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Vegetation Treatment Options and Management Objectives: A Case Study in Longleaf Pine

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INTRODUCTION

Fire has been a critical process in most southern ecosystems for thousands of years, with impacts on plant, animal, and human communities. In the absence of free-spreading fire that was the natural rule in the past, prescribed fire has been widely used throughout the region to maintain and/or restore forest, range, and even wetland communities. It is conducted for diverse and often complimentary objectives, such as reducing fuel loads and the risk of damaging wildfires, maintaining particular plant or animal species, improving forage and food sources for animals, and restoring whole ecosystems. Yet the use of prescribed fire is constrained in many locations by human development and risk aversion. For these reasons, management options other than fire may be necessary to achieve objectives. A critical step in evaluating and selecting vegetation treatment options is to understand how they affect a variety of ecosystem components. Unfortunately, most research into alternative treatment methods has looked at relatively few treatments and measured effects. To address this need in a southern ecosystem, a recent study in South Carolina assessed multiple vegetative treatment options and impacts within a 35-year-old longleaf pine plantation stand on a xeric sandhill site.

FUEL TREATMENTS

As part of his doctoral research at Clemson University, Brett Moule compared prescribed fire, herbicide application (hexazinone as Velpar ULW, 1.15 lb ai/ac), and mechanical mastication of midstory vegetation (with minimal soil disturbance) for their effects on understory species diversity, wiregrass presence and recruitment, survival of longleaf pine seedlings, litter depth, and gopher tortoise forage species. The study was conducted at the South Carolina Department of Natural Resources' Aiken Gopher Tortoise Heritage Preserve (AGTHP), where regular prescribed fire has been used to maintain the ecosystem. Variables were measured prior to the treatment in 2007 and for two or three growing seasons after treatments were applied in May 2008.

MANAGEMENT IMPLICATIONS

- Prescribed fire was the best option for increasing wiregrass cover.
- Herbicide was the best treatment for supporting longleaf pine seedling survival.
- Mechanical, herbicide, and prescribed fire had similar effects on maintaining herbaceous species diversity and gopher tortoise forage.

Similar to many sandhill sites with previous burns, the pretreatment vegetation included a highly diverse understory of grass and herbaceous species, a short and relatively open midstory dominated by oak species, and a cohort of small natural longleaf seedlings that established after a 2005 prescribed burn. By the end of the second growing season after treatment, initial reductions in herbaceous species diversity in the herbicide treatment had almost disappeared and returned to pretreatment levels. Herbaceous species diversity in the prescribed fire and mastication plots was actually slightly higher than pretreatment levels. At the end of the second growing season, total herbaceous species counts were similar for the burn, herbicide, and mastication treatments, respectively. Finally, the midstory oaks and shrubs were greatly reduced by all treatments, but had resprouted in the prescribed fire and mastication treatments within two years (Figure 1).

As in many longleaf pine forests, wiregrass was a significant component of the herbaceous layer. Moule looked at treatment effects on both wiregrass cover and litter depth, in order to assess the potential recruitment of new wiregrass plants into the herbaceous layer. Although both herbicide and mastication treatments initially reduced wiregrass cover, wiregrass nearly returned to pretreatment levels in both treatments by the end of the second growing season. In the prescribed fire treatment, wiregrass cover

Figure 1. Post-mastication 35-year old longleaf pine plantation with pre-treatment midstory stature visible in background.

was slightly higher than pretreatment at the end of the second season. Wiregrass seedling recruitment was similar among the herbicide and mechanical mastication treatments; a small side study did show that raking litter after the mechanical treatment could substantially increase wiregrass germinants.

In significant contrast to the similarities among treatments in species diversity and wiregrass cover, only 2% of the small longleaf seedlings that were present in 2007 survived one year after prescribed burning, compared to 42% survival after mastication and 81% after the herbicide treatment. Thus, if recruitment of new longleaf stems is an important objective, herbicide application and mastication (above the litter and seedling layer) may be better options than prescribed fire.

Finally, Moule evaluated treatment impacts on herbaceous layer species that are listed by Ashton and Ashton (2008) as medium, high, or very high forage value for gopher tortoises (the focal species for management at the AGTHP). There was no change observed in the occurrence of these key species two years after the prescribed fire treatment, while a slight reduction was observed following mastication, and a significant reduction observed following the herbicide treatment. However, despite the decrease from pretreatment levels in the herbicide plots, the total number of forage species counts were actually similar across all treatments at the end of the second year. These results suggest that both herbicide and mastication may be valuable treatments for maintaining understory grasses critical for gopher tortoise diets.

SUMMARY

For plant diversity, results were fairly similar among treatments. The most notable difference was the very low survival of longleaf pine seedlings in the prescribed burn sites compared to high survival in the herbicide treatments. In sites where fuel treatments are intended to meet multiple vegetative and wildlife oriented objectives, Moule concluded that prescribed fire would often be the preferred treatment option. However when prescribed fire may not be possible, Moule suggests: "*...the broadcast application of granular hexazinone at a relatively low rate and above ground mechanical mastication treatments ... may be used to sustain the diversity of the herbaceous understory vegetation, promote natural longleaf pine seedling regeneration, and remove competing hardwoods from the midstory*." In conclusion, these results are comparable to a number of other research studies that have evaluated just one or two of the treatments and outcome variables.

REFERENCES

Ashton, R. E. & Ashton, P. S. (2008). *The Natural History and Management of the Gopher Tortoise: Gopherus polyphemus (Daudin)*. Malabar, FL: Krieger Publishing Co.

Moule, B. (2013). Comparing mechanical mastication, herbicide application, and prescribed fire within an established longleaf pine (*Pinus palustris Mill.*) ecosystem. Clemson University TigerPrints All dissertations. Paper 1156. 237 p.

Selected results of treatments	Rx	Mx	H
Herb. species (#) pre-treatment	62	67	75
Herb. species (#) 2 yr. post	64	69	68
Wiregrass cover (%) pre-treatment	5	3	5
Wiregrass cover (%) 2 yr. post	8	3	5
LLP Seedling survival (%) 1 yr. post	2	42	81
LLP Seedling survival (%) 2 yr. post	3	33	67
Grass species (#) 2 yr. post	10	12	13
Tortoise forage species (#) 2 yr. post	404	428	406

Table 1. Select experimental treatment results where: "Rx" is prescribed fire, "Mx" is mechanical treatment, and "H" is Velpar ULW granular herbicide. Values reported represent total counts (#) and percent (%) survival or cover before treatment (pre-treatment) and one and two years following treatment (post).

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