2016-2017 Webinar Series

December 15, 2016

Reconstructing Historical Fire Regimes and Forest Structure in Wisconsin's Red Pine Dominated Forests

Jed Meunier

Nathan S. Holoubek, Peter M. Brown, &
Tricia A. Gorby-Knoot

WISCONSIN
DEPT. OF NATURAL RESOURCES

Rocky Mountain
Tree-Ring Research

Audio will start at top of the hour.
This webinar is listen only – to ask questions please use the chat box in lower right of screen.

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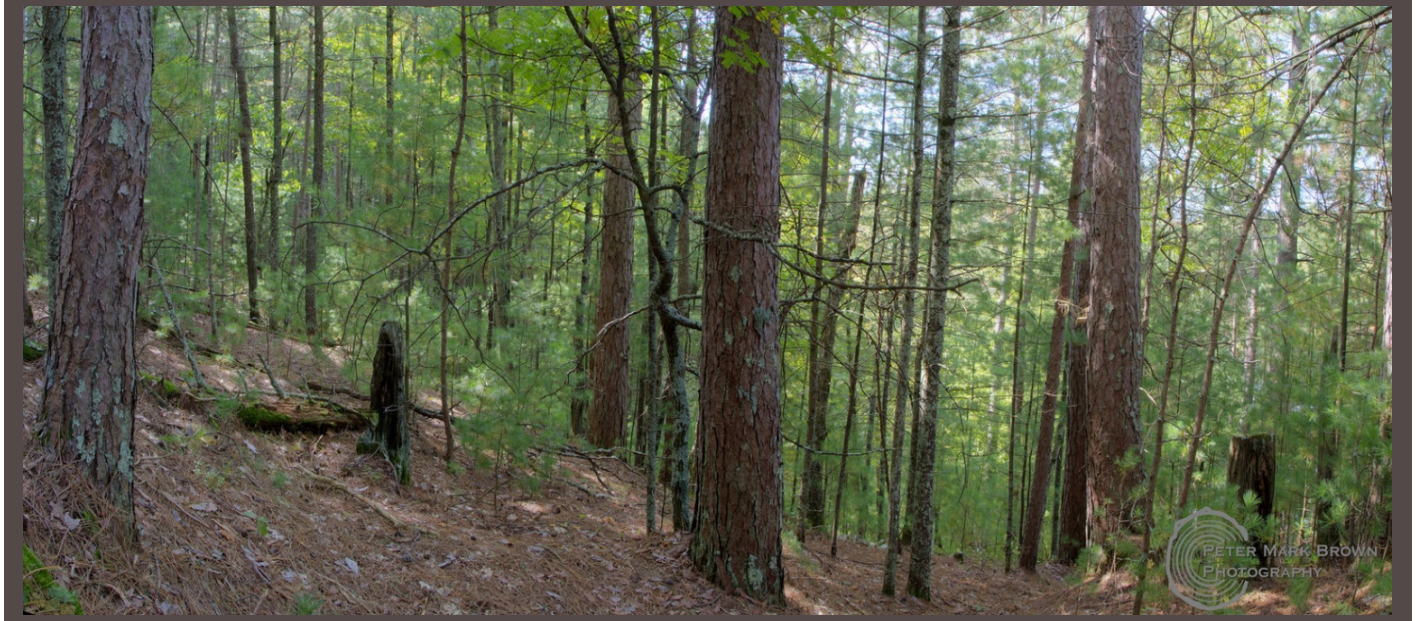
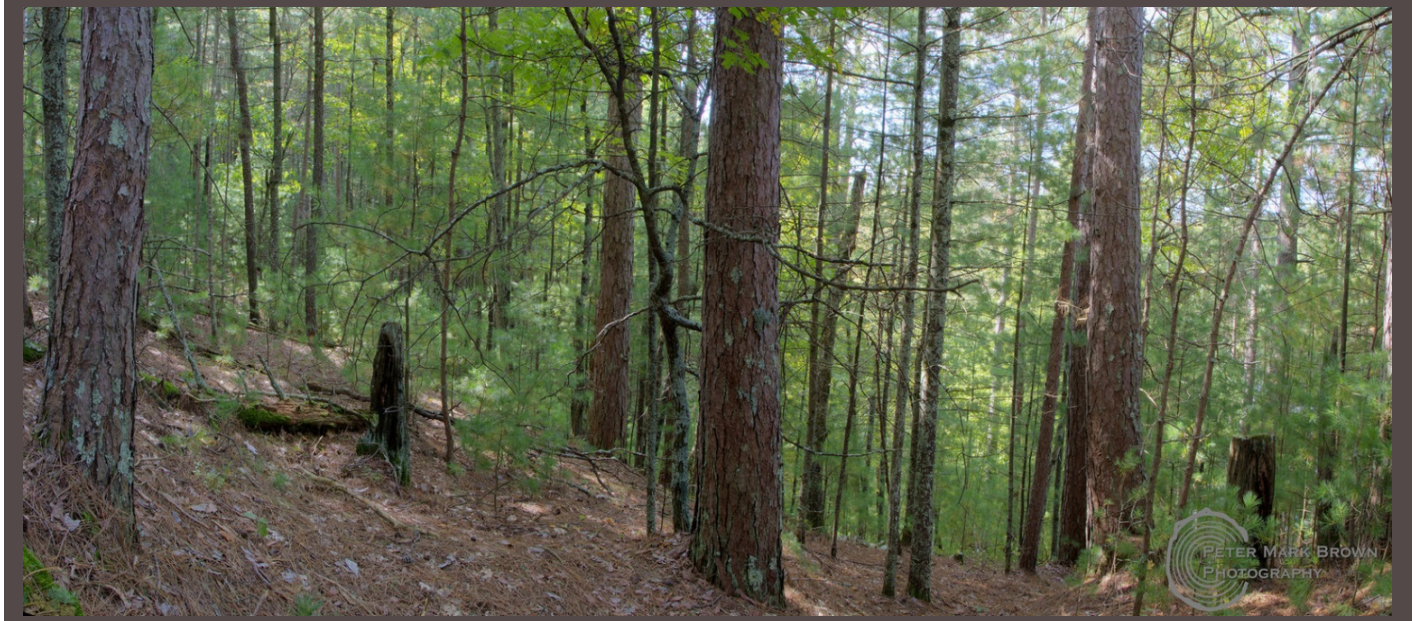
RECONSTRUCTING HISTORICAL FIRE REGIMES & STRUCTURE IN WISCONSIN'S RED PINE FORESTS

Jed Meunier, Nathan S. Holoubek, Peter M. Brown, & Tricia A. Gorby-Knoot



I. Fire History

- We need detailed local fire regime information across large geographic areas to test basic assumptions.
- Fire frequency, size, source, severity, seasonality etc.

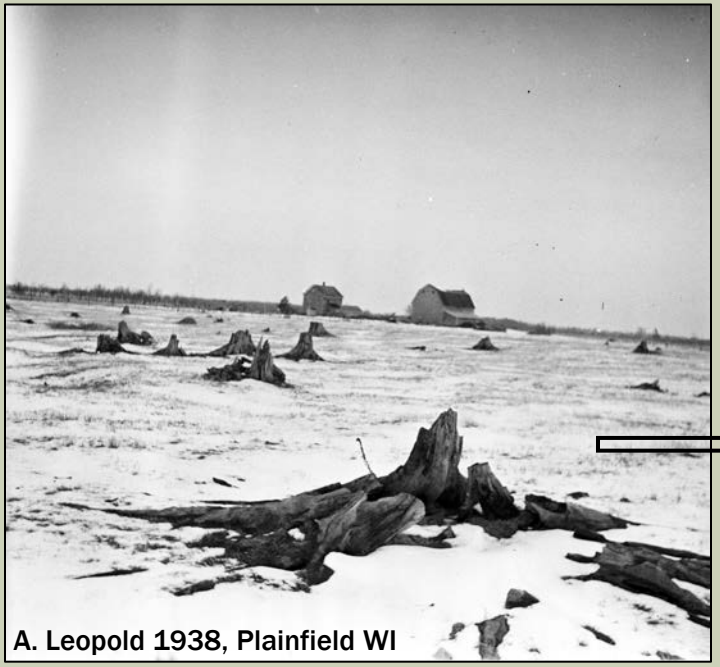


“It is astonishing how few of those who have learned by rote rule or ‘nature study’ the statics of the land’s present inhabitants or condition, ever learn to read the *dynamics* of its past history and probable future.

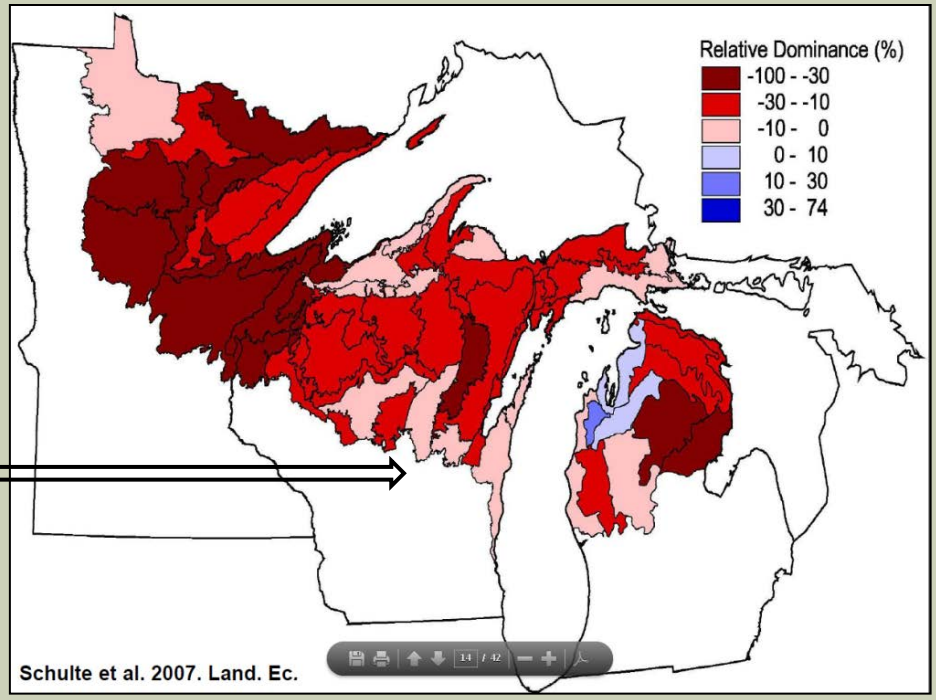
To see merely what a [forest] is or has is to see nothing. To see *why* it is, how it *became*, and the direction & velocity of its changes – this is the great drama of the land” – Leopold 1933

FUTURE DESIRED CONDITIONS?

- Only 0.6% of relatively intact pines remain. (Frelich 1995)
- Pine forests have not recovered from logging era.
- We know little about GLR pine systems.



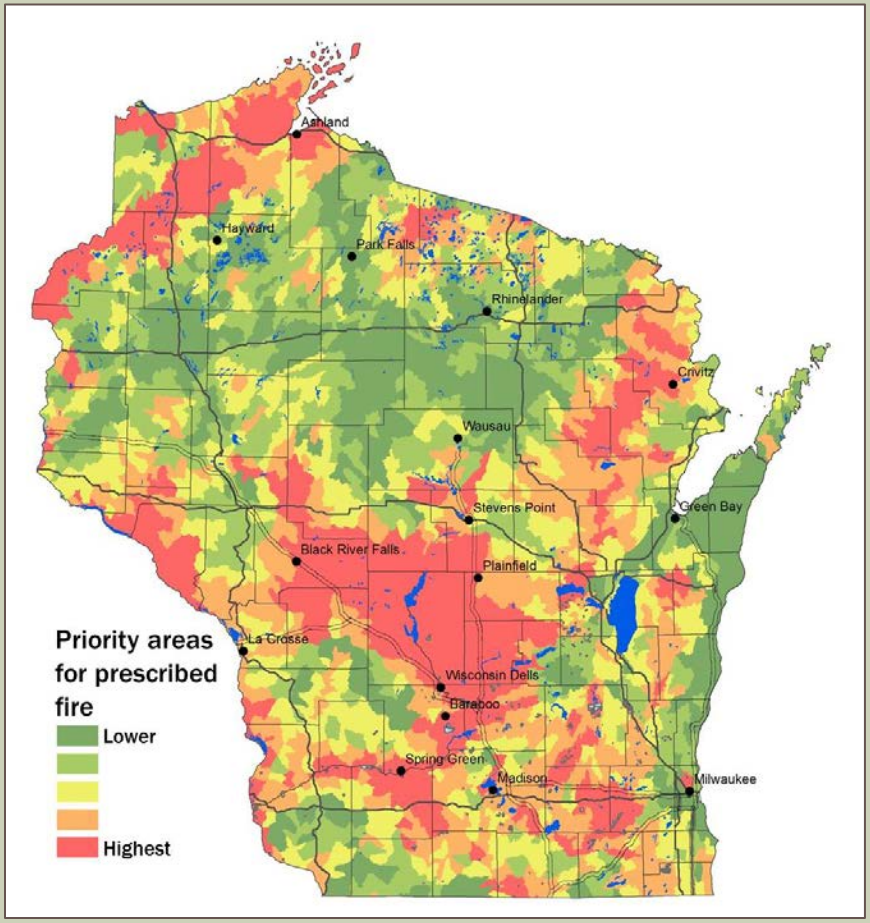
A. Leopold 1938, Plainfield WI



Schulte et al. 2007. Land. Ec.

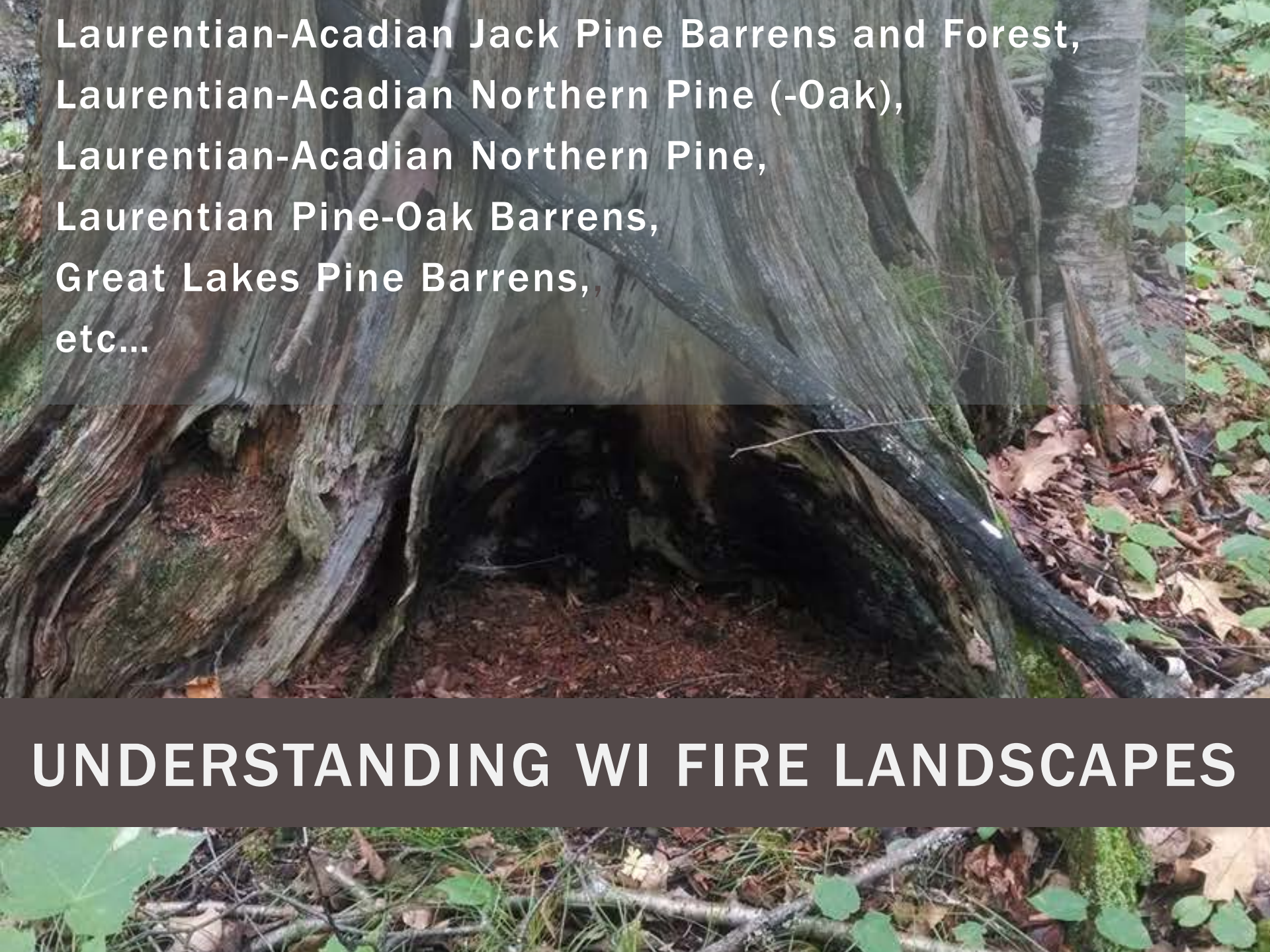
PINE SYSTEMS REPRESENT GREAT OPPORTUNITIES

WI Fire Needs Assessment



Plant Communities Ranked by Greatest Opportunity for Prescribed Fire Use

1	Managed Grasslands	7	Pine-Oak Forest
2	Pine Barrens	8	Bluff and Talus
3	Oak Forest	9	Oak Barrens
4	Oak Woodland	10	Dry Prairie
5	Herbaceous Wetlands	11	Oak Savanna
6	Pine Forest	12	Tallgrass Prairie



UNDERSTANDING WI FIRE LANDSCAPES

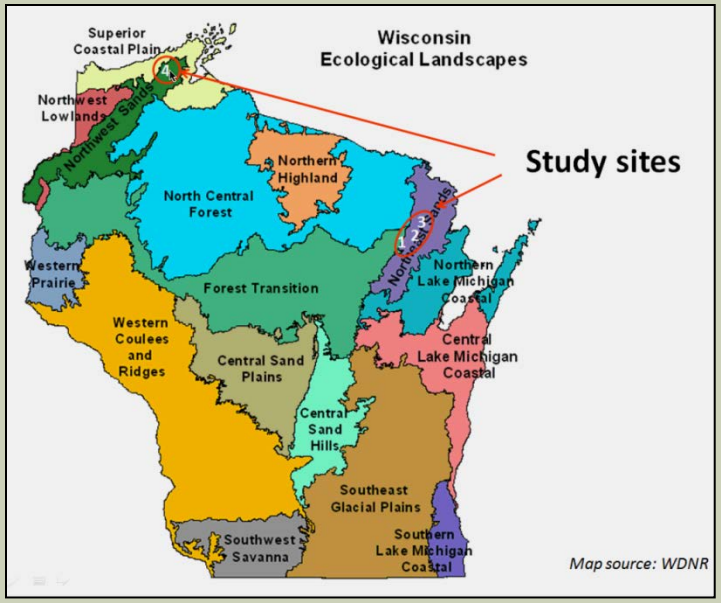
LAURENTIAN-ACADIAN NORTHERN PINE (-OAK) FOREST

~ 8 million acres mapped in LANDFIRE BpS GLR

- FRG III (fires every 41-50 yrs).
- Pine regen. able to survive fires after 50 yrs.
- Natural fuel breaks (wetlands and lakes) inhibited fire spread = longer fire rotations.
- Historical fire size max area = 100,000 acres, Avg = 10,000 acres.
- Anthropogenic fire most sig. in this system.

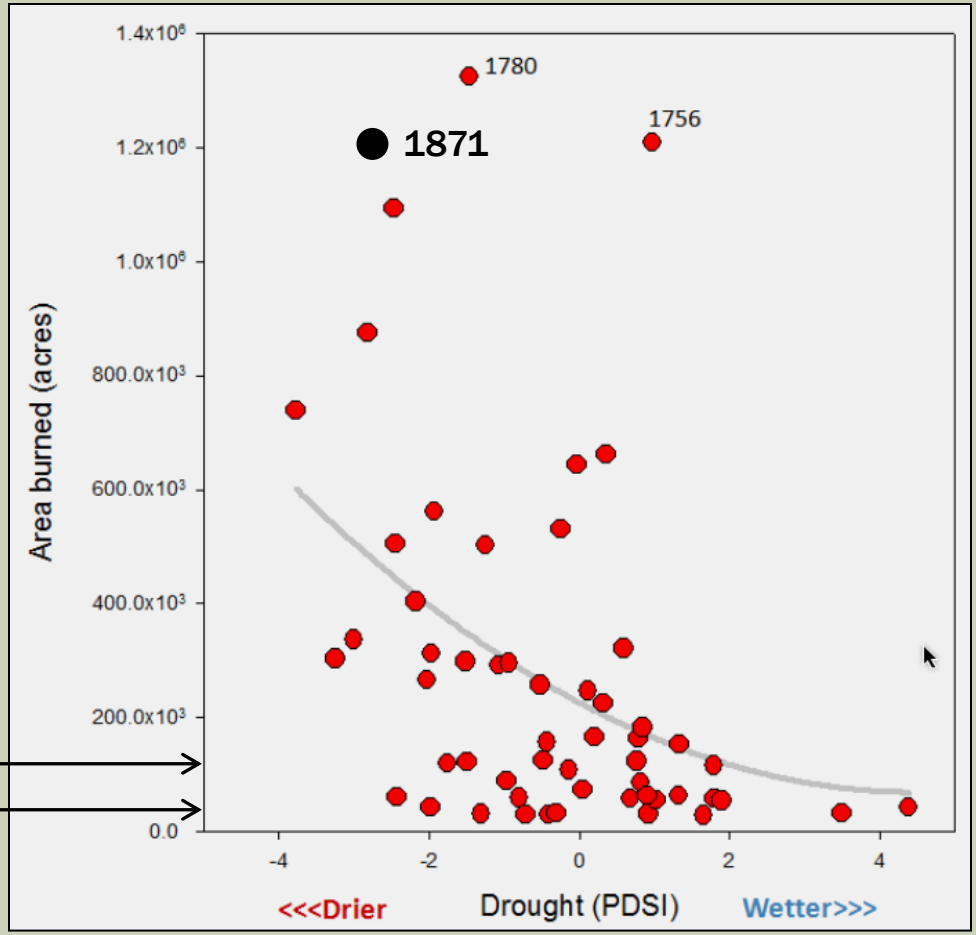
LAURENTIAN-ACADIAN PINE (-OAK) FOREST

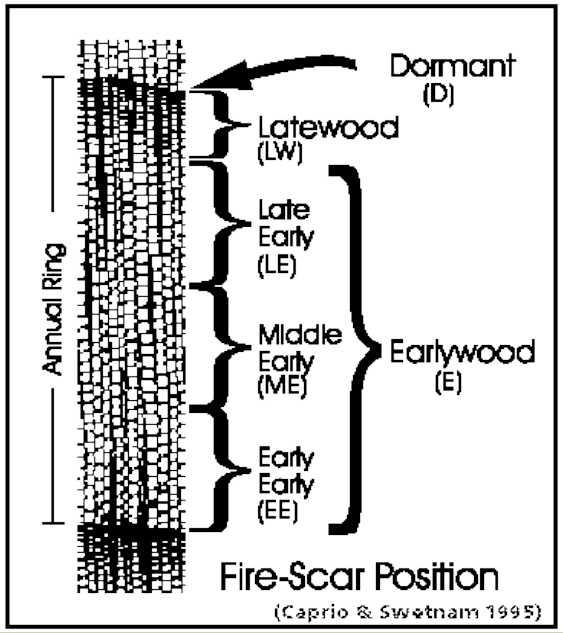
- Fire extent index (% sites burned*% trees scarred*area)



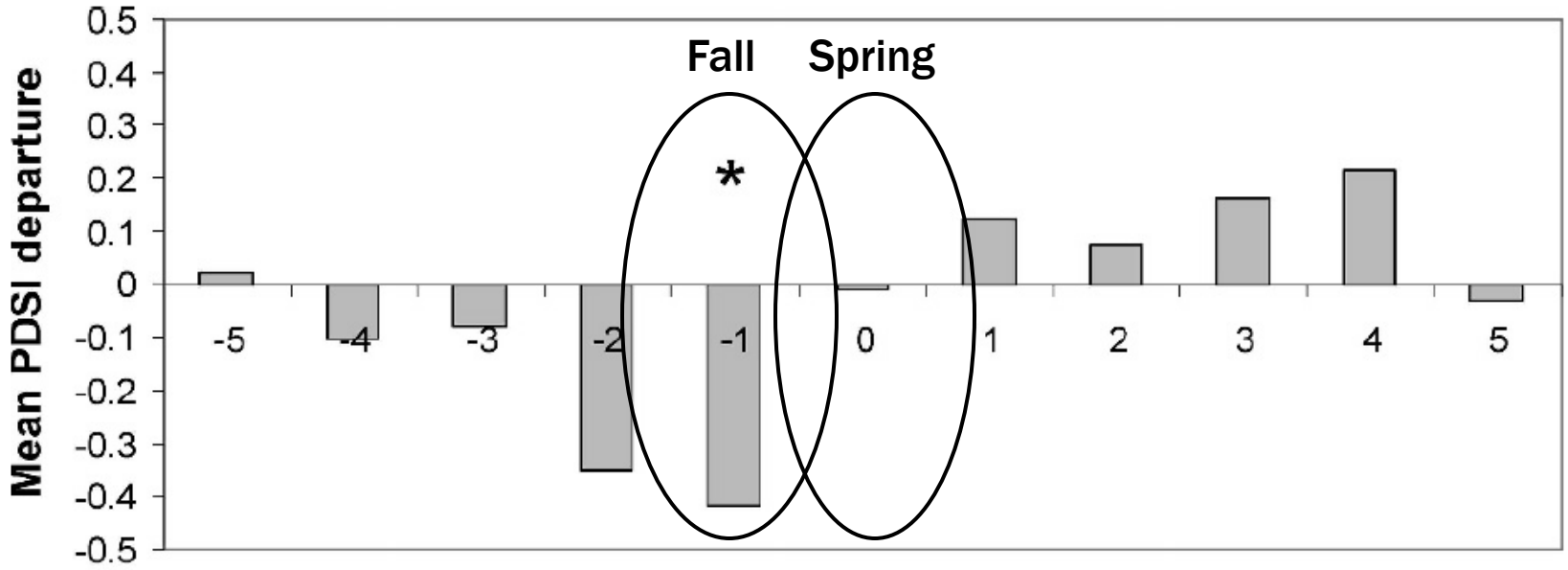
Rich Guyette & Mike Stambaugh

LANDFIRE Max
LANDFIRE Avg





76% of fire scars on Menominee occurred in the dormant season



Sands & Abrams 2011

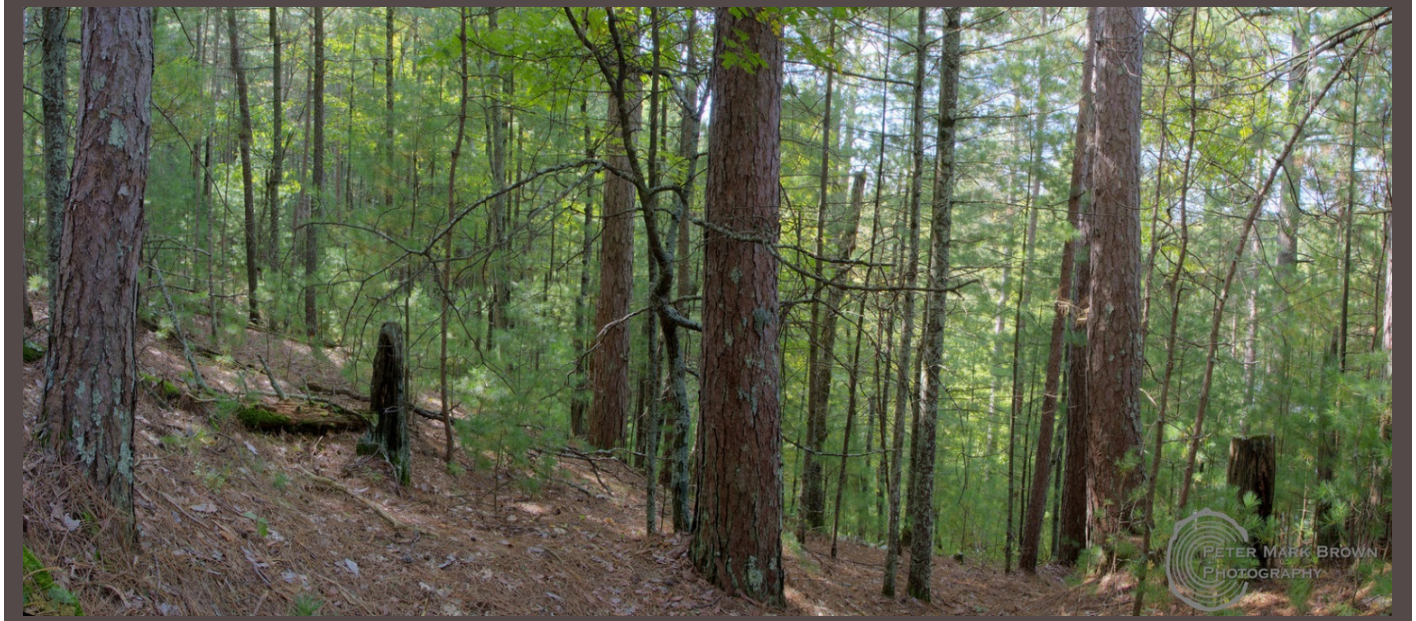
"The sky in the night time is a fiery red, and the smoke in the day prevents the sun from being seen until 10 o'clock in the forenoon. This smoky season is what is called here Indian Summer" -- Newhall 1821

Firsthand fire accounts (primarily 1800s)	
Spring	17
Fall	43
Winter	6
Summer	7
Unspecified	3
Total	76

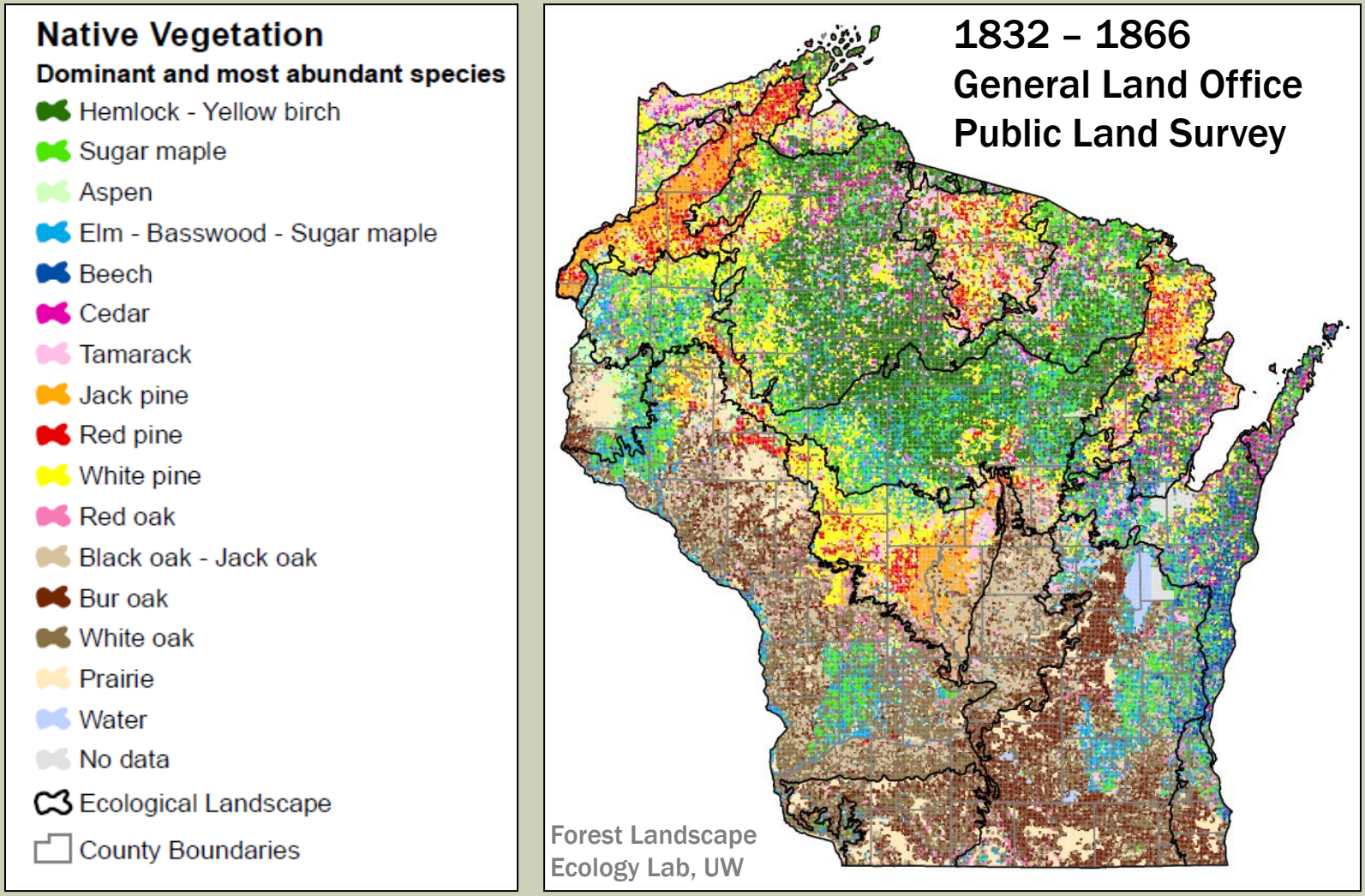
*Data: Rich Henderson, WI DNR
Unpublished 600 source bibliography

II. Forest Structure

- What was Pre(Euro)-settlement structure of red pine dominated forests across moisture gradients (natural range of variability in stand and age structure)?
- How does structure relate to fire regime and vice versa?



PRE-EURO-SETTLEMENT VEGETATION

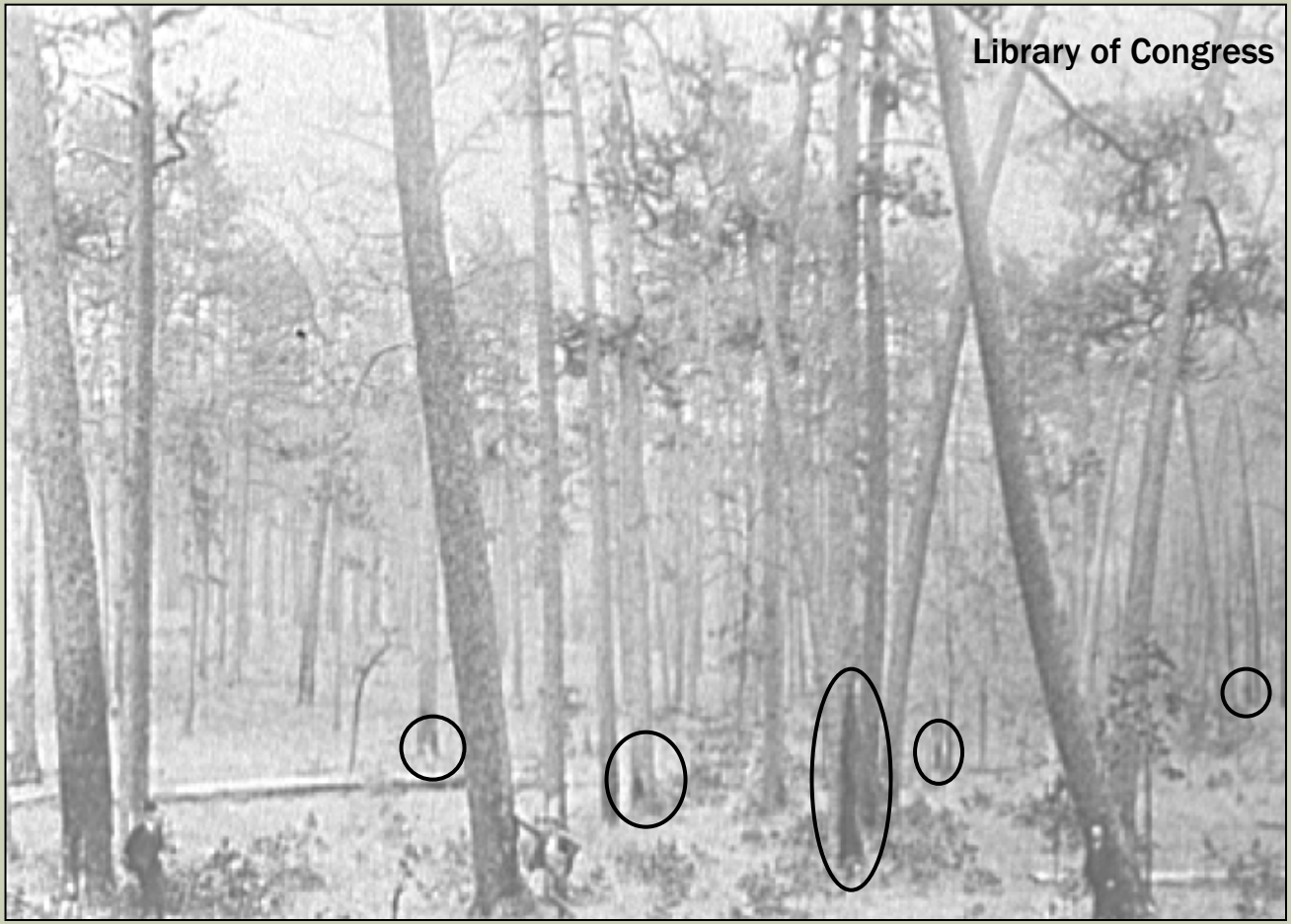


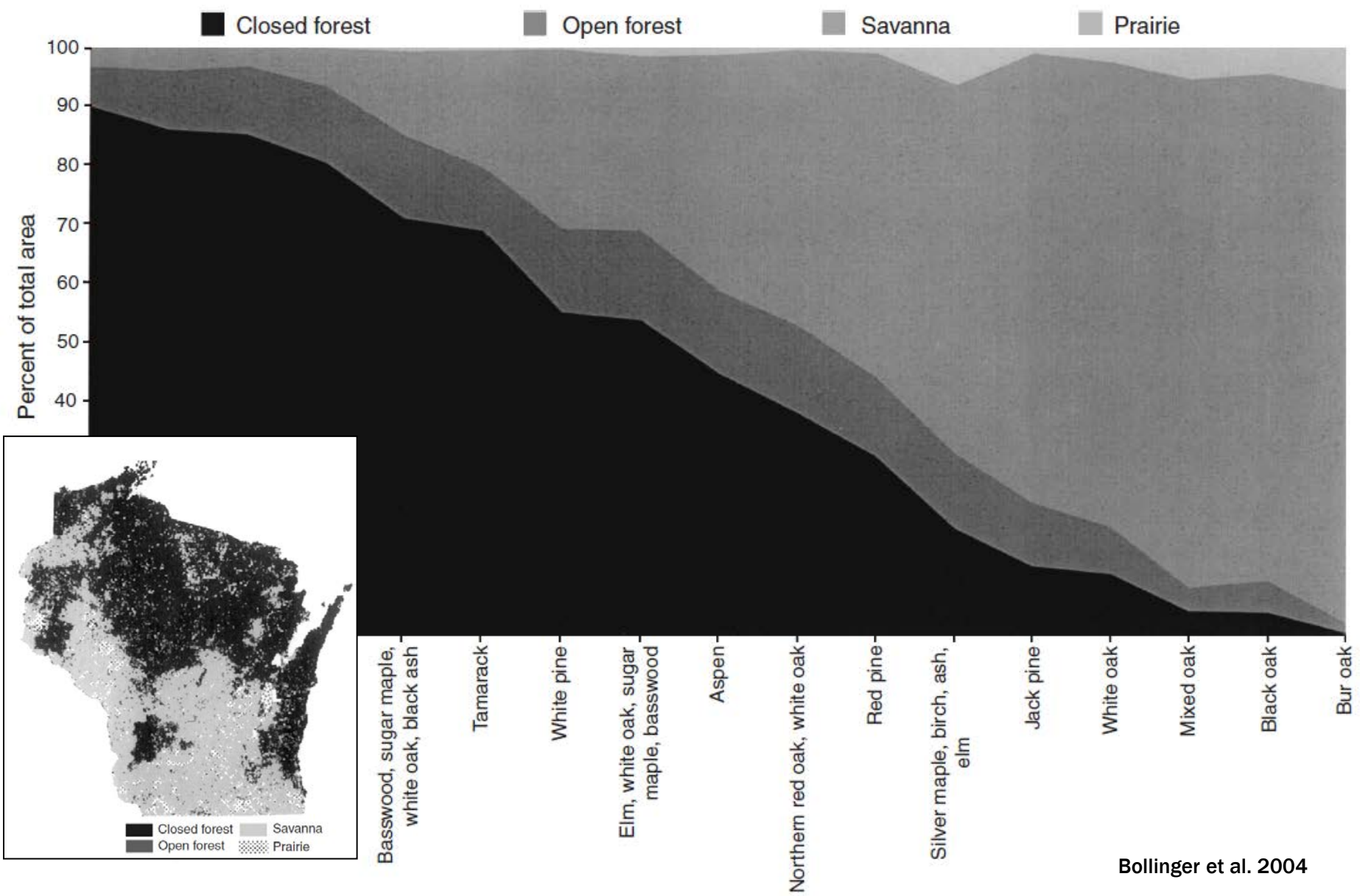
PRE-EUROPEAN SETTLEMENT MIXED-PINE FOREST OF UPPER MI

Trees/ha

- Forest: >99
- Woodland: 47-99
- Savanna: 0.5-47
- Prairie: <0.5

- Anderson & Anderson 1975

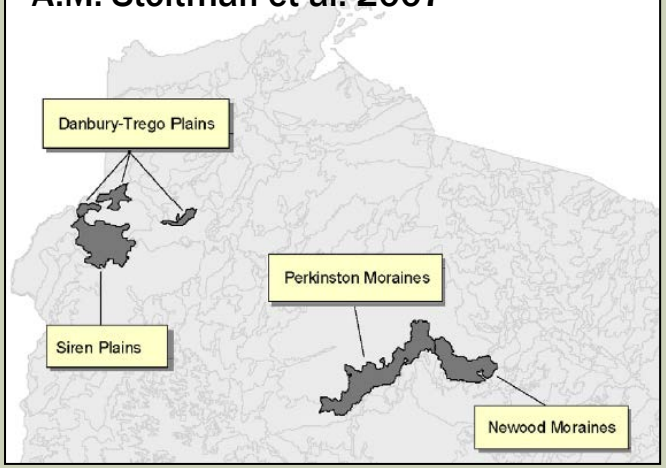


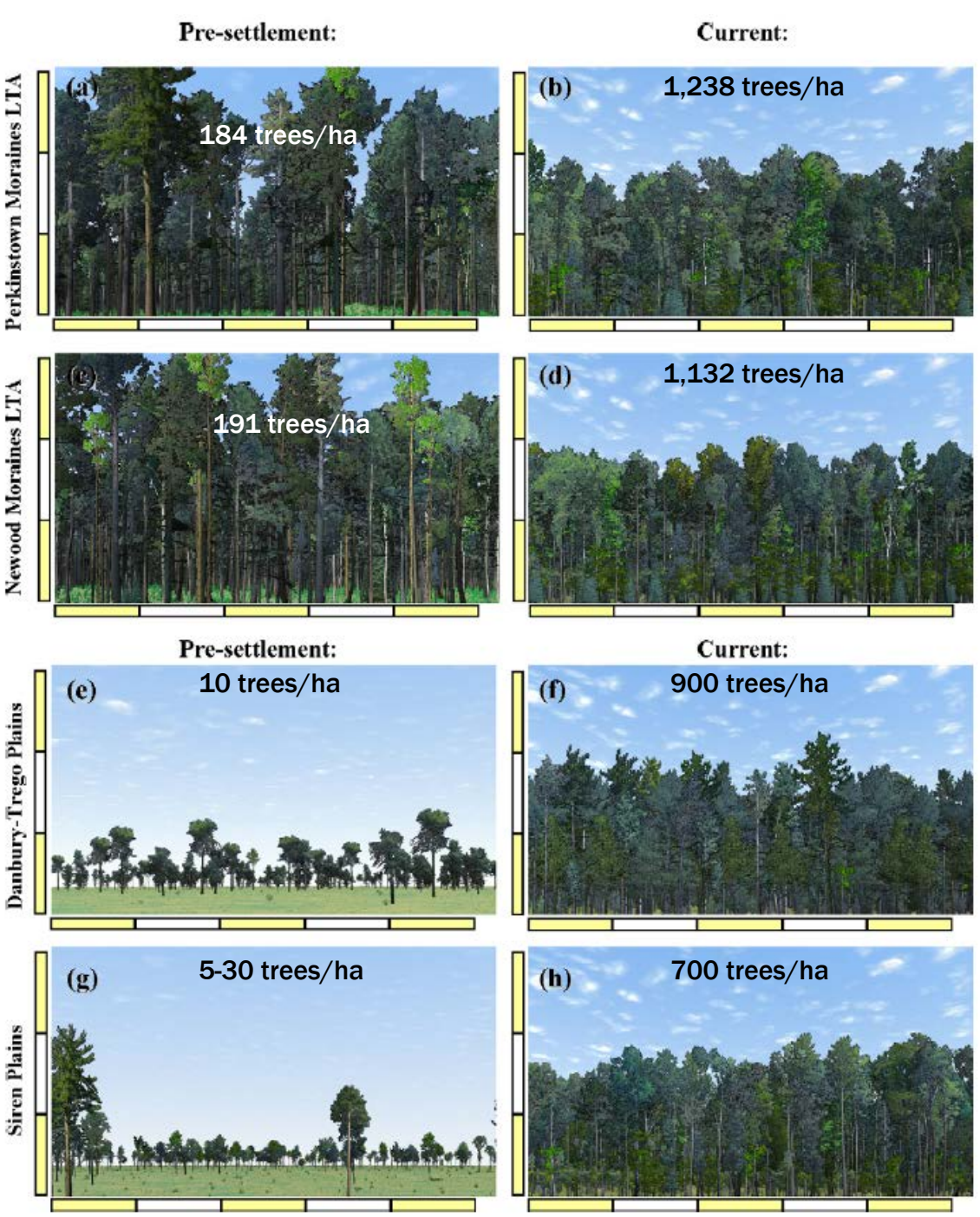


Bollinger et al. 2004

VISUALIZING DENSITY VIA GLO DATA

A.M. Stoltman et al. 2007





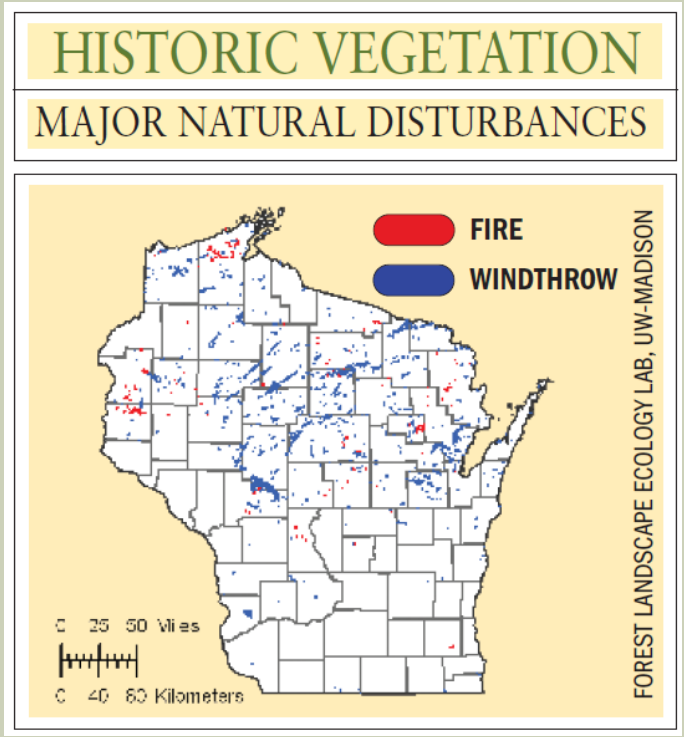
GLO DATA HAS LIMITATIONS!

SEVERE WIND AND FIRE REGIMES IN NORTHERN FORESTS: HISTORICAL VARIABILITY AT THE REGIONAL SCALE

LISA A. SCHULTE[1] AND DAVID J. MLADENOFF

Department of Forest Ecology and Management, University of Wisconsin, 1630 Linden Drive, Madison, Wisconsin 53706 USA

Ecology, 86(2), 2005, pp. 431–445



- Severity based on GLO tree density within disturbed and undisturbed patches.
- Fire rotation intervals (yrs):

  Jack Pine – 488

  Red Pine – 810

  White Pine – 3,029

OLD GROWTH RED PINE DOMINATED FORESTS ARE LIMITED!

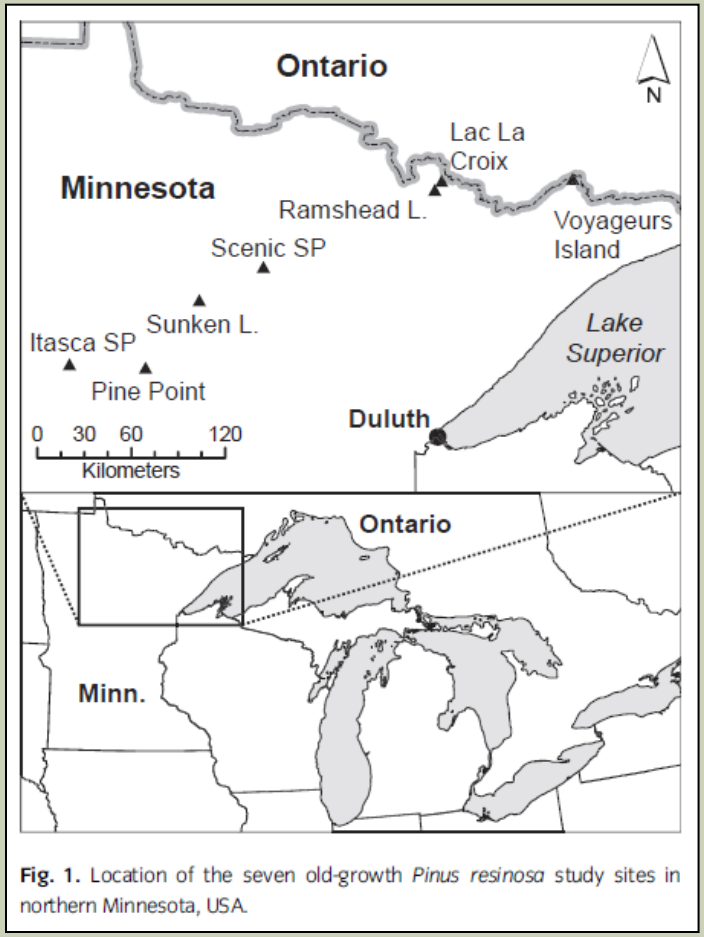


Fig. 1. Location of the seven old-growth *Pinus resinosa* study sites in northern Minnesota, USA.

Fraver and Palik 2012

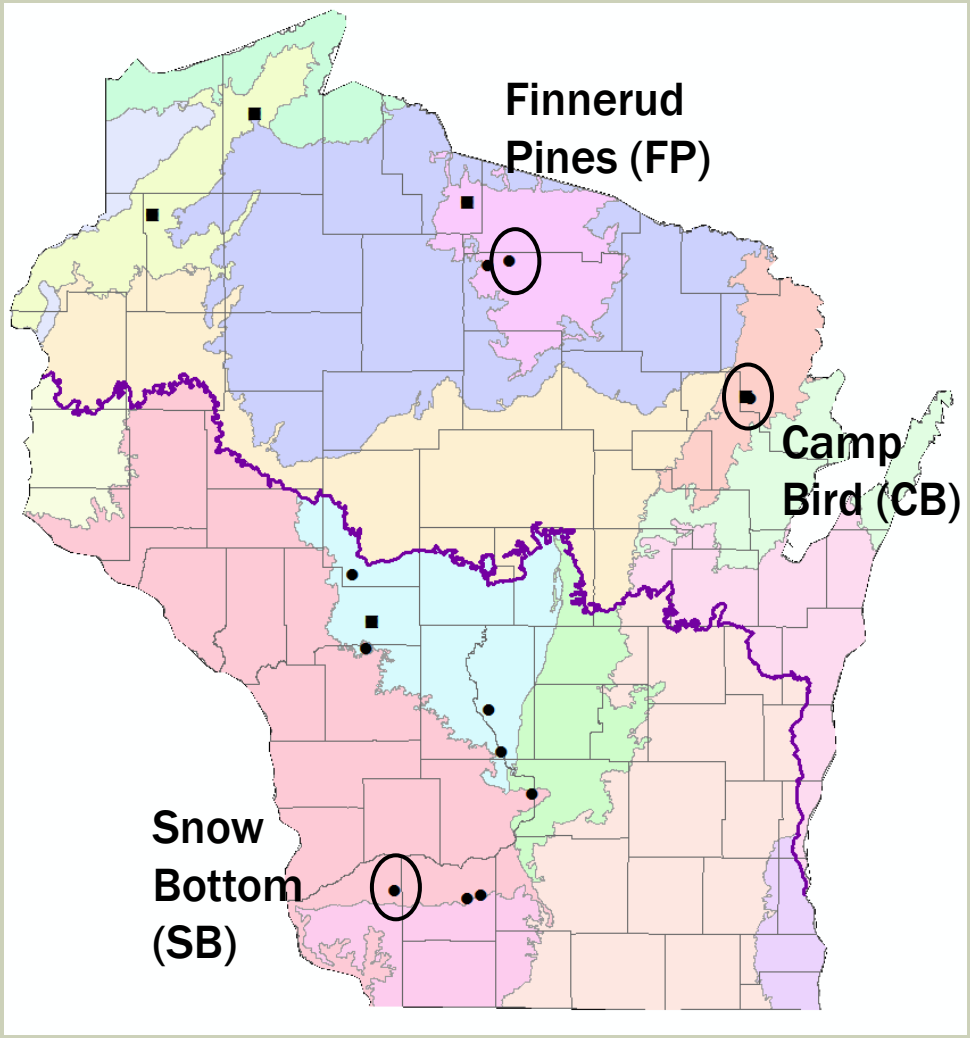
- Mean Trees/ha = 408
- Mean saplings/ha:

  P. resinosa – 5

  P. strobus – 496

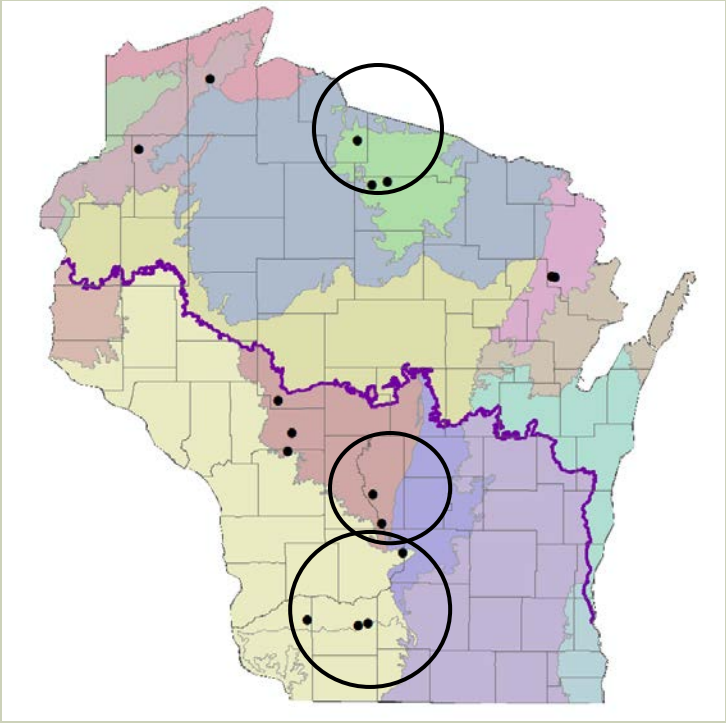
  Non-pine – 1,575

DETAILED LOCAL FIRE HISTORIES OVER A LARGE GEOGRAPHIC SCALE

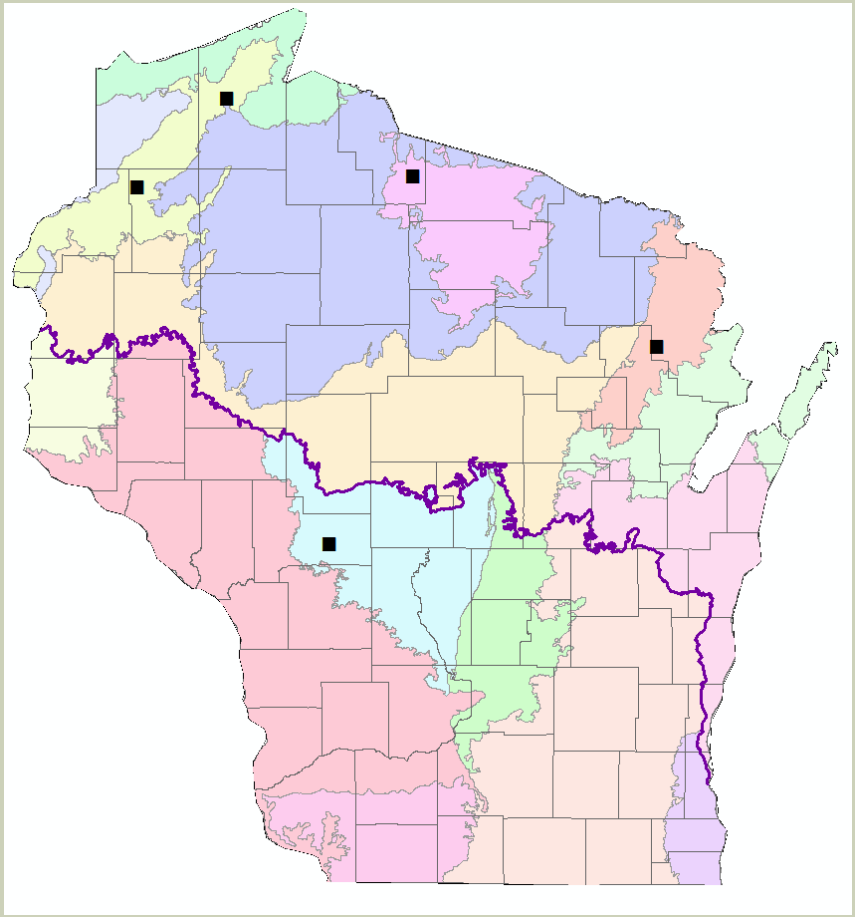


- 11/21 fire history sites (8 m radius plots)
- 5/8 stand reconstructions sites (0.5 ha plots)
- 436 cross sections, 2,380 cores

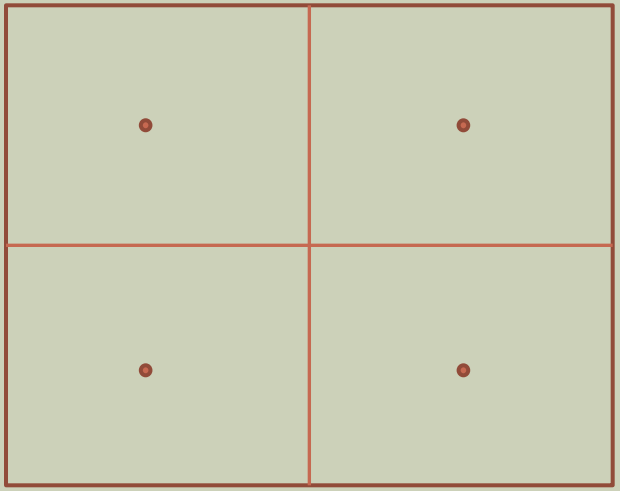
DETAILED LOCAL FIRE HISTORIES OVER A LARGE GEOGRAPHIC SCALE



STAND STRUCTURE 0.5 HA PLOTS

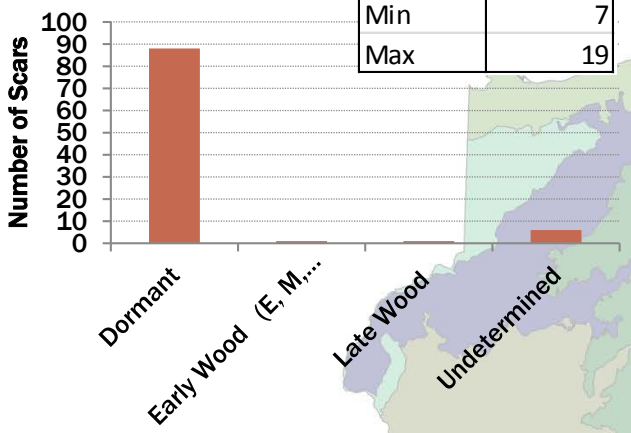


70.7m x 70.7m = 0.5 ha



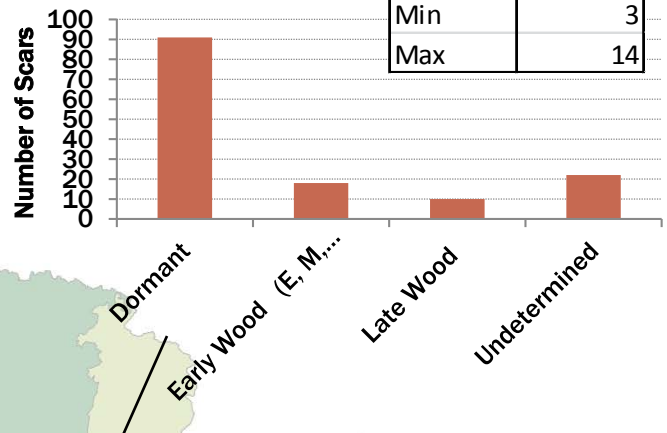
FP Scar Position

MFI	12.43
Min	7
Max	19



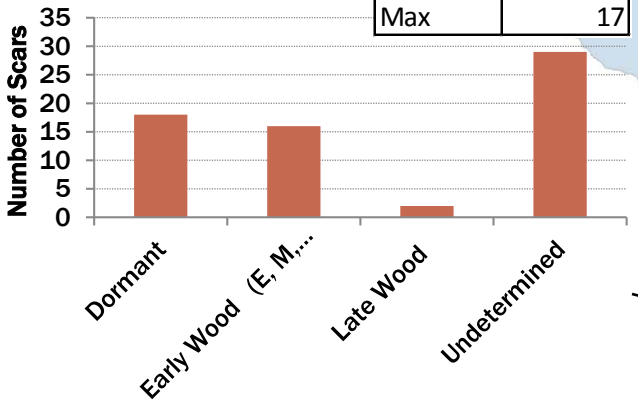
CB Scar Position

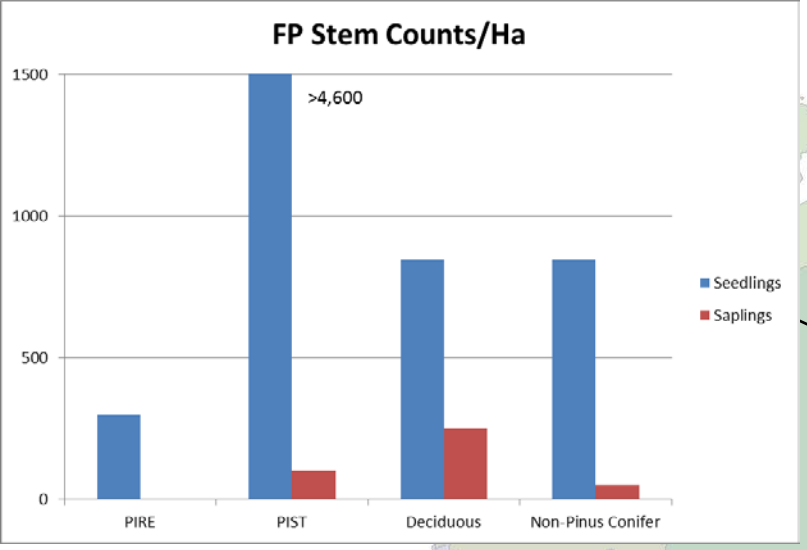
MFI	7.11
Min	3
Max	14

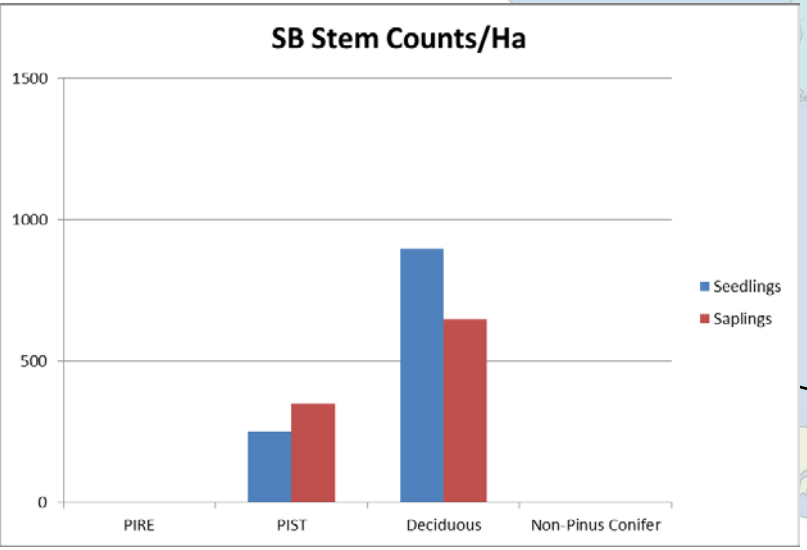


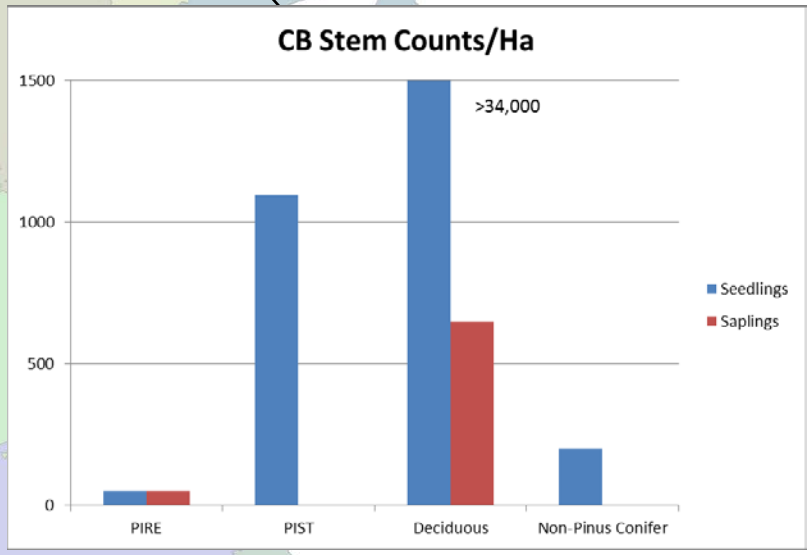
SB Scar Position

MFI	3.72
Min	1
Max	17







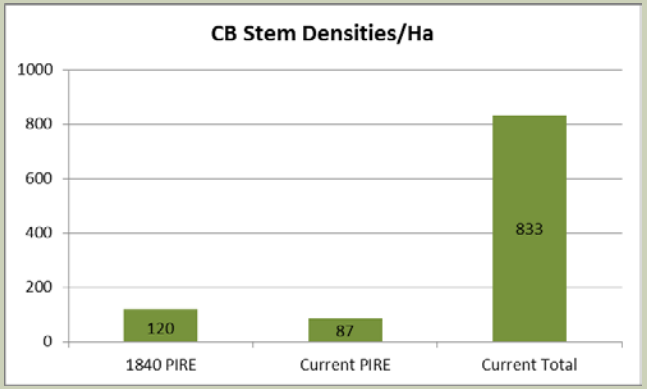


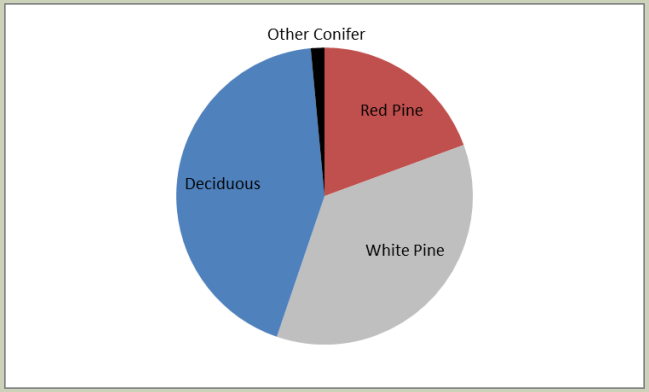
0 15 30 60 Miles

N

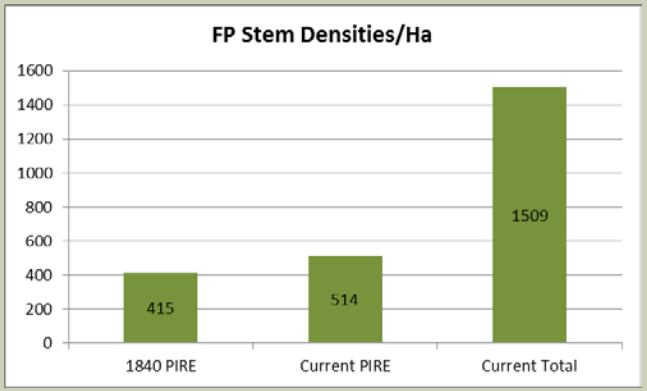
Historical vs Current Tree Density

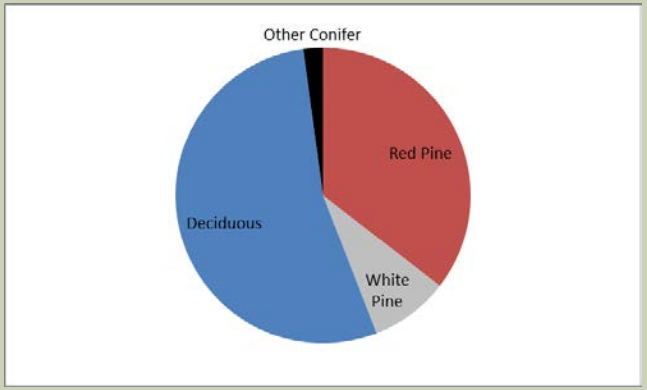
Current Stand Composition





< PIRE
> PIST
>> Deciduous





> PIRE
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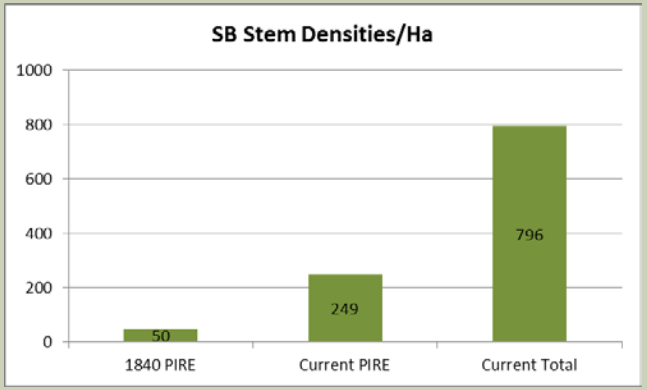
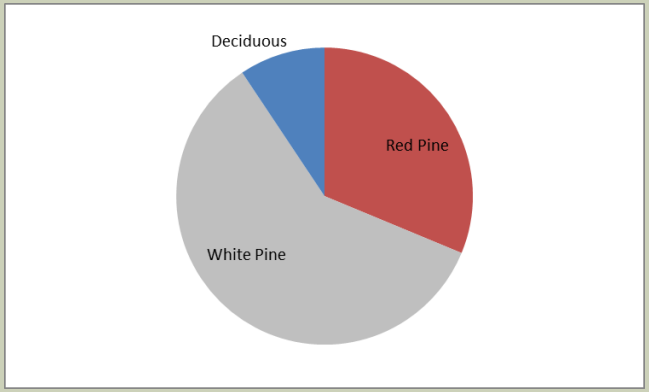
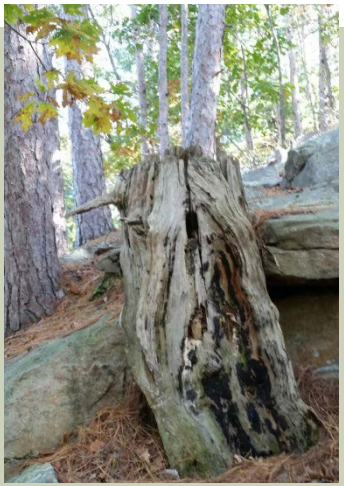
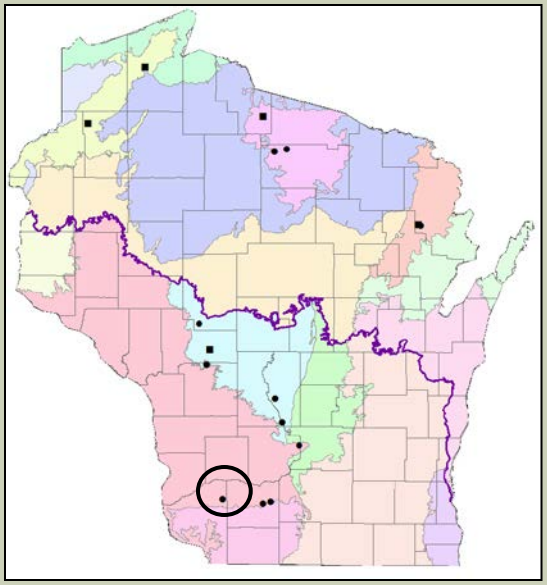


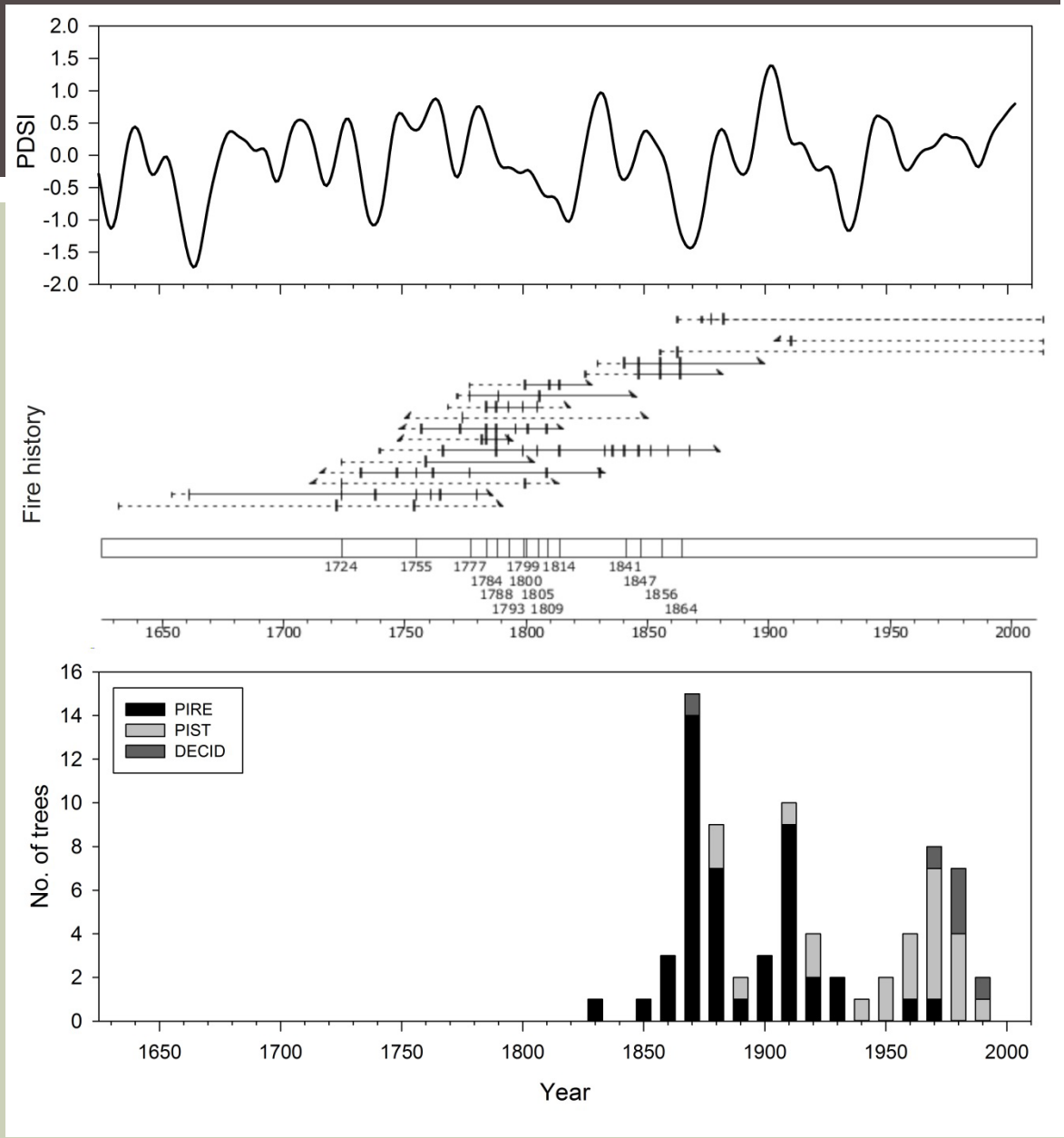


> PIRE
>> PIST
> Deciduous

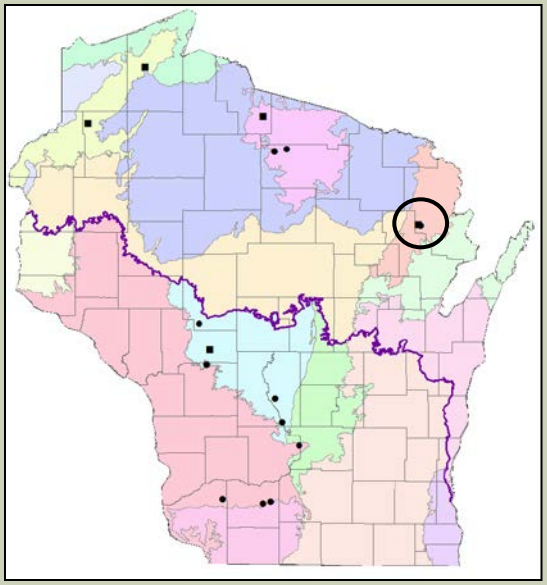
SNOW BOTTOM

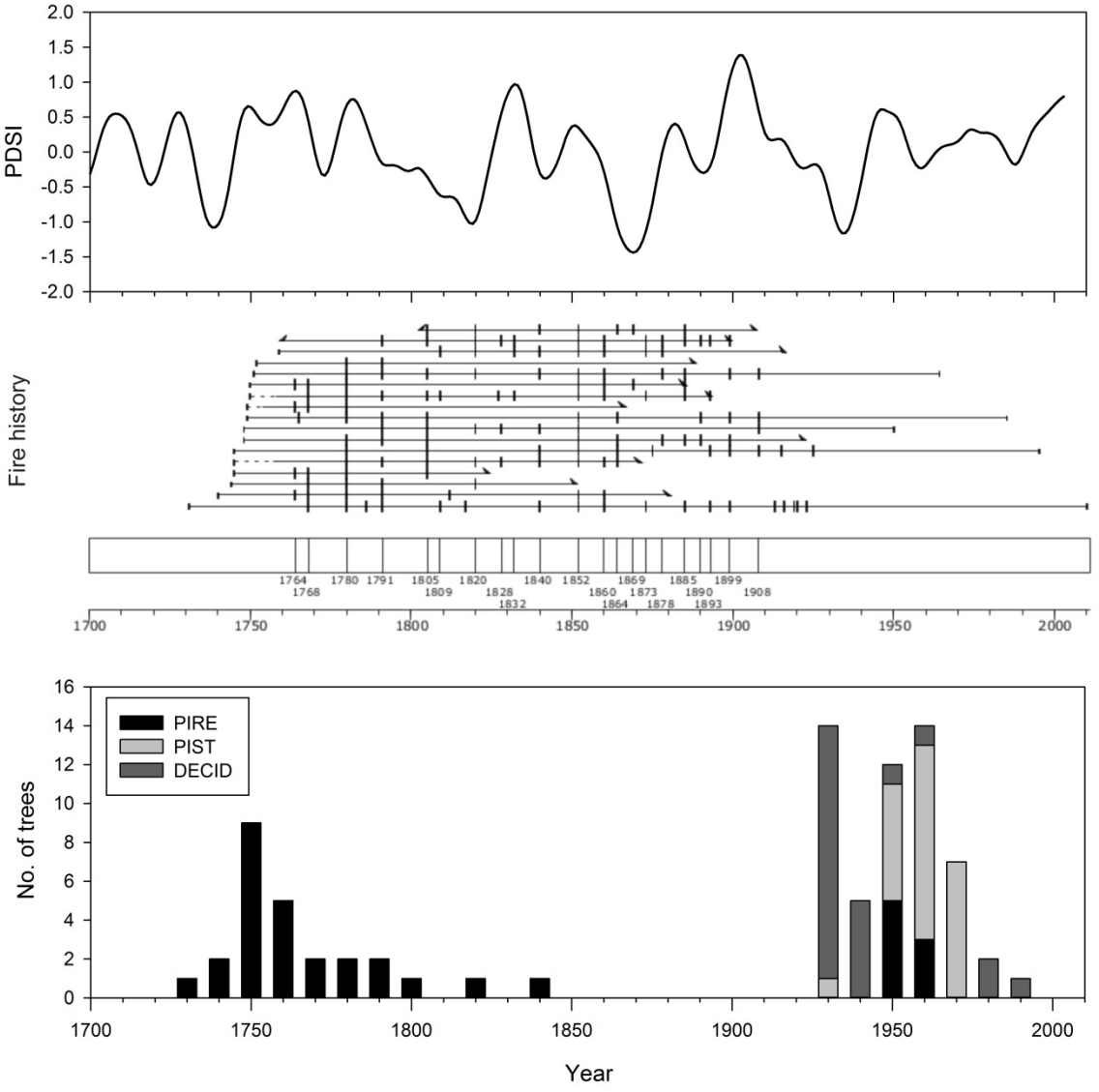





PDSI
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
Fire history
1724
1755
1777
1784
1788
1793
1799
1800
1805
1809
1814
1841
1847
1856
1864
1650
1700
1750
1800
1850
1900
1950
2000
No. of trees
PIRE
PIST
DECID
16
14
12
10
8
6
4
2
0
1650
1700
1750
1800
1850
1900
1950
2000
Year

CAMP BIRD




PDSI
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
Fire history
1764
1768
1780
1791
1805
1809
1820
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1840
1852
1860
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1873
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1885
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1750
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1850
1900
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No. of trees
PIRE
PIST
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8
6
4
2
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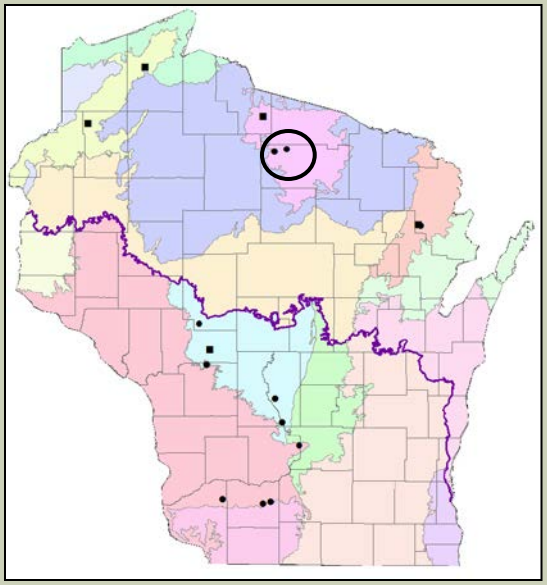
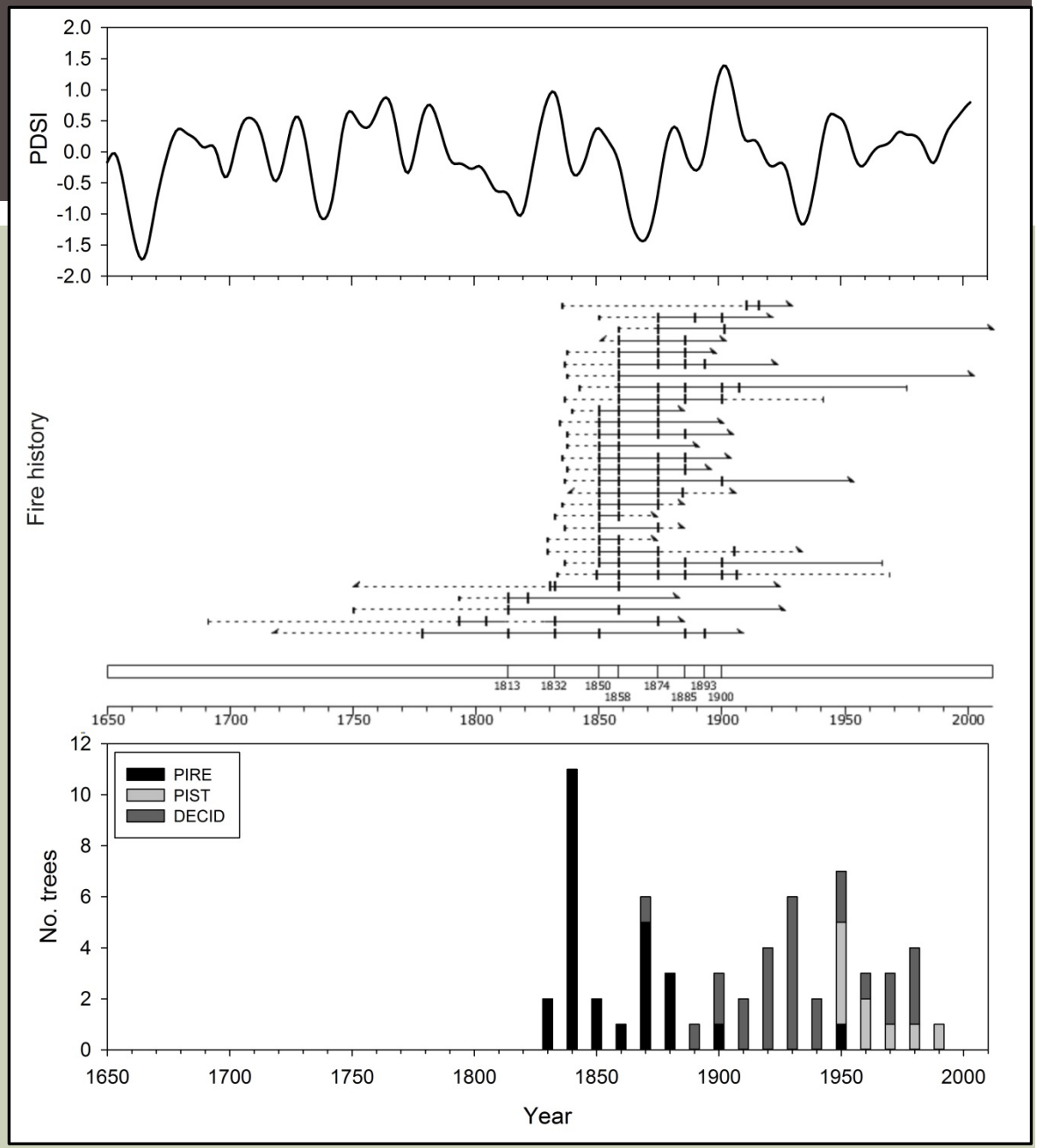
Year

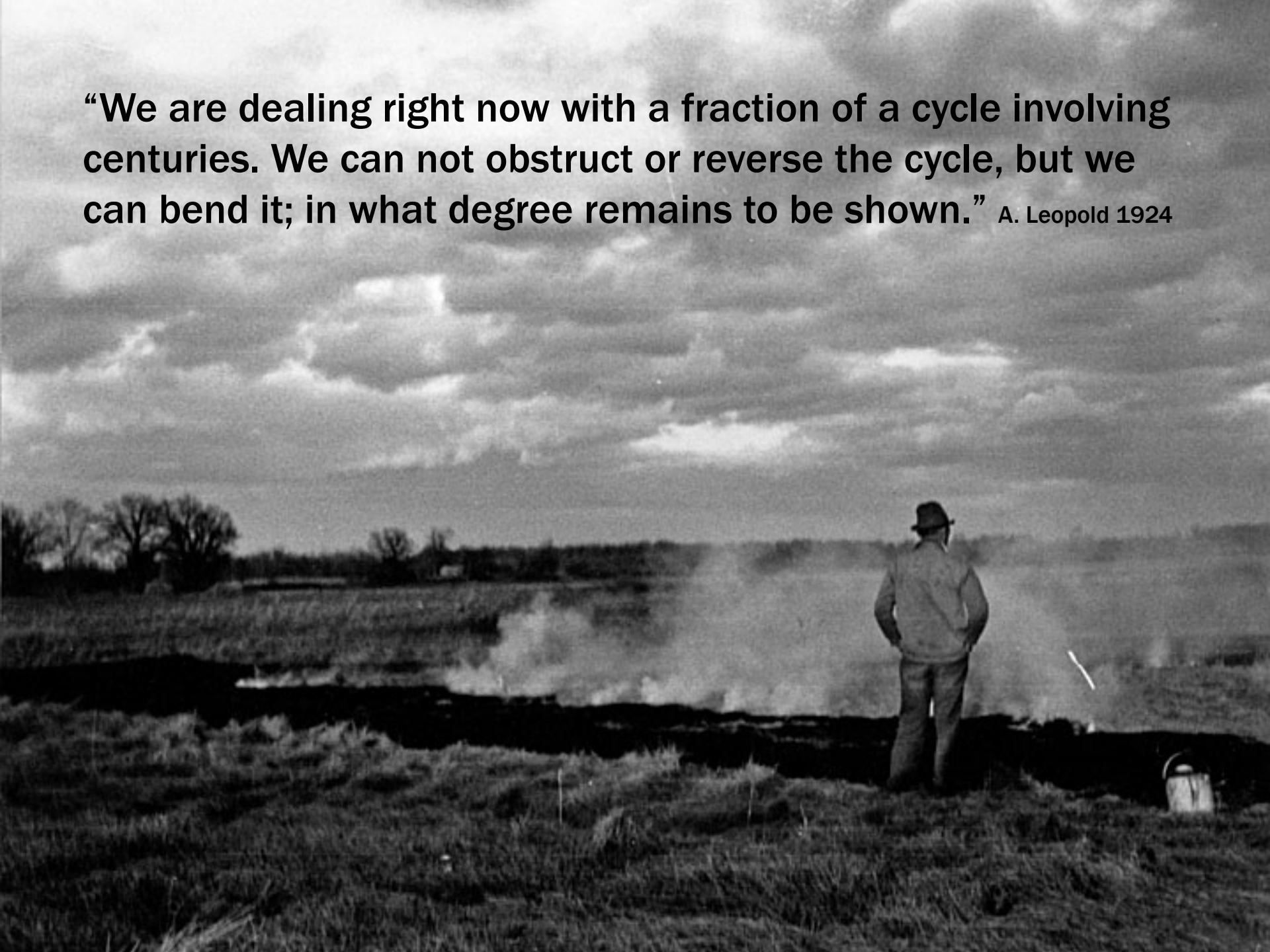
FINNERUD PINES





SOME FINAL THOUGHTS

- Fire ecology and management in GLR is still rooted in a "biophysical paradigm".
- We need hypothesis testing with explicitly stated assumptions.
- We have a great opportunity to both understand fire history and manage fire dependent systems, but need to think outside the box.
- Fire was a ubiquitous process in WI systems!
- We have a lot of work left to do!!


“We are dealing right now with a fraction of a cycle involving centuries. We can not obstruct or reverse the cycle, but we can bend it; in what degree remains to be shown.” A. Leopold 1924

THANK YOU

2016-2017 Webinar Series

January 19, 2017

Fire and Aspen in the Lake States

Lee Frelich

Director of the University of Minnesota

Center for Forest Ecology