

ACCURACY OF TREE GRADE PREDICTIONS FOR FIVE APPALACHIAN HARDWOOD SPECIES

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Tree quality is an important factor that influences cut-or-leave decisions in thinning prescriptions implemented by landowners, forest managers, and wood-using industries. Tree grade is a useful estimate of tree quality, and predicted tree grade can be used to assess changes in tree quality and value over time. This study measured the accuracy of predicted tree grades for five Appalachian hardwood species over a period of 12 to 15 years.

Two West Virginia sites were used in this study. The first study area is located on the Monongahela National Forest (MNF) in northern Pocahontas County (Miller 1997), where the initial overstory was predominantly black cherry (*Prunus serotina* Ehrh.), with some white ash (*Fraxinus americana* L.) and red maple (*Acer rubrum* L.). The second study area is located on the West Virginia University Forest (WVUF) in Monongalia and Preston Counties (Graves and others 2000), where the initial overstory consisted of yellow-poplar (*Liriodendron tulipifera* L.), northern red oak (*Quercus rubra* L.), black cherry, sweet birch (*Betula lenta* L.), white oak (*Quercus alba* L.), chestnut oak (*Q. prinus* L.), and scarlet oak (*Q. coccinea* Muenchh.), with smaller amounts of red maple.

Thinning treatments were applied in each study area, and permanent plots were used to monitor stand and individual tree development. All residual trees were graded according to Hanks (1976) in thinned and control plots after the thinning treatments. Initial tree grade data were collected in 1986 on the MNF site and in 1989 on the WVUF site. At that time, a future tree grade was predicted assuming that DBH would increase to ≥ 15.6 inches and the tree would retain the surface and cull defects apparent at the beginning of the study.

In 2000, each tree was graded a second time using the same rules, thus providing a means of assessing the accuracy of tree grade predictions in both thinned and control stands. The data set consisted of 588 black cherry, 404 northern red oak, 167 red maple, 191 white and chestnut oaks, and 450 yellow-poplar, for a grand total of 1,800 trees. Pearson chi-square tests were performed on tree counts by three grade prediction categories (higher, correct, and lower) to detect differences between thinned and control plots. When chi-square tests were significant ($p < 0.05$), asterisks were placed on values that contributed most to the chi-square statistic (table 1), based on an examination of standardized deviates (SYSTAT 2000).

When all 1,800 trees were considered together, 9 percent were higher than the predicted grade, 80 percent were predicted correctly, and 11 percent were lower than the predicted grade (table 1). Grade predictions for black cherry and northern red oak appeared to be less accurate in thinned stands compared to controls, but such differences were not apparent for other species. Grade predictions for larger diameter and higher grade trees were generally less accurate than those for smaller or lower grade trees. Trees that had lower grades than predicted usually exhibited unforeseen increases in cull deduction. While grade factors such as DBH and percent sweep are readily apparent and can be measured uniformly, estimation of internal rot and prediction of clear cuttings are less exact and may be an important source of error. Still, the conservative approach of assuming that current surface defects and cull deductions would persist, as used in this study, provided remarkably reliable predictions of future tree grade.

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Table 1.—Accuracy of predicted tree grades in 2000 by species and treatment.

Species	Treatment	Actual Grade vs. Predicted ¹			n	Chi ²	p-value ²
		Higher	Correct	Lower			
		%					
Black cherry	Thinned	11	72	17*	445	11.3	<0.01
	Control	7	87	6*	143		
Northern red oak	Thinned	10	79	11*	174	7.5	<0.01
	Control	10	86	4*	230		
Red maple	Thinned	12	83	5	82	1.9	0.17
	Control	11	78	11	85		
White oak group	Thinned	10	80	10	81	0.2	0.67
	Control	4	84	12	110		
Yellow-poplar	Thinned	9	80	11	203	0.3	0.57
	Control	5	82	13	247		

¹Tree grades were predicted in 1986 for black cherry; 1989 for other species.

²Pearson chi-square tests were performed on tree counts by species, treatment, and grade prediction.

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