U. S. FOREST SERVICE
RESEARCH NOTE PSW- 101

PACIFIC SOUTHWEST
FOREST & RANGE EXPERIMENT STATION
Berkeley, California 1966

# Crown and Tree Weights of Madrone, Black Oak, and Tanoak

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ABSTRACT: Preliminary curves for estimating crown and tree weight are given for madrone, black oak, and tanoak. These curves complement previously published slash weight tables for westside Sierra Nevada mixed conifers. Tanoak crowns in trees 12 to 20 inches d.b.h. were two to three times heavier than black oak and madrone crowns.

Information on the size of trees and the proportion of crowns in relation to their boles is often used in present-day forestry technology. Such data permit estimates of heat intensities, fire hazard, and ease of ignition for controlled burnings. Estimates of logging slash weight serve as an alternate basis for computing the cost of slash disposal. The need for more data on tree weight is pointed out by the ever-present problems of slash disposal and by the increasing use of fire as a silvicultural technique.

On clearcut sites at the Challenge Experimental Forest, in Yuba County, California, three hardwoods--Pacific madrone (Arbutus menziesii Pursh.), California black oak (Quercus kelloggii Newb.), and tanoak (Lithocarpus densiflorus (Hook. & Arn.)Rehd.)--contribute 7 to 50 tons of slash per acre.[1] Slash weights for westside Sierra Nevada conifers have been previously published.[2] Total slash estimates for an area could not be made, however, because hardwood weights were not available.

Curves for crown and total tree weights given here (fig. 1), provide a way to estimate weights of madrone, black oak, and tanoak. Because these curves are based on a limited number of trees they should be regarded as preliminary and used with caution. I know of no other published slash weight data for these three hardwood species.

The proportion of crown to bole weight is consistently greater for tanoak. This is particularly apparent in trees from 12 to 20 inches d.b.h. In this range of the sample, tanoak crowns were about three times

[1] U.S. Forest Service research at the Challenge Experimental Forest is conducted in cooperation with the Soper-Wheeler Company, Strawberry Valley, Calif.

[2] Chandler, Craig C. Slash weight tables for westside mixed conifers. U.S. Forest Serv. Pacific SW. Forest & Range Exp. Sta. Tech Paper 48, 21 pp., illus. 1960.

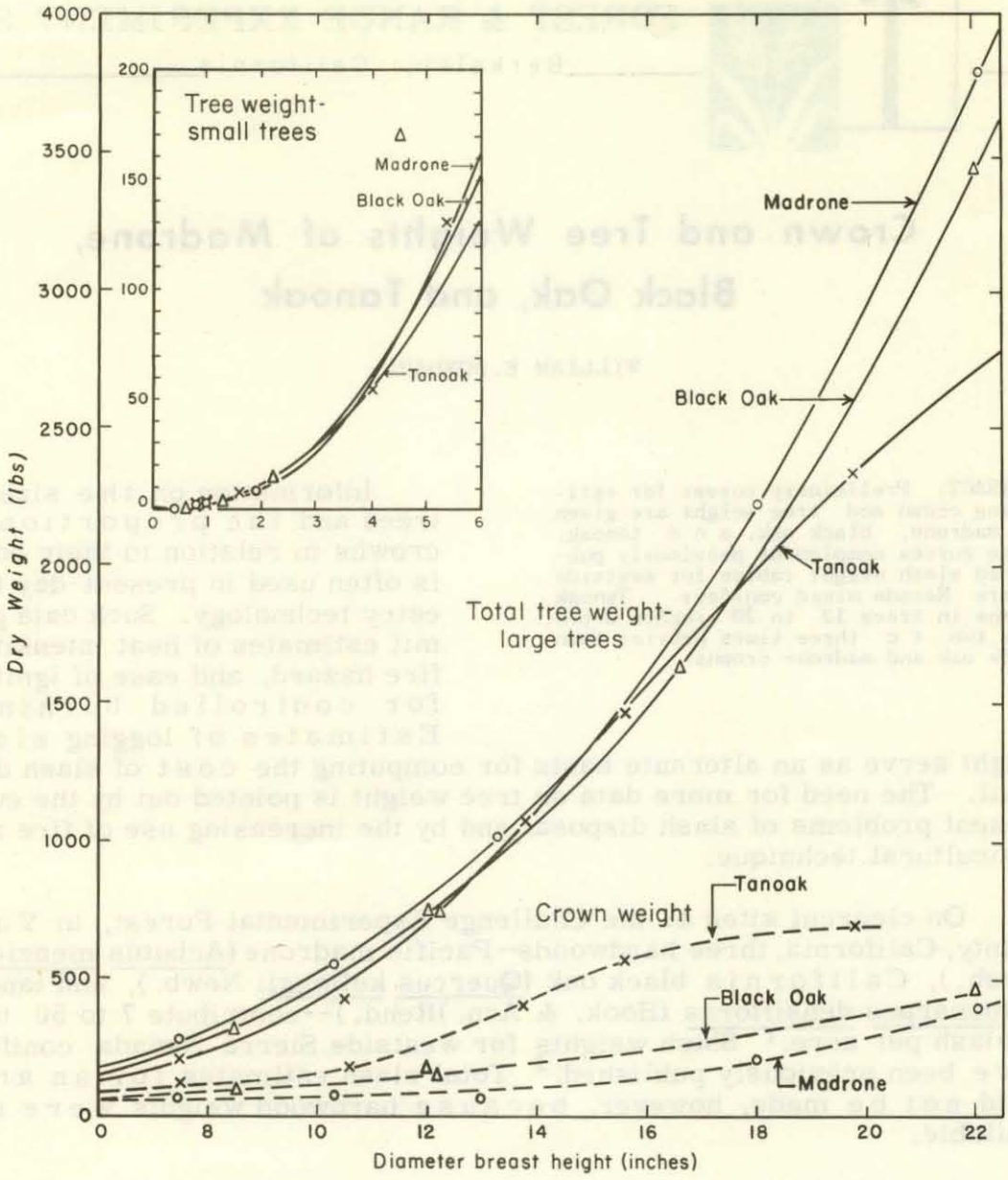


Figure 1.--Crown and tree weights of madrone, black oak, and tanoak.

heavier than the crowns of madrone and two times heavier than those of black oak.

## Methods

Trees from 1 to 22 inches in d.b.h. were selected for weight measurements. The massive weight of some trees made it necessary to select two tree size-classes for weight measurements: large trees 6 inches in

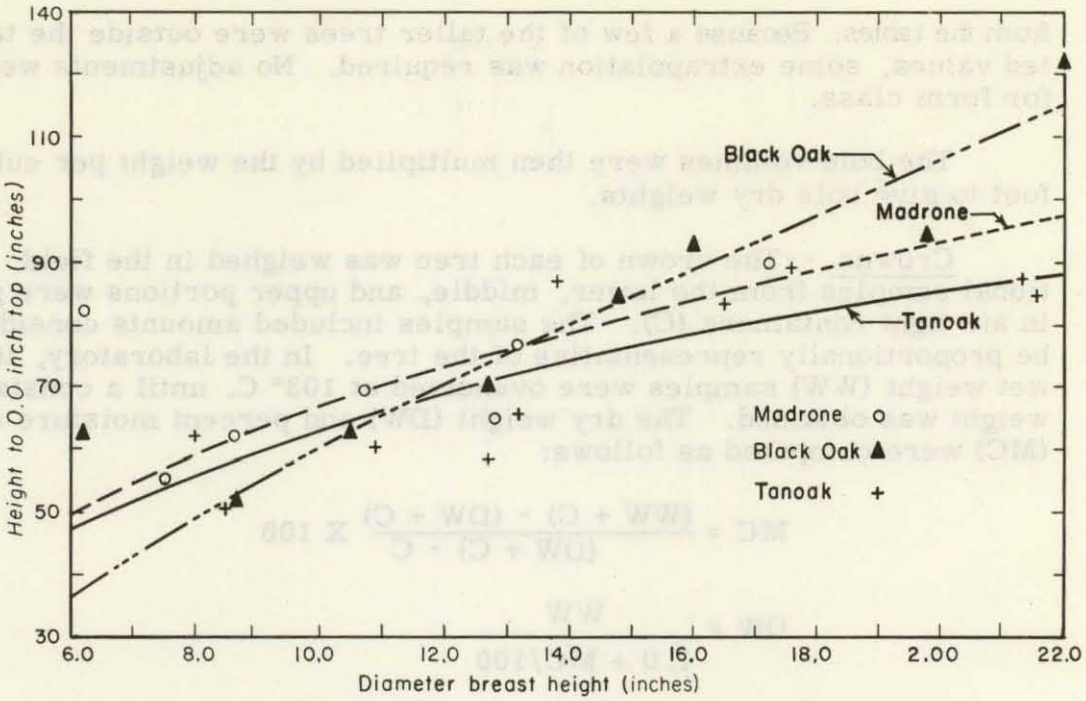


**Figure 2.--Tree heights of madrone, black oak, and tanoak at the Challenge Experimental Forest.**

diameter or over, and small trees less than 6 inches. In the large trees, two size-classes of materials were recognized: (a) material less than 4 inches d. i. b., made up of crowns; and (b) material over 4 inches d. i. b., comprised of boles, including large limbs to a 4-inch minimum diameter. In trees less than 6 inches in diameter, no differentiation in size of materials was made.

All weights are presented in pounds on an ovendry basis. The cubic-foot weights[3] adjusted to an ovendry basis, were: madrone 40, black oak 36, and tanoak 36 pounds.

Eight to ten trees of each species were arbitrarily selected for height and wet weight measurements. Field wet weights were obtained for small trees and the crowns of large trees. Bole weights of large trees were obtained in a different manner.

## Large Trees

Boles. --Existing cubic foot volume tables[4] were used to develop bole weights to a 4-inch top d. i. b. Diameter-height relationships were established for each species (fig. 2), and the corresponding volumes interpolated

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[3] Craig, George A., and Maguire, William P. The California pine region forest handbook. Ed. 1, p. 21. Sacramento: Calif. State Div. Forestry. 1949.

[4] Hornibrook, E. M., Larson, R. W., Van Akkeren, J. J., and Hasel, A. A. Board-foot and cubic-foot volume tables for some California hardwoods. U.S. Forest Serv. Calif. Forest & Range Exp. Sta. Res. Note 67, 31 pp. 1950.

from the tables. Because a few of the taller trees were outside the tabulated values, some extrapolation was required. No adjustments were made for form class.

The bole volumes were then multiplied by the weight per cubic foot to give bole dry weights.

Crowns. --The crown of each tree was weighed in the field. Fractional samples from the lower, middle, and upper portions were placed in air tight containers (C). The samples included amounts considered to be proportionally representative of the tree. In the laboratory, these wet weight (WW) samples were ovendried at 103° C. until a constant weight was obtained. The dry weight (DW) and percent moisture content (MC) were computed as follows:

$$MC = \frac{(WW + C) - (DW + C)}{(DW + C) - C} \times 100$$

$$DW = \frac{WW}{1.0 + MC/100}$$

The wet weight of each crown was adjusted by its average moisture content to give the dry weight.

The dry weights of the crown and bole were then combined to obtain tree weight.

## Small Trees

The small trees were weighed by sections in the field. To determine moisture content, a fractional sample was taken from the lower one-third of the stem and lower, middle, and upper portions of the crown. Moisture contents of the four samples (unweighted) were averaged and used to adjust tree wet weights to an ovendry basis.

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