

# Fire in Wildland Management



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Illinois Forestry Association  
Touch of Nature  
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## Dr. Charles Ruffner, Professor of Forestry

### Research & Teaching Interests:

- Fire in Wildland Management
  - Changing fire regimes
  - Applying prescribed fire
- Historical Ecology
  - Fire history
- Disturbance Ecology
  - Old-growth stand dynamics
- International development & Study Abroad

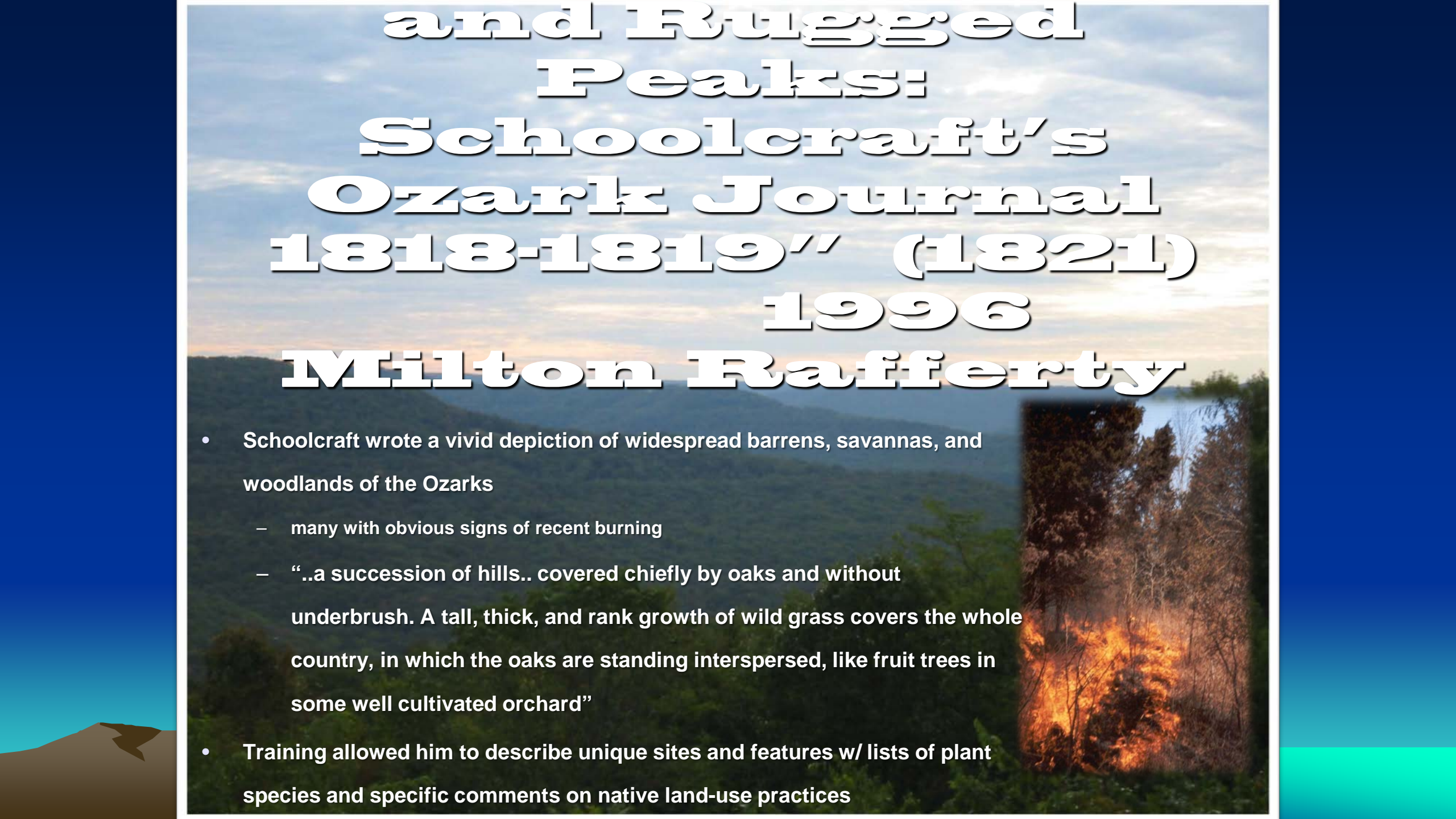




# Objectives

- Describe history of fire across Midwestern region
  - Historic role of fire
  - Modern uses of fire
- Major management issues
  - Timing treatments for best effect
  - Interagency coordination
  - Training more crews
  - Funding levels



The background of the slide is a photograph of a sunset or sunrise over a range of hills. The sky is filled with soft, white and orange clouds. In the foreground, there are dark, silhouetted hills. On the right side of the slide, there is a vertical inset photograph showing a forest fire with bright orange flames and thick black smoke rising from the trees.

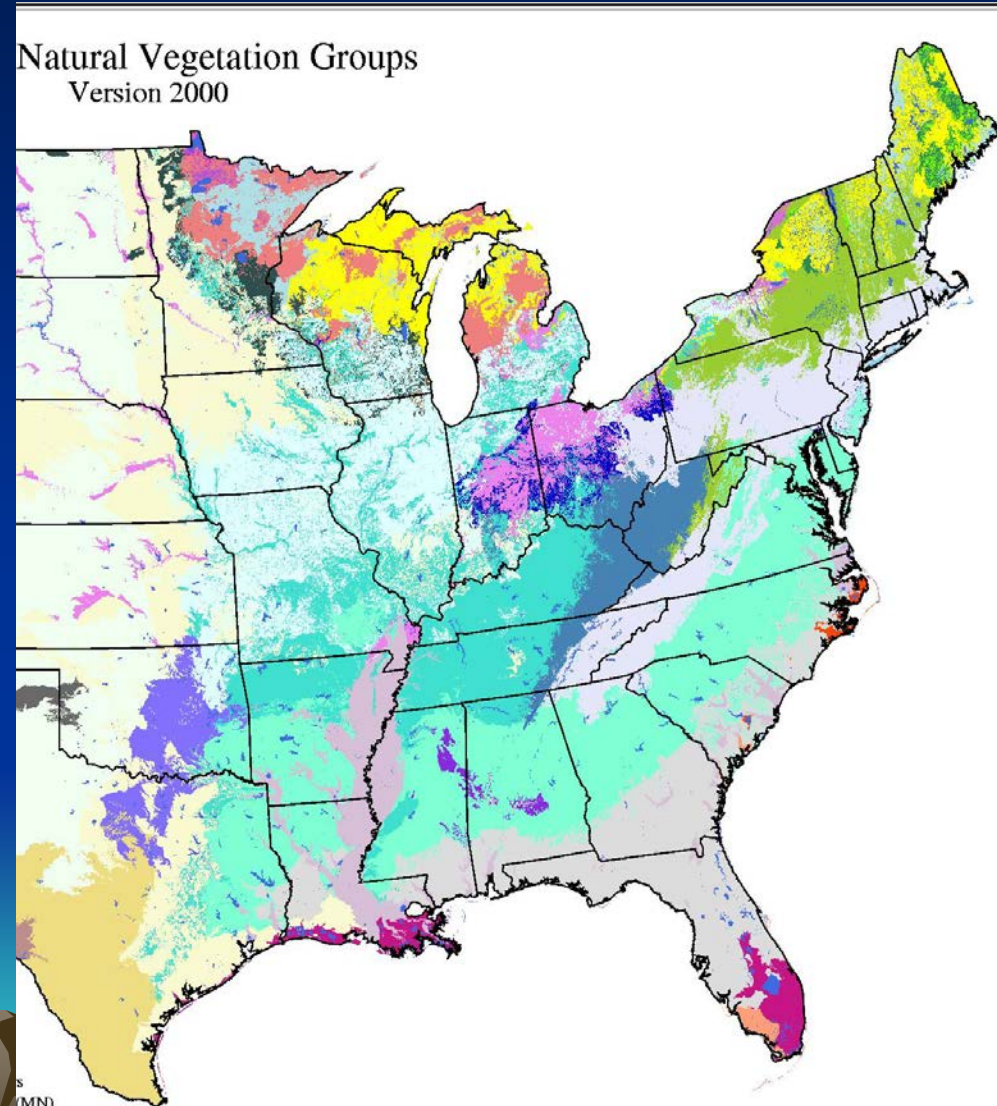
# **and Rugged Peaks: Schoolcraft's Ozark Journal 1818-1819" (1821) 1996 Milton Rafferty**

- Schoolcraft wrote a vivid depiction of widespread barrens, savannas, and woodlands of the Ozarks
  - many with obvious signs of recent burning
  - “..a succession of hills.. covered chiefly by oaks and without underbrush. A tall, thick, and rank growth of wild grass covers the whole country, in which the oaks are standing interspersed, like fruit trees in some well cultivated orchard”
- Training allowed him to describe unique sites and features w/ lists of plant species and specific comments on native land-use practices

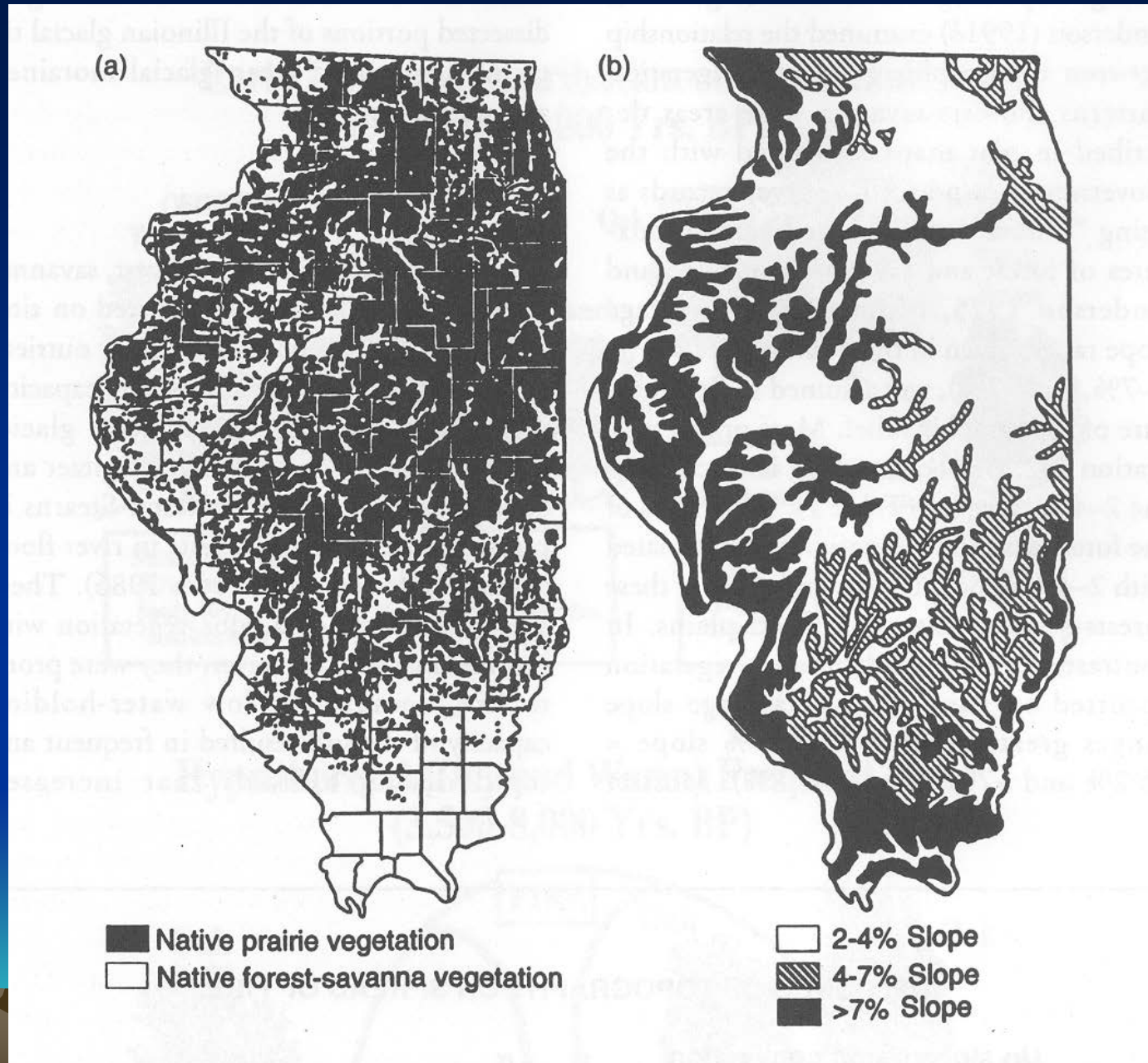


# Our regions forest dynamics

- Central Hardwoods
  - Mixtures of white and red oak-hickory on dry uplands
  - Elm, maple, ash, gum, poplar and various oaks on moist bottoms
  - Prairie peninsula







Development of oak savannas, woodlands, and forests in Illinois. Anderson 1991



# Post-settlement Fire History

- Ozark Hills- burned every 15-20 years (Robertson and Heikens 1994)
- Shawnee Hills- burned every 8-15 years (Fralish 1991)
- Shoal Creek- burned every 2.81 years between 1880-1940 (Harris 2011)
- Post 1940- effective fire prevention, detection, and suppression activities reduce ignitions
- No large fires > 1950





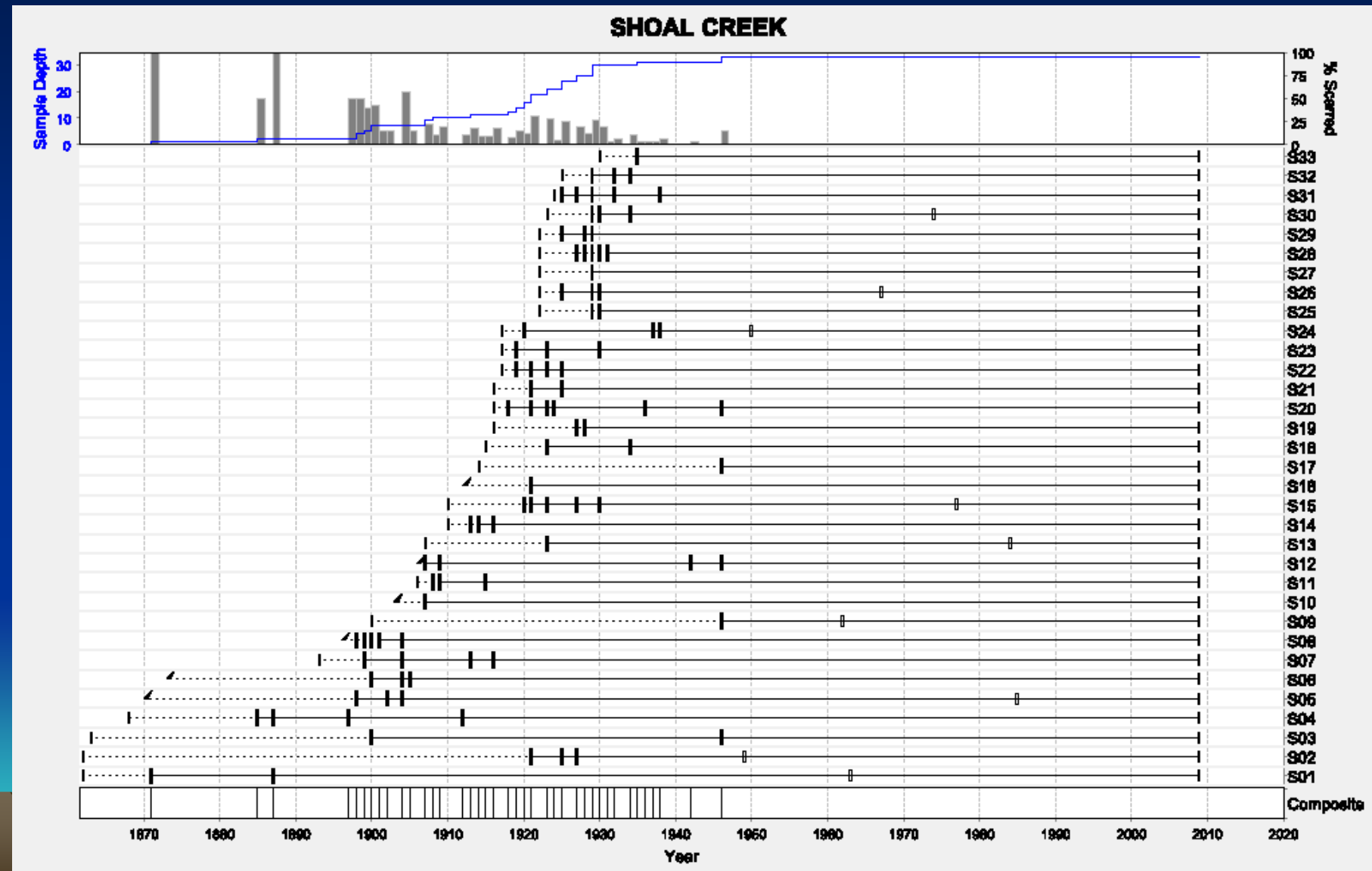
# Land Use History



- Fire was widely used by farmers and landowners to clear land & reduce slash
- State Forester (Miller 1910) reported frequent fire being the most important factor reducing forest cover in southern Illinois
- *Upland hill type, Union County, second growth on upper slope, ash, mulberry, and oak, of poor quality due to repeated fires from a nearby railroad.*
  - Ill. Nat. History Survey 1910



# Shoal Creek Composite Fire History



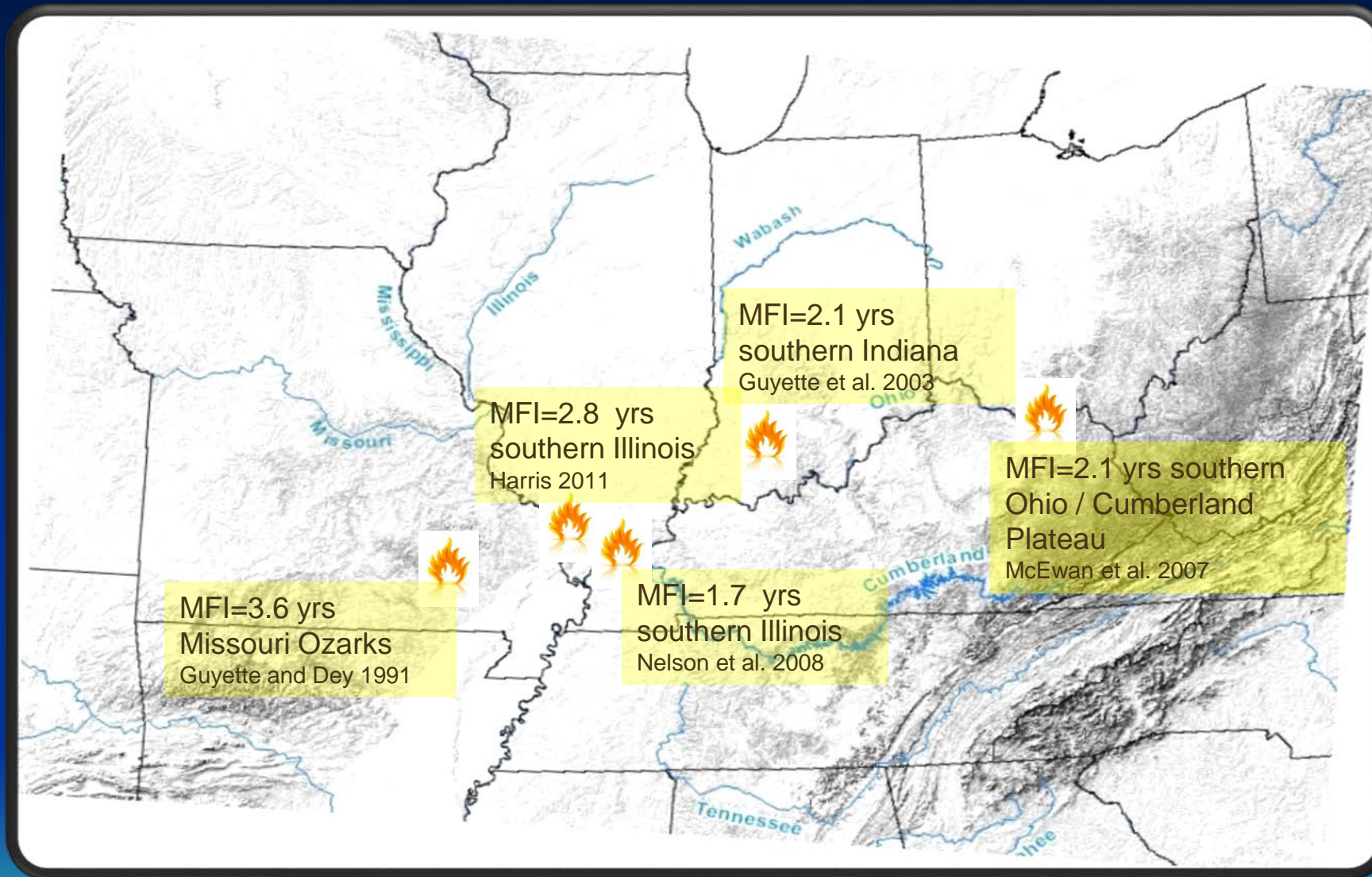


# Shoal Creek Fire Statistics

Shoal Creek	Sample s (n)	Fire intervals (n)	Mean fire interval (years)	Min. fire interval (years)	Max fire interval (years)	MFOP
All Scarred Class						
1887-1946	33	21	2.81	1	11	3.54

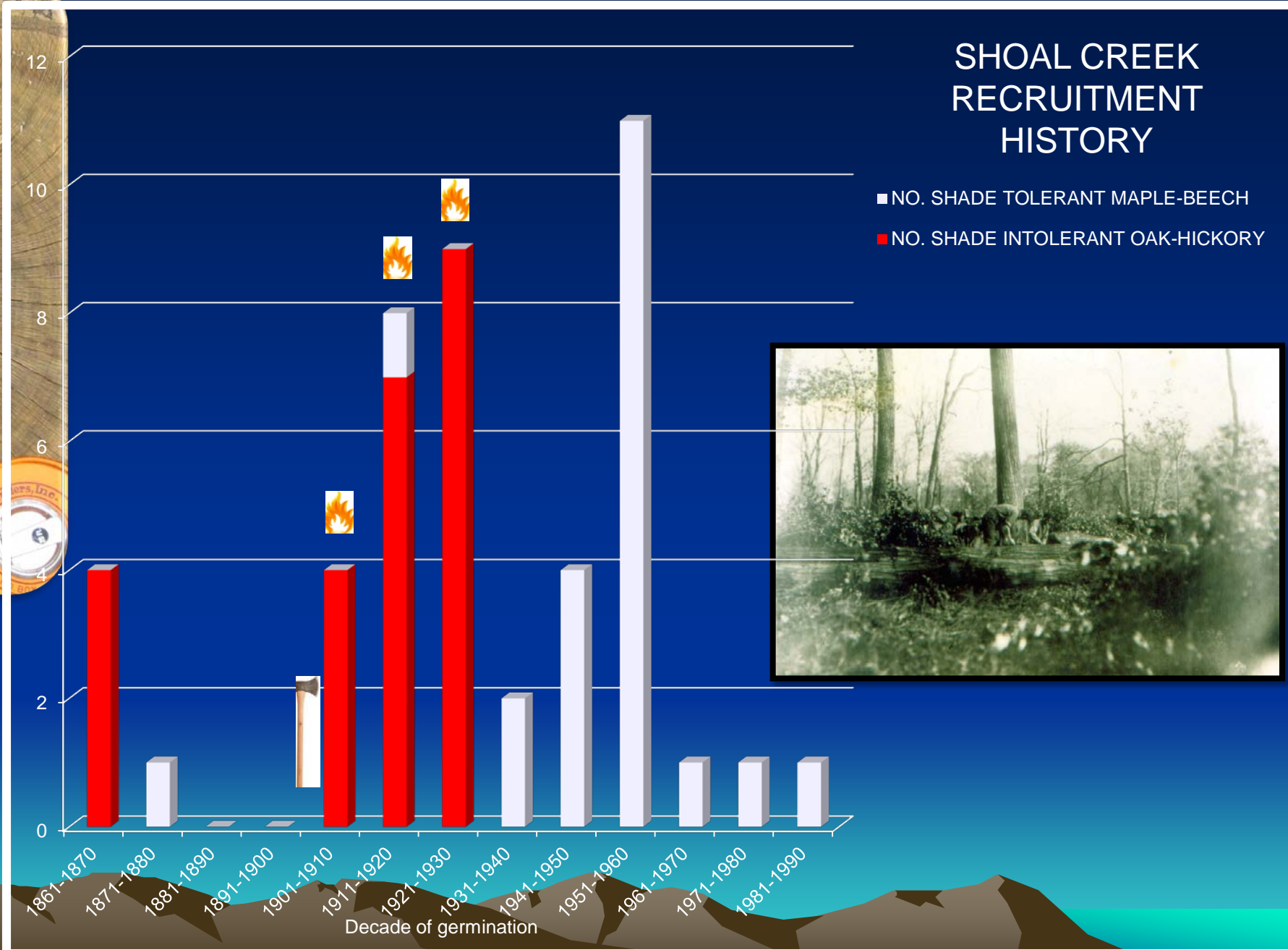
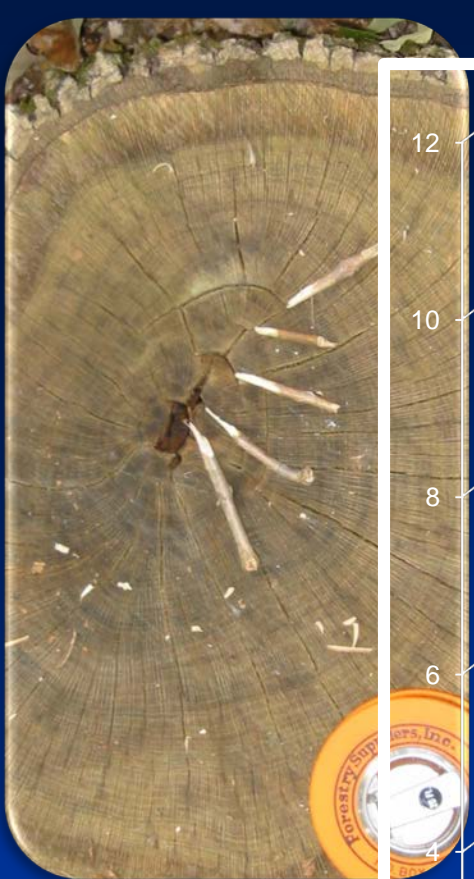
Wildfire on Bald Knob near Alto Pass, Illinois - 1920





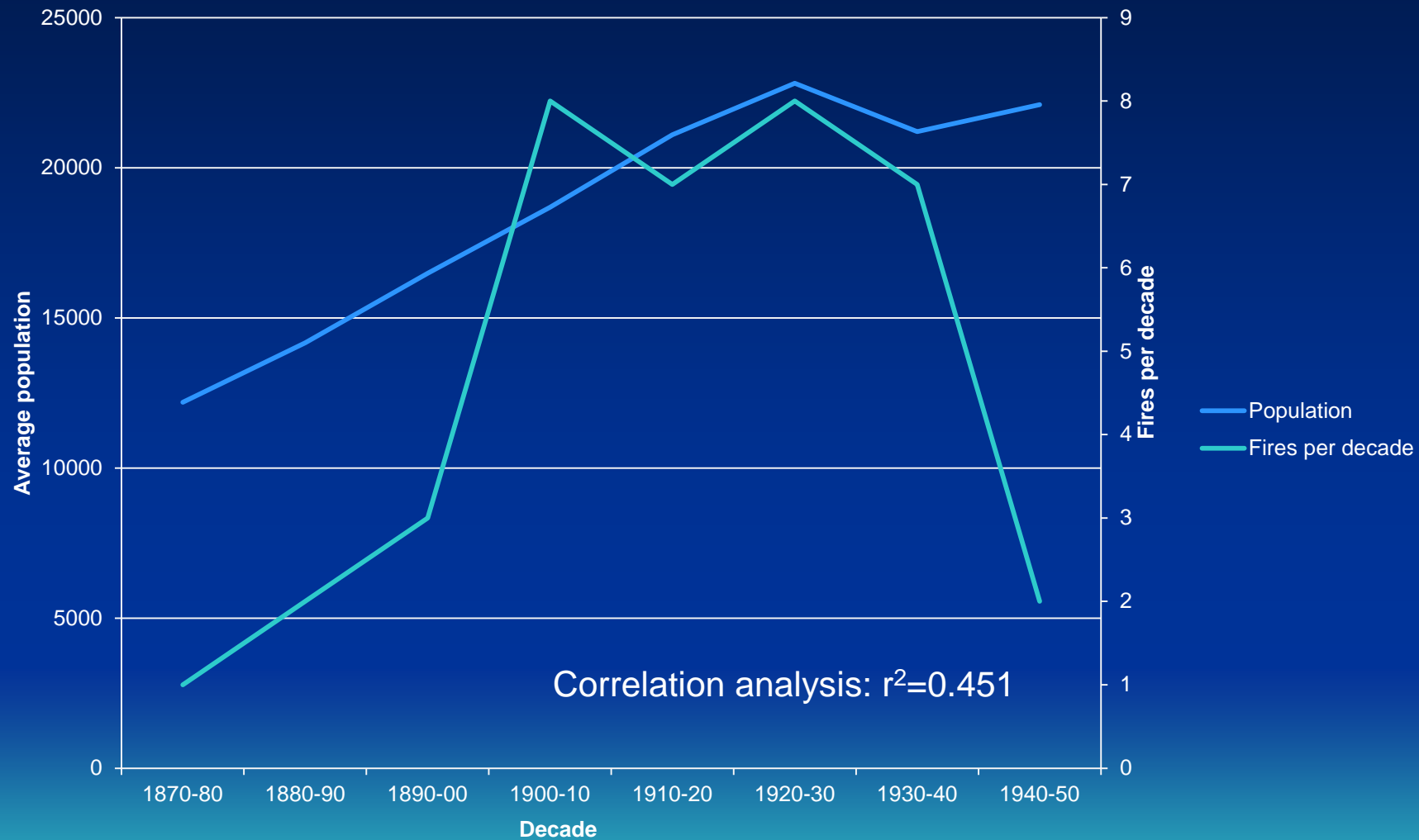
## Post-settlement Fire History of the Central Hardwood Region (1880-1940)





Harris (2011)

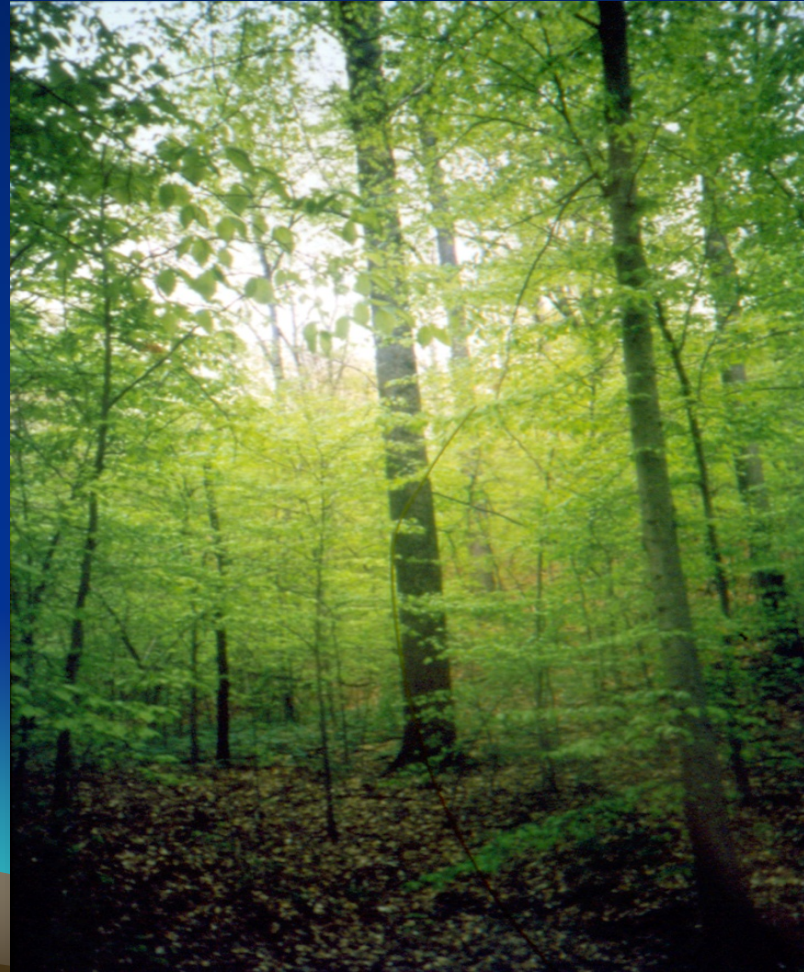
# Population vs. fires per decade





# Over the past 80 years.....

- Reduced cutting
- Fire suppression
- Reduced grazing





## Current Forest Composition

- $\pm 120$  yr mixed oak overstory
- 60-75 yr of woody encroachment
- Oak being replaced by beech, winged elm, red maple
- Loss of
  - Open condition and high light dynamics
  - Grassy-herbaceous understory
  - Unique and valuable habitat





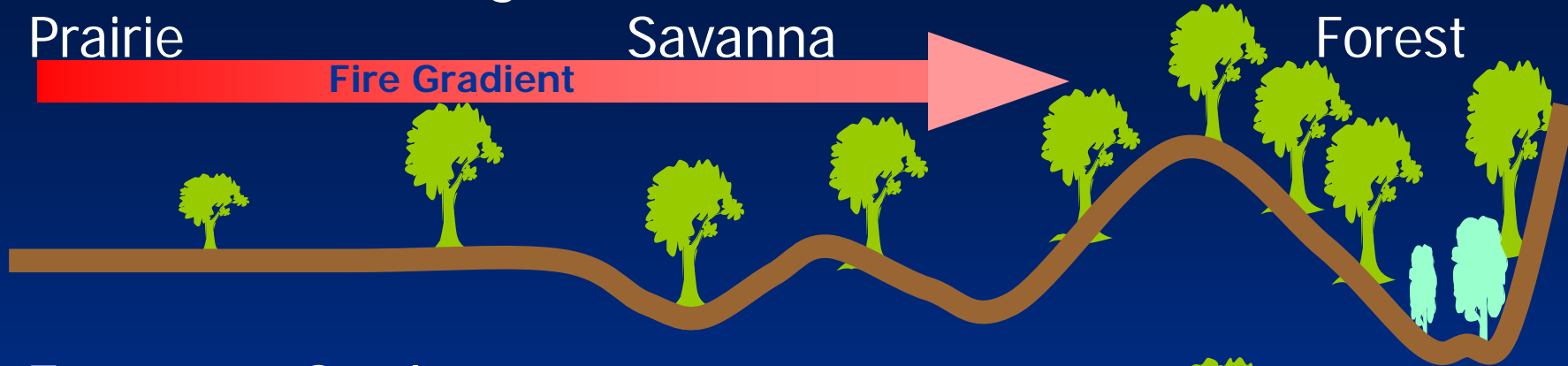
# Presettlement Vegetation -- Illinois

Prairie

Savanna

Forest

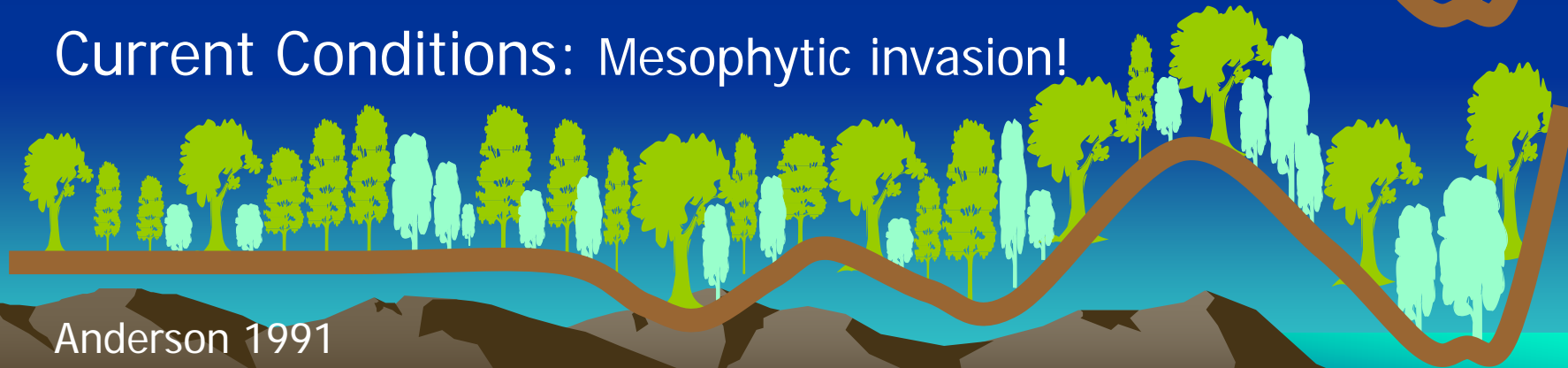
Fire Gradient



European Settlement: Fire cessation  
& forest expansion



Current Conditions: Mesophytic invasion!



Anderson 1991



# Bringing Fire Back





# Fire in Managing Oak Ecosystems



**Forest**



**Woodland**



**Savanna**

The ultimate outcome we desire of our lands directs what role fire plays in management. Fire to favor oak regeneration in a forest with timber values is very different than fire for restoring open woodlands and grassy savannas.



# Modern Uses of Fire on the Landscape

- Woodland habitat management
- Prairie/pollinator maintenance
- Conservation Reserve Program
- Invasive species control
- Site preparation/clear understory
- Species composition control
  - Oak restoration and maintenance





- **Forest Management Treatments:**

- **Thin from below:**

- Reduce undesirable species in midstory
    - Chainsaws and stump treatments must be used for effectiveness

- **Rx burns to follow:**

- Reduces density of shade tolerant stems
    - Reduces Coarse Woody Debris (CWD)
    - Recycles nutrients, stimulating mast crops
    - Rejuvenates successional sequence
    - Stimulates resprouting and herbaceous species
    - Increases structural complexity
    - Increases biodiversity and landscape mosaic





## Herbaceous Response to Thinning and Burning



Ozark pine understory after fire



Warm season grasses and prairie forbs



Big-bluestem



Rattlesnake master



Understory composition from Dixon Springs Plots 2014.  
Top five species for each treatment

Treatment	Species	Cover (%)
Burn only	Virginia Creeper	18
	Japanese honeysuckle	15
	Poison Ivy	9
	Raspberry	6
	Grapevine	5
Thin only	Virginia Creeper	24
	Japanese honeysuckle	7
	Poison Ivy	7
	Wild Licorice	3
	Bromegrass	2
Burn and thin	Virginia Creeper	38
	Japanese honeysuckle	24
	Poison Ivy	14
	Grapevine	4
	Garlic mustard	2
Control	Poison Ivy	21
	Virginia Creeper	12
	Japanese honeysuckle	8
	Raspberry	4
	Tick-trefoil	3

# Stand Dynamics

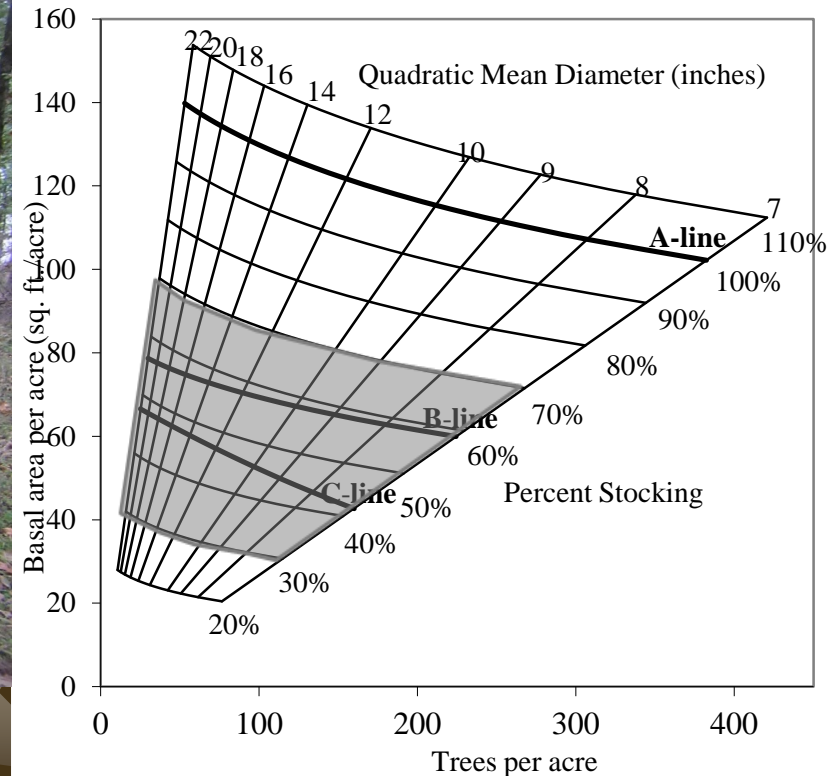
**Table 1.** Mean (S.E.) of overstory basal area, stem density, and stocking by treatment of the three forested stands used in this study. Stocking was calculated using Gingrich [15] upland stocking guide. Means are post treatment and were separated by Tukey option for post-hoc comparisons when ANOVA revealed a clear difference between treatments ( $P < 0.05$ ).

Treatment	Basal Area (ft <sup>2</sup> /ac)	Density (stems/ac)	Stocking (%)
Control	104 (11) a	160 (14) a	90
Burn	113 (10) a	155 (7) a	95
Thin	105 (18) a	90 (10) b	82
Thinning and Burning	74 (11) a	102 (9) b	63

Means followed by same letters do not differ significantly ( $P < 0.05$ ).

**Facilitating Oak and Hickory Regeneration in Mature Central Hardwood Forests**  
Eric J. Holzmüller \*, John W. Groninger and Charles M. Ruffner (Forests 2014)

- GLO data suggests thinning stands necessary to restore woodland structure
  - Forestry Summer Camp field exercises 2008-present
  - Students cut non oak-hickory stems (crop tree release)
  - Apply stump treatment to reduce stump sprouting
  - Use stocking guides to develop stand structure targets
    - 35-75 sq ft Basal Area with about 40-60% stocking
    - Average tree diameter  $\pm$  14-18"



Gingrich Stocking Guide



# There is hope for oak regeneration

**Table 2.** Mean (S.E.) height and diameter (of the tallest seedlings) and density of all large seedlings (>20 cm in height) by species class and treatment. Means were separated by Tukey option for post-hoc comparisons when ANOVA revealed a clear difference between treatments ( $P < 0.05$ ) for each species class and treatment.

Species Class	Height (m)	Diameter (cm)	Density (stems/ha)
White oak			
Control	0.16 (0.04) b	0.19 (0.05) b	2552 (549) b
Burn	0.17 (0.03) b	0.19 (0.03) b	5469 (1271) ab
Thin	0.23 (0.05) ab	0.28 (0.06) ab	4010 (1232) ab
Thinning and Burning	0.38 (0.07) a	0.47 (0.09) a	7135 (1820) a
P-value	<0.001	<0.001	0.05
Red oak			
Control	0.18 (0.04) b	0.23 (0.06) c	1493 (327)
Burn	0.19 (0.04) b	0.26 (0.05) bc	2162 (394)
Thin	0.35 (0.07) ab	0.53 (0.11) ab	2471 (448)
Thinning and Burning	0.43 (0.09) a	0.58 (0.13) a	2420 (485)
P-value	<0.001	<0.001	0.25
Hickory			
Control	0.12 (0.02) b	0.15 (0.03) b	2471 (499)
Burn	0.21 (0.04) b	0.29 (0.06) ab	3568 (523)
Thin	0.37 (0.05) a	0.44 (0.06) a	4221 (471)
Thinning and Burning	0.40 (0.06) a	0.39 (0.06) a	3346 (502)
P-value	<0.001	0.003	0.06

- Thin and burn had a larger residual diameter which supports our thin from below suggestions
- Thin and burn resulted in more oak regeneration than other treatments
- A two cut system would work nicely in these stands now that advanced oak regen is present
- Continue to use maintenance fire to enhance oak response and hinder *other* less fire tolerant species

# Restoring fire as a process

- Variation in burn intensity is encouraged and will reflect differences in topography, vegetation, fuel moisture and weather conditions at the time the flame front crosses an area
- This more likely reflects native burning as they weren't worried about a uniform burn to meet even-aged regeneration objectives
- Burning should occur at different stages of stand development, not just at times that would satisfy or support timber objectives
- There is a stand down period for all oak stands after a strong cohort is formed; keep fire out until they recruit into overstory through crop release or other weeding cut
- Use natural features to delineate burn units, as opposed to cutting FMU boundaries along property boundaries
- Train crews to protect sensitive, high value species; target those otherwise
- Burn at different times of the year if possible to limit development of a super-dominant vegetation type or condition





# Oak Woodlands and Forest Fire Consortium







- The Joint Fire Science Program funds scientific research on wildland fires and distributes results to help policymakers, fire managers and practitioners make sound management decisions
- Regional Fire Consortia serve as clearinghouses of current fire knowledge and application materials
- [www.Oakfirescience.com](http://www.Oakfirescience.com)



**FIRESCIENCE.GOV**  
Research Supporting Sound Decisions



# Illinois Nature Preserves Commission

- The mission:
  - assist private and public landowners in protecting high quality natural areas
  - habitats of endangered and threatened species; in perpetuity
  - promotes the preservation of these significant lands
  - provides leadership in their stewardship, management and protection





- Certified Prescribed Burn manager program
  - Train more apprentices
- Burn 10K+ acres annually across multiple divisions
  - Unique area maintenance
  - Nature Preserves
  - Oak regeneration
  - Habitat management
  - Growing season burns
- Ageing personnel not being replaced in timely manner
- Many lands go untreated





# Illinois Prescribed Fire Council

- Recent Fire Needs Assessment suggested:
- Of 1,049,000 acres reported, 790,000 (76%) are held in habitat acres, of which only 50,789 (6%) were managed with prescribed fire between 6/14-5/15
- 213,000 more acres must burn annually in Illinois to effectively manage and restore target acreages
- 20% of conservation lands are too degraded to carry effective, healthy, needed fire
- Without committed and supported conservation efforts, these numbers will increase over time





# SIPBA working with Private Landowners

- fostering a stewardship ethic
  - Involves them in actively managing where effects are noticeable over time
  - Provides satisfaction thru land enhancement and investing in future health and productivity across generations





# SIUC- Fire Dawgs

- **Integrates Federal oriented training**
  - Wildland fire crew conducts prescribed burning for agencies, landowners, and SIUC
- **SIUC Forestry Department-**
  - fits mission of undergraduate forest management & ecological restoration
  - Important qualifier for job placement of students
- **Cooperating Agencies:**
  - IDNR, Foresters and Natural Heritage
  - Shawnee RC&D
  - Crab Orchard NWR
  - Shawnee NF
  - Rural Fire Districts





# SIUC-Forest Resources Management

- Manage forest resources on public and private lands
- Develop strong outdoor/field knowledge and conservation skills
- Habitat and vegetation management, ecosystem restoration, Rx fire operations





# Increasing Public Awareness and Education

- Public walk and talks
- Oaktober workshops
- Professional Field trips
- Elder hostel exposure





# Work for Future

- “Fully” integrate efforts across multiple ownerships
- Increased attention paid to smoke management
- Research Fire and Invasive Exotics??
- Public outreach and acceptance of wildland urban interface in our region

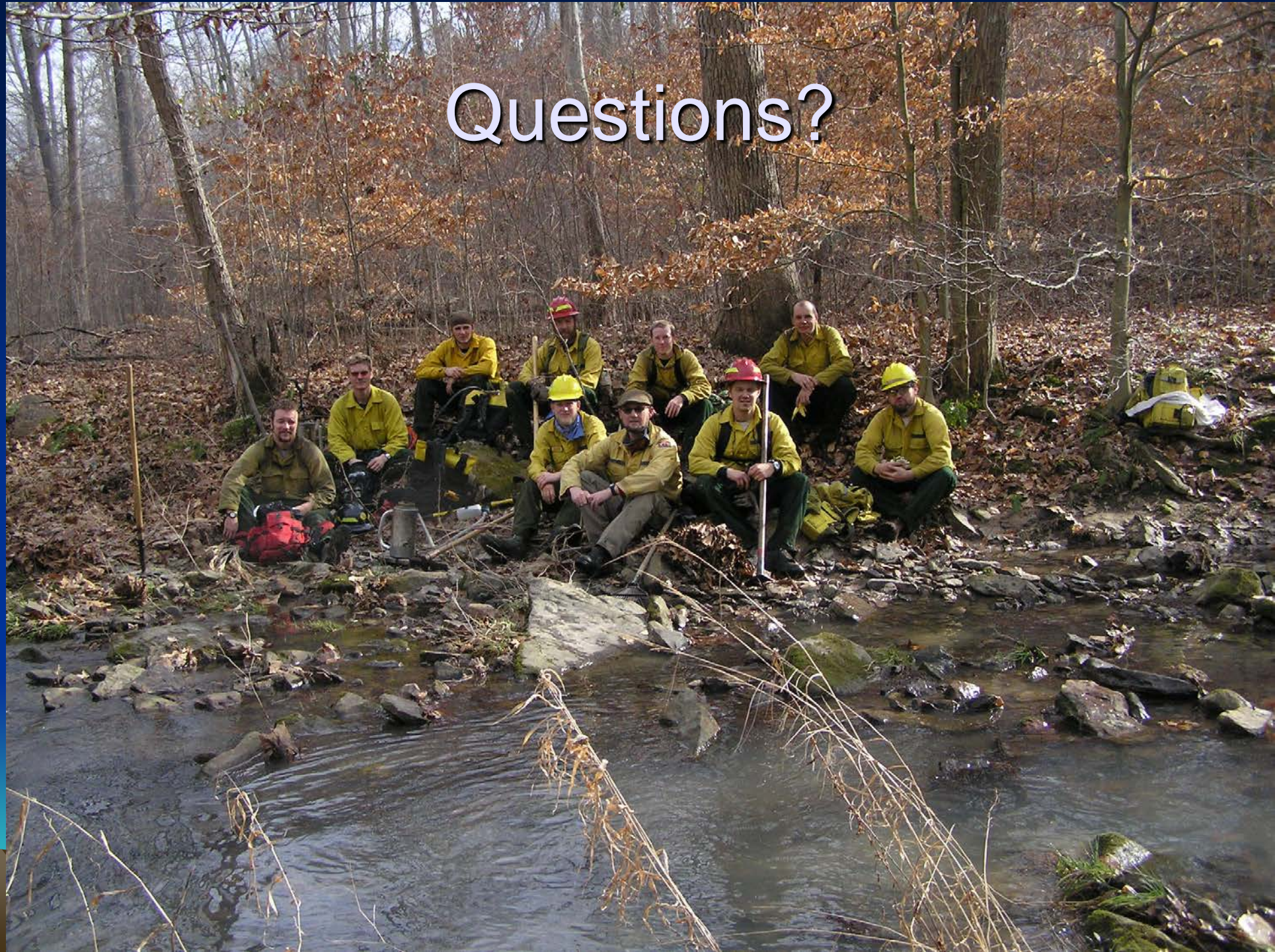








# Questions?





# Questions?





# Fire Suppression coupled with Farm Abandonment (1930-Present):

- Badly eroded and cutover lands purchased in 20's and 30's for parks and forests
- Cessation of fire accompanied by development of national and state forests
- Permitted major increase of mixed-mesophytic component into current understory
- Illinois Ozark Hills may be first contiguous forest region in central North America to convert from oak-hickory to maple-beech (Fralish and McArdle 2009)





# Trainings

- “Red-Card” firefighter training
- Chainsaw Safety
- Fireline Construction
- Ignition Methods
- Direct/Indirect Attack
- Yearly Refresher
- Fire shelter deployment





## Post-settlement (1820-1930):





# Chillicothe Pond, KY

- Archaic and Woodland natives cleared forest gaps and burned them to maintain small garden plots increasing oak, chestnut, and pine in surrounding forests



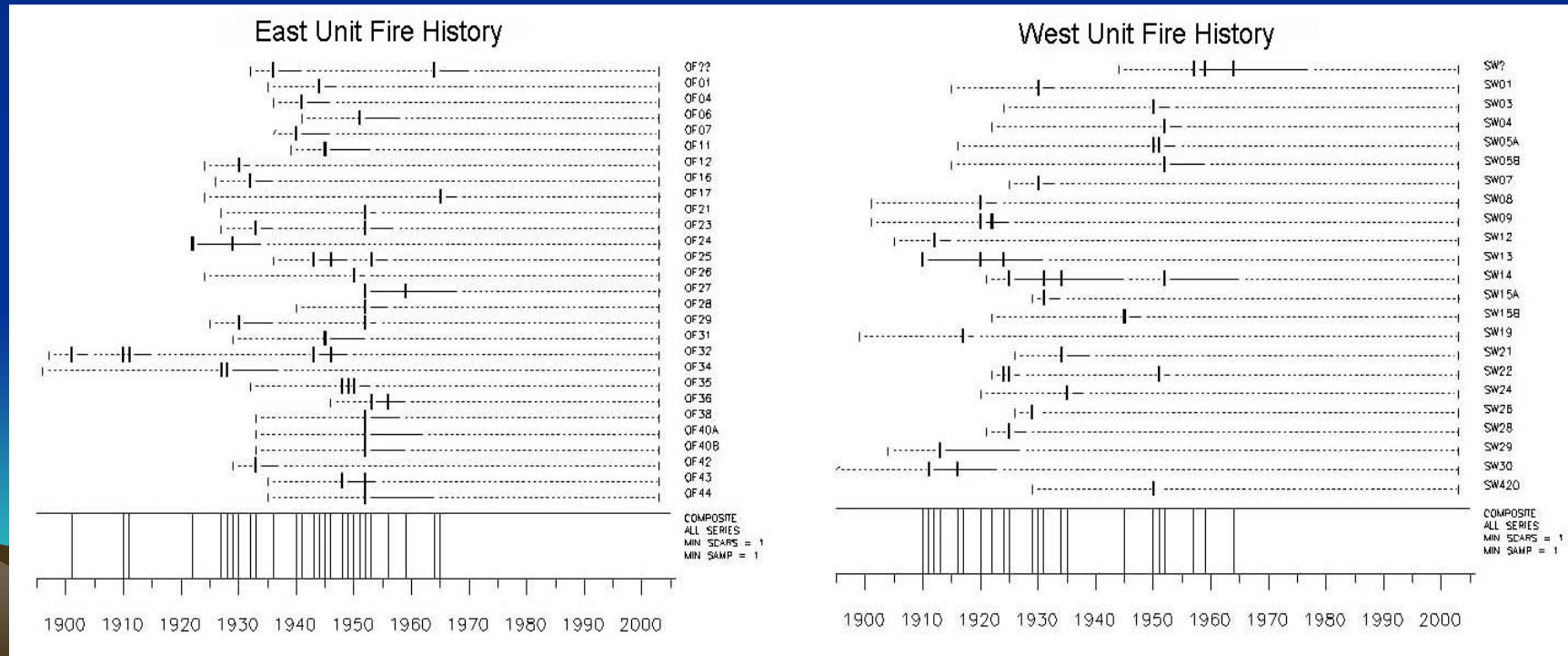
- Delcourt et al. 1998





# Agricultural clearing alters bottomland hardwood fire regimes

- Pre-settlement forests were cypress-tupelo-gum according to GLO records
- Post-settlement drainage and land clearing for agriculture (xerification) were associated with increased fire frequency and transition to mixed oak forest
- Mean fire interval (MFI) for the study period (1895-1965) was 1.73
  - minimum interval of 1 year and a maximum of 9 years
  - Weibull median percent interval (WMPI) of 1.04 to 3.18





# Mixed oak fire regimes

- fire return intervals vary across biome & range 2-24 years
- Buell 1954- Mettler's woods, NJ mean fire return interval of 14 years (1641-1711)
- Guyette and Cutter 1991- Missouri Ozarks, Native American period (11.96 yr) versus Euro-American period (3.64 yr)
- Shumway, Abrams, Ruffner 2001- western Maryland, pre-settlement fire free interval of 7.6 years

