

# Tallgrass Prairie and Oak Savanna Fire Science Consortium

A JFSP KNOWLEDGE EXCHANGE CONSORTIUM



**2015 Midwest Fire Conference  
Feb. 17-19, 2015, Dubuque, Iowa**

<http://www.tposfirescience.org/mwfire15-overview/>

## **Special Track: Fire in Oak-Dominated Systems**

### **Presentations at a Glance:**

#### **Oral Presentations**

- 1) Plenary: Pauline Drobney, Prairie and Savanna Zone Biologist, USFWS
- 2) The Silviculture of Oak Woodland Restoration
- 3) Fire Effects and Fuel Moisture Monitoring: The importance of using monitoring and data collection to solve unknowns in grassland and forest ecosystems.
- 4) Oak woodland restoration using annual prescribed fire and understory thinning – Indian Cave State Park, Nebraska
- 5) Where Fire Isn't Enough: Developing Strategies for Restoration of Dry-mesic Oak Hickory Woodland Communities Using Five Canopy Thinning Regimes
- 6) Using Fire, Mechanical Tree Removal, and Selective Herbicide to Tease Out Remnant Vegetation From Exotic Competition in North Missouri
- 7) Restoring and Managing Oak Savannas in Northwest Iowa's Prairie Pothole Region and Associated River Valleys
- 8) Oak Savanna Management: A Case Study at Pine Island State Wildlife Area

#### **Discussion and Synthesis**

Oak Roundtable—Identifying Priorities for Information Sharing and Research Needs for Fire and Oak Systems

#### **Concluding Workshop**

Taking Steps to Thin the Thicket of Unknowns—Accelerating Learning Through a Fire and Oak Working Group for the Upper Midwest

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## Abstracts and Authors

**Tuesday, Feb. 17**

### *The Silviculture of Oak Woodland Restoration*

Daniel C. Dey<sup>1</sup>, Callie J. Schweitzer<sup>2</sup>, John M. Kabrick<sup>1</sup>

<sup>1</sup>U.S. Forest Service, Northern Research Station

<sup>2</sup>U.S. Forest Service, Southern Research Station

Oak woodlands are characterized by open understories and dense ground flora comprised of forbs, grasses and sedges. They once were common in the western Central Hardwood Region and prairie-forest transition zone where low intensity fires occurred frequently. In the absence of fire, many of the woodland ecosystems throughout much of the Midwest have succeeded to compositions and structures resembling those of mesophytic forests. Consequently, there is increasing interest by forest managers to restore the structure and composition of oak woodlands by thinning and applying prescribed fires. Despite the increasing interest, there are few guidelines based on silvicultural principles for restoring and managing woodland ecosystems. Lacking are (1) structural and stand density targets based upon historic reference conditions, (2) thresholds for quantifying canopy openness or closure linked to stocking equations and measures of available sunlight, and (3) guidelines for maintaining fire-free periods for ensuring regeneration and recruitment for sustaining trees in woodland ecosystems and for producing merchantable timber. Many silvicultural concepts, principles, and methods for managing forests can also be used for managing woodlands. However, the application and timing of treatments may differ to meet the objectives of woodland management. We offer guidelines for restoring and managing oak woodlands based on research findings and long-standing silvicultural principles.

*Fire Effects and Fuel Moisture Monitoring: The importance of using monitoring and data collection to solve unknowns in grassland and forest ecosystems.*

Lindsey Barney<sup>1</sup>, Emily Hohman<sup>2</sup>

<sup>1</sup>Iowa Department of Natural Resources - District Forester

<sup>2</sup>The Nature Conservancy – Broken Kettle Grasslands – Western Iowa Land Steward

Are the fire and forest management treatments we are implementing effective – or doing more harm than good? Observational and plot-based ecological monitoring can help us quantify what is happening before and after thinning and fire treatments. Fuel

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moisture monitoring can help land managers make better prescribed fire implementation decisions and help them reach their management objectives. We will discuss fire effects monitoring, fuel moisture monitoring, plot monitoring protocols, fire effects software, and the applicability of this data collection to unanswered questions in the Loess Hills oak woodlands of Western Iowa.

*Oak woodland restoration using annual prescribed fire and understory thinning – Indian Cave State Park, Nebraska*

Krista Lang<sup>1</sup>

<sup>1</sup>Northern Prairies Land Trust – Woodland Ecologist

Annual dormant season prescribed fires are being used at Indian Cave State Park in southeast Nebraska to restore oak woodland. Decades without fire have allowed the forest to become overgrown with shade-tolerant tree species. Our primary goal in the restoration is to increase sunlight to the forest floor for oak regeneration, but also to promote plant diversity, improve wildlife habitat, and reduce invasive plants. Several years of annual fire is necessary to kill resprouting trees and shrubs in the understory. We have also used understory thinning (chemical injection method) to speed up opening the woodland. After six consecutive years, we are starting to see sunlight increasing and dramatic vegetation changes. Invasive plant populations are also beginning to decrease due to fire and other control efforts. Oak seedlings are beginning to establish, and the patchy nature of woodland burns should allow some of these seedlings to reach sapling size even with our annual fire regime.

*Where Fire Isn't Enough: Developing Strategies for Restoration of Dry-mesic Oak Hickory Woodland Communities Using Five Canopy Thinning Regimes*

Debbie Maurer <sup>1</sup>, Robert Fahey <sup>2</sup>

<sup>1</sup> Lake County Forest Preserve District

<sup>2</sup> Morton Arboretum, rfahey@mortonarb.org

Oak (*Quercus* sp.) woodlands are of significant ecological and cultural value in Lake County Illinois and within the much broader prairie peninsula region; however, changes in the canopy structure due in part to suppression of fire and historic human landuse have resulted in a lack of native shrubs, little to no oak regeneration and an understory sapling layer that is transitioning to more shade tolerant, mesic species. Even with 20

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years of deer management, reintroduction of low-intensity fire, and removal of invasive woody species, these communities are showing few signs of recovery.

Current understanding of oak regeneration suggests that light is a limiting factor in many historically oak-dominated systems. Where absence of fire has allowed these systems to develop a closed canopy, reintroduction of prescribed surface fire alone has not lead to the restoration of more open canopy conditions. Management that emulates mixed-severity fire regimes through a combination of gap creation, canopy thinning, and prescribed surface fire is likely to be most successful at maintaining canopy structure, promoting oak regeneration and restoring the shrub, herbaceous and wildlife assemblages characteristic of historic woodland communities. The Lake County Forest Preserve District in partnership with the Morton Arboretum is implementing a science-based, adaptive restoration plan integrating five overstory thinning regimes across three sites and 175 acres in suburban Illinois nature preserves to restore oak woodland communities. This presentation will provide an overview of the thinning strategies, monitoring protocol, public outreach and lessons learned during the initial implementation of on-the-ground implementation of tree removal.

### **Wednesday, Feb. 18**

*Using Fire, Mechanical Tree Removal, and Selective Herbicide to Tease Out Remnant Vegetation From Exotic Competition in North Missouri*

John Murphy<sup>1</sup>

<sup>1</sup> Private Land Conservationist, Missouri Department of Conservation.

In the past 20 years, land managers in Northern Missouri have been discovering rich, native plant communities. Often, these floristic gems are hidden, suppressed by 1) exotic vegetation, 2) woody plant encroachment, or 3) a past land management regime that suppresses expression of native plant communities. Existing in these altered states, native habitats can be difficult to identify, and equally challenging to restore. In the past 10 years, some of these landscapes that hold good potential for native restoration have been identified as priority geographies for state and federal agencies, as well as partnering NGOs. Within these focus areas, efforts on private land to restore native prairies and savannas by using a combination of prescribed fire, mechanical tree removal, and selective herbicides have been met with phenomenal botanical results. I will discuss landowner case studies and relay anecdotal information on successes, failures, and techniques in combining fire, saws, and herbicide on native grasslands.

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*Restoring and Managing Oak Savannas in Northwest Iowa's Prairie Pothole Region and Associated River Valleys*

Bryan Hellyer<sup>1</sup>, Lucas Straw<sup>1</sup>

<sup>1</sup> Iowa DNR, Prairie Lakes Wildlife Unit

Oak savannas in Northwest Iowa are typically found in moderately fire protected areas of the prairie pothole region and associated large river systems. Over grazing, fire suppression, invasive species, and timber harvest have been highly detrimental to this habitat type in the area. The loss of natural processes that maintain savanna directly corresponds to lower and less diverse wildlife populations, a decrease in native herbaceous cover, increased soil erosion, larger invasive species populations, and decreased public use potential. We will be discussing two savanna restoration projects currently ongoing within the Prairie Lakes Wildlife Unit of the Iowa DNR; one along the Little Sioux River and the other on the leeward side of the Ingham-High Lake Wildlife Complex. Techniques including undesirable tree removal, brush management through mechanical and chemical means, invasive species control, and prescribed fire have been used to return sunlight to the system and restore the native savanna flora and fauna.

*Oak Savanna Management: A Case Study at Pine Island State Wildlife Area*

Sara Kehrl<sup>1</sup>

<sup>1</sup> Wisconsin DNR

A tornado hit the Pine Island State Wildlife Area in 2006, prompting much timber clean up and paving the way for multiple oak stand conversions to savanna units. I will discuss different oak savanna units at Pine Island State Wildlife Area and the various states of management and unit 'maturity'. Some of the management units have had no mechanical disturbance and others have gone through active timber management intended to restore oak savanna. Various techniques of fire management, herbicide use, and interseeding will be discussed.

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## **Wednesday afternoon**

*Oak Roundtable—Identifying Priorities for Information Sharing and Research Needs for Fire and Oak Systems (Discussion and Synthesis)*

Tricia G. Knoot<sup>1</sup>, Craig Maier<sup>2</sup>, Ann Calhoun<sup>3</sup>

<sup>1</sup>Wisconsin DNR

<sup>2</sup>Tallgrass Prairie and Oak Savanna Fire Science Consortium

<sup>3</sup>The Nature Conservancy, Wisconsin Chapter

This facilitated roundtable discussion session is organized to provide an opportunity for researchers, land managers, foresters and private landowners to share their thoughts on information needs and research needs limiting restoration of oak-dominated systems. In addition, the roundtable format was chosen to support networking and exchange among participants.

The information we collect will be used:

- 1) to inform the consortium's future education and outreach activities, and
- 2) to inform researchers, agencies, and other partners involved in funding or conducting research in the region.

A summary of results will be published on the consortium's website and will be utilized by the Fire and Oak Working Group.

To reduce group size, the session will be conducted twice on Wednesday afternoon. See the final conference program for times.

## **Thursday, Feb. 19**

*Concluding Workshop: Taking Steps to Thin the Thicket of Unknowns—Accelerating Learning Through a Fire and Oak Working Group for the Upper Midwest*

Craig Maier<sup>1</sup>

<sup>1</sup>Tallgrass Prairie and Oak Savanna Fire Science Consortium

We anticipate that the Fire and Oak Track at this conference will result in sharing knowledge and strengthening connections among stakeholders, but these are just the first steps. The consortium has committed resources to organizing field events and other activities focused on key sites and topics identified via Wednesday's Oak Roundtable session and other scoping activities.

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Working groups provide a useful model for developing networks to bridge information and research gaps. The concluding workshop to the fire and oak track is an opportunity to recruit a core group of people whose goals and activities align with the objective of developing collaborative, action-oriented network.

## **Other talks relevant to fire in oak-dominated systems**

*Pre-Conference Workshop: Native oaks for native places: planting and protecting ecotype oaks in savannas and woodland remnants.*

Note - Tuesday Feb. 17, 8:30-11:30 a.m., separate registration required (\$40 fee)

Presenter: Jack Phillips

Description: Native oaks make significant contributions to the stability of savannas and woodlands, but recruitment is often low and many established populations are in decline. Without protection and enhanced regeneration, oak communities and the larger ecosystems in which they live will continue to decline and disappear. Good stewardship of savannas and woodlands includes strategies to support native oaks (and other native trees) where they naturally grow and historically have grown.

Methods and Objectives: This will be a workshop in a true sense: together we will develop strategies for ecotype native oak sapling establishment (seed collecting, germination, planting, and early care) and for protecting existing oaks. Strategies will be based on root/soil ecology, phenology, and tree physiology. Learning methods will include rhizosphere studies with dissection and microscopy on live samples. Enrollment will be kept small to facilitate active learning.

Presenter: Jack Phillips is a naturalist and registered consulting arborist with New Tree School and teaches on the faculty of Arboriculture Canada Training and Education. He teaches and consults throughout North America and partners with Hitchcock Nature Center in Iowa's Loess Hills on stewardship education and plant community monitoring. He is a regular contributor to *Prairie Fire Newspaper: the Progressive Voice of the Great Plains* and is author of *The Bur Oak Manifesto* published by Prairie Fire Press.

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*Fire histories and 60 years of change in Wisconsin savannas plant communities*

Laura M. Ladwig<sup>1</sup>, Ellen I. Damschen<sup>1</sup>, and David A. Rogers<sup>2</sup>

<sup>1</sup>University of Wisconsin – Madison

<sup>2</sup>University of Wisconsin – Parkside

Fire plays a critical role in savanna maintenance and changes in fire patterns can have large influences on plant communities. We are resurveying savannas that were originally surveyed in the 1950s to examine the connection between recent fire histories and changes in the plant community. From 1951 to 1954, the Plant Ecology Laboratory at the University of Wisconsin – Madison surveyed ~40 savanna plant communities across central and southern Wisconsin. In the summer of 2014, half of the sites were resurveyed and the remainder of the sites will be visited in summer 2015. At each site, understory and canopy plant communities were surveyed following the same methods used for the 1950s surveys. Information about land use and fire histories during the past 60 years is currently being gathered from landowners. Results thus far indicate considerable change within the savanna communities. Canopy density has increased at most sites and the number of tree species present has also increased. The herbaceous understory also changed and most of the prairie species present in the 1950s are gone and replaced by species typical of local forest understories. Additionally, many woody species, including problematic invasive species, have moved into the understory. Fire frequency was very low or absent over the past 60 years. Current management varies between sites, and ranges from active cutting and burning, canopy thinning, grazing, or no management. In the absence, or near absence, of fire over the past 60 years many sites now resemble closed canopy forests.

*Fire suppression and intensive deer browsing changes forest tree species composition and abundance*

Roger C. Anderson<sup>1</sup>

<sup>1</sup>Illinois State University

During the past two centuries, fire suppression resulted in Midwest woodlands on mesic upland sites transitioning from dominance by fire-resistant, shade-intolerant oak and hickory species to dominance by fire-sensitive, shade-tolerant mesophytes. I studied changes in tree species composition and diversity in one of these upland forests over 34 years. The 13 ha study site currently supports a closed canopy, sugar maple dominated forest. However, in 1977 scattered large (120-180 cm dbh) living and dead open-grown

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burr oaks provided evidence of an open historic forest. Government Land Office records (1820) indicate oaks dominated the historic vegetation with a combined Importance Value (IV) of 43.2, (all species combined IV = 100). Historic tree density was 28 trees/ha compared to current densities of 318 trees/ha. In 1977, American elm dominated the forest (IV = 29), but due to Dutch elm disease it experienced a rapid decline (IV = 1.6) by 1984, and sugar maple (IV = 46) was the dominant tree. In the past 10-15 years, white-tailed deer browsing diminished seedlings of most tree species, except paw paw, which deer rarely browse. Aerial deer counts made during the 2007-2008 winter yielded a density of 75 deer km<sup>-2</sup>. Current trajectory of canopy tree recruitment suggests that development of a dense paw paw understory will restrict canopy tree recruitment and diversity. Returning vegetation to historic conditions requires: (1) sugar maple thinning, (2) reducing paw paw seedlings and saplings, (3) decreasing deer density to 7-10 km<sup>-2</sup> or less, and (4) implementing a prescribed fire regime.

### *Ecological Site Factors across the Prairie-Forest Continuum*

Kyle Steele<sup>1</sup>, John Kabrick<sup>2</sup>

<sup>1</sup>USDA Natural Resources Conservation Service, Soil Science Division

<sup>2</sup>USDA Forest Service, Northern Research Station

A variety of environmental factors operating at multiple scales determined the extent to which prairie and forest ecosystems portrayed themselves historically. These factors can be applied to the modern day landscape and can be used as a basis for ecosystem restoration and management. We will introduce both landscape and site level factors that drove the historic range of plant communities across the prairie-forest border regions of the Midwestern U.S., with a particular focus on soil and plant community relationships and how they might be applied to prairie, savanna, and woodland restoration

### *Setting Priorities – Management Implications in Canopy and Ground-Layer Interactions from Woodland to Prairie*

John B. Taft<sup>1</sup>

<sup>1</sup>Illinois Natural History Survey, Prairie Research Institute, University of Illinois

Woody encroachment is a significant threat in native grassland, savanna, and woodland habitats that most managers face. Establishing management priorities can be informed

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by signals of restoration potential available from monitoring data utilizing a nested sample design. Expectations in the tallgrass prairie region are that losses of ground layer and functional group diversity follow woody encroachment due to insufficient compensation from shade-tolerant species. The Species and Functional Group Attrition models provide a generalized framework for examining restoration potential following woody encroachment. This study examines interactions between overstory and ground layer from woodland to prairie. The attrition pattern is suggested as a signal of restoration potential because it provides an indication that shade-intolerant species are present, albeit responding negatively to increasing encroachment. This is in contrast to a null regression model where primarily only species indifferent to increasing shade levels remain. Ordered patterns of plant functional groups related to levels of woody encroachment provide evidence of species groups most sensitive to encroachment and which to consider including in habitat augmentation in restoration efforts.

*More bitter than sweet: the effects of prescribed burning on the spread of Oriental bittersweet (Celastrus orbiculatus) at the University of Wisconsin-Madison Arboretum*  
Timothy R. Kuhman<sup>1</sup>

<sup>1</sup>Edgewood College

Prescribed burning is sometimes used as an effective management tool to control woody invasive plants in grasslands, savannas, and oak woodlands. However, relatively little is known about the effects of burning on the non-native invasive liana, *Celastrus orbiculatus*. The invasiveness of *C. orbiculatus* is undoubtedly related in part to its prolific root suckering and its dense crops of fruit, which remain on the vines throughout the winter and are bird dispersed. Though seed rain can be heavy, seed viability drops significantly after the first growing season, leaving a “seedling bank” but negligible seed bank. Several studies were conducted in an oak savannah/woodland in Madison, Wisconsin to determine how burning affects the spread of *C. orbiculatus*. In one study, mature vines were cut a year prior to burning to minimize post-fire seed rain, and the effects of burning on smaller vines and seedling recruitment were tracked over two seasons following the spring 2012 burn. Results suggest that prescribed burning might not be an effective control method for *C. orbiculatus*, at least not in areas where fires are patchy and low-intensity. Neither percent cover of *C. orbiculatus* nor the number of established stems was significantly reduced in burned plots. Seedling recruitment following the burn was greatly reduced across all plots, apparently related to the abnormally dry conditions rather than any effect of the cutting or burning treatments. In a separate experiment, fruits and seeds of *C. orbiculatus* vines were

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collected from traps every two weeks from December 2012 to August 2013 to determine rates and timing of fruit/seed fall. Seeds from each collection date were planted to determine their viability. Results showed that fruits/seeds continued falling well into the spring and summer months and viability remained high regardless of fruit/seed fall timing, suggesting that a spring burn would not be very effective at limiting recruitment of new *C. orbiculatus* seedlings.

*Increasing Ecological Resilience in Southern Indiana Forests As Adaptation for Future Climate Regimes*

Chad Bladow<sup>1</sup> and John Shuey<sup>1</sup>.

<sup>1</sup>Indiana Chapter, The Nature Conservancy.

Future climates are expected to have very significant effects on forest habitats in southern Indiana. Prolonged late summer drought-stress, when precipitation is expected to be at its minimum and temperatures at their highest, will likely have the greatest effect on mesic tree species currently dominating the regeneration of dry/mesic forests. Ironically, on-going management of ecological processes (fire suppression) over several decades has increased the mesic nature of southern Indiana forests, further increasing their vulnerability to future climate regimes. Adapting dry/mesic forests in southern Indiana is intended to increase ecological resilience of “mesophied” forests by reducing the dominance of mesic trees within the forest understory in favor of trees more resilient to prolonged droughts. This project addresses the following climate adaptation goals for our work in southern Indiana forests: (1) implement on the ground forest management improving the ecological resilience of dry-mesic forests on 350 acres for climate change; (2) advance discussions with regional partners who are managers of public and private lands about managing forests in light of predicted climate changes in the region; and (3) provide demonstration sites with baseline data from which progress toward development of ecological resilience can be tracked. A smaller pilot project began in 2007 on a nature preserve in Brown County, Indiana. After just five years, the results from forest management already show a shift towards trees more resilient to predicted future climates. Continued long-term monitoring will drive future management decisions and discussions with forest managers.

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