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.

H.A.I. Madgwick
36 Selwyn Road,
Rotorua,
New Zealand

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 over-bark stump diameters. Though the diameter range was mistakenly quoted as stump diameter, the equation quoted (Heth & Donald 1978 p. 66, Equation 10)

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

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

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

and

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

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 ($p>0.05$).

(3) The term total root weight refers to the sum of the weights of the root diameter classes recovered, not the "total weight" as in every last rootlet. It was with this in mind that the word "structural" was used in the title.

In practical terms I would suggest that 5 mm diameter would be about what could be considered to be a minimum diameter of a structural root. Recovery of any roots of a smaller diameter possibly indicates a good extraction technique and/or says something for the patience of the field personnel. When dealing with large root systems, the percentage weight contribution of roots less than 5 mm diameter (whether air- or oven-dried) is very minor.

The main objective of the comparisons of the Mangatu data with that of the other researchers was to show that the datasets were statistically similar, and therefore to reinforce the idea that root biomass could be estimated from a single above-ground parameter, and hence eliminate the necessity for the time-consuming business of root excavation.

(4) When discussing the root weight component of the surcharge on a potentially unstable slope, it may be more realistic to talk of the green-root weight than either the air- or oven-dried weights. Hence, I don't think the Mangatu stand weights given need be treated with the caution suggested.

REFERENCES

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

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*: 91–110.

Alex Watson
Forest Research Institute
P.O.Box 31-011
Christchurch