

Impact of Fire History and Seed Depredation on Seedling Emergence of Four Southeastern Tree Species

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Across the southeast region of the U.S., decades of intentional fire exclusion have contributed to substantial decreases in cover of fire-dependent longleaf pine (*Pinus palustris*) forests, with consequent declines in biodiversity of associated flora and fauna, including endangered species such as the gopher tortoise (*Gopherus polyphemus*) and red-cockaded woodpecker (*Leucotopicus borealis*) (Jose et al. 2006). In response, there has been considerable research investigating factors that impact natural regeneration of longleaf pine, especially in fire-restored forests. However, one especially important, yet understudied, process that could impact longleaf regeneration relative to hardwood competitors is seed depredation. A seed is depredated if it is damaged and no longer viable or removed from the system by an animal. Thus, the objective of this research is to quantify how fire history and seed depredation impact early seedling emergence of longleaf pine seeds in comparison to three common competitors, tulip poplar (*Liriodendron tulipifera*), sweetgum (*Liquidambar styraciflua*), and blackgum (*Nyssa sylvatica*).

In January 2023, we deployed several types of predator exclosures, which differentially restrict access of vertebrate and invertebrate predators, at two study sites near Auburn, AL, USA: the Mary Olive-Thomas Demonstration Forest and the Tuskegee National Forest. Within each site, three stands with no burn history and three stands that are on two-year burn intervals were selected to study. Ten seeds were placed in petri dishes within each exclosure type: invertebrate only access, full access by small vertebrates, or complete exclosure (Figure 1). During each trial, the exclosures were monitored for

seed removal rates after two weeks. Three trials have been conducted in the months of February, March, and April 2023.



Fig. 1. Longleaf pine seeds placed in an exclosure that restricts vertebrate access and allows invertebrate access.

In February 2023 Trial 1, we observed no significant difference in depredation rate between tree species ($p = 0.3$). We also observed no significant difference in depredation rate between burned and unburned stands ($p = 0.4$) (Table 1).

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Table 1 The average number of seeds remaining after two week trial in February 2023 in burned and unburned stands

	Burn	Yes	No
Tree Species			
<i>blackgum</i>		9.28 (2.05)	9.82 (0.53)
<i>longleaf pine</i>		9.83 (0.71)	9.44 (2.12)
<i>sweetgum</i>		9.56 (0.92)	8.67 (2.66)
<i>tulip poplar</i>		9.83 (0.51)	9.72 (0.75)

Overall, the data collected from this research will alleviate a deficit in research on the early seedling establishment and seed depredation rates of four southeastern species in unburned and burned stands. Further awareness of the early life stages of longleaf pine in relation to competing hardwood species will aid forest managers in understanding the interacting influences of fire frequency and seed predators on community assembly.

Statement of Research Advisor

Payton contributed ideas to project experimental design, built seed predation exclosures, implemented seed predation field trials at Mary Olive Thomas Demonstration Forest, assisted with those at Tuskegee National Forest, and performed preliminary data entry and analysis. She did a great job with her research project!
-Heather D. Alexander, College of Forestry, Wildlife and Environment

References

- [1] Jose, S., Jokela, E. J., Miller, D. L., "The Longleaf Pine Ecosystem" (Chapter 2). Retrieved March 29, 2023, from https://doi.org/10.1007/978-0-387-30687-2_1 (2006)

Authors Biography



Payton Brewer is a senior-year student pursuing a B.S. degree in Wildlife Ecology and Management at Auburn University. She has played key roles in the research through implementing the experimental design at Mary Olive Thomas Demonstration Forest.



Dr. Heather D. Alexander is an associate professor of forest and fire ecology at Auburn University. She has served as the designated mentor and research facilitator for this study.



John L. Willis is a research forester at the Southern Research Station of the U.S. Forest Service. He served as an experimental designer and aided in the implantation of the study at Tuskegee National Forest.



Kathleen Gabler is an instructor and research technician at the College of Forestry, Wildlife and Environment at Auburn University. She has conducted three trials of this study at Tuskegee National Forest.