

## LETTERS TO THE EDITOR

**COMMENT ON "STRUCTURAL ROOT MORPHOLOGY AND BIOMASS OF THREE AGE-CLASSES OF *PINUS RADIATA*"**

The paper by Watson & O'Loughlin (1990) contains a number of errors which are too important to ignore.

In their discussion they quote from papers by Heth & Donald (1978) and Jackson & Chittenden (1981). They quote the range of dbh for Heth & Donald's trees as 39.2 cm to 64.5 cm. These are over-bark stump diameters, and dbh ranged from 33.2 cm to 56.7 cm. They quote the equation for estimating oven-dry root weight, namely:

$$\text{Total root weight} = 11.9 \text{ dbh} - 267$$

but this excludes the weight of the stump and so is not compatible with their own data which are for air-dry material. Their Fig. 5 indicates that linear regression of untransformed data is inappropriate in any case, as confirmed by the log-log regression given in their Fig. 6. Heth & Donald (1978) provided data on stump diameter and air-dry weights, making a direct comparison of the two sets of the data possible. Using the data in Watson & O'Loughlin's Tables 1 and 2 yields a regression of the form:

$$\log_e(\text{total air-dry root weight}) = 2.53 \log_e(d \text{ stump}) - 4.03$$

with a standard error of estimate of 0.105. This equation yields estimates between 86% and 128% of the air-dry weights of roots measured by Heth & Donald (mean 105%), suggesting that the two sets of data are strictly comparable.

They quote an equation of Jackson & Chittenden in the form:

$$\log_e(\text{total root weight}) = 2.73 \log_e(\text{dbh}) - 5.01$$

This is one of the equations given by Jackson & Chittenden (1981) for estimating the weight of oven-dry roots over 5 mm in diameter, not total root weight. Consequently, it is not surprising that the total air-dried root weights measured by Watson & O'Loughlin exceeded those for only part of the oven-dried root system predicted from Jackson & Chittenden's equation.

I conclude that there is no evidence to support the authors' conclusion that "the Mangatu trees had a consistently higher root biomass".

Heth & Donald (1978) provided data for both air- and oven-dry weights. (Note that there is a misprint of the total roots + butt weight for tree 16 in their Table 4). Oven-dry weight varied between 62% and 76% of air-dry weight and was correlated with stump diameter ( $r = 0.675$ ). Consequently, the stand weights of roots given by Watson & O'Loughlin must be interpreted with caution.

## REFERENCES

- HETH, D.; DONALD, D.G.M. 1978: Root biomass of *Pinus radiata* D. Don. *South African Forestry Journal* 107: 60-70.

- JACKSON, D.S.; CHITTENDEN, J. 1981: Estimation of dry matter in *Pinus radiata* root systems. 1. Individual trees. *New Zealand Journal of Forestry Science* 11: 164–82.
- WATSON, A.; O'LOUGHLIN, C. 1990: Structural root morphology and biomass of three age-classes of *Pinus radiata*. *New Zealand Journal of Forestry Science* 20: 97–110.

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## REPLY

I would like to thank Dr H.A.I. Madgwick for his comments and suggestions concerning the paper “Structural root morphology and biomass of three age-classes of *Pinus radiata*”, which was published in the *New Zealand Journal of Forestry Science* 20(1): 97–110. My reply is as follows:

- (1) The overbark diameter at breast height (dbh) range should have been 33.2 to 56.7 cm (Heth & Donald 1978 Table 4) and not 39.2 to 64.5 cm (Heth & Donald 1978 Table 3) as stated by Watson & O'Loughlin (1990 p.106) as the latter figures represent overbark stump diameters. Though the diameter range was mistakenly quoted as stump diameter, the equation quoted (Heth & Donald 1978 p. 66, Equation 10)

$$\text{Total root weight} = 11.9 \text{ dbh} - 267 \quad r^2 = 0.86$$

is for dbh.

- (2) The linear regression equation (Watson & O'Loughlin 1990 p.105, Equation 2), derived from the Mangatu data, like that of Heth & Donald (1978 p. 66, Equation 10) excluded the weight of the stump, defined by Heth & Donald (1978 p. 62) as that portion of the stem from ground level to 20 cm above the ground.

Figure 5 of Watson & O'Loughlin (1990 p. 107) may not be the best way to present the data, but it was the method Heth & Donald (1978 p. 66, Fig. 6) chose to present theirs, and was therefore included to give continuity of data analysis. It should be noted that in Fig. 5 the units of the y axis should be in kilograms and not centimetres as printed.

I took Dr Madgwick's suggestion and compared Heth & Donald's (1978) over-bark, air-dried roots with similar Mangatu data, giving

$$\log_e(\text{root wt}) = 2.41 \log_e(\text{stump dia.}) - 3.65 \quad r^2 = 0.91 \quad (1)$$

and

$$\log_e(\text{root wt}) = 2.54 \log_e(\text{stump dia.}) - 4.08 \quad r^2 = 0.99 \quad (2)$$

respectively.

The estimated parameters of slope and intercept (Equation 2) with their standard errors were compared with those of Heth & Donald (1978, Equation 1) using a single sample t-test. Neither slope nor intercept were found to be statistically different ( $p > 0.05$ ).