EVALUATION OF ECOSYSTEM RESPONSE TO SILVICULTURAL TREATMENTS IN UPLAND HARDWOOD FORESTS IN NORTHERN MISSISSIPPI, USA

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PURPOSE AND SCOPE

Upland hardwood forests (UHF) of Mississippi are important habitat for wildlife and have significant ecological, economic, and cultural values. These forests are dominated by oak-hickory and mixed pine-hardwood forest types, with other species common to both open woodland and closed-canopy forest conditions. The regeneration of hardwood species, especially oaks, is necessary to maintain species diversity and the proper functioning of these forests. Historically, open forests were more dominant ecosystems but are now rare due to historical forest management and changes in disturbance regimes (Hanberry et al. 2020). Oak-dominated UHFs serve as food sources for small rodents, wild turkeys (*Meleagris gallopavo*), white-tailed deer (*Odocoileus virginianus*), ruffed grouse (*Bonasa umbellus*), and woodcock (*Scolopax* spp.). However, successfully regenerating oak in UHF in the region can be challenging. The overall objective of this study was to assess how various silvicultural treatments impact residual tree growth, seedling recruitment and diversity, and aboveground carbon storage in upland hardwood forests. The aim was that treatments promoting oak regeneration will enhance biodiversity and provide diverse ecosystem benefits.

METHODS AND APPROACH

The study was conducted at Spirit Hills Farm, a mixed upland hardwood forest in Tate County, MS. The forest was naturally regenerated with a diverse mix of hardwood and softwood species. We used a randomized block design with three silvicultural treatments: T1: hack and squirt + overstory removal to residual basal area of approximately 11 m^2/ha; T2: hack and squirt + overstory removal to residual basal area of approximately 7 m^2/ha (fig. 1); and T3: no treatment (control). Hack and squirt were used to remove all nonoak species <20 cm in diameter at breast height. We divided the study area into 12 variable-sized

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treatment units ranging from 5 to 10 ha with 4 replicates per treatment and 98 nested fixed-area plots to monitor ecosystem responses. Plots of 0.05 ha, 0.01 ha, and 0.0013 ha were established to measure trees of large (≥25 cm), medium (≥5 cm and <25 cm), and small diameters (<5 cm), respectively. The 0.0013-ha plots were located 4 m from the center of the 0.05-ha plot at a 180° angle. In these plots, tree species were inventoried, and total vegetation cover, biodiversity indices of woody species, and aboveground carbon were measured and quantified.

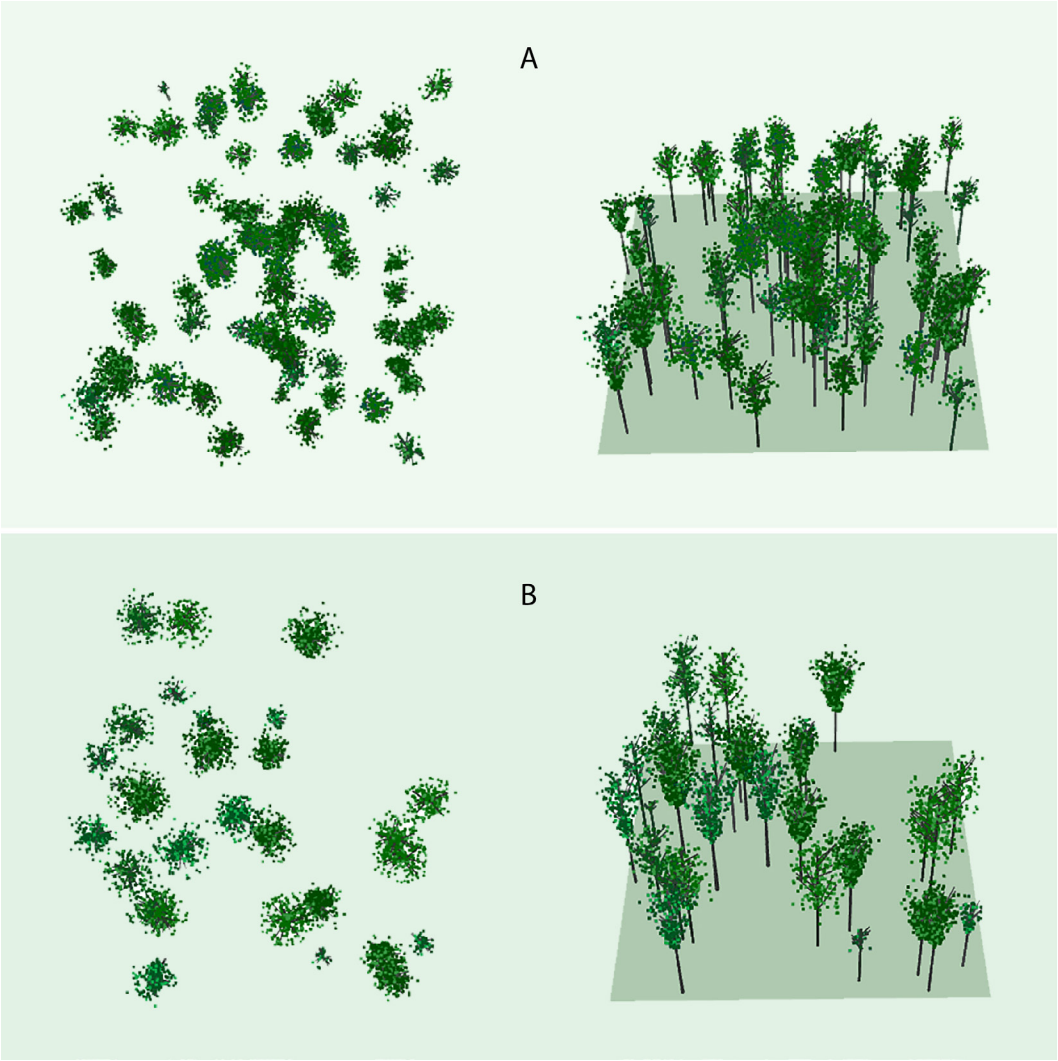

Figure 1—Overhead and perspective views of the overstory removal to the basal area of (A) approximately 11 m^2/ha and (B) approximately 7 m^2/ha.

FINDINGS AND IMPLICATIONS

The results of our study will inform the effectiveness of each treatment in promoting oak regeneration and enhance our understanding of how ecosystems respond to these treatments. Our study will contribute to forest management strategies that balance timber production with ecological restoration, thereby aiding the sustainable management of UHFs in the region. By addressing the challenge of oak regeneration, our study's outcomes could guide restoration and silviculture efforts in UHFs. The study will serve as a valuable demonstration site

for upland oak silviculture, facilitating outreach and educational efforts at both regional and national levels. The significance of oak species in upland hardwood forests, both for their commercial value and ecological benefits, underscores the importance of this research.

LITERATURE CITED

Hanberry, B.B.; Bragg, D.C.; Alexander, H. D. 2020. Open forest ecosystems: An excluded state. Forest Ecology and Management. 472: 118256. https://doi.org/10.1016/j.foreco.2020.118256.

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