# LETTERS TO THE EDITOR

Sir, — I regret to inform you that in preparing my paper on "The impact of log small-end diameter . . ." for publication in the previous issue of your journal a minor error was perpetrated. While both the text and the figure of the paper imply that the s.e.d. in the regression equation is in millimetres, in fact the analysis was done in centimetres and the s.e.d. in centimetres should be used in calculating the percentage conversion.

I am grateful to A. C. Caddie for pointing out this error and regret any inconvenience it may have caused.

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Sir, — I was interested to read the article by Dr H. E. Burkhart "Stand modelling for radiata pine in New Zealand" in Volume 22, No. 2, 1977, of your journal. However, there was little in the article about work done over the last ten years in New Zealand, and the uninformed reader could be forgiven for assuming that the New Zealand Forest Service in particular is not engaged in such work. Perhaps this letter could correct those impressions.

First, the model built by N.Z. Forest Products Ltd, described by Clutter and Allison,[1] deserves more than passing mention. This must be one of the better distance-independent individual tree growth models (those models which require knowledge of the individual tree sizes but not of their spatial distribution) in existence. This model simulates a stand by maintaining a list of 25 basal area classes, each containing an equal number of trees. The list can also be optionally generated from average stand parameters. The annual growth in basal area is predicted for the stand and then allocated across the basal area classes. Similarly annual stand mortality is calculated and varying numbers of trees removed from each class until the required total is attained. The height of the mean tree in each class is also calculated, allowing the use of individual tree taper and volume equations. This procedure can be repeated to predict growth over many years, and also allow the effect of thinnings to be simulated. In addition to predicting the yield as a result of varying thinning intensities, this approach allows experimentation in the effects of different thinning methods; for example, thinning from below as opposed to crown thinning. However, in view of the very narrow range of site qualities covered by the data used to construct the model, site index is not an explicit factor and the model is suitable only for N.Z. Forest Products land around Tokoroa. Within this limitation the success of the model does indicate that it is not always necessary to obtain information on individual inter-tree distances except where a model is to be used in experiments specifically concerned with tree spatial distribution.

A growth model for radiata pine has been developed for Kaingaroa Forest by the New Zealand Forest Service which is applicable over a wide range of site indices. Circumstances dictated that this was developed as a stand model, that is, it does not require information on individual

tree sizes to predict growth, nor does it produce such information, all statistics being at the stand level. The model consists of equations to predict the top height development over age as a function of site index; the annual gross basal area growth; the annual mortality in terms of numbers of stems; the basal areas of the mortality and any thinnings; and the total stand volume. The model can be run given the age, basal area, numbers of stems, either site index or top height and the future thinning prescription of a stand. A similar model was obtained for the forests on the sand-dune areas of Auckland Conservancy, and Southland Conservancy modified the Kaingaroa model to suit their conditions. Nelson Conservancy have also developed a local yield model for their particular forests and regimes.

It was recognised that stand statistics are not enough to prepare management plans, and a "stand volume generator" has been developed. Given the basal area, top height and numbers of stems at a given age before and after any thinnings — *i.e.,* a line of output from a stand growth model — this programme predicts the stand table and the assortment of logs expected when a particular cross-cutting pattern is applied. The basic stand parameters are used to predict the coefficients of the Weibull function which in turn predicts the dbh distribution. The tree height, breakpoint and taper are calculated for the mean tree in each class and the stems cross-cut under direction from a cutting pattern defined by the user in terms of log sizes and either order of preference or position up the stem. The growth model and stand volume generator can be used in combination to answer such questions as "What is the volume and small end diameter distribution of pruned butt logs from a given regime at a certain age?" Although the models can predict the results of thinnings, the assumption is made that the same type of thinning is applied as has been in the past, namely, thinning from below. The models are thus insensitive to changes in thinning method in contrast to the N.Z. Forest Products model.

The problem of differing growth patterns over regions throughout New Zealand has not been satisfactorily accounted for in the past and work is proceeding at the Forest Research Institute on a general growth model and estimation procedures. The model will consist of a set of differential equations to predict basal area, number of stems and top height development. The parameters are estimated using maximum likelihood procedures to account for both environmental variation and measurement errors. Because the parameters of the model can be varied or held constant between plots or groups of plots, it is hoped to define regions within which growth patterns are essentially the same over a range of site qualities.

The Forest Service models have been implemented as part of an integrated mensuration system[2] for use by foresters in regional management planning. It is envisaged that management will make use of both simulation and linear programming to formulate long-range plans. A simulation model has been obtained from N.Z. Forest Products Ltd, the latest version of which (FPS76) has been implemented and just recently used by Nelson and Rotorua conservancies. A system comprising computer programs to create input for a standard linear programming package and to generate forest management reports from the output has also been implemented, and a second generaiton system is under design.

Whilst at the time of writing, the Forest Service is in the throes of converting from the State Services Commission's ICL 1904S to its new ICL 2980 computer, many of the components of the system are now running[3] and have been used by foresters at the regional level.

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[1] Clutter, J. L.; Allison, B. J., 1974. A growth and yield model for *Pinus radiata* in New Zealand. *In*: "Growth Models for Tree and Stand Simulation" (Ed. J. Fries), *Res. Notes 30, Royal College of Forestry, Stockholm.*

[2] Mensuration Project Team, 1976. *Review of Current Practices and Recommendations for Forest Service Mensurational Systems.* N.Z. Forest Service unpublished report.

[3] Users' Manuals (1976/1977) Mensuration Project Team. New Zealand Forest Service:
(a) A forest modelling system based upon linear programming.
(b) FPS76 A forest simulation system.
(c) Growth model programs.
(d) A program to calculate log assortments.
(e) A computer program for evaluating long-term forestry investments.