

Integrating Fuel and Forest Management: Developing Prescriptions for the Central Hardwoods Region



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Introduction:

Vegetation and fuel structure and composition have changed since European settlement, due to altered disturbance regimes and timber management. Generally, historic Ozark forest conditions were described by early explorers as open forests, thinly scattered trees, and rich in grasses and wildflowers. Comparing current and historic Ozark forest conditions four general differences are noted: 1) Tree density has increased. 2) A midstory and shrub layer has developed. 3) Shortleaf pine densities have decreased. 4) The ground cover has changed from predominantly grasses and forbs to leaf litter and shade tolerant forbs. We are initiating a study to quantitatively evaluate the effects of prescribed fire, with and without partial overstory removal, on fuel reduction, fire behavior, and vegetation with in the Missouri Ozarks. The project will facilitate the evaluation and development of fuel reduction methods for the Ozarks and the effects of those methods on fuel, fire behavior, ground flora, and understory and overstory woody plants.

Study Objectives:

- Determine changes in fuel loading and structure in thinned and unthinned oak-hickory and oak-pine stands following prescribed fire.
- Analyze the effects of fuel reduction treatments on ground flora, understory, and overstory vegetation.
- Evaluate the differences in prescribed fire behavior between fuel reduction treatments.
- Compare cost effectiveness and efficacy of the four fuel reduction treatments.

Methods

- 3 study sites are located in the Black River Hills Landtype Association.
- The study design is a split-plot design.
- The treatment variables include fire (2 levels) and timber harvests (2 levels), applied on 3 aspect classes (3 levels). All combinations of these treatments will be installed on each of three blocks (Figure 1).
- Treatments: Each block will contain 4 fuel management treatments each treatment will be installed on a Ridge, Protected Aspect (315o-45o), and Exposed Aspect (135o-225o):
 - Control – no timber harvesting or prescribed fire
 - Prescribed fire – no timber harvesting only prescribed fire (spring)
 - Thinning only – timber harvesting (reduce stocking to 60 ft²/acre) no prescribed fire
 - Thinning and prescribed fire - timber harvesting (reduce stocking to 60 ft²/acre) and prescribed fire (spring)



Ground Flora Sampling



Randomizing Plot Location



Subplot Layout

Figure 1. Location of study sites and arrangement of treatments.



Table 1a. Top 5 woody species by cover.

Site 1		Site 2		Site 3	
North		North		North	
Acer rubrum	Red maple	Acer rubrum	Red maple	Acer rubrum	Red maple
Myrica sylvatica	Black gum	Comus florida	Flowering dogwood	Myrica sylvatica	Black gum
Comus florida	Flowering dogwood	Sassafras albidum	Sassafras	Carya texana	Black hickory
Carya tomentosa	Mockernut hickory	Quercus alba	White oak	Sassafras albidum	Sassafras
Sassafras albidum	Sassafras	Quercus coccinea	Scarlet oak	Corylus americana	American hazelnut
Ridge		Ridge		Ridge	
Sassafras albidum	Sassafras	Quercus alba	White oak	Sassafras albidum	Sassafras
Comus florida	Flowering dogwood	Quercus velutina	Black oak	Corylus americana	American hazelnut
Acer rubrum	Red maple	Carya texana	Black hickory	Carya texana	Black hickory
Despyros virginiana	Common persimmon	Myrica sylvatica	Black gum	Quercus alba	White oak
Quercus alba	White oak	Sassafras albidum	Sassafras	Rhamnus caroliniana	Carolina buckthorn
South		South		South	
Sassafras albidum	Sassafras	Sassafras albidum	Sassafras	Comus florida	Flowering dogwood
Acer rubrum	Red maple	Quercus alba	White oak	Sassafras albidum	Sassafras
Myrica sylvatica	Black gum	Myrica sylvatica	Black gum	Myrica sylvatica	Black gum
Quercus velutina	Black oak	Acer rubrum	Red maple	Quercus velutina	Black oak
Carya tomentosa	Mockernut hickory	Quercus velutina	Black oak	Quercus alba	White oak

Table 1a. Top 5 ground flora by cover.

Site 1		Site 2		Site 3	
North		North		North	
Desmodium nudiflorum	Bare-stemmed tick trefoil	Desmodium nudiflorum	Bare-stemmed tick trefoil	Desmodium nudiflorum	Bare-stemmed tick trefoil
Acer rubrum	Red maple	Acer rubrum	Red maple	Acer rubrum	Red maple
Parthenocissus quinquefolia	Virginia creeper	Parthenocissus quinquefolia	Virginia creeper	Parthenocissus quinquefolia	Virginia creeper
Myrica sylvatica	Black gum	Sassafras albidum	Sassafras	Myrica sylvatica	Black gum
Comus florida	Flowering dogwood	Quercus alba	White oak	Carya texana	Black hickory
Ridge		Ridge		Ridge	
Desmodium nudiflorum	Bare-stemmed tick trefoil	Quercus alba	White oak	Parthenocissus quinquefolia	Virginia creeper
Parthenocissus quinquefolia	Virginia creeper	Quercus velutina	Black oak	Sassafras albidum	Sassafras
Rhus radicans	Poison ivy	Carya texana	Black hickory	Corylus americana	American hazelnut
Sassafras albidum	Sassafras	Myrica sylvatica	Black gum	Carya texana	Black hickory
Comus florida	Flowering dogwood	Desmodium nudiflorum	Bare-stemmed tick trefoil	Desmodium nudiflorum	Bare-stemmed tick trefoil
South		South		South	
Sassafras albidum	Sassafras	Vaccinium vacillans	Lowbush blueberry	Comus florida	Flowering dogwood
Desmodium nudiflorum	Bare-stemmed tick trefoil	Sassafras albidum	Sassafras	Desmodium nudiflorum	Bare-stemmed tick trefoil
Acer rubrum	Red maple	Quercus alba	White oak	Sassafras albidum	Sassafras
Parthenocissus quinquefolia	Virginia creeper	Myrica sylvatica	Black gum	Vaccinium vacillans	Lowbush blueberry
Myrica sylvatica	Black gum	Acer rubrum	Red maple	Myrica sylvatica	Black gum

Fuel Data Collection

- Fuel collected using transect intercept method (Figure 3)
- Fuel transect located at 12 understory and 3 overstory plots
- Fuel data collected by fuel size class
 - 0 - 0.24 in.
 - 0.25 - 0.99 in.
 - 1.00 - 2.99 in.
 - > 3.0 in.
- Litter, duff, and fuel height measured every 5 ft along transect
- Litter and herbaceous fuel loading estimated from clip plots

Fire Behavior Data to be Collected

- Rate-of-Spread
- Flame length
- Fuel consumed
- % area burned
- Fireline intensity

Tasks to be completed:

- Timber harvest: Spring 2002
- Post harvest fuel sample: Spring 2002
- Post harvest vegetation sample: Summer 2002
- Pre-prescribed fire fuel sample: Winter 2002
- Prescribed fire treatment: Spring 2003
- Post-fire vegetation sample: Summer 2003
- Pre-prescribed fire fuel sample: Winter 2003
- Prescribed fire treatment: Spring 2004
- Post-fire vegetation sample: Summer 2004

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Vegetation Sampling (Figure 2):

- Plots randomly located off a 40 x 40 m sampling grid installed at each site.
- 15- 1/500th acre understory subplots
- 3 – 1/5th acre overstory plots
 - 8 – 1/500th acre subplots will be located within the overstory plot
- Ground flora will be measured using 1 m² quadrates at each 1/500th acre subplot

Vegetation Definitions and Data Collected

- Understory: stems dbh <1.5 cm. Stems identified to species and tallied by height
- Overstory: stems dbh > 1.5 cm. Stems identified to species and dbh measured
- Ground flora: vegetation less than 1 m tall. Identified to species and % cover estimated (Table 1a and 1b).

Figure 2. Plot layout

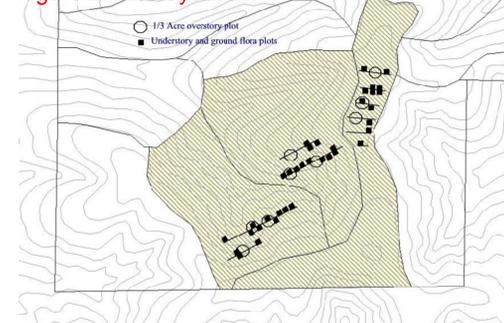


Figure 3. Fuel Sampling Transect

