RESEARCH BRIEF

Effects of Oak-hickory Woodland Restoration Treatments on Native Groundcover and the Invasive Grass, *Microstegium vimineum*

J. Stephen Brewer, Matthew J. Abbott and Sean A. Moyer

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In this study, combined treatments of forest thinning and biennial low-intensity prescribed fire were applied to a mesic forest in the south-central United States to achieve oak-hickory woodland conditions. Portions of the study area had previous agricultural land use and some contained dense patches of Japanese stiltgrass (*Microstegium vimineum)*, an invasive grass from Asia which has spread through forests within much of the eastern U.S.

Woodland community restoration goals are compromised if treatments intended to foster native groundcover instead encourage the spread of aggressive non-native plants and/or ruderals (plants that readily move into disturbed soil). Thus, the focus of this study was to understand treatment effects on the density and spread of native woodland groundcover, rare forest plants, ruderals, and Japanese stiltgrass.

MANAGEMENT IMPLICATIONS

- Restoration treatments (prescribed fire and forest thinning) increased abundance and richness of native groundcover in undisturbed sites that contained remnants of woodland plant communities.
- Treatments did not successfully revitalize native groundcover in former agricultural sites or in areas containing large populations of invasive Japanese stiltgrass.
- Sites lacking Japanese stiltgrass should be given priority for ecological restoration.

The study site was located at the Strawberry Plains Audubon Center in north-central Mississippi, a 1,000-ha bird sanctuary characterized by gently rolling loess plains. At the study's beginning in 2003, the site consisted of mature closed-canopy forests growing on mesic silt and sandy loam soils. No fires had occurred at the site for an extended period.

*Yellow hairy sunflowers (*Helianthus hirsutus*) are among the native plants that responded positively to forest thinning and prescribed fire at the study site. (Photo: Stephen Brewer)*

Researchers designated two one-hectare treatment units, each with an adjoining control unit of equal size. Prescribed burns were conducted in treated plots every other year, usually in March or April. Thinning treatments consisted of girdling and herbicide application to about half the overstory trees, resulting in canopy densities more typical of the early 1800s.

Priority was given to retain tree species known to be historically present, such as post oak, black oak, and blackjack oak. Species targeted for removal were those historically absent or uncommon, such as blackgum, sweetgum, winged elm, black cherry, and red maple. White oak, southern red oak, and mockernut hickory were targeted for partial removal to approximate historic densities.

Vegetation measurements were made to determine pre- to post-treatment effects on native groundcover richness and abundance. Researchers measured the response of patches of stiltgrass to treatment, including the response of

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Effects of woodland restoration on native groundcover

native vegetation embedded within these patches. Measurements were made each fall and spring for both stiltgrass and native vegetation and changes in abundance were analyzed.

Prior to treatment, groundcover species richness and density were similar in control plots and treated plots. Following treatment, the treated plots showed increases in both of these measures, but each of the plant categories responded differently to the treatments.

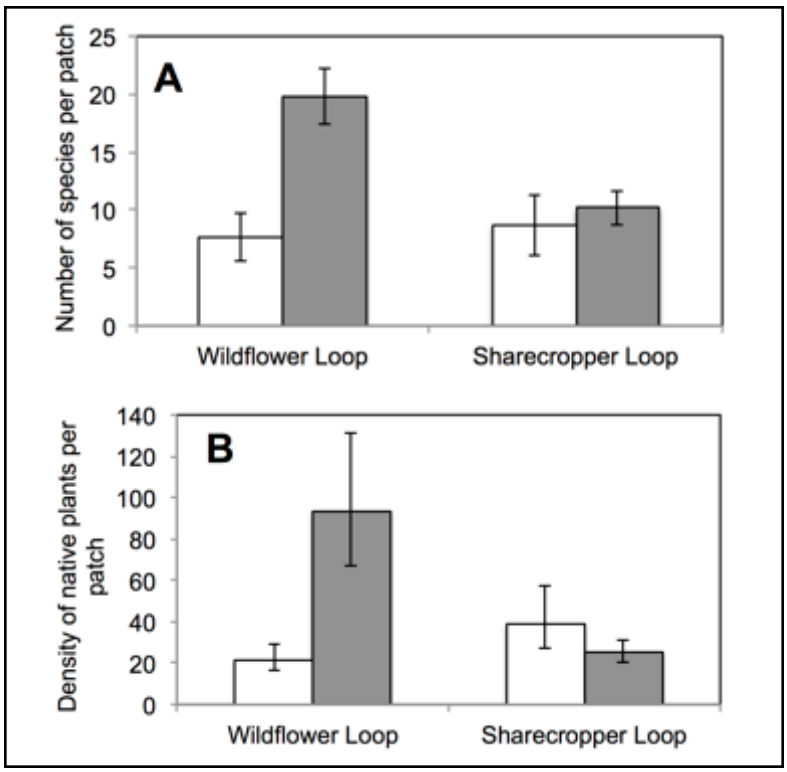
Consistent with previous research, **woodland indicator species** generally responded with significant increases in species richness and density. Many woodland species are fire-adapted perennials with deep taproots, below-ground buds, and/or the ability to spread through rhizomes. A number of these species were present prior to treatments, though sparse and shade suppressed. Among the open-habitat species that responded well to the treatments were Ozark sunflower (*Helianthus silphioides*), panic grasses, and several native legumes.

Forest indicator species did not decrease following the fires, contrary to researchers' expectations. Rather, they subtly increased, possibly because some of these plants are commonly found in both open woodlands and closed-canopy forests.

Most **ruderal species** did not increase significantly. One ruderal in particular, Japanese honeysuckle (*Lonicera japonica*), which previously dominated the groundcover, did not react positively to treatment. However, two native ruderals, broomsedge (*Andropogon virginicus*) and little bluestem (*Schizachyrium scoparium*), responded positively. The latter is considered desirable because it provides wildlife cover and forage, as well as fuel to carry fire.

Invasive Japanese stiltgrass, also a ruderal, is the exception to the trend. After treatment, the number and density of stiltgrass patches increased in burn units, especially in the unit with a history of agricultural disturbance. Native species richness decreased within patches of stiltgrass in both treated areas and control areas. In previous studies (see Flory 2010, and Emery et al. 2013), stiltgrass had been shown to hinder woodland restoration. Stiltgrass can grow in the shade, suppressing native groundcover and seedling trees, yet also responds well to canopy disturbance and prescribed fire. Study authors warn of the potential for prescribed fire to encourage the spread of stiltgrass, therefore threatening native groundcover community restoration goals. Thus, they recommend that land managers give low priority to restoring woodlands with a heavy stiltgrass component, instead focusing on sites with higher probability of success.

In summary, the authors found that under certain conditions, selective thinning and prescribed fire were effective and practical methods for long-term restoration of diverse plant species in oak-hickory woodlands. Prescribed burning had a beneficial effect when the following conditions applied: previous conditions favored fire-tolerant species rather than fire-sensitive species; fire exclusion had not eliminated fire-tolerant species; current-era degradation was primarily caused by fire exclusion rather than agricultural disturbance; and the site did not contain a significant stiltgrass component.



A) Species richness and B) density of native groundcover species within Microstegium *patches in treated and control plots at each site. Values are patch mean leverage residuals averaged over initial and final censuses and corrected for site and treatment effects and the site x treatment interaction. Filled bars correspond to treated plots, open bars to control plots. Error bars are +/- 1 standard error.*

FOR FURTHER READING

Emery, S.M., S.L. Flory, K. Clay, J.R. Robb and B. Winters. 2013. Demographic responses of the invasive annual grass *Microstegium vimineum* to prescribed fires and herbicide. *Forest Ecology and Management.* 308:207-213.

Flory, S.L. 2010. Management of *Microstegium vimineum* invasions and recovery of resident plant communities. *Restoration Ecology* 18:103-112.

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