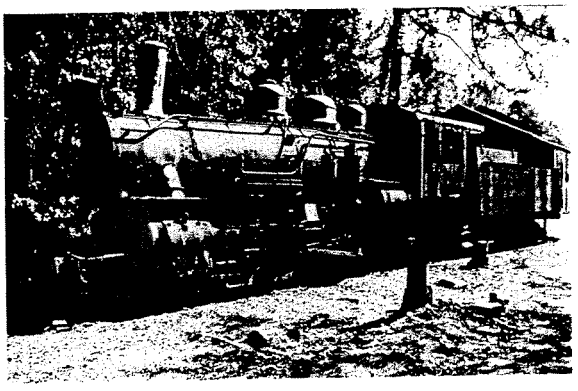
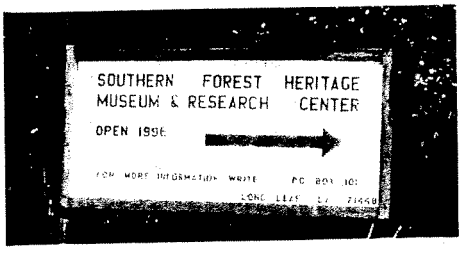
PROCEEDINGS of the Third Longleaf Alliance Regional Conference



FOREST FOR OUR FUTURE

Restoration and Management of Longleaf Pine Ecosystems: Silvicultural, Ecological, Social, Political and Economic Challenges



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EFFECTS OF 40 YEARS OF WINTER BURNING IN LONGLEAF PINE ON INSECTS AND OTHER ARTHROPODS

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ABSTRACT: Longleaf pine (Pinus palustris) once occupied 60-90 million acres but it is found on <3 million acres today. Much of the remaining longleaf habitat no longer contains the representative understory plant communities, so recent efforts are focusing on using fire to restore them. However, little is known about the long-term impacts of this strategy. A unique study on the Osceola national Forest in northern Florida allowed us to determine the long-term effects of winter prescribed burning applied at frequencies of 1, 2 or 4 years over a 40 year period on the abundance and diversity of insects and other arthropods. Plots burned annually had the lowest diversity while plots burned every 2 or 4 years were similar. All three treatments reduced arthropod diversity below that of unburned controls. Burning did not increase the number of rate species but arthropod community composition were affected. Over 100 species were affected by burning. Spiders as a group were the most severely affected but arthropods in 11 other orders were also impacted by winter burning. Some populations responded positively to burning while others were reduced. In many cases, 4 years was not enough time for arthropod populations reduced by burning to recover to the levels found on unburned controls. The results suggest that some areas should be left unburned to remain overall diversity on the landscape.

Longleaf pine, *Pinus palustris*, forests once occupied >24 million hectares in the southern United States. Today, <1.3 million hectares remain as small isolated parcels (Outcalt and Sheffield 1996). Of those, less than 1 million retain the longleaf pine/grassland association. Although most agree that increasing longleaf pine abundance in the landscape and restoration of existing degraded longleaf pine communities is a desirable goal, how to achieve that goal is unclear. Under natural conditions longleaf pine communities probably burned during the growing season and growing season fires are recommended for longleaf pine community maintenance and restoration (Frost 1990). However, burning large acreages during the growing season at recommended fire frequencies is difficult because the growing season provides fewer days when wind and fuel conditions are good and new Environmental Protection Agency restrictions on smoke and volatile emissions from prescribed burning may prevent significant increases in growing season burning. Therefore, dormant season prescribed burning is likely to remain an important management tool for longleaf pine communities. We took advantage of a unique long-term study on the Osceola National Forest (Baker Co., FL) where growing season burns were applied to longleaf pine stands over a 40 year period at frequencies of 1, 2, or 4 years. The study was replicated (N=6) and included unburned control plots. The study was conducted from November 1994 to October 1999.

We measured arthropod abundance with pitfall traps and termite abundance with wooden trap blocks. We also measured large woody debris volume, log decomposition and nitrogen content, and live and dead plant material on the plots. Logs were placed on the plots in November 1994 and sampled annually (1 log/year/plot) to measure decomposition rates (change in specific gravity) and changes in nitrogen content of the wood. Wooden blocks (5x10x25cm) were distributed over the plots (15/plot) and monitored every other month for termites over a two-year period.

We operated 8 pitfall traps/plot every other month throughout the study. Four pitfalls were located along 3 m long logs and 4 were along 3 m long metal drift fences. We did not see any interaction between arthropod use of logs and burn frequency so we combined the two types of traps for analyses of burn effects on arthropods.

The frequency of burning had no effect on the overall amount of large woody debris on the plots or the numbers of snags but it did affect the volume of logs. Plots burned annually or biennially had lower log volumes than plots burned quadrennially. The rate of log decomposition and the loss of nitrogen from wood was unaffected by burning frequency. Winter burning frequency also had no effect on termite abundance. These results suggest that winter burning has little effect on the wood decomposer community of longleaf forests but that winter burning does reduce large woody debris lying on the forest floor.

Burning altered the composition of the live and dead plant material on the forest floor. Total dead plant matter was almost 5 times higher on the unburned control plots than on the annually burned plots. Likewise, live plant biomass was over 4 times higher on the unburned plots. Annual winter burning caused nearly a 20-fold reduction in palmetto biomass and a 5 fold increase in grasses. Gallberry was unaffected.

We looked at over 163,000 arthropods from, 31 orders, 265 families, and 932 genera. We observed an overall increase in total arthropod abundance and biomass in burned plots compared to unburned ones but this was do to one very abundant millipede. Frequent winter burning reduced the diversity of ground-dwelling arthropods but did not affect overall richness or the number of rare genera (<5 caught/5years). Frequent burning reduced arthropod community similarity.

We classified each arthropod into one of four groups by feeding habits. Dormant season burning reduced predators compared to unburned controls. Detritus feeders increased in abundance with burning, herbivore numbers were the same on all treatments, and omnivores as a group were also relatively unaffected by dormant season burning.

A total of 86 different arthropods were affected by dormant season burning in some way. Frequent burning reduced the abundance of 41 genera and in many cases 4 years was not enough time for their populations to recover. Thirty-one genera increased with frequent burning and 14 genera exhibited a response to intermediate frequencies of burning.

These results are the first to show how burning over a long period of time affects arthropods. The slow recovery rate of so many species suggests that management oriented toward conservation of biodiversity in longleaf pine should include areas excluded from fire. Our plots were less than 1 ha but they apparently were large enough to provide a refuge for a number of species. In addition, the unburned plots were invaluable for research allowing us to detect effects on a number of species that otherwise would have gone unnoticed without them.

REFERENCES

Beach, V. 1993. An up & coming forest. South Carolina Wildlife. Jan/Feb: 44-49.

Frost, C. C. 1990. Natural diversity and status of longleaf pine communities. In: Forestry in the 1990's - a changing environment. Proc. Society of American Foresters Reg. Tech. Conf. Pinehurst, NC.

Outcalt, K. W., and R. M. Sheffield. 1996. The longleaf pine forest: trends and current conditions. U.S. Forest Service Resource Bull. SRS-RB-9.