

## **APPENDIX B**

### **GUIDELINES FOR SELECTING SUPERIOR TREES**

## Goal

A long range goal of the California Region Tree Improvement Program is to produce large quantities of genetically superior planting stock. Genetic improvement will be achieved by selecting outstanding individuals, rigorously testing their ability to transmit their desirable characteristics and establishing seed orchards for interbreeding among the best trees.

## Superior Tree Defined

A superior tree is defined by the U.S. Forest Service, California Region as:

a phenotypically outstanding tree that has no visible undersirable characteristics and produces more cubic volume per year when compared to its immediate even-aged neighbors.

## Criteria For Locating Superior Trees

### Land Ownership

Selection will be done only on national forest land except where approval has been granted through written agreement among cooperators. Land ownership status will be determined from standard green Forest maps (0.5 inch per mile).

### Site Quality

Although superior trees may be found on all sites, the primary use for seed orchard seed will be on the more productive sites. Thus, majority of selections should be made on average or better sites (S.I. 80 at 100 years or higher for ponderosa pine and Site Class III for all other species).

### Distribution of Trees

Within each geographical and elevational breeding zone approximately 200 superior trees will be selected. Trees should be well distributed to obtain a broad representation of outstanding phenotypes. Superior trees of the same species can never be located closer than 200 yds apart and for the most part they should be separated by one mile or more.

### Where to Search

Suitable areas for selection will be searched first by traveling along roads. To the degree possible without degrading the quality of the selections or falling short of

the required number, superior trees will be located within five chains of roads. When it is necessary to search less accessible stands, potential areas should be identified from stand maps, aerial photographs, or other available means.

### Stand Structure and Uniformity

The search for superior trees will be made within small groups of vigorous, healthy trees (or stands) of approximately the same age and size class and occupying the same site. Uniformity in age and site influences among trees in a stand offers the best opportunity to select trees that will transmit their superiority to their offspring. Cut-over stands in which the largest young growth trees were removed should be avoided.

Most selections will be in the 60 to 90 year age class but they may range from 20 to 120 years old. Typical wolf trees, even though they are great volume producers, should not be selected. A good rule-of-thumb is to select trees that will make good sawlogs.

### Selecting Among Comparison Trees

#### Number and Distribution

To select a superior tree a minimum of three and a maximum of five dominant trees are identified. Only one of these will become the superior tree. At this point they are considered as comparison trees each having the potential for superior status. These trees must all be on the same relative site. Trees located in swales cannot be compared with those on a sidehill and trees in a well-stocked stand. Trees should be growing under similar competitive stresses. The comparison trees must occur within a 100-ft diameter circle on level ground. On a slope the circle changes to an ellipse where the short axis (up and down the slope) decreases 1 ft (slope distance) for each percent of slope. The steeper the slope the nearer to the same contour the trees should be.

#### Marking

Tag each comparison tree with a small aluminum tag at breast height. Record tree number, age, d.b.h. and height, and map individual trees on the reverse of the data form. Aluminum nails are required whenever a tag is nailed to a tree. Trees located along travel influence roads must be marked in a manner that will not degrade the aesthetic quality (check with the District Ranger).

### Undesirable Defects

Since comparison trees are potential superior trees, they cannot have any of the following defects:

Forking - A tree with a fork below 4½ ft will be considered as two trees and the fork will not be considered as defect. Multiple forking indicates a tendency toward inheritance of this defect. Care must be taken to inspect the tree for old forks that may have died and dropped off.

Sinuosity - This defect will give a wavy appearance to the upper bole and in minor cases may only appear as slight alternating sweeps. Sinuosity is most readily detected in the upper portion of the crown and the defect is generally covered up in the lower bole. (For a similar tree characteristic occurring in the lower bole of the tree see "Sweep in Two Planes.")

Spiral Grain - Spiral grain can occasionally be detected by observing spiral of the bark fissures. If the bark fissures spiral, you can assume the wood spirals.

Snow or Wind Break - Old top breakage can usually be detected by a crook at the old break. In general, top breakage will run in patches and these areas should be avoided when selecting a superior tree.

Sweep in Two Planes - This defect is characterized by a cork screw appearance or an "S" shaped bole. (Accountable sweep in one direction is allowed.)

Repeatability of a defect within a group of trees or a stand is an indication that the undesirable characteristic may be heritable. A stand with a repeated defect should be passed over even though it may be possible to select the minimum number (3) of comparison trees.

When the comparison trees are scored (cubic ft per year calculated) and the superior tree is determined, a permanent tag is placed on the tree. All selections used for a seed orchard must show evidence of cone production. If the tree with the highest score shows no evidence of cone production, defer using the tree in a seed orchard.

### Individual Tree Measurements

Age at Breast Height - Age will be determined from use of a standard increment borer. Every attempt should be made to hit the pith of the tree. Trees will be bored

at 4½ ft above the ground. No adjustment will be made for age to 4½ ft. Simply count the annual rings and record. On large diameter trees when it is not possible to reach the center of the tree, calculate the age by averaging the rings-per-inch in the last two inches of the core (nearest the pith) and project this average to the center of the tree.

When the ages of the trees are recorded, compute an average age. Reject any tree whose age is six percent greater or 12 percent less than the average. Trees rejected are simply lined out and another tree is selected if one is available. With each new selection, a new average must be computed and again any tree whose age is six percent greater or 12 percent less than the average must be rejected.

D.B.H. - O.B. - (Diameter Breast Height - Outside Bark) - Measure tree diameters at a point 4½ ft above the ground on the uphill side of the tree. Diameters will be measured with a diameter tape. Record diameters to the nearest one-tenth i.e., 21.4, 32.7, etc. When knots, swellings, bumps, branches, etc. occur at breast height, take two measurements equidistant above and below the obstruction and average the readings.

Height - Measure total height to the nearest ft. Measure the distance from the tree and shoot the height with an abney (topographic or percent), clinometer, Haga altimeter, Speigel-relaskop or other similar height measuring instruments. Ocular estimates or heights measured with a hypsometer are not acceptable. Measure all heights on a plot with the same instrument. When it is necessary to measure heights from an uphill vantage point, refer to Graphic Solution of Tree Heights using percent and topographic angles.

Volume Determination - The cubic volume of comparison trees will be determined using the following formula:

$$\text{Cubic ft} = \text{d.b.h.}^2 \times \text{height} \times .00231$$

Divide the volume by the age at breast high and the tree with the highest increment is usually the superior candidate.

#### Wood Quality

One wood sample will be taken from each superior tree candidate and from each comparison tree whose cubic volume per year is within 20 percent of that of

the superior candidate. For example, if the candidate produced 1.00 ft<sup>3</sup>/yr, then any comparison tree that produced 0.80 ft<sup>3</sup>/yr or more would also be sampled.

Wood samples will be extracted at breast height with a 12mm increment borer equipped with a ratchet handle and starting device. Care will be taken to collect samples at points located at right angles to the direction of tree lean (or at right angles to the long axis of cross-sectional growth). The approximate position of the pith will be known from previous extractions of 4mm cores for age determination.

Immediately after extraction each 12mm core will be measured for length. Cores will be marked with indelible pencil as follows: (a) a mark will be made at or even with the pith, and at the outer end, (b) a mark will be made a distance point 3/4 the core length from the outer end to the pith, with that 3/4 length being recorded directly on the core, and (c) the tree identification number or code will be written on the core.

Plugs made from 3/4 inch dowels will be used to close the holes. Cores will be placed in wooden holders.

Specific gravity (wood density), uniformity of specific gravity, and tracheid length will be determined in the laboratory.

#### Single Tree Selection

The single tree method approaches a "plus tree" selection. Occasionally, individual trees, either standing alone or within a stand, are vastly superior both in phenotypic characteristics and volume production. When such a tree is found, cruise and record the measurements. Explain on the plot form some of the reasons why the tree was selected.

#### Superior Tree Candidate Report (Fig.7)

The identification, location, and measurements for the Superior Tree Candidate Report will be recorded on forms in the field. Most of the information will later be transferred and stored on computer tapes.

A line drawing showing the route to the reference point and the motor log will be prepared on the field form. The location and identification of each tree will be accurately plotted on a forest map.

Fig. 7. Superior tree candidate report.

USDA · FOREST SERVICE					FOR FIELD USE ONLY	
SUPERIOR TREE CANDIDATE REPORT					SPECIES	
<i>(Instructions and drawing of map on reverse side)</i>					TREE NO.	
ACCESSION NO.	NAT. FOREST	RANGER DIST	COMPARTMENT		T. R. S.	
(1-5) _____	(6-7) _____	(8-9) _____	(10-12) _____			
SPECIES	TREE NO.	DEGREES		MINUTES	UTM M.E.	
(13-15) _____	(16-19) _____	LAT. (20-24) _____	_____	_____ N		
		LONG. (25-30) _____	_____	_____ W	UTM M.N.	
SEED ZONE	ELEVATION	ASPECT	SITE INDEX		R.P.	
(31-33) _____	(34-35) _____	(36) _____	(37-39) _____		DBH	DECLIN.
BREEDING ZONE	SEED CROP	OWNERSHIP	DATE SELECTED		BEAR.	DIST
(40) _____	(41) _____	(42-43) _____	(NO.) _____	(YR.) _____	CREW	
INDIVIDUAL TREE MEASUREMENTS						
LARGEST TREES (SAME SPECIES WITHIN 100 FT.)	AGE (AT DBH)	TOTAL HEIGHT (FT.)	DBH (NEAREST 0.1 IN.)	VOLUME (CU. FT.)	VOLUME PER YR. (CU. FT.)	SPECIFIC GRAVITY
A						
B						
C						
D						
E						
TOTAL						
AVERAGE						
SELECTED TREE	(48-50) _____	(51-53) _____	(54-60) _____	(57-60) _____	(61-63) _____	(64-66) _____
% SUPERIORITY		(67-68) _____			(69-70) _____	
TREE NO. _____ IS THE SUPERIOR TREE.			NUMBER OF LADDERS IS _____.			
REMARKS:						
CONE COLLECTION			SCION COLLECTION			UNDESIRABLE DEFECTS ARE:  FORKING SINUOSITY SNOW OR WIND BREAKAGE SPIRAL GRAIN EXCESSIVE SWEEP SWEEP IN TWO DIRECTIONS TYPICAL WOLF TREES
DATE	NO. CONES	SOUND SEED	DATE	NO.	COMPATIBILITY	

MOTORLOG TO REF. TREE OR POINT

MAP SHOWING:

ROUTE TO REFERENCE POINT

INDIVIDUAL TREES

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INSTRUCTIONS

Send original copy to Timber Management Staff, U.S. Forest Service, 630 Sansome Street, San Francisco, Ca. 94111.

- ACCESSION NUMBER:** Leave blank. RO will assign numbers in sequence.
- CODE NUMBERS:** For National Forest and Ranger District see FSM 1344.73a. For species see FSH 4813.1. For compartment see district records. Ownership codes to be established in RO (indicate in remarks space).
- COORDINATES:** Record to nearest 0.1 minute.
- SEED ZONE:** Use latest revision of California Seed Zone Map.
- ELEVATION:** Record to nearest 100 feet.
- ASPECT:** 1=N 2=NE 3=E 4=SE 5=S 6=SW 7=W 8=NW 9=Nearly level ground.
- SITE INDEX:** Use average height and age of comparison trees and determine S.I. at 100 yrs from these references:
- DOUGLAS-FIR:** Site classification curves for Douglas-fir, PNW Res. Note 44.1948.
- PONDEROSA:** Arvanitia, L.G., J. Lindquist, and M. Palley. 1964. Site index curves for evenaged young-growth ponderosa pine of Westside Sierra Nevada Calif. For. & For. Prod. 35. 8p.
- OTHERS:** Dunning, D.1942. A site classification for mixed conifer selection forests of The Sierra Nevada. PSW Res. Note 28. 21p.
- BREEDING ZONE:** See Breeding Zone Maps in Tree Improvement Plan.
- SEED CROP:** 0=None evident 1=Light 2=Medium 3=Heavy 4=Undetermined at time of selection.
- % SUPERIORITY:** Divide the value of the selected tree by the average value of the comparison trees and multiply by 100.