Southern Forest Experiment Station

Research Note

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Description and Yields of an 11 -Year-Old Hardwood Stand on Sharkey Clay Soil

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SUMMARY

A hardwood stand on Sharkey clay soil, where dominant and codominant trees averaged 1.8 inches dbh and 18.4 feet tall, yielded 17.8 tons per acre (dry weight) at age 11.

Additional keywords: Green ash *(Fraxinus pennsylvanica),* American elm (*Ulmus americana),* sugarberry (*Celtis laevigata*), Nuttall oak (Quercus *nuttallii*), water hickory *(Carya aquatica*), roughleaf dogwood (*Cornus drummondii*), biomass.

INTRODUCTION

Biomass yields are unknown from young, even-aged hardwood stands on slackwater sites in the Midsouth. Although these sites are less productive than medium-textured soils, it would be desirable to know their potential contribution to the energy picture. This note presents yields of an 11 -year-old hardwood stand on Sharkey clay soil (figure 1) that developed following logging of the overstory, shearing of stumps and remaining stems, removal of debris with a dozer blade, and planting of Nuttall oak *(Quercus nuttallii* Palmer) acorns at 5- by 1 O-foot spacing. Five-foot wide, mowed swaths on IO-foot centers were maintained the first 5 years after clearing and reopened after the 10th and 11 th growing seasons. The stand is located on the Delta Experimental Forest, Washington County, Mississippi.

METHODS

All stems >1 .O foot in height were tallied on fifteen 5- by 30-foot measurement plots. The plots were parallel to the mowed strips. Data taken were species, total height, diameter at l-foot heights (dof), dbh for stems >4.5 feet tall, and tree crown class.

All trees in a plot were cut within 1 to 3 inches of the ground with a chainsaw and fed into a tree-limb chipper. Chips were caught in a woven nylon bag placed over the end of the discharge chute, weighed, and dumped into a graduated container to determine cubic volume. For each plot, a sample of chips was taken for moisture determination. Chips were dried in a kiln at 104°C until they reached a constant weight.

RESULTS AND DISCUSSION

Tree data, in number of stems and basal area per acre, and yields, in volume and weight, are based on the hardwood rows themselves. To obtain per acre values for the area as it exists with alternating mowed rows, one must divide the values in half.

A total of 20 species was found in the 15 plots. Four species-green ash (*Fraxinus pennsylvanica* Marsh.), American elm (*Ulmus americana* L.), sugarberry (*Celtis laevigata* Willd.), and Nuttall oak-made up 83 percent of the stems. The major species was green ash, with about a third of the total stems and a third of the basal area. Elm and sugarberry combined had about 40 percent of the stems but only a fifth of the basal area, while Nuttall oak had 14 percent of the stems and a fifth of the basal area.

Seventy-six percent of the stems were >4.5 feet tall with an average density of 10,551 per acre (range 4,937 to 16,843). Trees >1 .O foot tall (including trees >4.5 feet) averaged 13,900 stems per acre (range 5,518 to 20,618). Basal area (dbh) averaged 59.0 square feet per acre (range 39.0 to 91.4)

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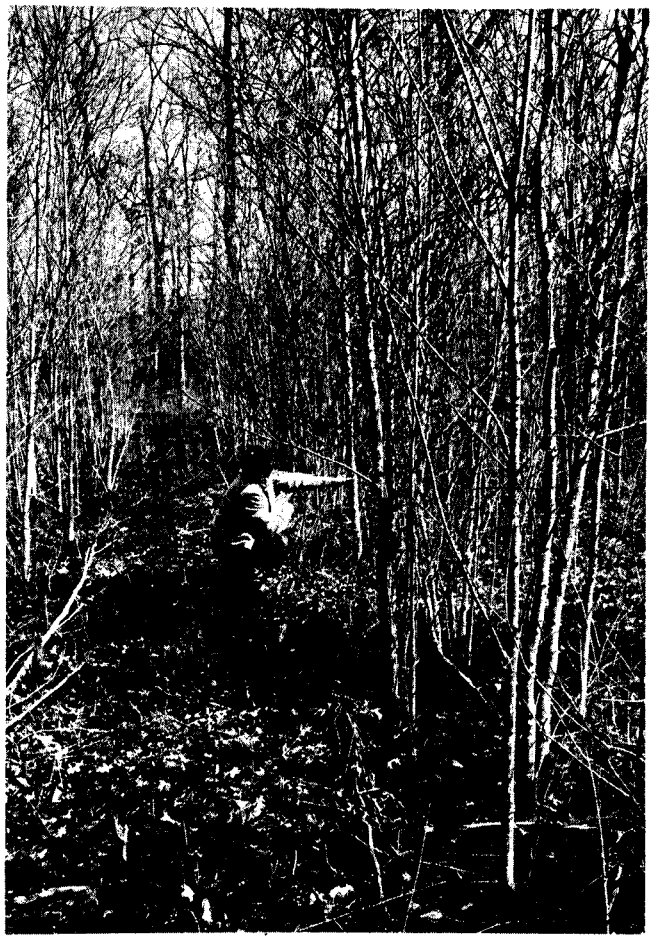

Figure 1 .-Eleven-year-old hardwood stand with 5-foot mowed strips prior to cuffing.

Maximum tree sizes were: dof-5.4 inches, sugarberry; dbh-4.4 inches, water hickory (*Carya aquatica* (Michx. f.) Nutt.); and height-29 feet, honeylocust (*Gleditsia triacanthos* L.). Only 581 trees per acre had dbh ≥2.0 inches and 2,575 trees per acre had dbh from 1 .O to 1 .9 inches. For all stems, 3.5 percent (484 per acre) were ≥20 feet in height, 14.5 percent (2,013 per acre) were 15 to 19 feet tall, and 23.5 percent (3,272 per acre) were 10 to 14 feet tall.

For stems >1 .O feet in height, 14 percent (1 ,917 per acre) were classified as dominant or codominant crown class, at age 11. Fourteen percent were tallied as intermediate and 72 percent suppressed. Of the dominant/codominant trees, 30 percent were ash (581 per acre), 28 percent Nuttall oak(503 per acre), 21 percent elm (407 per acre), 11 percent water hickory (213 per acre), 5 percent sugarberry (97 per acre), and 3 percent overcup oak (*Quercus lyrata* Walt.) (58 per acre). Other dominant/codominant species were honeylocust, red maple (*Acer rubrum* L.), and haw (*Crataegus* spp.). The average dominant/codominant stem was 1.8 inches dbh (range 0.7 to 4.4 inches), and 18.4 feet tall (range 11 to 29 feet). By species, average heights of dominant/codominant trees were: water hickory, 21 feet; sugarberry and ash, 20 feet; Nuttall oak and elm, 17 feet; and overcup oak, 16 feet.

Green chipped volume per acre averaged 3,073 cubic feet (range 1,379 to 5,009). Dry weight per acre averaged 35,635 pounds (range 21,990 to 58,309) or an average annual production of 1.62 tons per acre (range 1 .OO to 2.65).

Hitchcock (1979) reported 2-, 4-, and 6-year-old hardwood stands in Tennessee on oak-hickory sites (oak site index 70 at age 50) with net annual productions of 1.4, 1.1, and 1.4 dry tons per acre. This study was on an oak-gum-cypress site with Nuttall oak site index of 90 (Broadfoot 1976). Where only the measurement plots are considered, without the mowed swaths, yields appear similar. The influence of mowed swaths on tree development in this stand is not known, although it is unlikely that mowing affected stand growth significantly considering the species, age, and site represented. A continuous stand may have lower biomass production per unit area than indicated by present values due to greater competition.

Best estimator of plot volume and dry weight was plot Σ diameters*. In this study, where trees ≤4.5 feet accounted for 24 percent of the stems but only 1 percent of the Σ dof² and 0.2 percent of Σ dof²*h, dbh gave higher r^2 and lower $S_{y.x}$ values than dof. Predictive equations on an acre basis for yields at age 11 are as follows:

Chipped $ft^3 = -5196 + 220.5\ (BA) - 1.26\ (BA)^2$
$(R^2 = 0.98,\ S_{y.x} = 479\ ft^3\ (S_{y.x}/\bar{X})100 = 15.5\%)$

Tons dry wt = $-1.3768 + 0.3256\ (BA)$
$(r^2 = 0.95,\ S_{y.x} = 1.36$ t., $(S_{y.x}/\bar{X})100 = 7.6\%)$

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