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Guide to the Measurement of TREE CHARACTERISTICS Important to the QUALITY CLASSIFICATION SYSTEM for YOUNG HARDWOOD TREES

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Abstract

A procedure is shown for measuring external tree characteristics that are important in determining the current and future quality of young hardwood trees. This guide supplements a previous study which describes the quality classification system for young hardwood trees.

AS A SUPPLEMENT to the quality classification system for young hardwood trees (Sonderman and Brisbin 1978), we have developed this guide to illustrate how to select and measure quality-related tree characteristics that are important in the classification system. Forest managers need this information in selecting and culturing potential high-value hardwood trees from regeneration through final harvest.

Systematically measuring the external characteristics of a tree to determine current quality establishes a solid base for predicting the future product potential of young hardwood stands.

RELATIVE QUALITY INDEX

As part of the overall quality classification system, we have developed relative quality indexes which are used to quickly rank trees as good, medium, or poor. The relative quality index is derived from numerical values or points assigned to the external characteristics of a tree (Table 1). These characteristics include crown class, sweep and crook, total number of limbs, forks, and rot and seams (Fig. 1). When a tree is evaluated for these characteristics, the individual numerical indexes are summed to produce the following quality classes:

Sum of individual indexes	*Relative quality class*
10-12	Good
8-9	Medium
1-7	Poor

These indexes were formulated from field tests on numerous trees of varying quality.

AS AN OPERATIONAL GUIDE

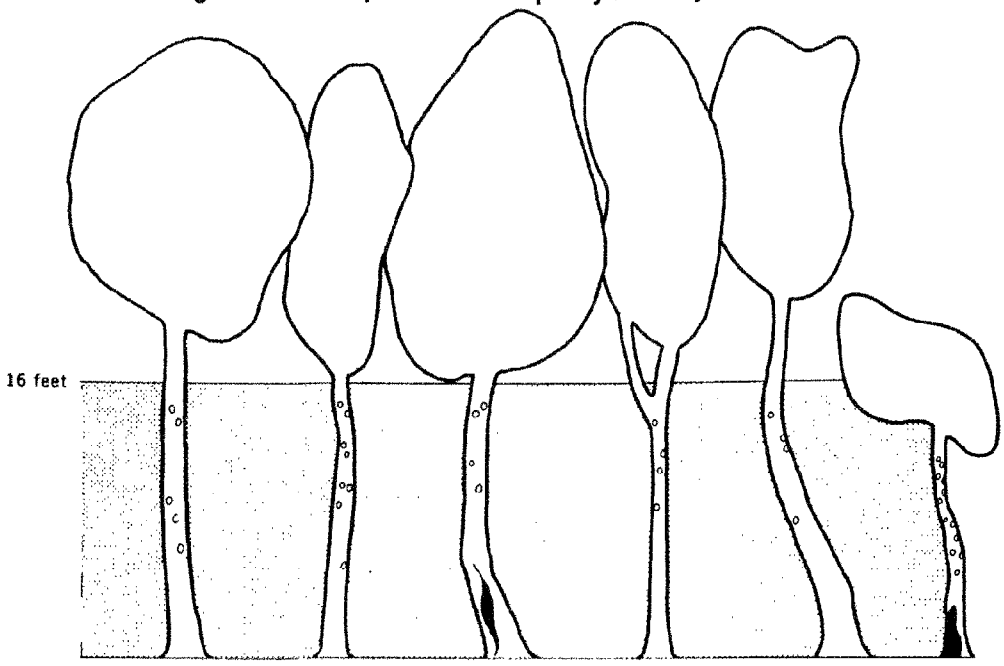
The quality classification system can be used as an operational guide and applied in several ways. Subsampling techniques could be used to estimate the means and variances of individual tree characteristics. Area sampling could be used to estimate the proportion of trees or the proportion of area stocked with trees that have certain characteristics. An average index could be estimated for stands or strata within stands to aid in making decisions on cultural treatment.

Table 1.—Numerical values assigned to selected tree characteristics to determine tree quality indexes

Characteristics	Value
Crown class	
Dominant	4
Codominant	3
Intermediate	2
Suppressed	1
Sweep and crook (deviation in inches)[a]	
1	4
2-4	3
5-6	2
7-8	1
9+	0
Limb count (No. live and dead limbs ≧ 1/3 inch)	
1-2	4
3-4	3
5-8	2
9-16	1
17+	0

[a]If tree has fork, rot, or seams, the numerical value is 0.

Figure 1.—Example of relative quality index system.



CROWN CLASS:	DOMINANT 4	INTERMEDIATE 2	DOMINANT 4	CODOMINANT 3	CODOMINANT 3	SUPPRESSED 1
SWEEP and CROOK:	NO SWEEP 4	2" SWEEP 3	*5" SWEEP (SEAM) 0	*NO SWEEP (FORK) 0	6" SWEEP 2	*4" SWEEP (ROT) 0
LIMBS:	5 LIMBS 2	8 LIMBS 2	4 LIMBS 3	4 LIMBS 3	4 LIMBS 3	12 LIMBS 1
REL. QUAL. INDEX:	10	7	7	6	8	2

* IF TREE HAS FORK, ROT, OR SEAM, THEN QUALITY INDEX VALUE = 0

The small woodlot owner could apply the tree quality classification system to his stand. By carefully following the instructions in this guide in measuring tree characteristics and observing them over time, he can accurately assess the quality of each tree. This information would be useful in deciding whether to culturally treat a stand or do nothing.

TREE CHARACTERISTICS THAT AFFECT QUALITY

The quality of young hardwood trees is determined primarily by the condition, size, and frequency of naturally occurring external characteristics. For example, trees with limby and crooked butt sections yield low-quality lumber. Although we used crown class, sweep and crook, total number of live and dead limbs, forks, and rot and seams in determining tree quality indexes, additional variables must be measured to make quantitative estimates of future product potential. These include crown ratio, tree height, size of limbs, overgrowths, epicormic branches, and overgrowths with associated epicormic branches.

Each of these tree characteristics was selected because of its consistent relationship with use requirements for most of today's products.

HOW TO MEASURE TREE CHARACTERISTICS

The following are the characteristics that we measured or estimated and intend to observe over time. Numerical designations for each variable are recorded on the sample tally sheet (Fig. 2).

Figure 2.—Example of tree data tally sheet.

TREE NO.	SPECIES	DBH (IN)	CROWN CLASS	CROWN RATIO	TOTAL HT (FT)	FORK HT (FT)	SWEEP/ CROOK (IN)	ROT/SEAM FACES (NO)	ROT/SEAM LEN. (FT)	SURFACE DEFECT 0' to 8' LIVE (NO)	LIVE (SIZE)	DEAD (NO)	DEAD (SIZE)	OVER (NO)	OVER (EPIC)		SURFACE DEFECT 8' to 16' LIVE (NO)	LIVE (SIZE)	DEAD (NO)	DEAD SIZE	OVER (NO)	OVER (EPIC)		COMMENTS
XXX	XXX	XXX	X	XX	XXX	XX	XX	X	XXXX	XX	XXX	XX	XXX	XX	XX(A)	X(B)	XX	XXX	XX	XXX	XX	XX(A)	X(B)	
047	001	063	2	40	072	15	04	1	0105	04	250	00	000	02	02	1	00	000	00	000	00	00	0	

FOREST_____ LOCATION_____ PLOT NO._____ GRADER_____ SHEET_____OF_____

Tree number

Record the tree number as painted or tagged on the tree. Record as 3 digit code. EXAMPLE: Tree number is 47—enter 047 in "Tree No." column.

Species

Record the appropriate tree species as a 3 digit code. (See Appendix.) EXAMPLE: Species is white oak—enter 001 in "Species" column.

Diameter at breast height

Measure all trees 3.5 inches or larger in diameter at breast height to the nearest 1/10 inch and record as a 3 digit code. EXAMPLE: Dbh is 6.3 inches—enter 063 in "Dbh" column.

Crown class

Crown class (Fig. 3) includes the following categories:

Dominant (Code 1). Trees with well-developed crowns extending above the general level of the crown cover and receiving full light from above and partial light from the sides; the crowns may be somewhat crowded on the sides. A dominant tree is larger than the average tree in the stand.

Codominant (Code 2). Trees with medium-size crowns forming the general level of the crown cover and receiving full light from above, but little from the sides. The crowns usually are somewhat crowded on the sides.

Intermediate (Code 3). Trees with small crowns that are below or that extend into the crown cover formed by codominant and dominant trees. The crowns receive little direct light from above and none from the sides; and usually are crowded considerably on the sides.

Suppressed (Code 4). Trees with crowns entirely below the general level of the crown cover; the crowns receive no direct light either from above or from the sides.

Crown class is recorded as a single digit code. EXAMPLE: Tree is in the codominant crown class—enter 2 in "Crown Class" column.

Figure 3.—Crown class.

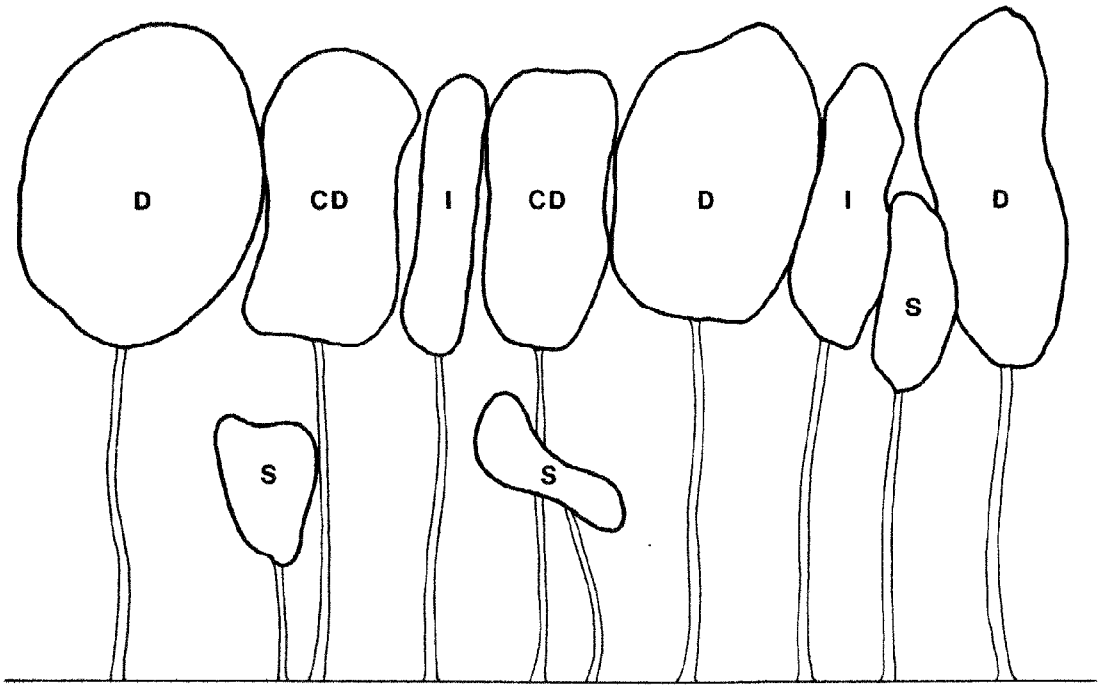
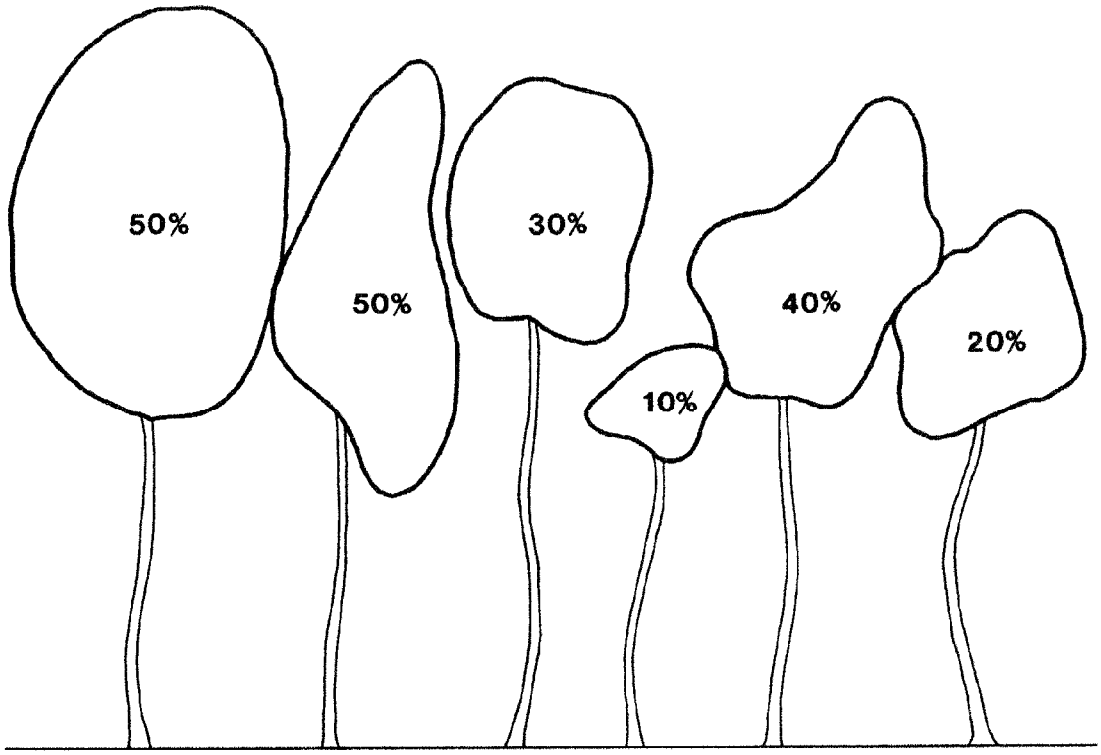


Figure 4.—Crown ratio.



Crown ratio

Crown ratio (Fig. 4) is that portion of the tree bole that supports live green foliage which contributes to tree growth. Crown ratio is expressed as percent of total tree height to the *nearest 10 percent* and recorded as a 2 digit code. For trees of uneven crown length, visually transfer lower branches on the longer side to fill holes in the upper portion until the crown is full and even. EXAMPLE: The crown ratio is estimated to be 40 percent—enter 40 in "Crown Ratio" column.

Total height

Use an appropriate instrument to measure total height (Fig. 5) from a 1-foot stump to the top of the tree. Measure to the nearest foot and record as 3 digit code. EXAMPLE: Total tree height is 72 feet—enter 072 in "Total Height" column. For trees with forks, measure from a 1-foot stump to the top of the largest forked section and record in "Total Height" column. If the tree forks *below* the 1-foot stump (as in sprout growth), consider as *two* trees.

Fork height

For forked trees (Fig. 6), measure the fork height (butt 16 feet of the tree only) from a 1-foot stump to the center of the first main fork. Record as a 2 digit code. EXAMPLE: Fork height measures 15 feet—enter 15 on "Fork Height" column.

A fork results from the division of the main stem into two or more stems. Each of the resulting stems must be at least ½ the diameter of the main stem just below the fork. Trees with exceptionally large single limbs and not qualifying as a fork will be noted in the "Comments" column, and *will not* be tallied as single largest live or dead limbs (under "Surface Defects" column).

Figure 5.—Total height.

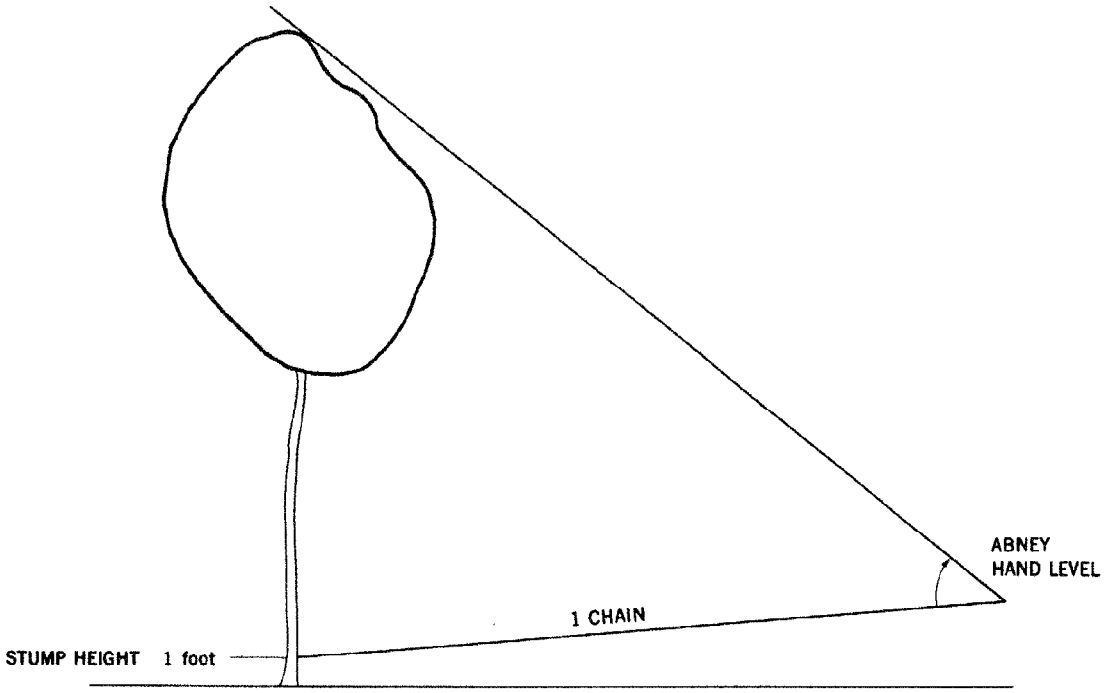


Figure 6.—Fork height.

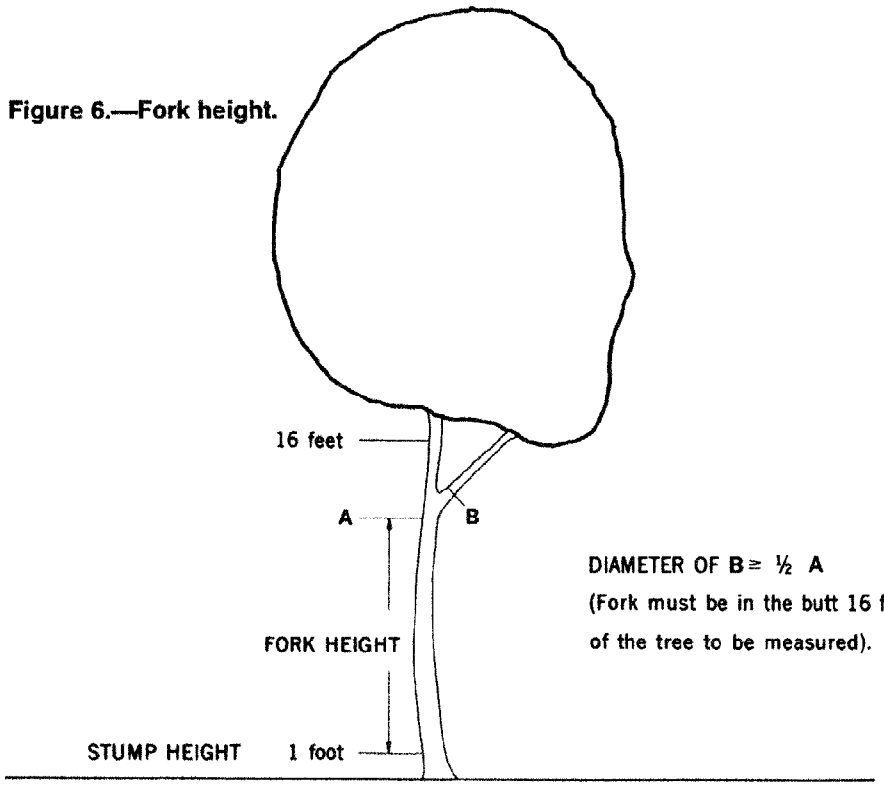
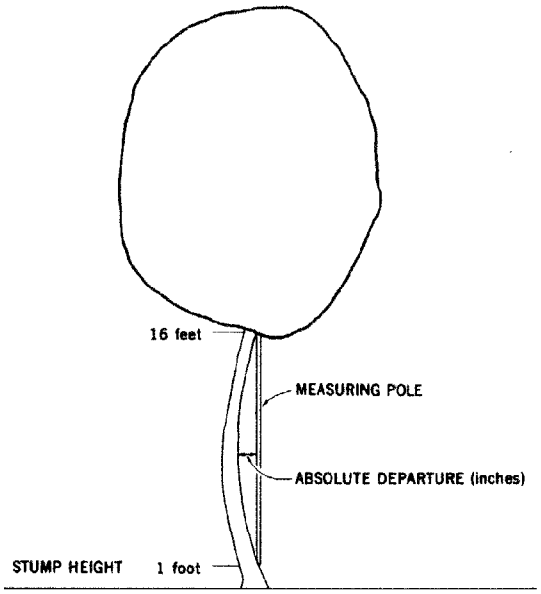


Figure 7.—Sweep and crook.



Sweep and crook

Measure the departure (offset) in inches of sweep or crook (Fig. 7) in the butt 16 feet of the tree and record as a 2 digit code. EXAMPLE: Sweep is 4 inches—enter 04 in "Sweep/Crook" column.

Rot and seams

Consider rot and seams (Fig. 8) in the butt 16 feet of the tree. Visually square the butt 16 feet of the tree into four faces to include as many indicators in one face as possible. Examine each face and *count* the number of faces affected and record as a single digit code. EXAMPLE: One face is affected—enter 1 in the "Faces" column under "Rot/Seam."

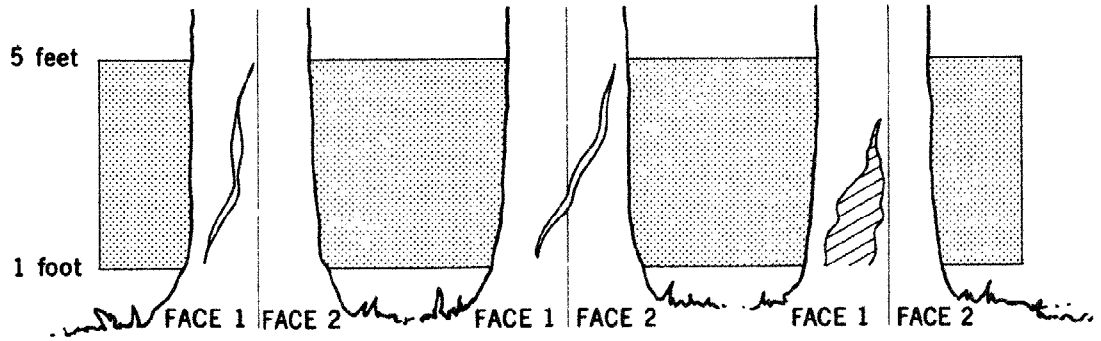
Now measure the length affected from starting point to end point on each face and record the minimum and maximum height as a 4 digit code. Measurements are taken from a 1-foot stump. EXAMPLE: The length affected extends from 1 foot to 5 feet—enter 0105 in "Length" column under "Rot/Seam."

Surface defects

For each 8-foot section of the butt 16 foot log, tally all trees ≥3.5 inches as follows: *Count* the number of live and dead limbs ≥1/3 inch in diameter (Figs. 9 and 9a). Record as a 2 digit code. EXAMPLE: Upper 8-foot section has four live limbs ≥1/3 inch—enter 04 in "Number" column under "Surface Defect" (Live).

Now *measure* or *estimate* the size (to the nearest ¼ inch) of the single largest qualify-

Figure 8.—Rot and seams.



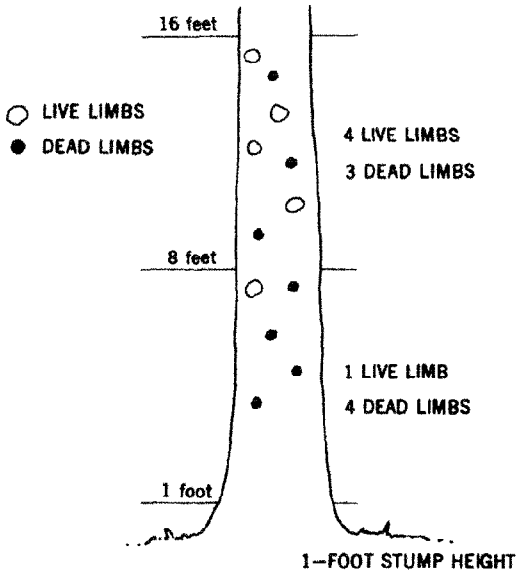
ONE FACE AFFECTED:
LENGTH FROM
1 foot to 5 feet

TWO FACES AFFECTED:
LENGTH FACE ONE
1 foot to 3 feet
LENGTH FACE TWO
3 feet to 5 feet

ONE FACE AFFECTED:
LENGTH FROM
1 foot to 3 feet

Note: MEASUREMENTS TAKEN FROM 1—FOOT STUMP HEIGHT

Figure 9.—Surface defects.



ing live and single largest qualifying dead limb. Record as a 3 digit code. EXAMPLE: Single largest live limb is 2.5 inches—enter 250 in "Size" column.

Overgrowths

A measurable overgrowth (Fig. 10) is the result of a defect caused by a branch stub or insect damage. For example, if a branch has fallen off recently, the branch stub will be exposed—this is considered a dead branch rather than an overgrowth. However, a scar will be visible if the branch stub has been covered over by callous material. If this scar is at least 1 inch in diameter and protrudes ¼ inch from the main stem, it is considered a measurable overgrowth and should be counted. Overgrowths on trees 6.0 inches or larger in dbh are likely to cause product defects because they usually extend into the quality zone.

Figure 9a.—Dead limb ≥ ⅓ inch.

Figure 10.—Overgrowth (measurable).

Figure 11.—Overgrowths.

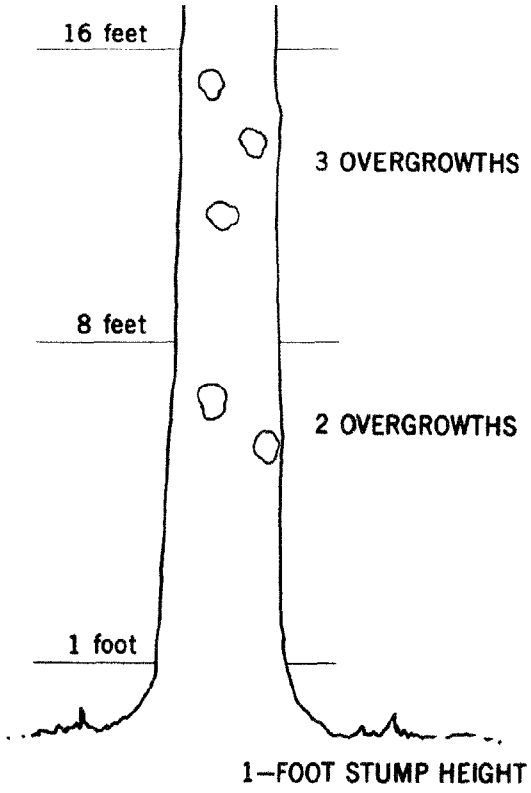


Figure 11a.—Overgrowth.

For each 8-foot section of trees 6.0 inches and larger in dbh, count the number of overgrowths (Figs. 11 and 11a) and record as a 2 digit code. EXAMPLE: Tree contains 2 overgrowths in the first 8-foot section—enter 02 in "Number" column under "Surface Defect" (Overgrowths).

Overgrowths with associated epicormic branches

For each 8-foot section of the butt 16 feet of the tree, *count* the number of overgrowths that are surrounded by related epicormic branches (Figs. 12 and 12a). Record as a 2 digit code. EXAMPLE: Two overgrowths have related epicormic branches—enter 02 in "Epic A" column under "Surface Defect" (Overgrowths).

Figure 12.—Overgrowths with associated epicormic branches.

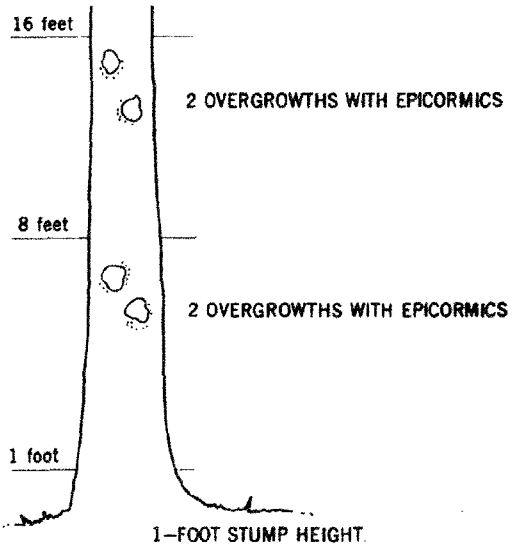


Figure 12a.—Overgrowths with associated epicormic branches.

Figure 13.—Single epicormic branches not associated with overgrowths.

Epicormic branches/bundles not associated with overgrowths

Epicormic branches are small branches which push through crevices in the bark; many grow rapidly but few develop into a major branch (Fig. 13). Epicormic branches found in small tufts of six or more are called epicormic bundles (Fig. 14).

For each 8-foot section of the butt 16 feet of the tree, *count* the number of epicormic branches/bundles that are not associated with a primary limb overgrowth (Fig. 15). Record as one of the following single digit codes:

(0) No epicormic branches/bundles
(1) 1 to 6 epicormic branches/bundles
(2) 7 or more epicormic branches/bundles

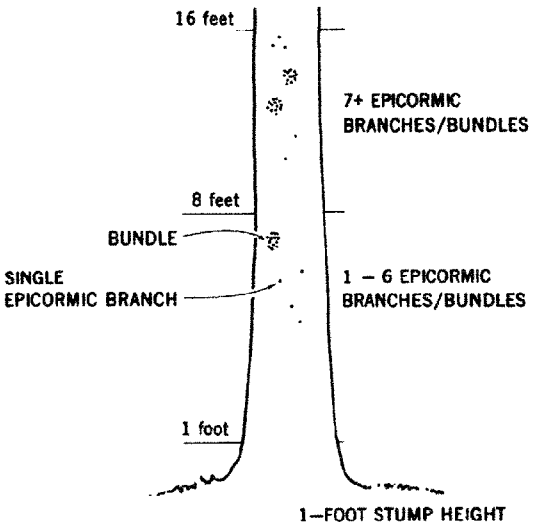
EXAMPLE: An 8-foot section has 5 epicormic branches/bundles—enter 1 in "Epic B" column under "Surface Defect" (Overgrowths).

LITERATURE CITED

Sonderman, David L., and Robert L. Brisbin. 1978. **A qualty classification system for young hardwood trees—the first step in predicting future products.** USDA For. Serv. Res. Pap. NE-419. 7 p.

Figure 14.—Epicormic bundle not associated with overgrowths.

Figure 15.—Epicormic branches/ bundles not associated with overgrowths.



APPENDIX

Species List and Codes

Code	*Species*	*Code*	*Species*
01	White oak	28	Beech
02	Black oak	29	Ironwood
03	Scarlet oak	30	Bigtooth aspen
04	Chestnut oak	31	Black cherry
05	Northern red oak	32	Red elm
06	Pin oak	33	American chestnut
07	Blackjack oak	34	Hazelnut (including witch-hazel)
08	Post oak		
09	Southern red oak	35	Sumac
10	Yellow-poplar	36	Persimmon
11	Ash	37	Virburnum
12	Hickory	38	Redbud
13	Basswood	39	Hawthorn
14	Black gum	40	Black locust
15	Shortleaf pine	41	Shingle oak
16	Sycamore	42	Hackberry
17	Sweetgum	43	Mulberry
18	Red maple	44	Burr oak
19	Sugar maple	45	River birch
20	Black walnut	46	Willow
21	Hemlock	47	Butternut
22	Cucumber	48	Crab apple
23	Dogwood	49	Cottonwood
24	Sourwood	50	Wild-plum
25	Serviceberry	51	Hornbeam
26	Holly	52	Buckeye
27	Sassafras		

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