PRESCRIBED FIRES AFFECT SEEDLING ESTABLISHMENT AND SURVIVAL IN A CENTRAL APPALACHIAN FOREST

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Introduction

A lack of oak recruitment, coupled with increasing abundance of fire-intolerant species (e.g. red maple), threatens the maintenance of upland oak forests in the central and southern Appalachians. Prescribed fire is considered a potential tool to facilitate oak recruitment by reducing fire-intolerant competitors, preparing the seedbed for acorn establishment, and increasing the vigor and growth of top-killed seedlings and saplings. This poster presents two separate studies investigating tree seedling recruitment and establishment of oak seedlings after a mast crop.

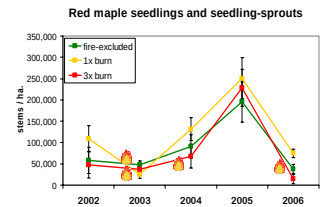
Experimental Design

3 Treatments: Fire-excluded, 1x burn (2003), 3x burn (2003, 2004, 2006)
each treatment replicated 3 times

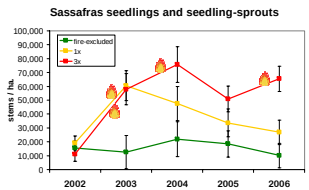
8 - 12 plots per site/treatment combination for a total of 93 plots

How does fire frequency affect seedling recruitment?

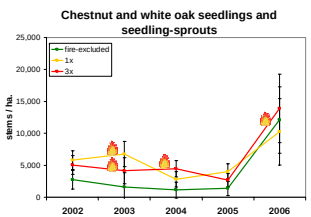
New seedlings in 2002 were identified; for each year thereafter we tallied the seedlings alive from the previous year(s) + new seedlings and seedling-sprouts found in each year. (flame icons denote fires)



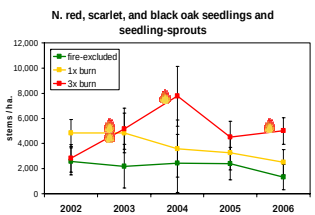
Similar densities of red maple seedlings across all treatments suggest that red maple seedling densities are more influenced by available seed than fire treatments.



Sassafras responds positively to fire, as seen by an increase in density in years with fire treatments.



Fire treatments had little effect on recruitment of chestnut and white oak seedlings.



Seedlings in the red oak group seem to respond more positively to fire than seedlings in the white oak group.

Yellow poplar

Yellow-poplar seedling densities sharply increased in 1x & 3x treatments after the first fire compared to fire-excluded; yet, in 2006 densities have returned to approximate pre-treatment levels.

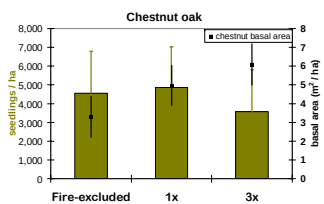
Methods:

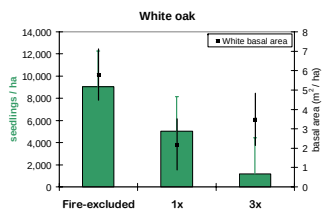
- Two 1-m^2 sub-plots within each main plot
- New seedlings and seedling-sprouts identified annually in July
- Each summer the same area is sampled

How do acorn mast crops respond to different fire treatments?

A bumper acorn crop in the Fall of 2005 from white and chestnut oak trees presented a unique opportunity to study the effects of different fire treatments on a new cohort of seedlings establishing in 2006. We sampled the established oak seedlings in May of 2006 and mortality of the same seedlings in August 2006.

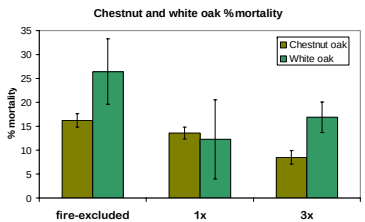
Is oak seedling establishment related to basal area?





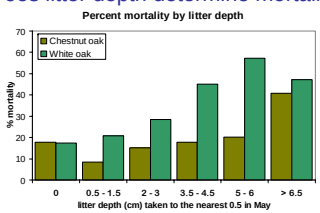
Oak seedling establishment is positively correlated with basal area of potential mast trees, except in sites burned after acorns were on the ground. In 3x burned sites, burned in April 2006, oak seedlings established in lower numbers compared to 1x and fire-excluded; chestnut oak acorns may withstand heating better than white oak acorns.

Is mortality of mast-crop seedlings affected by fire treatments?



Percent mortality was lower in fire treatments after the seedlings' first growing season, due in part to lower litter depth.

Does litter depth determine mortality?



Seedlings had better survival when they established in minimal litter. This effect is most pronounced for white oak.

Shoot elongation ~ 3 wks. post-burn (chestnut oak in 3x with minimal litter)

Chestnut oak in May

Methods:

- 2 belt transects (20m x 1m) per plot
- Identified all new oak seedlings by locating acorn cotyledons
- Affixed a unique tag number for tracking
- Measurements made on individual seedlings (e.g. litter depth)

FYI: 3,492 new oak seedlings identified in May 2006

White	53.32%
Chestnut	45.62%
Northern red	0.77%
Black	0.22%

Upcoming 2007 field season…

We will measure each alive oak seedling's: root-collar diameter, height, new growth, and percent canopy closure.

2007 Hypotheses:

Oak seedlings in 3x burn treatment will have better growth and survival b/c:

- less litter at time of establishment
- less competition
- more available light

Acknowledgements: