RESEARCH BRIEF

Reversing legacy effects in the understory of an oak-dominated forest

Thomas-Van Gundy, M., J. Rentch, M. B. Adams, and W. P. Carson. 2014.
Reversing legacy effects in the understory of an oak-dominated forest.
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MANAGEMENT IMPLICATIONS

- Fire treatments reduced understory maple abundance and importance
- Browse control may be necessary to promote oaks with fire or canopy removal treatments
- Multiple fire treatments may be necessary to increase oak abundance and importance

In this study, the authors evaluate how different disturbance processes (surface fire, canopy gaps, browsing) and their interactions affect forest regeneration at two mixed mesophytic hardwood forest sites in the western Allegheny Mountains of West Virginia: the Fernow Experimental Forest (FEF) and the Monongahela National Forest (MNF). Here, as is the case in many areas of the central hardwood forest region, oak-dominated overstories are being succeeded by tree species that are browse/shade-tolerant and fire-intolerant. Compared to historical conditions, these second growth forests contain increased deer densities, reduced fire frequencies, denser forest canopies, and smaller canopy gaps. These legacy effects are all frequently attributed as causes of low levels of advanced oak regeneration.

In this study, the authors evaluate treatment effects (prescribed fire, browsing exclusion fences, and mechanically-created canopy gaps) and their interactions on seedling and sapling demographics.

Four study plots were installed; two at FEF, two at MNF. Half of each main plot was burned once, and within these treatments, subplots were randomly assigned to fenced, gap, fence + canopy gap, or control. Canopy gaps (average size ~250 m^2) were created by girdling overstory trees and injecting them with an herbicide, prescribed fires were strip head fires, and browsing exclusion fences were two meters tall.

The researchers found that, independent of the presence of canopy gaps or browsing exclusion fences, fire significantly reduced the importance values and relative abundance of red maple seedlings, sugar maple seedlings and striped maple seedlings and saplings. Similarly, independent of canopy gaps or fire, browsing decreased the relative abundance of sugar maple and red maple seedlings. Canopy gaps led to an increase in maple seedling abundance and maple sapling importance. Yellow poplar, considered fire-sensitive though well suited to colonize after a disturbance, increased in abundance and importance after a single prescribed fire.

Photo by Steve Horsley

The authors found that excluding browsers like deer (right of fence) in combination with creating canopy gaps increased the relative frequency, density, and dominance of oak seedlings in the western Allegheny mountains of West Virginia.

Oak seedlings showed the greatest increase in importance values in areas with canopy gaps and browse exclusion, independent of fire (see figure on next page). No combination of treatments contributed to increased relative abundance of oaks. Previous studies have shown that one fire is typically not sufficient to reverse

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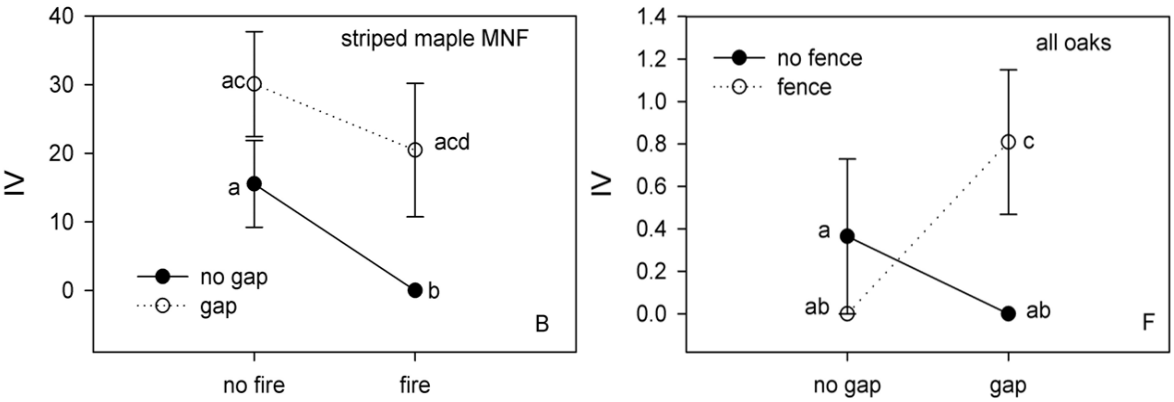
decades of effects of fire suppression, and that multiple fire treatments may be necessary to increase oak abundance and importance (see Alexander et al. 2008 and Iverson et al. 2008).

The authors emphasize the importance of considering species regeneration strategies when determining management plans. For example, oaks rely on a bud bank (seedling sprouts resulting from dieback and resprouting and stump sprouts), as opposed to yellow-poplar which rely on a seed bank that can be viable for up to 4 to 7 years (see Johnson and Shifley 2009, Dey et al. 2010, and Heggenstaller et al. 2012).



Significant (α = 0.05) two-way interactions for mean sapling importance values (IV) for striped maple and oaks. Note that fire lowered striped maple importance to zero, and that browse control fencing increased oak importance.

FOR FURTHER READING

Alexander, H. et al., 2008. Survival and growth of upland oak and co-occurring competitor seedlings following single repeated prescribed fires. Forest Ecology and Management. 256(5):1021-1030.

Dey, D. et al., 2010. An ecologically based approach to oak silviculture: a synthesis of 50 years of oak ecosystem research in North America. Revista Colombia Forestal. 13(2):200-222.

Heggenstaller, DJ, et al. 2012. How much older are Appalachian oaks below-ground than above-ground? Northern Journal of Applied Forestry. 29(3):131-146.

Iverson, L. R. et al. 2008. Thinning, fire, and oak regeneration across a heterogeneous landscape in the eastern U.S.: 7-year results. Forest Ecology Management. 255: 3035–3050.

Johnson, P.S. and S.R. Shifley, 2009. The Ecology and Silviculture of Oaks, 2nd ed. Wallingford, UK: CABI Publishing.

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