EFFECT OF THINNING ON PARTITIONING OF ABOVEGROUND BIOMASS IN NATURALLY REGENERATED SHORTLEAF PINE (*PINUS ECHINATA* MILL.)

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INTRODUCTION

In traditional harvesting systems, yield of forest stands may increase if a greater proportion of net primary production is allocated to bole wood. However, for management related to whole-tree harvesting, carbon sequestration, biofuels, and wildland fire avoidance, assessments of biomass partitioning to all aboveground components is needed. Thinning increases bole growth of residual trees; it also affects the growth and partitioning of biomass to other stand components. Given the emphasis on new objectives and management strategies, it is necessary to understand how thinning and stocking density affect allocation of biomass in all the aboveground tree parts. The objectives of this study were, therefore, to quantify the biomass (in kg/ha) in aboveground tree components in shortleaf pine stands that were thinned to different stockings and compare the biomass proportions for the different aboveground tree components, i.e., bole wood, bole bark, foliage, and branch.

METHODS

The study site was located in the Ouachita Mountains in Pushmataha County in southeast OK, on industrial forest land owned by Plum Creek Timber Company. In 1990, Wittwer and others established a thinning study in dense previously unthinned naturally regenerated shortleaf pine stands. The stands were 30 to 37 years old with a basal area of 44 m^2/ha. Measured site index at base age 50 averaged 22.3 m (Wittwer and others 1998).

Nine 0.08-ha circular plots, each surrounded by a 10.1-m buffer strip, were established in the stands to serve as experimental units. These plots were assigned to two thinning treatments and an unthinned control in a randomized complete block experimental design. The two thinning treatments were 1) thinned to 70 percent of full stocking, and 2) thinned to 50 percent of full stocking. The plots assigned to the thinning treatments were thinned to the required densities using the low thinning method.

Biomass data were collected in January and February of 2006. Four trees, sampled across the diameter classes in a plot, were harvested from each of the nine experimental plots. Each felled tree was cut into logs of 2.13 m and weighed. A disc about 3-cm-hick was sampled from the upper end of each log and from the stump. Green and dry weight of wood and bark on each disk were determined. Dry weight-green weight ratios were used to estimate bole wood and bark dry weight of each sampled tree. The terminal leader and one branch randomly selected from every whorl of branches on the sample trees were harvested. Foliage was plucked from the harvested branches. Dry weights of branches and foliage on the sampled branches were determined. Regression equations based on branch basal diameter were used to estimate branch and foliage dry weights for the unsampled branches. Branch and foliage dry weight on each sample tree were obtained by summing up dry weights of individual branches on the sample trees.

Tree biomass equations, fitted by nonlinear seemingly unrelated regression, were used to estimate the dry weight of each tree component on each tree in each experimental plot. Tree level biomass estimates were summed up and converted to per hectare estimates.

The effect of the treatments was investigated by doing an analysis of variance and multiple comparisons of the treatment means by the Restricted Maximum Likelihood approach using the MIXED procedure in SAS/STAT® software, Version 9.1.3 (SAS Institute Inc. 2000-2004). The hypothesis of equality of the means was rejected at p-value ≤ 0.05 experiment-wise type I error rate.

RESULTS

Unthinned stands had more bole wood, bark, and foliage standing biomass but less branch standing biomass, per hectare, than the thinned stands. Total per hectare aboveground standing biomass was also higher in unthinned stands. However, no difference was observed in bole wood biomass and foliage biomass proportions among the three treatments. Bark biomass proportion was, however, significantly higher in unthinned controls with the proportion in the two thinning treatments being similar. The proportion in branches was significantly higher in the thinned to 50 percent treatment when compared to the proportion in the unthinned controls.

CONCLUSIONS

Thinning naturally regenerated shortleaf pine stands at the age of 30 to 37 years did not affect the proportion of biomass partitioned to stem or foliage. Thinning, however, increased partitioning of biomass to branches and decreased partitioning to bole bark. These results indicate that thinning 1) does not alter the relationship between total aboveground growth and bole wood production, 2) increases branch production which may be utilized in whole-tree harvesting systems and contribute to coarse woody fuels, and 3) does not alter the proportion of aboveground growth partitioned

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to leaf biomass, an important consideration for carbon and nutrient cycling and fine fuels.

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