CALIBRATION OF D.B.H.-HEIGHT EQUATIONS FOR SOUTHERN HARDWOODS

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Poster Summary

Data from southern hardwood stands in East Texas were used to estimate parameters for d.b.h.-height equations. Mixed model estimation methods were used, so that the stand from which a tree was sampled was considered a random effect. This makes it possible to calibrate these equations using data collected in a local stand of interest, by using d.b.h. and total height measurements from a particular stand to estimate random parameters appropriate for that stand. The calibrated d.b.h.-height equation provides an improved fit for the conditions in a particular stand with less data than would be required to estimate parameters in a new d.b.h.-height equation. These data were obtained from the western portion of the natural range for most southern hardwood species, where relatively little information concerning d.b.h.-height relationships exists for southern hardwoods.

Water oak (*Quercus nigra* L.) was selected to demonstrate calibration of d.b.h.-height relationships. Water oak d.b.h. and height measurements were obtained from 538 trees located in 61 stands in east Texas. Sample trees were selected from transects running across drainages using a BAF=10 point sampling angle gauge.

The mixed model was:

$$\ln(H_{ki} - bh) = b_0 + b_1/D_{ki} + a_{0k} + a_{k1}/D_{ki} + e_{ki}$$

H_{ki} is total height (feet) of tree i in stand k, D_{ki} is d.b.h. (inches) of tree i in stand k, bh is breast height (4.5 feet), ln(x) is the natural logarithm of x, b_0 and b_1 are fixed population parameters, a_{0k} and a_{1k} are random parameters for stand k, and e_{ki} is random residual error for tree i in stand k. Estimates of the fixed population parameters based on 538 trees for water oak were b_0 = 4.87952440 (standard error=0.02678038), b_1 = -7.44722234 (standard error=0.47185702), and the residual standard error was 0.1667. This mixed effects model formulation is similar to the model used by Lappi (1991) for Scots pine.

Calibration can be accomplished by sampling in a new stand to estimate values of the random parameters a_0 and a_1 for that stand. A matrix formula given by Lappi (1991) can be used to estimate these random parameters. The calibrated model provides improved height prediction for the stand from which data are obtained but requires less data than would be needed to develop a new d.b.h.-height equation.

The calibration procedure was tested by reserving all data associated with one of the 61 stands as a calibration data set. The fixed parameters, variance-covariance matrix for the random effects parameters, and residual standard error were estimated using data from the remaining 60 stands. Ten trees from the calibration stand were used to estimate random parameter values for that stand. The d.b.h.-height curve, which included the random parameter values obtained from calibration, provided substantially better height predictions than a d.b.h.-height model which used only estimates of the fixed parameters.

LITERATURE CITED

Lappi, J. 1991. Calibration of height and volume equations with random parameters. Forest Science. 37(3): 781-801.

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