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PROCEEDINGS

8th Central Hardwood Forest Conference

University Park, Pennsylvania
March 4-6, 1991

For attending this conference, each registrant was eligible for 12 hours of Continuing Forestry Education (CFE) credit offered by the Society of American Foresters.

ACKNOWLEDGEMENTS

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8TH CENTRAL HARDWOOD FOREST CONFERENCE

Proceedings of a Meeting

Held at

The Pennsylvania State University

University Park, PA

March 3-6, 1991

Edited by

Larry H. McCormick and Kurt W. Gottschalk

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FOREWORD

This conference is the eighth in a series of biennial meetings that began in 1976 at Southern Illinois University. Other conferences have been hosted by Purdue University, University of Missouri, University of Kentucky, University of Illinois, and University of Tennessee. The purpose of these conferences has remained the same: to provide a forum for the exchange of information concerning the central hardwoods and to engender coordination among forest scientists in the central hardwood region. This purpose is evidently well-served: the last several conferences have each attracted some 45 to 65 program contributions, and the audiences have been correspondingly large.

Previous organizers have refrained from drawing precise boundaries around the "central hardwood region." We prefer to continue that policy on the grounds that to do otherwise might preclude some very worthwhile participation. Thus, while the principal focus has remained on the oak resource for reasons that are obvious, the ecological scope has broadened from oak-hickory (in the early meetings) to Appalachian oak (Knoxville and State College) and mesophytic forests. With a few exceptions, the commercially significant species are similar for all these forest types, and advancements in knowledge are of general interest.

But the central hardwood region is not merely a collection of similar forest types. It also has historical, demographic, political, and economic characteristics that tend to distinguish it from other forest regions of the United States. For example, the population is heavily rural and agricultural, primary wood markets tend to be diffuse and unorganized, wilderness values and endangered species have generally not been overriding issues, and a relatively minor proportion of the forest land is controlled by public agencies or corporate ownerships. These and related conditions play critical roles in the practice of forestry in this region, and in the aggregate they emphasize its distinction from other regions; but no single one is necessarily unique to the central hardwoods. For these reasons, the characteristics of nonindustrial private forest land owners in Massachusetts might be just as relevant to the central hardwood region as regeneration methods for white oak in Indiana.

Since these proceedings are being published in advance, we have no way of judging the ultimate success of the upcoming Eighth Conference. Of course, our earnest hope is that this meeting shall sustain the excellent reputation of the series. We believe this hope is encouraged by the quality of the papers in these proceedings.

REVIEW PROCEDURES

Each manuscript published in these proceedings was critically reviewed by at least two scientists with expertise in disciplines closely aligned to the subject of the manuscript. Reviews were returned to the senior author, who revised the manuscript appropriately and resubmitted it in a diskette format suitable for printing by the Northeastern Forest Experiment Station, USDA Forest Service where they were edited to a uniform format and type style. Manuscript authors are responsible for the accuracy and style of their papers.

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POSTER SESSION

TREEGRAD: A GRADING PROGRAM FOR EASTERN HARDWOODS

Jeffrey W. Stringer and Darryl W. Cremeans[1]

Abstract: Assigning tree grades to eastern hardwoods is often a difficult task for neophyte graders. Recently several "dichotomous keys" have been developed for training graders in the USFS hardwood tree grading system. **TREEGRAD** uses the Tree Grading Algorithm (TGA) for determining grades from defect location data and is designed to be used as a teaching aid. The program takes individual tree inputs and determines the best grade for the tree as well as the location and the length of the grading section giving the best grade. The program can be used to objectively determine grades from field data of defect location and size as well as for instructional purposes to show the effect of defect positioning on grade.

After the introduction screen the user is prompted by the following screen:

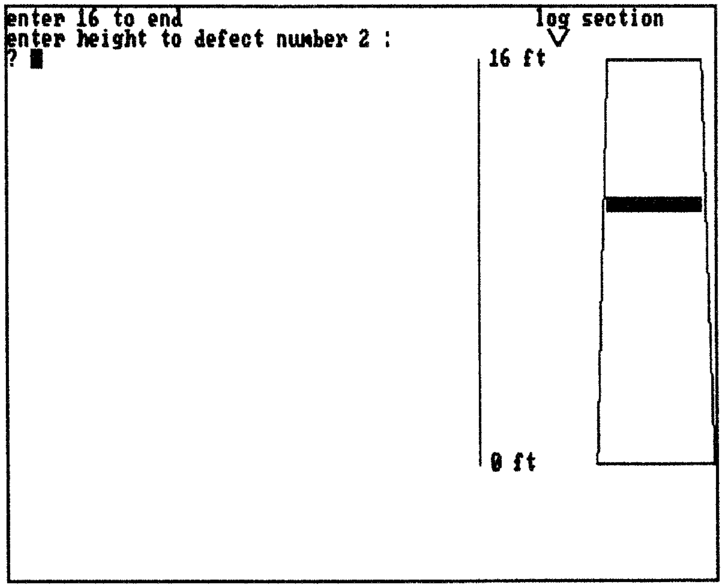
```
IS THIS A BASSWOOD OR ASH TREE?

ENTER TREE DBH IN INCHES AND TENTHS (FORMAT XX.X)

ENTER DIAMETER INSIDE BARK AT TOP OF GRADING SECTION

ENTER PERCENT CULL DEDUCTION FOR SWEEP AND CROOK

ENTER PERCENT CULL DEDUCTION FOR ROT
```

Inputs are provided for each of the prompts and the following screen appears:

```
YOU MAY NOW ENTER UP TO 7 DEFECTS AND THEIR SIZES

IF 2 DEFECTS DO NOT HAVE A CLEAR TWO FOOT SECTION
BETWEEN THEM, COUNT IT AS 1 DEFECT

ENTER HEIGHT TO DEFECT IN FEET AND TENTHS (XX.X)

THEN ENTER THE THICKNESS (from bottom to top)
OF THE DEFECT IN FEET AND TENTHS

do not let the top of the highest defect be more than 14 feet

hit any key when you understand these instructions
```

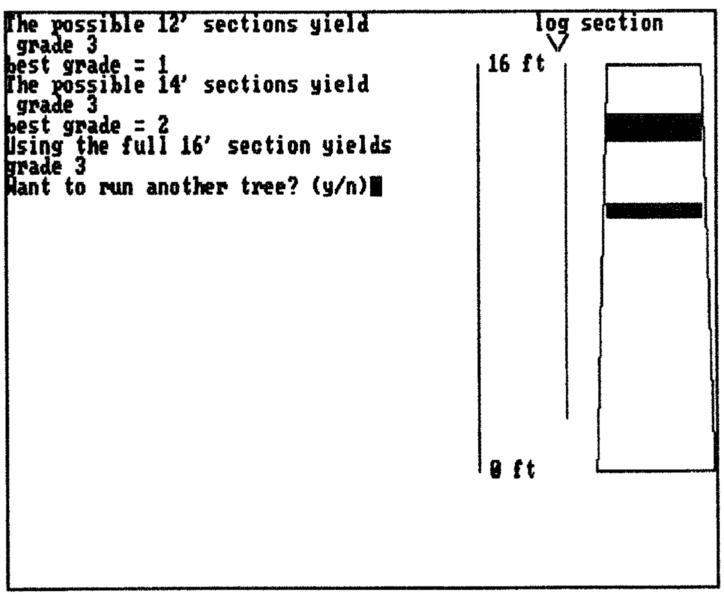
[1]Research Silviculturalist and Scientific Analyst Programmer, Department of Forestry, University of Kentucky, Lexington, KY. 40546-0073.

After the previous screen has been viewed the first graphic screen appears.



In this example screen the location and thickness of the first defect has been entered and the program is prompting the user for the second defect location which it will plot on the grading face to the right of the screen.

After the user has input defect location and size TREEGRAD then advances to the following screen.



The user can watch the program analyze each possible, 12 ft, 14 ft, and 16 ft grading section. The program then lists the best possible grade for each length grading section.

TREEGRAD uses 128K of RAM and runs on any IBM or compatible with any color monitor.

WHITE OAK SEEDLING SURVIVAL AND VIGOR FOLLOWING ACORN REMOVAL AND WATER STRESS

Eugene R. Thorn and Walter M. Tzilkowski[1]

Abstract: A lack of viable acorns, due to rodent depredation, may be the primary cause of advanced regeneration failure of oak in Pennsylvania. White oak (*Quercus alba*) acorns germinate immediately upon falling. Within three weeks, 30-50% of the nutrients in the cotyledon are transferred into the upper taproot; removing the cotyledon during winter may not affect survival and growth. Our objective was to determine whether nondormancy of white oak acorns contributed to seedling survival. Thirty-three or 34 sound white oak acorns were randomly assigned to each of six perforated trays (95 x 46 x 10 cm) filled with a mixture of 1/2 peat moss and 1/2 sterilized sand. Two weeks after acorns were planted at a depth of 2.5 cm in 8 equally spaced rows, cotyledons were carefully removed from the growing radicles in three randomly chosen trays, simulating removal by small mammals. Remaining acorns were used as controls. For the first nine weeks, the germination phase, trays were watered three times weekly until the soil mixture was saturated. Beginning with week 10, the water stress phase, each tray received only 0.5 1 of water/week, until week 21, the resprout phase, when water was provided at the initial intensity. After eight weeks of greenhouse conditions, 68% of intact acorns germinated into seedlings, whereas only 53% of acorns without cotyledons germinated. After 10 weeks of water stress shoot mortality was observed. Seven weeks after watering was resumed, 17% of seedlings with cotyledons and 33% of seedlings without cotyledons resprouted. Seedling survival (with or without cotyledons) differed within the germination ($P < 0.0001$), water stress ($P < 0.0001$) and resprout phase ($P < 0.0001$). Variation in seedling survival within either the germination, water stress or resprout phase was accounted for primarily by time. Survivorship of seedlings that lose the acorn food reserve was lower initially; however, after stressing seedlings until the shoots died back, seedlings with cotyledons removed resprouted and survived at double the rate of control seedlings. Recovery from cotyledon loss evidently prepared these seedlings for the next stressful situation. Our results suggested a potential for establishment of vigorous seedlings from white oak acorns, even if cotyledons are removed from the radicle by small mammals during late winter-spring.

[1]West Virginia Department of Natural Resources, Division of Wildlife Resources, Simon, W. VA 24882 and School of Forest Resources, The Pennsylvania State University, University Park, PA 16802, respectively.

UNDERSTORY COMPOSITION OF HARDWOOD STANDS

IN NORTH CENTRAL WEST VIRGINIA

Mark J. Twery[1]

Abstract: Understory composition was measured on 960 10.5 m^2 plots in 16 stands on the West Virginia University Forest in north-central West Virginia. The overstory composition was dominated by oaks (*Quercus* spp.) on 50% of the stands and by a mixture of oaks and yellow-poplar (*Liriodendron tulipifera* L.) on 50%. All stands were without recent disturbance and ranged in age from 60 to 100 years. All woody stems under 7 cm dbh were counted by size class and percent cover was estimated for woody and herbaceous vegetation.

Ferns dominated the understory on 32% of the plots and tree species dominated on 30% of the plots. Dominance by ferns was correlated with more mature stands in both forest types. Woody vines such as greenbrier (*Smilax* spp.) were the dominant form on most of the remaining plots (26% of tthe total) in the mixed stands, while only 9% of the understory plots were dominated by shrub species such as blueberry (*Vaccinium* spp.). Total number of species on the 10.5 m^2 plots ranged from 1 to 25, while stand averages ranged from 7 to 14 species per plot (Figure 1).

A total of 38 different woody species were found on the study plots. The most common woody understory species (Figure 2) included red maple (*Acer rubrum* L.) (43% of total stems), black cherry (*Prunus serotina* L.) (17% of total stems), and sassafras (*Sassafras albidum* (Nutt.) Nees) (14% of total stems). Red maple was present on 94% of sample plots, black cherry on 79%, and yellow-poplar on 69%. Red oak (*Quercus rubra* L.), although not as abundant, was also well distributed, as shown by its presence on 54% of the study plots.

Significant differences were not found in Shannon's Diversity Index (H') for woody species between cover types, although the mixed oak-yellow poplar stands tended to have slightly higher diversity. Conversely, Hill's Evenness Index showed somewhat greater values for the oak stands.

Species abundances of the larger stems differed from the overall total, indicating differential abilities of woody species to survive early seedling stages. The dominance of cherry among the stems over 30 cm tall implies the possibility that it may well dominate the next stand. All areas are well-stocked with advance regeneration of commercial tree species and should respond well to future disturbances.

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[1]Research Forester, USDA Forest Service, Northeastern Forest Experiment Station, Morgantown, WV 26505-4360.

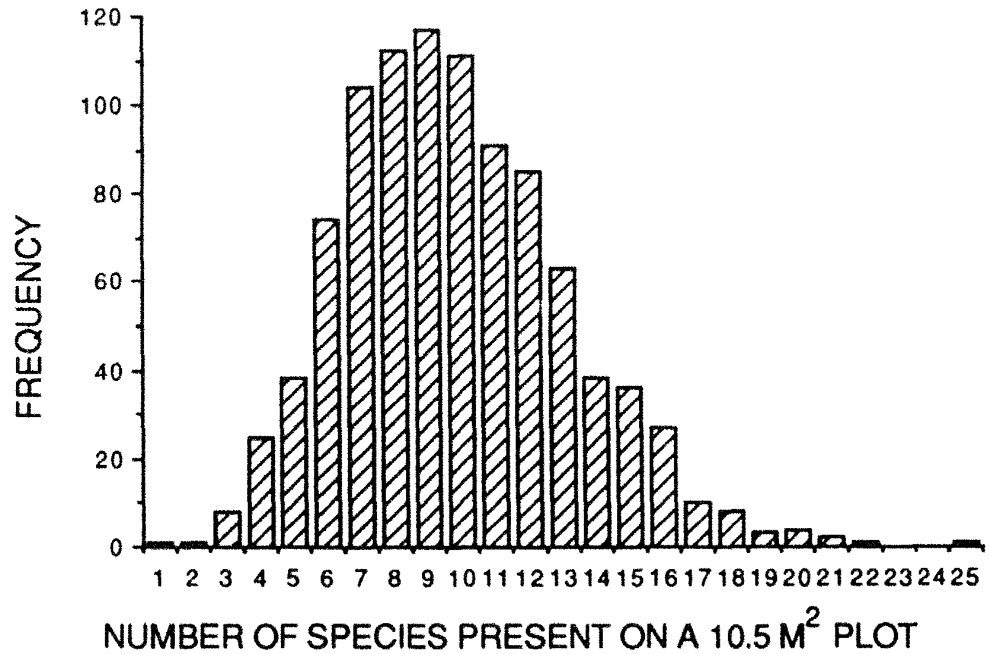

Figure 1. Species richness distribution on 960 understory plots in oak and mixed hardwood stands on the West Virginia University Forest.

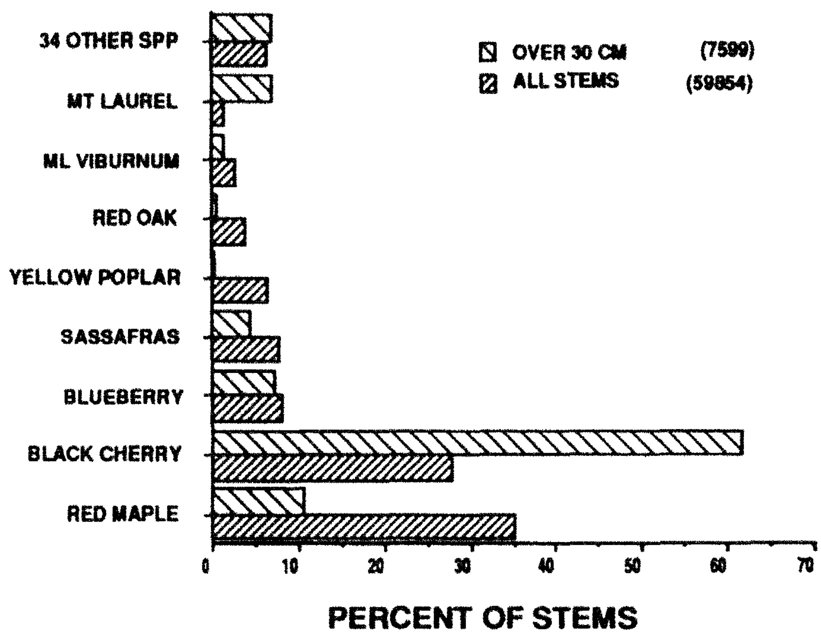

Figure 2. Abundances of common woody species on 960 understory plots in oak and mixed hardwood stands on the West Virginia University Forest.

HARDWOODS ARE NOW BEING HARVESTED AT RECORD LEVELS

Richard H. Widmann[1]

Abstract: Recent canvasses by the USDA Forest Service of the sawmills and pulpmills in the central hardwood region show large increases in the harvests of hardwood species. In Kentucky, the production of hardwood sawlogs rose from 457 million board feet in 1974 to 775 million board feet in 1986, a 70 percent increase. In West Virginia, hardwood sawlog production also increased. In 1987, hardwood sawlog production in the Mountaineer State totaled 566 million board feet, an increased of 39 percent over the 399 million board feet produced in 1979.

A variety of species make up the sawlog harvests in these two states. In West Virginia, northern red oak lead all other species with 129 million board feet cut for sawlogs followed by yellow-poplar with 113 million board feet. In Kentucky, yellow-poplar was the top species harvested with 109 million board feet; white oak was a close second with 108 million board feet. As a group, the oak species represented 52 percent of all hardwoods harvested for sawlogs in these states.

The harvest of hardwoods for pulpwood also has increased in these states. In 1988, 413,000 cords of hardwood pulpwood were harvested in Kentucky and West Virginia versus 171,000 cords harvested in 1978.

Increased activity at sawmills in Kentucky and West Virginia has made available more residue chips for pulpmills to use for furnish. Between 1978 and 1988, the use of hardwood residue chips for pulpwood more than doubled, from 338,900 cord equivalents to 757,500 cord equivalents in these two states.

Timber inventories in these states have been building over many years. The ratio of timber growth to removals is 3.7 to 1 West Virginia and 2.1 to 1 in Kentucky. Because of these favorable ratios and the large inventories currently available for cutting, it is likely that forest industry will continue to expand in these states to take advantage of existing opportunities.

[1]Forester, USDA Forest Service, 5 Radnor Corporate Center, 100 Matsonford Rd., Suite 200, Radnor, PA 19087.

PLANTING NORTHERN RED OAK: A COMPARISON OF STOCK TYPES

J. J. Zaczek, K. C. Steiner, and T. W. Bowersox[1]

Abstract: Height and survival values of northern red oak (*Quercus rubra* L.) were compared three years after outplanting as functions of: stock types (direct-seeded, 1-0, 2-0, 1-1, 2-1, and 2-year-old seedlings grown in 7.9-liter pots), presence or absence of undercutting in the nursery, and presence or absence of top-clipping when field planting. In all, 33 or more completely randomized single-tree plots for each of 17 different treatments or treatment combinations were represented at recently clear-cut sites in northern, central, and southern Pennsylvania. The same seed source was used in all seedling treatments. Seedlings were protected from white-tailed deer browsing by 6-strand electric fences and competing vegetation was removed.

After three growing seasons, survival ranged from 94% to 92% at the northern and central plantings, where there were no obvious treatment differences, to below 70% at the southern site. At the southern site, treatment survival percentages ranged from a high of 97 for unclipped containerized stock to a low of 48 for one of the unclipped 1-0 stock treatments. The only discernable pattern in survival at this site was that, for 2-0 and 1-0 stock treatments, undercutting resulted in an average 19% survival advantage.

Germination of direct-seeded acorns was 90%, 63% and 20% for the northern, central, and southern sites, respectively. Pilferage of acorns by animals accounted for only a 3% loss at all three sites combined. Germination differences were most likely due to soil physical properties and weather.

Site means for total height were statistically different ($p<0.0001$) at 62, 86, and 134 cm for the southern, northern, and central plantings, respectively. There was a statistically significant site x treatment interaction, but 41% of this interaction is attributable to the uneven performance of just two treatments across sites. The direct-seeded and 2-1 unclipped treatments performed relatively better (compared to other treatments) in the shorter, southern plantation than in the central and northern plantations. With these exceptions, the treatment rankings indicated by the data below are generally representative of individual site results.

Considering all sites together, treatment differences in total height after three years in the field were highly significant ($p<0.0001$). Of all treatments, two-year-old containerized seedlings were the tallest at 151 cm (162 and 141 cm, unclipped and top-clipped, respectively). Of all remaining treatments, the 2-0 seedlings were tallest at 115 cm, and these were 62% taller than 1-0 seedlings. Transplanted seedlings (2-1 and 1-1) were smaller than non-transplanted 2-0 seedlings. Undercutting in nursery beds produced variable results: it

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[1]Research Assistant and Professors, School of Forest Resources, The Pennsylvania State University, University Park, PA.

improved the height of 2-0 seedlings by 10% (P=0.05) but reduced the height of 1-0 seedlings, though not significantly. Except for containerized stock, top-clipped seedlings were generally taller than unclipped seedlings, but none of the differences were statistically significant. Seedlings arising from from direct-seeded acorns were not significantly different in height from 1-0 planted seedlings.

In summary, transplanting in the nursery did not result in improved field performance after three years, and undercutting gave variable results. The containerized seedlings performed best overall but their growth advantage may have been more than offset by the added costs and efforts of production and planting. Among all other treatments, 2-0 bareroot seedlings (especially if undercut in the nursery) unquestionably produced the tallest seedlings and had good survival. In most comparisons, top-clipped seedlings performed slightly better than unclipped seedlings, and this treatment facilitates handling. Perhaps most surprisingly, direct-seeded plants were as tall as seedlings from 1-0 stock, suggesting the possibility of a considerable savings in the cost of artificial regeneration if acorn viability is good and predation is minimized.

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