

## NOTE

**ESTIMATION OF THE OVEN-DRY WEIGHT OF STEMS, NEEDLES,  
AND BRANCHES OF INDIVIDUAL PINUS RADIATA TREES**

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The determination of tree weight on the basis of field sampling is expensive and time consuming. Prediction equations for a wide variety of species have been summarised by Young (1976) and, since Dargavel (1970) published equations for *Pinus radiata* D. Don, information on several hundred additional trees has been obtained in New Zealand, Australia, and South Africa. An earlier publication (Madgwick 1979) included results of an analysis of the data available at that time, concentrating on the comparison of different regression variables. The coefficients of the regression equations were not included in the 1979 publication as it was felt desirable to test the equations against an independent sample. This has now been done using information from 160 additional trees from 10 different samplings in the central North Island and in Eyrewell Forest in the South Island of New Zealand.

Following common practice, the equations tested earlier were of the logarithmic form. Recently Flewelling & Pienaar (1981) have brought together information on a variety of methods of allowing for bias in such regressions. In practice the differences in estimates using the four (non unity) correction factors in Flewelling and Pienaar were very small and the simplest correction factor  $\exp(\frac{1}{2} [\text{error mean square}])$  proved the most effective. The results of the tests are summarised in Table 1 using the "best" equation forms reported earlier (Madgwick 1979).

TABLE 1—Bias of estimated weight expressed as a percentage of measured weight, based on 160 test trees from 10 samplings

Dependent variable	Independent variable	Min.	Max.	Av.
Needles	Stem diameter at base of live crown (d.b.h. + 1.0) <sup>2</sup> height	-34	55	-1
Branches		-51	32	0
Stems		-7	13	8

Tentative estimating equations resulting from these tests are given in Table 2. The range of each regressor variable included in the data is shown in Table 3. Highly suppressed trees have been excluded from the regressions for foliage since the relevant regression equation was found to seriously over-estimate measured foliage weights on these trees. An equation for estimating live branch weight (not studied earlier) is also included. The large bias of estimates of crown components in some data sets suggests the need for continued testing and a need to determine additional variables which may affect the relationships between crown weight and stem size.

TABLE 2—Regression equations for estimating tree component weights for needles (excluding severely suppressed trees), live branches, total branches, and stems (intercepts not corrected for expected bias due to logarithmic transformation)

Dependent variable	No. of trees	Equation*	Error mean square
Needles	328	$\log_e w = 2.193 \log d_c - 3.952$	0.103
Live branches	298	$\log_e w = 2.835 \log d_c - 5.336$	0.096
Total branches	332	$\log_e w = 2.448 \log d_c - 4.189$	0.245
Stem	557	$\log_e w = 1.028 \log((d + 1.9)^2 \cdot h) - 4.892$	0.033

\*  $w$  = weight (kg)

$d_c$  = stem diameter at base of live crown (cm)

$d$  = d.b.h.o.b. (cm)

$h$  = height (m)

TABLE 3—Minimum, maximum, and geometric mean values of independent variables used in regressions

Variable	Minimum	Maximum	Mean
Diameter at breast height (cm)	1.4	62.1	11.5
Total height (m)	1.7	42.1	8.8
Diameter at base of live crown (cm)	2.1	37.7	12.2

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