-sized trees 1/	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Variable plot:																										
Sawtimber:	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Poletimber:	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Noncommercial species	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sawtimber-sized trees	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Poletimber-sized trees	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Dead trees:																										
Sawtimber-sized trees	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mortality	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Salvable dead	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Poletimber-sized trees	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mortality	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Salvable dead	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Stumps (1/50 acre fixed plot):																										
Sawtimber and poletimber-sized trees	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sapling-sized trees	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

1/ Only at points with no sapling-sized or larger live trees tallied.  
2/ Only at points with no live trees tallied.

FOREST SURVEY TATUM GUIDE No. 5, NORTH CENTRAL FOREST - STATION, MAY 1967-

CROOK DEDUCTION IN BOARD FEET

Crotch : Crook : depar-length: ture : (in.) : (ft.) :	Scaling diameter of section with crook (in.)													
	6	7	8	9	10	12	14	16	18	20	22	24	26	28
1	1	0	0	0	0	0	1	1	1	1	1	1	1	1
2	0	0	0	1	1	1	1	1	2	2	2	2	2	2
3	1	1	1	1	1	2	2	2	2	3	3	3	3	4
4	1	1	1	1	2	2	3	3	3	4	4	4	4	5
5	1	1	1	1	2	2	3	3	4	4	5	5	6	6
6	1	1	2	2	2	3	3	4	5	5	6	6	7	8
2	1	0	0	1	1	1	1	1	2	2	2	2	2	3
3	1	1	1	1	1	2	2	2	3	3	4	4	4	5
4	1	1	2	2	2	3	3	4	4	5	5	6	6	7
5	1	1	2	2	3	3	4	4	5	5	6	6	7	8
6	1	2	2	3	3	4	4	5	5	6	6	7	7	8
3	1	0	0	1	1	1	2	2	2	3	3	3	3	4
2	1	1	2	2	2	2	3	4	4	5	5	6	6	7
3	1	2	2	3	3	4	4	5	6	6	7	7	8	9
4	2	2	3	3	4	4	5	6	6	7	8	8	9	10
5	2	3	3	4	4	5	6	6	7	8	8	9	10	11
6	2	3	4	4	5	6	6	7	8	9	10	11	12	13
4	1	1	1	1	1	2	2	2	3	3	4	4	4	5
2	1	2	2	2	3	3	4	4	5	5	6	6	7	8
3	1	2	3	3	4	4	5	6	6	7	8	8	9	10
4	2	2	3	3	4	4	5	6	6	7	8	8	9	10
5	2	3	4	4	5	6	6	7	8	9	10	11	12	13
6	2	3	4	4	5	6	6	7	8	9	10	11	12	13
5	1	1	1	1	1	2	2	2	3	3	4	4	4	5
2	1	2	2	2	3	3	4	4	5	5	6	6	7	8
3	1	2	3	3	4	4	5	6	6	7	8	8	9	10
4	2	2	3	3	4	4	5	6	6	7	8	8	9	10
5	2	3	4	4	5	6	6	7	8	9	10	11	12	13
6	2	3	4	4	5	6	6	7	8	9	10	11	12	13
8	1	1	1	1	1	2	2	2	3	3	4	4	4	5
2	1	2	2	2	3	3	4	4	5	5	6	6	7	8
3	1	2	3	3	4	4	5	6	6	7	8	8	9	10
4	2	2	3	3	4	4	5	6	6	7	8	8	9	10
5	2	3	4	4	5	6	6	7	8	9	10	11	12	13
6	2	3	4	4	5	6	6	7	8	9	10	11	12	13
6	1	1	2	2	2	3	3	4	4	5	5	6	6	7
2	2	3	3	4	4	5	6	6	7	8	8	9	10	11
3	2	3	4	4	5	6	6	7	8	9	10	11	12	13
4	3	3	4	4	5	6	6	7	8	9	10	11	12	13
5	3	4	4	5	6	6	7	8	9	10	11	12	13	14
6	3	4	5	5	6	6	7	8	9	10	11	12	13	14
10	1	1	1	1	1	2	2	2	3	3	4	4	4	5
2	1	2	2	2	3	3	4	4	5	5	6	6	7	8
3	1	2	3	3	4	4	5	6	6	7	8	8	9	10
4	2	2	3	3	4	4	5	6	6	7	8	8	9	10
5	2	3	4	4	5	6	6	7	8	9	10	11	12	13
6	2	3	4	4	5	6	6	7	8	9	10	11	12	13
8	1	1	1	1	1	2	2	2	3	3	4	4	4	5
2	1	2	2	2	3	3	4	4	5	5	6	6	7	8
3	1	2	3	3	4	4	5	6	6	7	8	8	9	10
4	2	2	3	3	4	4	5	6	6	7	8	8	9	10
5	2	3	4	4	5	6	6	7	8	9	10	11	12	13
6	2	3	4	4	5	6	6	7	8	9	10	11	12	13
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2	1	2	2	2	3	3	4	4	5	5	6	6	7	8
3	1	2	3	3	4	4	5	6	6	7	8	8	9	10
4	2	2	3	3	4	4	5	6	6	7	8	8	9	10
5	2	3	4	4	5	6	6	7	8	9	10	11	12	13
6	2	3	4	4	5	6	6	7	8	9	10	11	12	13

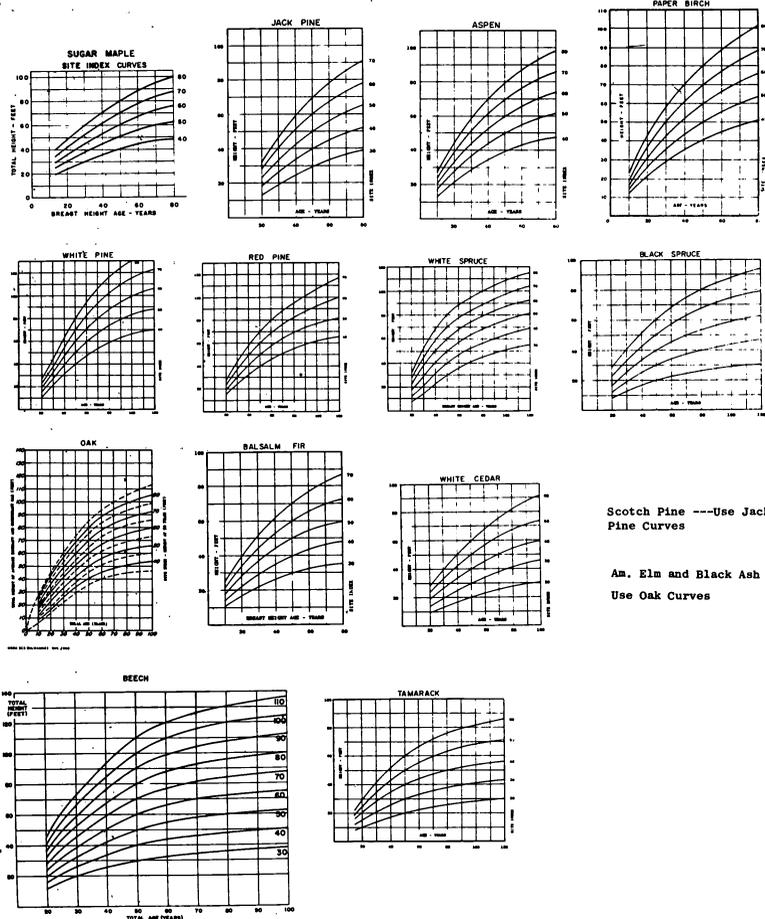
In blank spaces crook exceeds the maximum that is allowed. Boxed spaces are sound for softwoods, but cull for hardwoods.

SWEEP DEDUCTION IN BOARD FEET

Sweep : Sweep : depar-length: ture : (in.) : (ft.) :	Scaling diameter of section with sweep (in.)														
	6	7	8	9	10	12	14	16	18	20	22	24	26	28	
2	6	1	1	2	2	3	3	4	5	6	6	7	8	9	9
8	1	1	2	2	3	4	4	5	5	6	7	7	8	8	9
10	1	1	2	2	3	4	4	5	6	6	7	7	8	9	10
12	1	1	2	2	3	4	4	5	5	6	6	7	7	8	8
14	1	1	1	1	1	2	2	2	2	3	3	3	4	4	5
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	6	2	3	3	4	5	6	7	9	10	11	13	14	15	17
8	2	3	4	5	6	7	9	10	12	14	15	17	19	20	22
10	2	4	5	6	6	8	10	12	13	15	17	19	20	22	22
12	3	4	5	6	7	9	11	12	14	16	18	19	21	23	23
14	3	4	5	6	7	9	10	12	14	16	17	19	21	23	23
16	3	4	5	6	6	8	10	11	13	14	16	18	19	21	21
4	6	4	5	6	7	8	11	13	15	17	18	20	22	24	24
8	4	5	6	7	9	11	14	16	18	21	23	25	28	30	30
10	5	6	8	9	10	13	16	19	21	24	27	29	32	35	35
12	5	7	8	10	12	14	18	20	23	26	29	32	35	38	38
14	6	8	9	11	12	16	19	22	25	28	31	35	38	41	41
16	6	8	10	11	13	16	19	23	26	29	32	35	39	42	42
5	6	5	6	8	9	11	14	16	19	22	24	27	29	32	32
8	5	7	8	10	12	15	18	21	24	27	31	34	37	40	40
10	6	8	10	12	14	18	21	25	29	33	36	40	44	48	48
12	8	10	12	16	20	25	29	33	37	41	45	50	54	58	58
14	9	11	13	16	18	22	27	32	36	41	45	50	54	59	59
16	10	12	15	17	20	24	29	34	39	44	48	53	58	63	63
6	6	8	9	11	14	17	20	24	27	30	33	36	39	42	42
8	11	12	14	18	22	26	30	34	38	42	46	50	54	58	58
10	10	13	15	18	23	27	32	36	41	46	51	56	60	64	64
12	12	15	18	21	26	32	37	42	48	53	58	64	69	74	74
14	11	15	18	20	23	29	36	41	47	53	59	65	71	77	77
16	13	16	20	23	26	32	39	45	52	58	64	71	77	83	83
7	6	11	13	16	21	24	28	32	36	39	43	47	51	56	56
8	15	17	22	27	31	36	41	46	51	56	62	67	73	78	78
10	19	21	27	33	39	44	50	56	62	67	73	79	84	89	89
12	22	25	32	39	45	52	58	65	71	78	84	91	97	104	104
14	25	29	36	44	51	58	66	73	81	88	95	102	109	116	116
16	24	28	33	40	49	57	64	72	80	88	96	104	112	120	120
8	6	19	24	28	33	37	42	46	50	54	58	62	66	70	70
8	25	31	37	42	48	54	59	65	70	75	80	85	90	95	95
10	25	32	39	46	52	59	66	72	79	86	92	99	106	113	113
12	30	37	46	53	61	69	76	84	92	100	108	116	124	132	132
14	34	43	52	61	69	78	87	96	105	113	122	131	140	149	149
16	34	39	48	58	68	77	87	97	106	116	125	135	144	154	154
9	6	27	32	37	42	47	52	57	62	67	72	77	82	87	87
8	29	36	42	48	55	61	68	74	81	88	94	101	108	115	115
10	37	44	52	60	67	75	83	91	99	107	115	123	131	139	139
12	43	52	61	70	80	88	97	106	115	124	133	142	151	160	160
14	50	61	71	81	91	101	111	121	131	141	151	161	171	181	181
16	57	68	79	90	102	113	124	135	146	156	167	177	188	198	198

In blank spaces excessive sweep culls the entire section. Boxed spaces are sound for softwoods, but cull for hardwoods.

SITE INDEX CURVES REGION 9



Scotch Pine --- Use Jack-Pine Curves

Am. Elm and Black Ash --- Use Oak Curves

VARIABLE PLOT RADII BY DBH AND PERCENT SLOPE  
BASAL AREA FACTOR 37.5  
(1.42 feet radius per inch dbh)

DBH :	Percent slope				
	0	10	20	30	40</

ROTATION AGES BY FOREST TYPE AND SITE  
 USED TO CALCULATE DESIRABLE CUT IN THE  
 THIRD WISCONSIN FOREST SURVEY

Type	Rotation Age by Site Classes					
	80	70	60	50	40	30
Jack pine	50	50	50	50	40	-
Red pine	90 110	90 110	80 100	80 100	80 90	- -
White pine	90 110	90 110	80 100	80 100	80 90	- -
Balsam fir-white spruce	60	60	50	50	50	-
Black spruce	-	-	80	80	100	100
White cedar	-	-	-	90	100	120
Tamarack	-	90	90	100	100	120
Oak-hickory	100	100	100	100	90	-
Ash-elm-cottonwood	120	110	110	110	100	-
Northern hardwoods	140	140	140	140	140	-
Aspen	60	55	50	40	35	-
Paper birch	80	80	50	40	35	

DESIRABLE GROWING STOCK LEVELS<sup>1/</sup> BY FOREST TYPES USED TO CALCULATE  
DESIRABLE CUT IN THE THIRD WISCONSIN FOREST SURVEY

Type	Type of harvest cut <sup>2/</sup>	Site index	Basal area of tree 1" d.b.h.	
			Even spacing	Overstocked
(Square feet per acre)				
Jack pine	CC	All	85	105
Red pine	RC	All	105	140
White pine	CC	All	120	160
Balsam fir-white spruce	ST CC	All	95	125
Black spruce	ST CC	30+	95	125
	-	30-20	80	100
Cedar, Northern white	ST CC	26+	110	145
	-	26-20	100	135
Tamarack	ST CC	38+	95	125
	-	38-27	80	100
Oak	PCC	All	90	120
Ash-elm-cottonwood	SC	All	<u>3/</u>	125
Northern hardwoods	SC	All	<u>3/</u>	125
Aspen	CC	76+	70	95
	-----	Others No Cut	-----	-----
White birch	CC	All No Cut		-

Regeneration and clear cutting will be recommended for even-age-stands which will reach recommended ages within the next 10 years. Selection and intermediate cuts will be recommended if needed during the next 10 years. Recommended cuts must yield the equivalent of 3 or more cords per acre.

1/ These are the levels to which stands of relatively evenly spaced trees should be reduced in intermediate or selection cuttings when a 15-year period is anticipated between cut. For patchy or small pole stands reduce basal area level by 10 square feet per acre. These levels of basal area will not concentrate growth on a few trees nor spread it over a near maximum number. Growth will be slowed if basal area per acre exceeds "overstocked."

2/ Types of cut include CC-Clearcut; RC-Regeneration (shelterwood) cut; ST CC-Clearcut in strips; PCC-Clearcut in 1-to 3-acre patches; SC-Selection Cut; and STC-Clearcut leaving seed trees. Regeneration cuts should be made 20 years before rotation age reducing basal area to one-half of the desirable level.

3/ Desired structure of uneven-aged stands is 10 square feet saplings, 20 square feet poles, and 65 square feet of sawtimber when the last includes trees 11" and larger in d.b.h.