OVERSTORY AND SEEDLING RESPONSE TO REPEATED FIRES IN EASTERN KENTUCKY

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Background

- Oak regeneration failure has been documented throughout eastern deciduous forests.
- Increase in shade-tolerant, fire-intolerant species like red maple is occurring.
- Historical link between charcoal and oak pollen abundance suggests potential for use of prescribed fire as a management tool to benefit oak regeneration.

Objective

To test ability of repeated prescribed fires to increase oak seedling growth and survival by:

- increasing light at the forest floor
- decreasing competitor seedling survival
- enhancing leaf characteristics believed to promote oak seedling growth

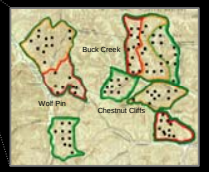
Black oak

Northern red oak

Chestnut oak

Study Design

Morehead District
Daniel Boone National Forest, Kentucky



- Three study sites
- Three treatments per site
- 8-12 plots per treatment

Unburned
Burned 1x (Spring '03)
Burned 2x (Spring '03, '04)

Sampling

Annual summer sampling since 2002 (pre-burn)

- Measure DBH and count understory (2-9.9 cm), midstory (10-19.9 cm) and overstory (> 20 cm) trees

Stand structure

- Quantify canopy cover as a proxy for understory light using hemispherical photography

Understory light

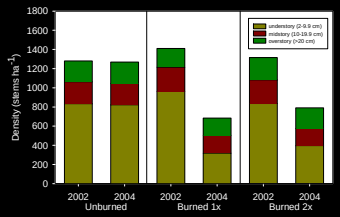
- Assess survival and growth of permanently tagged seedlings

Seedling survival and growth

- Measure seedling leaf number, leaf area, specific leaf mass, and nutrient content

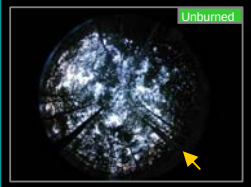
Seedling leaf characteristics

Stand Structure

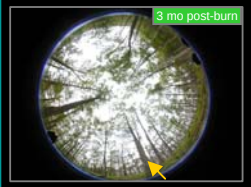


- Burning reduced understory stem density.
- Burning had no effect on mid- and overstory stem density, as expected.

Understory Light



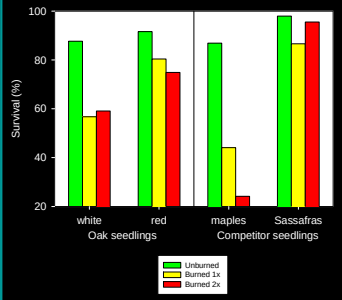
- Pre-burn canopy cover was near 90% on most plots.



- Burning temporarily reduced canopy cover to ~70%.

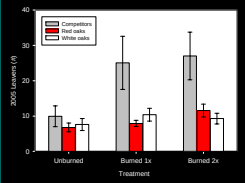
- Post-fire sprouting rapidly cancelled this positive effect.

Seedling Survival

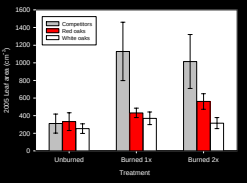


- Burning decreased white oak seedling survival but had no effect on red oaks.
- Among competitor seedlings, *Sassafras* was unaffected, but maple (red + sugar maple) survival decreased.

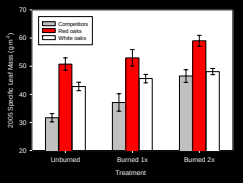
Seedling Leaf Characteristics



- Competitor seedlings that survived fire grew more leaves than oaks.



- These seedlings also had greater leaf area.



- Burning increased oak and competitor seedling specific leaf mass.

Conclusions

- Burning temporarily opened up the canopy, but post-fire basal sprouting rapidly cancelled this positive effect.
- Burning did not affect red oak survival, but white oak survival decreased slightly.
- Among competitor seedlings, burning had no effect on sassafras survival, but maples had the greatest mortality.
- Competitor seedlings that survived the fire grew more leaves and had higher leaf area than oaks.
- Burned red oaks had thicker leaves, but whether this leads to increased growth is still unknown.
- **Multiple, repeated fires with short burn intervals may be needed to maintain canopy cover and understory competition at levels needed to successfully regenerate oaks. Alternatively, fire alone may not be an effective tool for promoting successful regeneration and release of oak stems.**

Special Thanks to…

Joint Fire Science Program

Daniel Boone National Forest

Southern Research Station