

Considerations for Re-opening Remnant Ecosystems and Managing with Fire



Theo Witsell, Southeastern Grasslands Institute





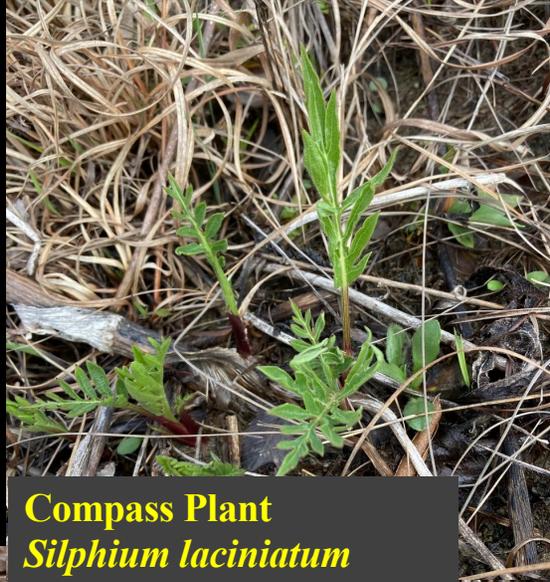
Disturbance and the Range of Historical Variation

What disturbance regimes created and sustained the natural communities present?

- Hydrology/Drought (source, intensity, frequency, duration, seasonality)
- Fire (source, intensity, frequency, seasonality)
- Grazing/Browsing (source, intensity, frequency, duration, seasonality)



Pale Purple Coneflower
Echinacea pallida



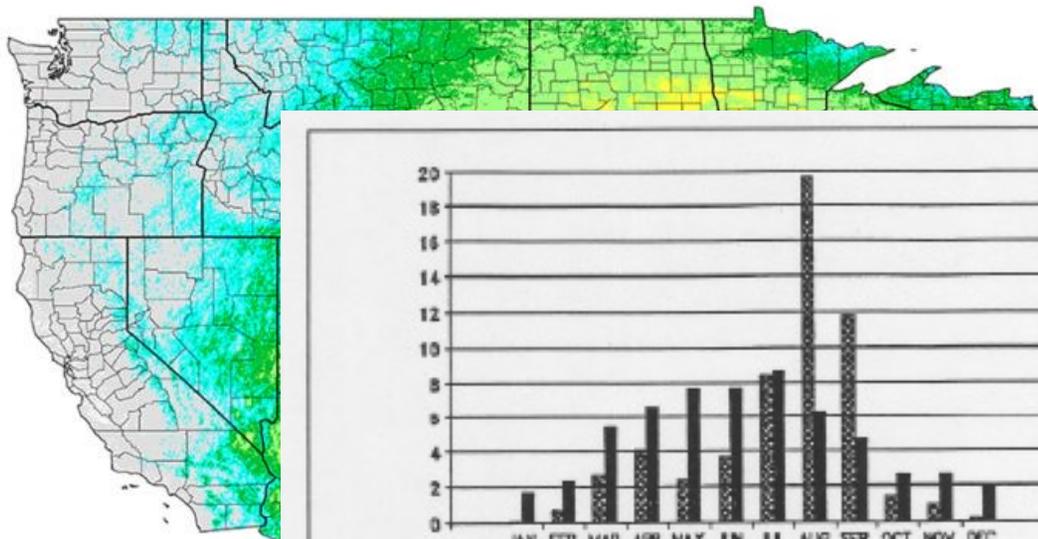
Compass Plant
Silphium laciniatum



Pale Indian Plantain
Arnoglossum plantagineum



Carolina Larkspur
Delphinium carolinianum



National Lightning I
2008 -

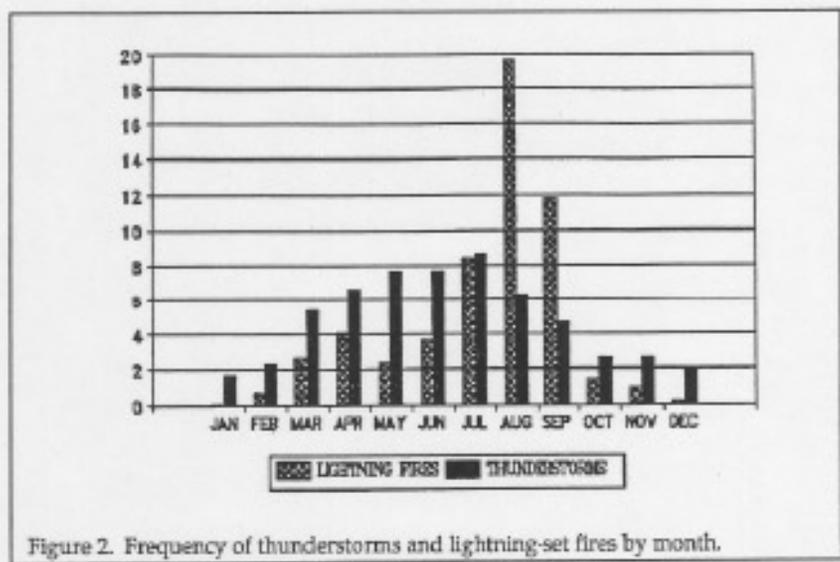
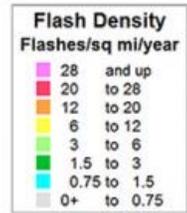


Figure 2. Frequency of thunderstorms and lightning-set fires by month.

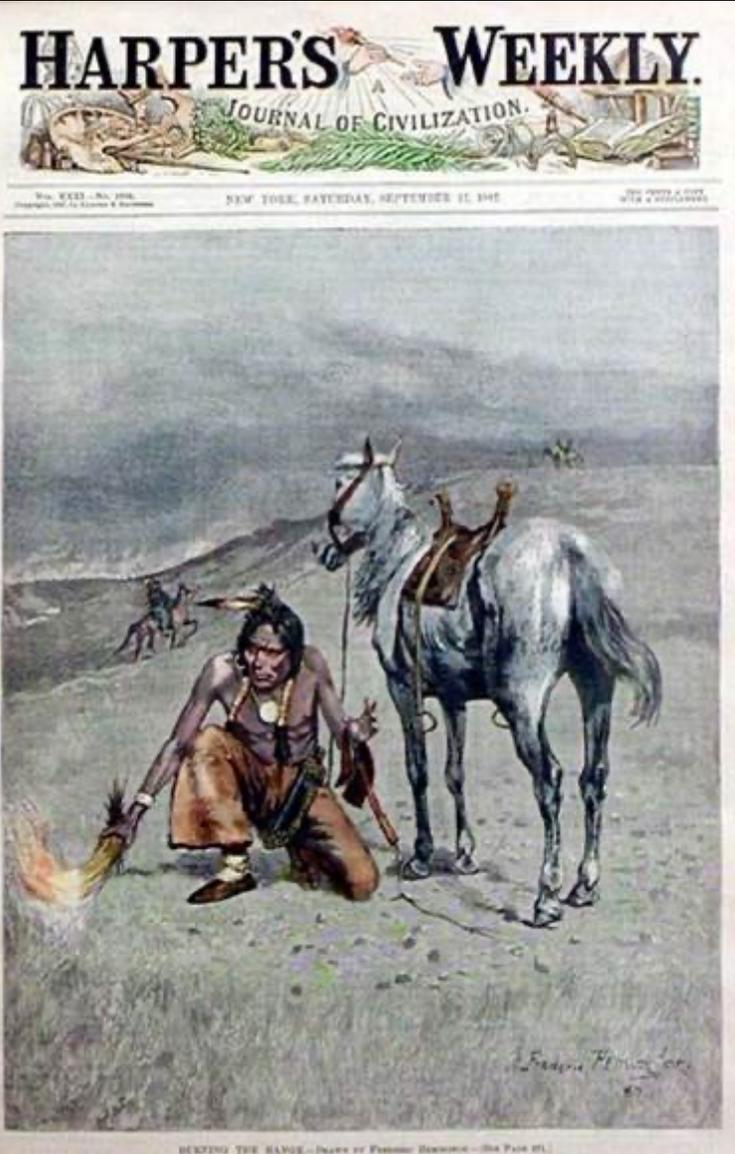
Foti & Glenn 1992



VAISALA



Charles Marion Russell



HERDING THE RANGE—DRAWN BY FRED S. BRICE—(SEE PAGE 87)

Historical Quotes Noting Fire Seasonality

*“Among the more remarkable features of the **autumnal season** in this country, is the aspect of the atmosphere, which in all directions appears so filled with smoke, as often to render an object obscure at the distance of 100 yards. The south-west winds at this season are often remarkably hazy, but here the effect is greatly **augmented by the burning of the surrounding prairies, annually practiced... ..for the benefit of the hunt, as the ground is thus cleared of a heavy crop of withered grass, prepared for an early vegetation in the succeeding spring, and also assisted in its growth by the stimulating effects of the alkaline ashes. Indeed, ever since the beginning of September, the prairies had appeared yellow and withered, with a prevailing mass of dying vegetation.**”*

Thomas Nuttall, **November 1819** – Arkansas Valley

Historical Quotes Noting Fire Seasonality

“The next day my road led over higher ground, and I rode over Grand Prairie. I wonder how many “Grand prairies” there are in the world? It was near the end of this days journey that I had my first experience in a prairie fire. It seemed to have no end, I rode nearly all day, and could see some cabins on the other side, but still the end was not yet. In the evening a stiff breeze sprung up from the south. I now saw distinctly the sheets of flame, and a gale blowing toward me. There was no time to be lost. There was a rank growth of grass and weeds throwing the flames almost to the clouds. My track could hardly be called a road, only the weeds had been beaten down. My horse began to be uneasy. Finding the barest place I could, I turn my horse's head square toward the flame. The distant roar was like the sound of the waters tumbling over the riffles of the familiar Susquehannah River. Herds of deer ran before the flames, wolves howled, and hawks shrieked. Every thing seemed frightened as the flames came rushing on. My horse seemed to understand it and only trembled but did not move. I buttoned up my coat to the chin, tucked in my collar, and pulled down my hat over my face and eyes, and shut my mouth. O for a woolen blanket. Steady! Whist! It is past, some singed hair on horse and rider is all the damage. But, what snapping and cracking, scorched weeds, roasting and frying mice and frogs, how they smell!”

Rev. William Graham, Fall 1844 – Grand Prairie

Historical Quotes Noting Fire Seasonality

Annually, after this rank growth of vegetation had become frosted, dead, and dry, the Indians set fire to it and burned it from the entire surface of the country. When this annual burning ceased, the germs of underbrush and young timber began to grow

Joseph Mudd, 1888 (describing earlier times) – northern Ozarks

Historical Quotes Noting Fire Seasonality

*“We set out in the month of September, which is the best season of the year for beginning a journey in this country: in the first place, because, during the summer, the grass is too high for travelling; whereas **in the month of September, the meadows, the grass of which is then dry, are set on fire**, and the ground becomes smooth, and easy to walk on: and hence it is, that at this time, clouds of smoke are seen for several days together to extend over a long track [sic] of country; sometimes to the extent of between twenty and thirty leagues in length [a league is variously 1.6 to 3.2 miles, usually estimated at about 3 miles], by two or three leagues in breadth, more or less, according as the wind sets, and is higher or lower.”*

Le Page du Pratz, **1720s** – uplands between Natchez, MS and NE AR.

Historical Quotes Noting Fire Seasonality

*“This was one of the most striking pictures of wild American scenery I had yet seen; there was nothing to break the comprehensive and uniform character of this woody desert, save **an immense conflagration that was raging in the distance, right in the line of our march, covering an immense area of country**, and from which rose a tremendous dense column of smoke. This desert, and the general aspect of the land ridges, seemed to portend some change in the geological character of the country. Into this plain we descended, bent upon getting through it as quickly as we could, for we knew the danger of being enveloped in a conflagration raging in a thick jungle where everything was dry, and the smoke of which sometimes destroys even animals before they can save themselves.”*

George Featherstonhaugh, **November 1835** – on or near Camp Robinson

Research Article

Patterns of Anthropogenic Fire within the Midwestern Tallgrass Prairie 1673–1905: Evidence from Written Accounts

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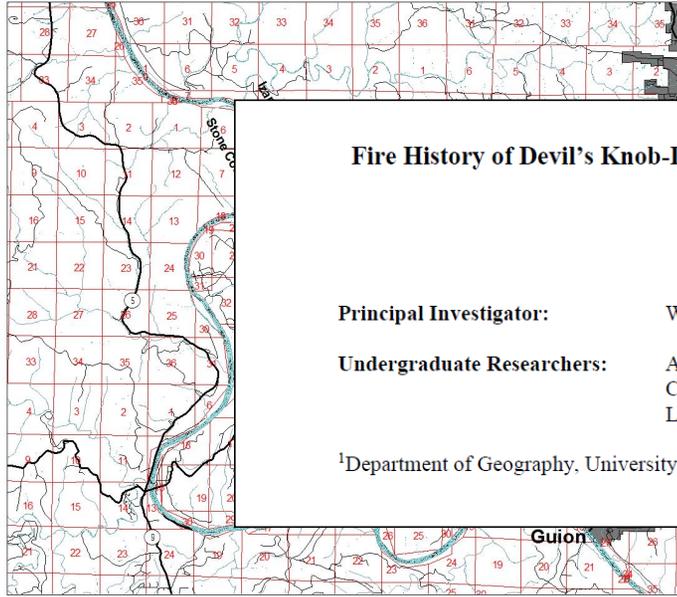
ABSTRACT

We conducted literature searches of records from Illinois, Indiana, Iowa, Minnesota, Missouri, North Dakota, Ohio, and Wisconsin to create a source bibliography of wildland fire descriptions occurring between 1673 and 1905. A total of 795 landscape fire records were identified within or near the eastern tallgrass prairie–forest transition region, including 32 attributed to Native Americans, 194 to Europeans from spontaneous records in the nineteenth century, and 569 to Europeans from a systematic dataset collected during the late nineteenth and early twentieth centuries in Minnesota. From these historical accounts, we find overwhelming evidence that a two- to three-week period during October and November, known then as

“A total of 795 landscape fire records were identified within or near the eastern tallgrass prairie–forest transition region.... From these historical accounts, we find overwhelming evidence that a two- to three-week period during October and November, known then as “Indian summer,” was the primary wildland fire season.”

9/19/2011

Arkansas Natural Heritage Commission
Department of Arkansas Heritage
Devil's Knob-Devil's Backbone Natural Area



Fire History of Devil's Knob-Devil's Backbone Natural Area, IZARD COUNTY, ARKANSAS

Final Report
June 10, 2019

Principal Investigator: William T. Flatley¹
Undergraduate Researchers: Alexander J. Russell¹
Cathleen B. McNutt¹
Lillian E. McDaniel¹

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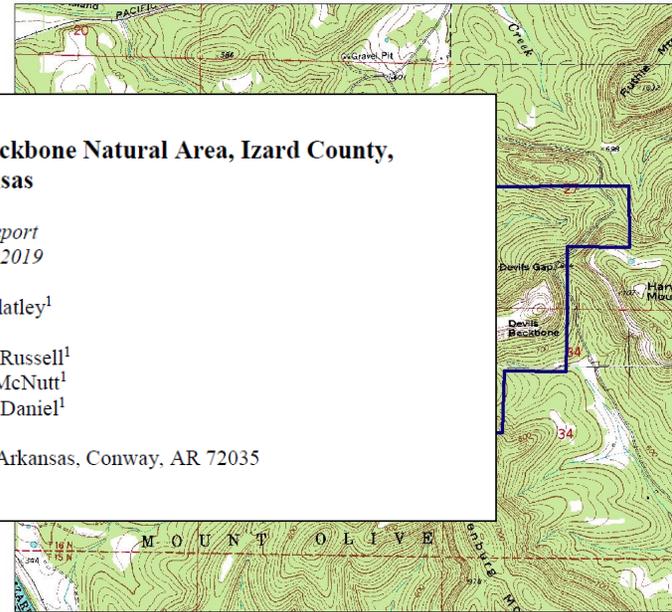


Devil's Knob-Devil's Backbone Natural Area
County: IZARD Date Added To System: 1976 Acreage: 822.13
Directions: Travel north on State Highway 9 from Mountain View approximately 15 miles.
Turn left on Mt. Olive Access Road and travel 1.3 miles to natural area sign
and small clearing on either side of the road for parking.



9/19/2011

Arkansas Natural Heritage Commission
Department of Arkansas Heritage
System of Natural Areas
Approximate Natural Area Boundaries



Devil's Knob-Devil's Backbone Natural Area
County: IZARD Date Added To System: 1976 Acreage: 822.13
USGS Topographic Quadrangle: Boswell 7.5', Sylamore 7.5'
Township/Range: T16N/R10W Section(s) 27, 28, 29, 33, 34
Contour Interval: 20 feet
Directions: Travel north on State Highway 9 from Mountain View approximately 15 miles.
Turn left on Mt. Olive Access Road and travel 1.3 miles to natural area sign
and small clearing on either side of the road for parking.



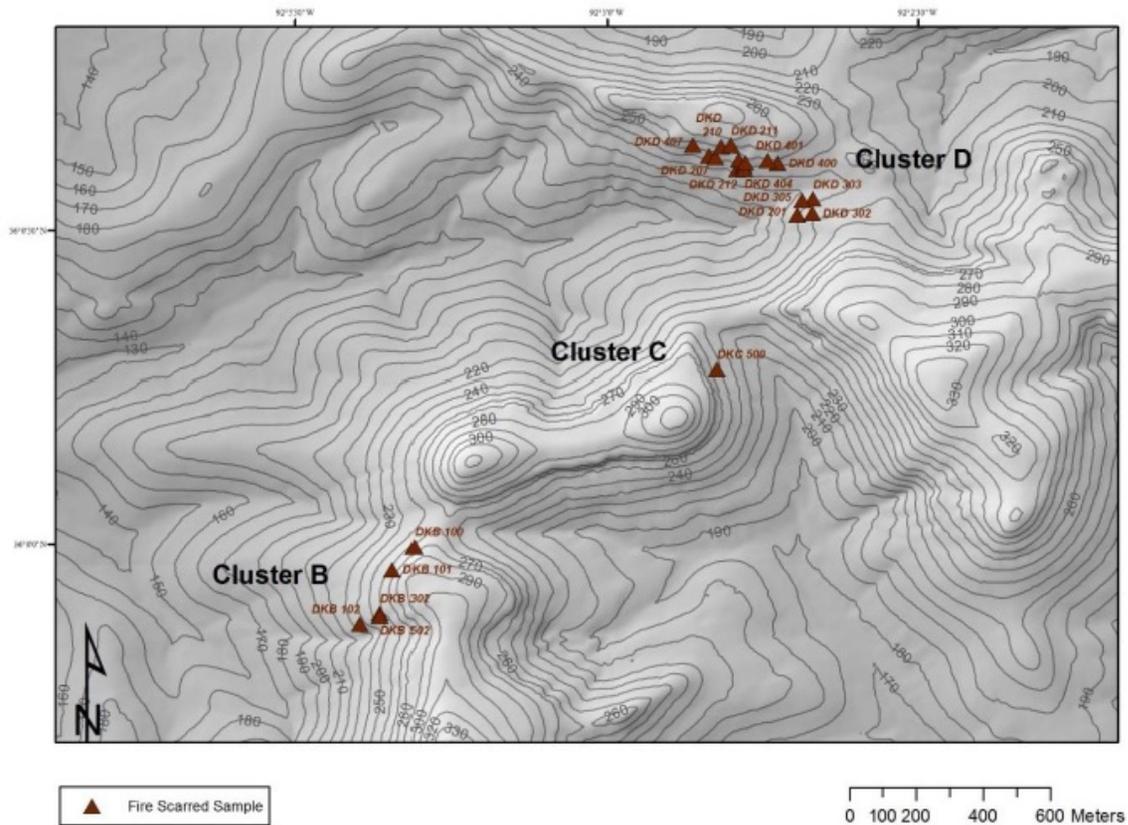
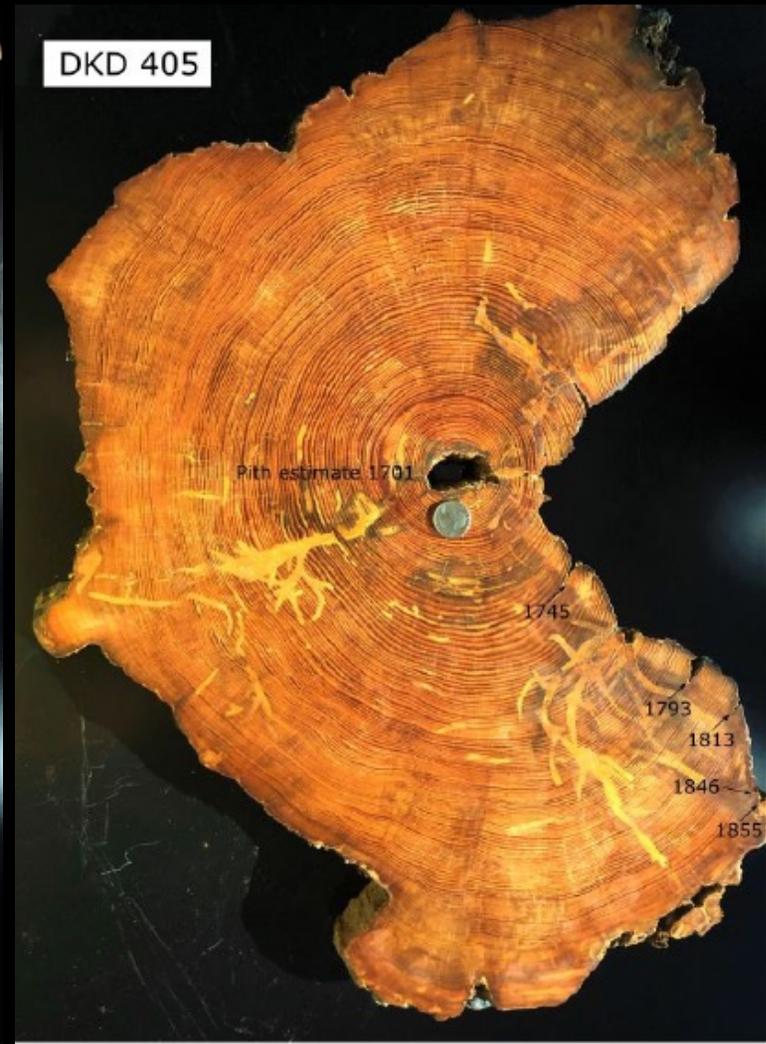


Figure 2. Study area map for fire-history reconstruction at Devil's Knob-Devil's Backbone Natural Area, IZard County, Arkansas. Cluster designations identify groupings of samples that are separated by distance or landform features.

DKB 101



DKD 405



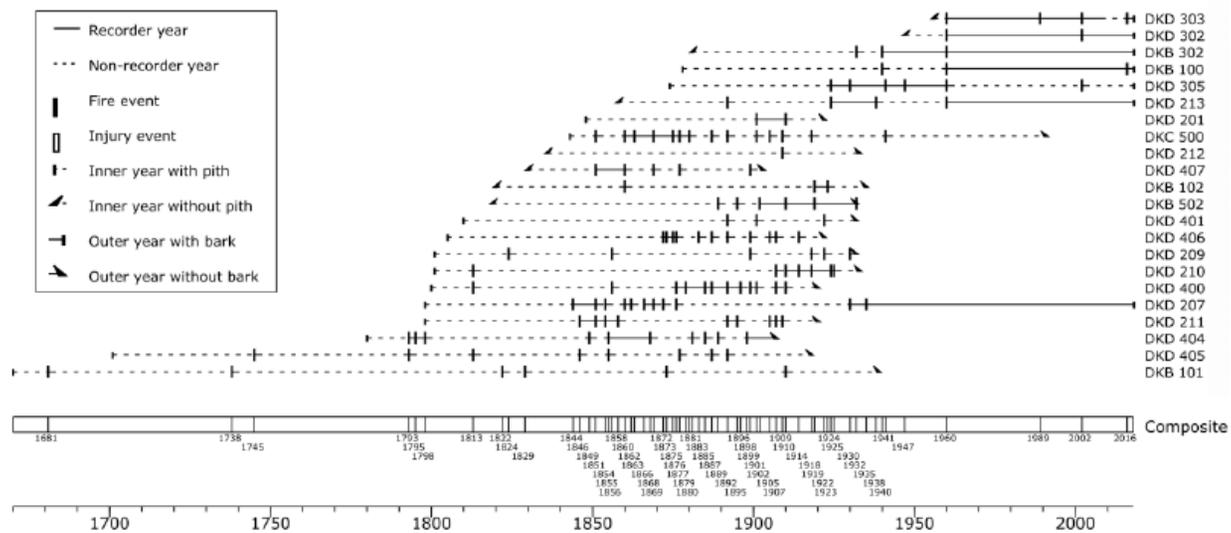


Figure 4. Fire chronology for all samples at the Devil's Knob-Devil's Backbone Natural Area, Arkansas. Horizontal lines indicate the time spanned by each tree/sample (e.g. DKD 303), with dashed lines indicating non-recording years and solid lines indicating recording years. Short vertical bars represent dated fire scars. The horizontal bar at the bottom of the chart represents the composite fire record, combining all fires that occurred at the site. List of years below the composite bar are individual years of fire occurrence.

Fire Seasonality

We were able to determine the seasonality of 72.1% of the scars, and the majority (98%) of scars that were identified by season occurred in the dormant season (Table 3).

Table 3. Seasonality of fire scars determined according to the position of scar within the annual growth ring.

	Dormant Season	Early Season	Late Season	Undetermined Season	Total
Number of scars	96	0	2	38	136
Percent of scars	70.6	0	1.5	27.9	100
Percent of fires with seasonality determined	98.0	0	2.0	---	100

Fire Seasonality

Nearly all of the scars at DKDB for which seasonality could be determined were dormant season scars. The dominance of dormant season scars aligns with results from previous studies in the Ozark Mountains and the broader eastern US (Guyette et al. 2006, McEwan et al. 2007, Flatley et al. 2013, Aldrich et al. 2014). The prescribed burn conducted at DKDB in late October 2001 left dormant season scars, indicating that dormant season fires in the tree-ring record could have occurred as early as late October. It is not possible to determine the source of ignition (i.e. lightning or anthropogenic) from tree-ring analysis. However, the dominance of dormant season scars in the fire record suggests that many ignitions were anthropogenic in origin. Lightning fires in the Ouachita Mountains are most frequent in July, August, and September (Foti and Glenn 1991), which would impart mid to late growing season scars. Lightning fires can occur in any month of the year in this region and it is quite possible that some of the historical fires that we identified were the product of lightning. However, if lightning was the dominant source of ignitions at DKDB, we would expect to have seen a much higher percentage of growing season scars, rather than almost exclusively dormant season scars.

Seasonality of Fire – Literature Review

August 26, 2018

Justin R. Thomas, Science Director

This literature review consists of all the published research that could be found that directly measured species or functional group responses to the seasonality of fire in the Midwest. The vast majority of such research has been conducted in prairie settings, but the dynamics appear to operate in much the same way in woodlands. Several of these papers also discuss fire intensity, which is included in this summary where applicable.

General Summary

- 1) There is a minor disagreement as to whether late spring prescribed fire increases productivity of C4 grasses.

- Most contemporary research demonstrates no difference between seasons, except for summer (May through August) burns (Weir and Scasta 2017) which decreases it.
- Older research demonstrated that late spring fire was best for production of quality grass for the purpose of forage, regardless of biodiversity or conservation concerns.

- 2) There is a minor disagreement about the effects of season of fire on woody plant populations.

- Most show that no seasonality or intensity of fire deters established woody plants in the long-term; but low intensity winter backfires did show some declines (Hajny et al. 2011).
- Most show that growing season fires (February through September) increase woody species; especially early successional woody species like sumac, blackberries and dogwood.

- 3) There is unanimous agreement (Abrams and Hulbert 1987; Heisler et al. 2003; Briggs et al. 2005; Lett and Knapp 2005; Bidwell and Engle 1992; Engle and Bidwell 2001; Towne and Kemp 2008; Dacy and Fulbright 2009; McCarthy et al 1997; Owensby and Anderson 1967; Weir and Scasta 2017; and Anderson et al. 1970), implicit or explicit, that...

- Burning increases plant productivity compared to not burning (but maybe not more than haying).
- After forbs and C3 grasses break dormancy (mid-February to early March) their rates of mortality increase with the lateness of burning into the season.
- Any herbaceous plant that is actively growing will be negatively impacted by fire to some degree – the degree depends on how advanced it is in growth cycle, and fire

Literature Reviewed

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**Thomas, J.R. 2018. Seasonality of Fire – Literature Review.
NatureCITE. 26 August 2018. Springfield, MO. 4 pp.**

4/29/2008

Fire Intensity

36.56738, -93.78528

Google earth

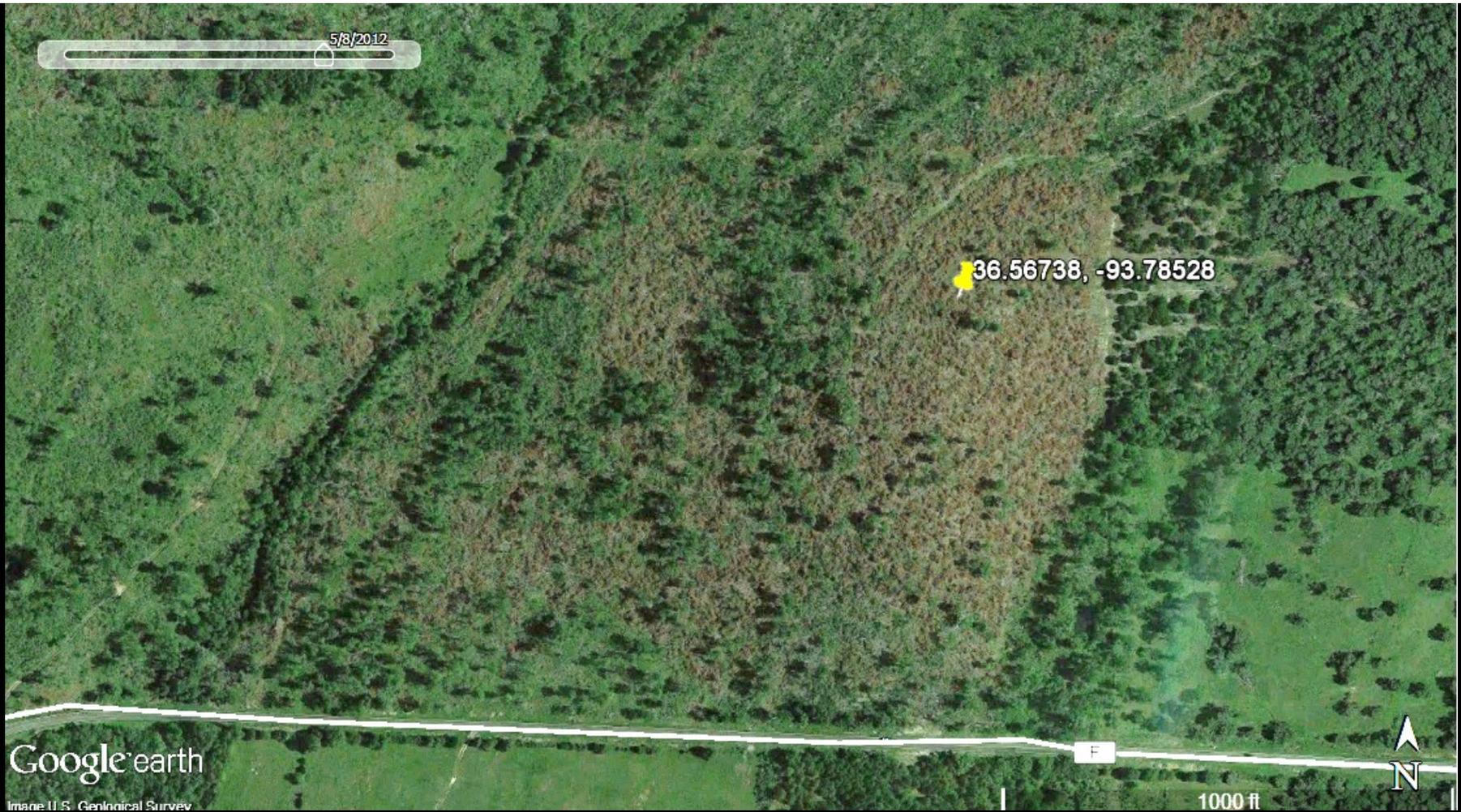
Image © U.S. Geological Survey

F

1000 ft



Glade/Savanna/Woodland “Restoration” (Ozark Highlands)



Glade/Savanna/Woodland “Restoration” (Ozark Highlands)



Glade/Savanna/Woodland “Restoration” (Ozark Highlands)



Glade/Savanna/Woodland “Restoration” (Ozark Highlands)



Glade/Savanna/Woodland “Restoration” (Ozark Highlands)



Glade/Savanna/Woodland “Restoration” (Ozark Highlands)



Glade/Savanna/Woodland Restoration (Ozarks – not in Arkansas)



SAVE BUTLER HOLLOW



SAVE ROARING RIVER





Woodland and Savanna Restoration (Gulf Mountain WMA, Van Buren County, AR)



Jennifer Akin

Cedar-encroached Shale Barrens (Middle Fork Barrens Natural Area, Saline County)



Jennifer Akin

Cedar Removal (Middle Fork Barrens Natural Area, Saline County)



Jennifer Akin

Cedar Removal (Middle Fork Barrens Natural Area, Saline County)



Jennifer Akin

Cedar Removal (Middle Fork Barrens Natural Area, Saline County)



Cedar Removal (Middle Fork Barrens Natural Area, Saline County)

Does Spring Fire Really Kill Woody Plants?



UN DECADE ON ECOSYSTEM RESTORATION



RESEARCH ARTICLE

Effects of fire seasonality and intensity on resprouting woody plants in prairie-forest communities

Jed Meunier^{1,2} , Nathan S. Holoubek³, Yari Johnson⁴, Tim Kuhman⁵, Brad Strobel⁶

Woody plant expansion is one of the greatest contemporary threats to fire-dependent ecosystems. Reducing woody plant prevalence is often a primary objective of prescribed burns, yet little attention has been given to understanding the efficacy of burning to reduce their abundance. Fire intensity characteristics and plant phenology/physiology, which are sometimes presented as competing hypotheses, influence how woody plants respond to a fire event. Little work has been done in the prairie-forest region of the upper Midwest to understand how fire characteristics interact with woody species phenology and/or physiology. Using a controlled field experiment, we examined effects of timing (seasonality) and intensity (temperature and duration) of fires on top-kill and resprouting of three invasive woody plants in this region (common buckthorn, *Rhamnus cathartica*; bush honeysuckles, *Lonicera* spp.; and a native species, northern pin oak *Quercus ellipsoidalis*). Honeysuckles and pin oak burned in the spring dormant period, a common practice in the region, resulted in low levels of top-kill and high levels of resprouting. Burning during the late growing season yielded highest levels of top-kill and lowest levels of resprouting for honeysuckles and pin oaks. However, there was no apparent effect of season or fire intensity treatment for buckthorn stems. Under all treatment combinations, buckthorn was easily top-killed but resprouted prolifically. Collectively, most prescribed burning in the Midwest appears to be conducted during the least effective season (early growing season), when top-kill is reduced and/or resprouting most pronounced. Our results indicate that fire use could be better prescribed in this region for controlling woody plants.

Key words: brush encroachment, fire effects, grasslands, Midwest, prescribed burn, top-kill, Wisconsin

Does Spring Fire Really Kill Woody Plants?

Munier et al. (2021) in Restoration Ecology:

“Burning during the late growing season yielded highest levels of top-kill and lowest levels of resprouting for honeysuckles and pin oaks. Collectively, most prescribed burning in the Midwest appears to be conducted during the least effective season (early growing season), when top-kill is reduced and/or resprouting most pronounced.”

“Mixing it up” – is it good for remnants?

Doug Ladd (The Nature Conservancy of Missouri):

“All too often it seems that there is a trend to diversify management treatments — fire timing, frequency, or other factors — simply from an assumption that a diversity of treatments is good because ecosystems are “dynamic.” This shallow thinking poses grave risks to system integrity, and courts irreversible degradation. In reality, our contemporary biological systems are the distillation of thousands of generations of selection for a discrete range of site conditions and process regimes — the direct legacy of the post-glacial environment, including its aboriginal influences. Maintaining or emulating this constrained dynamism must be the operative concept for managers, or the result will be inevitable loss of conservative biotic elements and cascading loss of system resiliency and function.”

-Doug Ladd, in *Ecologically Appropriate Fire in the Missouri Landscape: A 35 Year Reflection*

ANHC PERSPECTIVES ON NATURAL AREA MANAGEMENT version 1.1

Theo Witsell, ANHC Ecologist/Chief of Research

19 July 2023

INTRODUCTION

This is not an “official policy” document, but it is intended to lay out some agency perspectives on natural area management, particularly fire, and to explain the scientific rationale for our current approach, particularly cut-off dates for burns and the division of some sites (especially prairies) into multiple burn units. I realize that some of our contractors and others have said they do not share my perspectives on some of these issues or agree with some of my positions on fire ecology. I also know that some have suggested that I am overly concerned about certain issues, particularly fire seasonality.

My main concerns involve the intentional application of disturbances (especially fire but other ones too) in ways that are 1) outside of the range of their historical variation in an ecosystem, and 2) out of sync in general with the rhythms of life in the ecosystems. Lots more on all this below.



Timber Mulcher (Warren Prairie Natural Area, Drew County)



Timber Mulcher (Warren Prairie Natural Area, Drew County)



ANHC

Post Timber Mulcher (Warren Prairie Natural Area, Drew County)



Glade and Savanna Restoration (Harold Alexander WMA, Sharp County, AR)



Glade and Savanna Restoration (Harold Alexander WMA, Sharp County, AR)



Glade and Savanna Restoration (Harold Alexander WMA, Sharp County, AR)



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Glade and Savanna Restoration (Harold Alexander WMA, Sharp County, AR)



Woodland and Savanna Restoration (Gulf Mountain WMA, Van Buren County, AR)



Woodland and Savanna Restoration (Gulf Mountain WMA, Van Buren County, AR)



Glade/Woodland/Savanna Restoration (Gene Rush WMA, Newton County, AR)



ardship:
emnants

If you want great remnants like this



William Dark

and species like these



Then Follow these guidelines:

- 1) Apply prescribed fire during the historical fire season (inland of the Outer Coastal Plain = Aug-Oct lightning, Sept-Jan anthropogenic).
- 2) Limit fire intensity.
- 3) Leave unburned/unmanaged refugia in isolated remnants.
- 4) You can't manage what you don't know. Learn the plants, even if it's a few plants a year.
- 5) In sites where thinning or cedar removal has occurred, don't burn during the red needle phase of cedars.
- 6) Refrain from managing for instant gratification.
- 7) Think about how your management will affect the site over the next 100+ years.
- 8) Refrain from disking or dozing fire lines, these lines often destroy the most diverse portions of grassland systems (the ecotone) and encourage invasive species.
- 9) When using herbicide on sites, remember these are ancient communities and surgical precision is needed. Over-spraying sites can do as much or potentially more damage than the invasive species on the site.
- 10) Don't disk sites. This is often done for the benefit of game species but it is a detriment to the rest of the community.
- 11) On wooded sites be careful and don't over-thin. You can always go thinner but you can't put trees back.
- 12) On wooded sites limit grinding and logging to dry seasons.
- 13) Don't put logging decks on "open areas".
- 14) Put the food plots in old ag fields, not in ancient grassland communities.
- 15) Work with local seed collecting efforts to collect and conserve seeds.

Thank you

