

**TITLE:** Effects of prescribed fire on oak pests and invasive plant species

**LOCATION:** Ozark Highlands of Missouri

**DURATION:** Year one of two year project **FUNDING SOURCE:** Fire Plan

**PROJECT LEADER:** Rose-Marie Muzika, Department of Forestry, University of Missouri, 573-882-8835, [muzika@missouri.edu](mailto:muzika@missouri.edu)

**COOPERATORS:** Keith Grabner, US Geological Survey, Columbia, MO 65211

**PROJECT OBJECTIVES:**

Examine the ecological effects of using prescribed fire as a tool to restore oak-dominated communities in decline.

Specifically, we will determine the relationship between fire and two oak pests: acorn weevil and red oak borer

We also we examine the role fire has on reduction or enhancement of invasion by non-indigenous plants.

**JUSTIFICATION:**

This project addresses the evaluation monitoring criteria related to the biological impacts and political importance of fire and the significance in terms of geographic scale. This project will contribute to the National Fire plan, particularly with regard to further understanding the key points of hazardous fuel reduction and rehabilitation.

**DESCRIPTION:**

**a. Background**

In the Ozarks of the lower Midwest, oak decline has caused the loss of a key economic and ecological resource. Widespread mortality and loss of vigor has accelerated within the past 4-5 years, although there have been steady evidence of dieback and decline for at least 20 years. Many red oaks in the Ozarks have been stressed by cumulative droughts, red oak borers (*Enaphalodes rufulus*), and *Armillaria* root disease. The mortality contributes substantially to fuel accumulation in a forest in which decades of fire suppression have realigned ecological processes. General management needs for the oak-dominated Ozark forest are twofold: reduction of fuels and rehabilitation of the forest ecosystem. Fire has not heretofore been widely used in a comprehensive management scheme. The contribution of potentially hazardous fuel by the continual decline of oaks poses significant threat for wildfire, as well as an impediment to restoration. Furthermore, restoring oak dominated forests to the historic mix of oaks and pine necessitates intervention. Within the need for active restoration and rehabilitation of this forest resource, the inclusion of prescribed fire and an understanding of the consequences of managing with fire, represent critical links.

**b. Methods**

This study will evaluate the effects of using fire as a management tool, specifically focusing on the dynamics of non-native, invasive plants and two insect pests that may play important, albeit poorly understood, roles in long term sustainability of oak-dominated forests: the red oak borer and oak weevil(s).

We intend to use existing projects that represent a chronosequence of fire management in Ozark forests. The studies have also incorporated landscape position and topographic characteristics so to examine potential effects of these site characteristics. Studies using

prescribed burning and a variable burning regime have been in place in the southeast Missouri Ozarks for at least 10 years.

A fuel management demonstration site, funded by the joint fire science program, is located on the Clearwater Conservation Area and the Logan Creek Conservation, managed by the Missouri Department of Conservation. Existing overstory and understory vegetation plots provide data describing the initial response of the effects of burning. The other two sites, Chilton Creek and the Sinkin Experimental forest, are managed by the Nature Conservancy and USDA North Central Experiment Station, respectively. All three sites have instituted study areas where a portion of the landscape has been managed using fire with the emphasis on restoration, not monitoring. Attributes of the prescribed burns have been extensively documented for all studies. We intend to superimpose projects on the existing studies looking at the biotic and forest health effects of using fire a management tool.

Ten factor prisms will be used to establish variable radius plots and determine living and dead basal area in the study sites. Vigor of all trees falling within the plots will be determined. Within each variable radius plot, we will establish a fixed area understory/ ground flora plot to develop a species list of native and exotic plants and the coverage by species. We will generate a comprehensive list of invasive plants and determine if there is an association with prescribed burning.

The red oak borer has been associated with oak decline in the Ozarks. Low vigor trees tend to have the highest proportion of red oak borer. It will be important to assess how management influences vigor of the overstory and consequently the abundance of red oak borer. We will quantify red oak borer abundance using intercept traps during year of emergence and using visual estimation of randomly selected overstory trees, to evaluate bark eruptions and emergence holes. Emergence holes, intercept traps and tree assessments represent three different sampling approaches for red oak borer. None of these approaches are very time intensive, therefore, the combination provides a thorough means to monitor an relatively unknown beetle.

For sampling acorn weevils we will use pyramidal emergence traps and also evaluate acorns for damage. It is uncertain which weevil species we are likely to encounter, but we expect Asiatic oak weevil, *Cyrtopistomus castaneus* as well as common *Curculio* species.

### **c. Products**

This research will result in management guidelines for restoring and sustaining current oak-dominated forests. The guidelines will include specific recommendations for prescribed fires and may include harvest prescriptions. By examining the influence of multi-year burning, varying interval and frequencies it will be possible to finely tune the recommendations. The recommendations will be based on the effects of using prescribed fire on: tree vigor, ground flora richness and diversity, invasion potential of exotic plants, effects on oak weevils and red oak borer. The frequency and timing and seasonality of using prescribed fire can be addressed. This project will extend existing multi-year projects and as such will be a benefit to be understanding changes in the forests.

Weevil studies have not been conducted in oak forests of the Ozarks, and weevils may be detrimental to oak regeneration. This project will provide data describing the life history, phenology, habitat and ecological characteristics of weevils in the Ozarks.

Furthermore, this data will provide a further insight into the role of red oak borer in the Ozarks, a wood boring beetle whose epidemic activity seems to be related to low vigor oaks associated with certain topographic positions. .

This project will reveal trends in invasion by non-native plants, an important issue for maintaining and rehabilitating ecosystems.

A thesis will be completed integrating the novel approaches to evaluating forest health and management in Ozark forests.

#### d. Schedule of Activities

Spring 2005	Prescribed burning on selected forests
Spring – Summer 2005	red oak borer and weevil sampling
Late Summer - Fall 2005	vegetation sampling
Spring 2006	Prescribed burning on selected forests
Spring – Summer 2006	red oak borer and weevil sampling
Late Summer - Fall 2006	vegetation sampling
December 2006	analysis, completion of project

#### e. Progress / Accomplishments

The proposed project is a new request; however, the proposed project builds upon previously funded work evaluating oak decline and fire history in the Ozarks. The project also uses study areas of existing projects across State, Federal, and non-governmental organizations.

#### COSTS:

	Item	Requested FHM EM funding	Other Sources Funding	Source
<b>YEAR1</b>				
Administration	Salary	15,569		
	Overhead			
	Travel	2,500	1,000	USGS
			1,000	Univ of MO
Procurements	Contracting Equipment Supplies	1,500		
<b>YEAR 1 TOTAL</b>		<b>19,569</b>		
<b>YEAR2</b>				
Administration	Salary	16,052		
	Overhead			
	Travel	2,500	1,000	USGS
			1,000	Univ of MO
Procurements	Contracting Equipment Supplies	500		
<b>YEAR 2 TOTAL</b>		<b>19,052</b>		
<b>TOTAL</b>		<b>38,621</b>		