2015-2016 Webinar Series
November 19, 2015

An historical lens to investigate changes in the forest structure and fire adaptation of the Great Lakes National Parks

and

Response of insectivore pollinators, plant diversity, and fuel loads to a large-scale barren and northern dry forest restoration project in northeastern Wisconsin.

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.

@LSFireScience

LakeStatesFireSci.net

An historical lens to investigate changes in the forest composition and fire adaptation of the Great Lakes National Parks

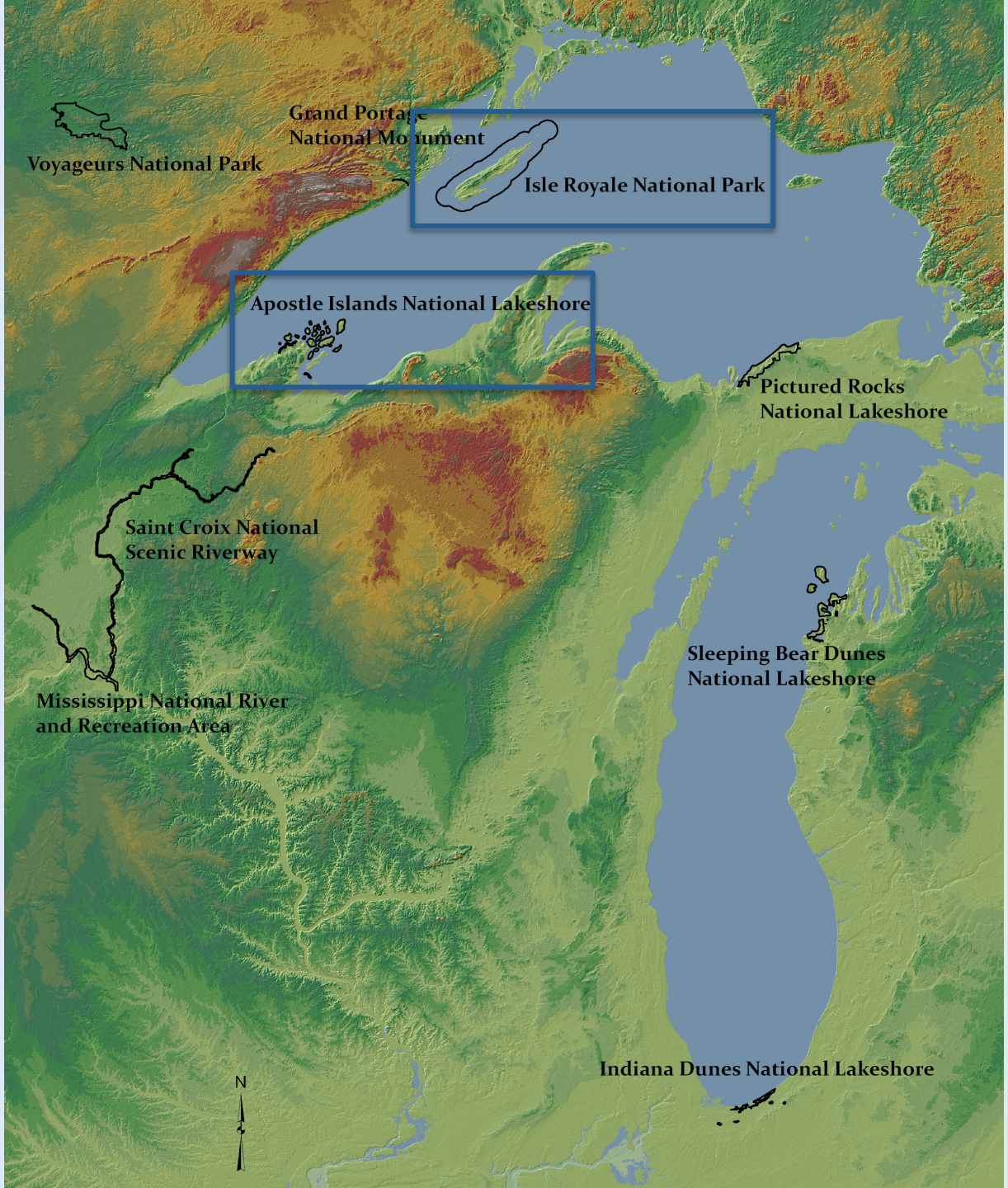
Alison Paulson[1], Suzanne Sanders[2], Jessica Kirschbaum[2], Don Waller[1]

1: Department of Botany, University of Wisconsin-Madison

2: National Park Service Great Lakes Inventory and Monitoring Network

National Park Service Great Lakes Inventory and Monitoring Network

National Park Service Great Lakes Inventory and Monitoring Network

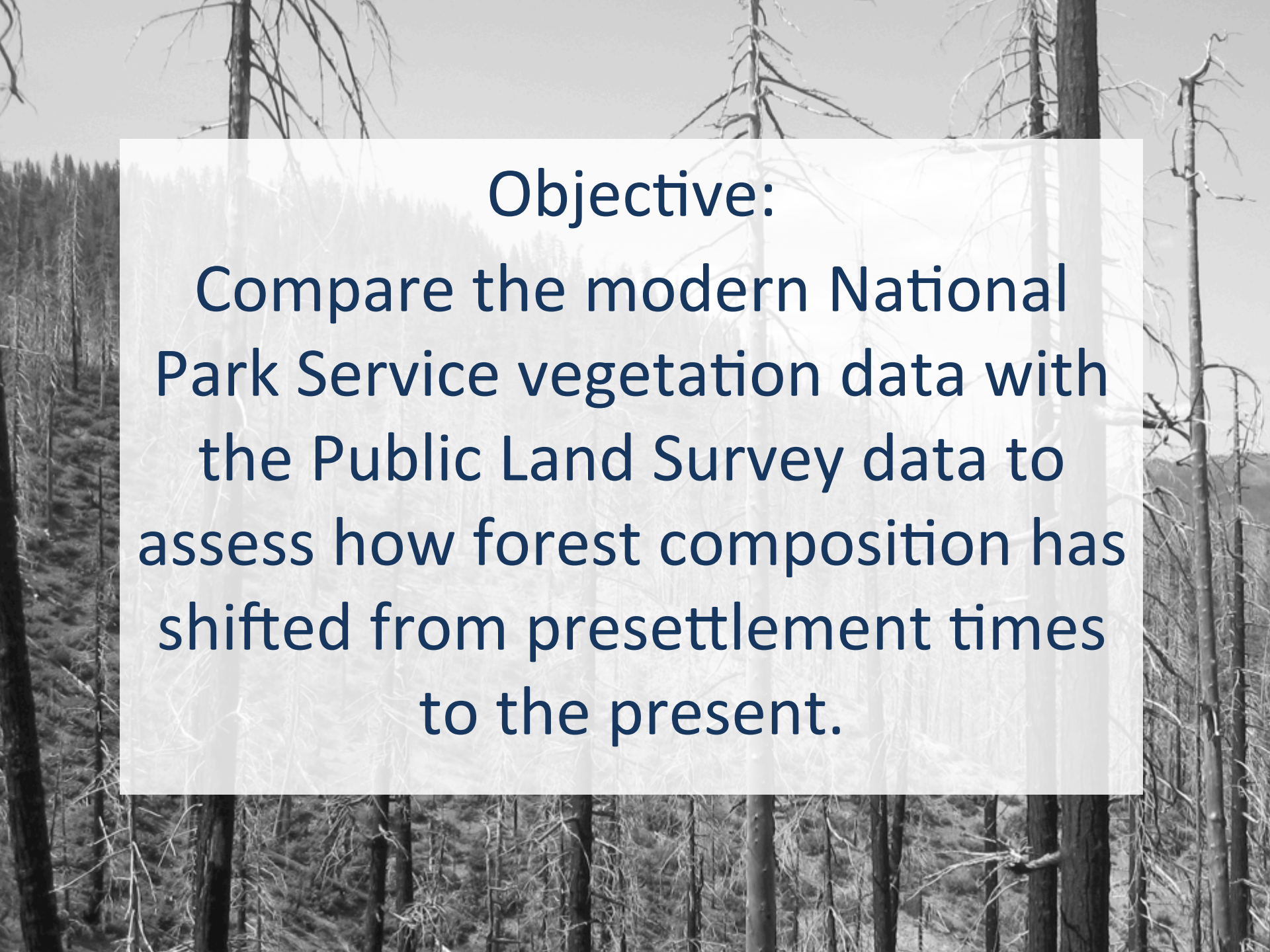


Kettle Falls, MN in Voyageurs National Park (1930)

Photo from Fritz, DL (1986)

Historical Perspectives

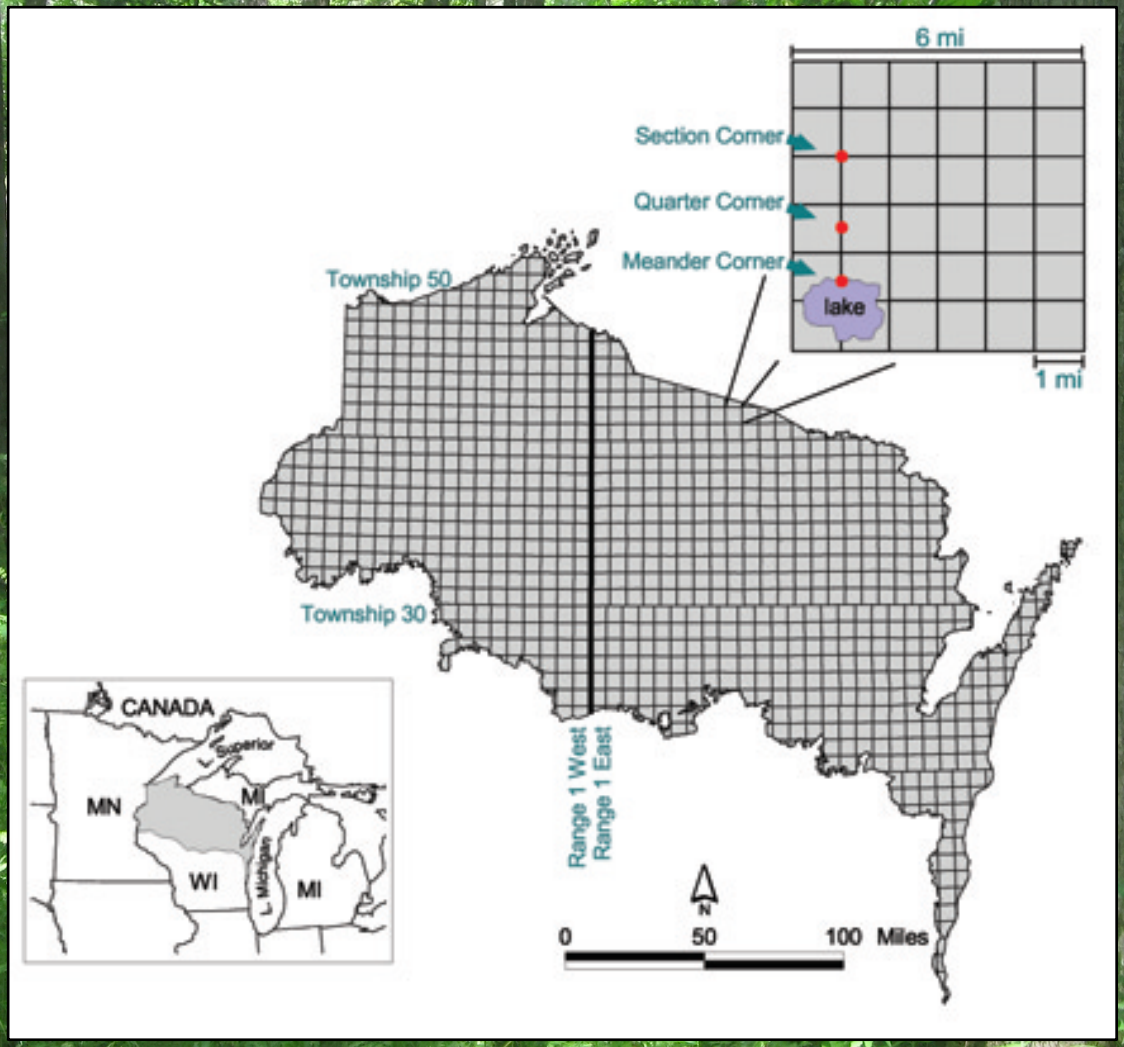
- Improve understanding of drivers of vegetation change:
  - Fire (e.g. Heinselman 1973, Janke et al. 1978, Nowacki et al. 2008)
  - Land use change (e.g. Schulte et al. 2007)
  - Climate (e.g. Davis et al. 2000)
  - Shifting disturbance regimes (e.g. Freidman and Reich 2005)
  - Herbivory (e.g. Mudrak et al. 2009)
  - Trajectories of change (e.g. Rhemtulla et al. 2009, Knoot et al. 2015)



Objective:

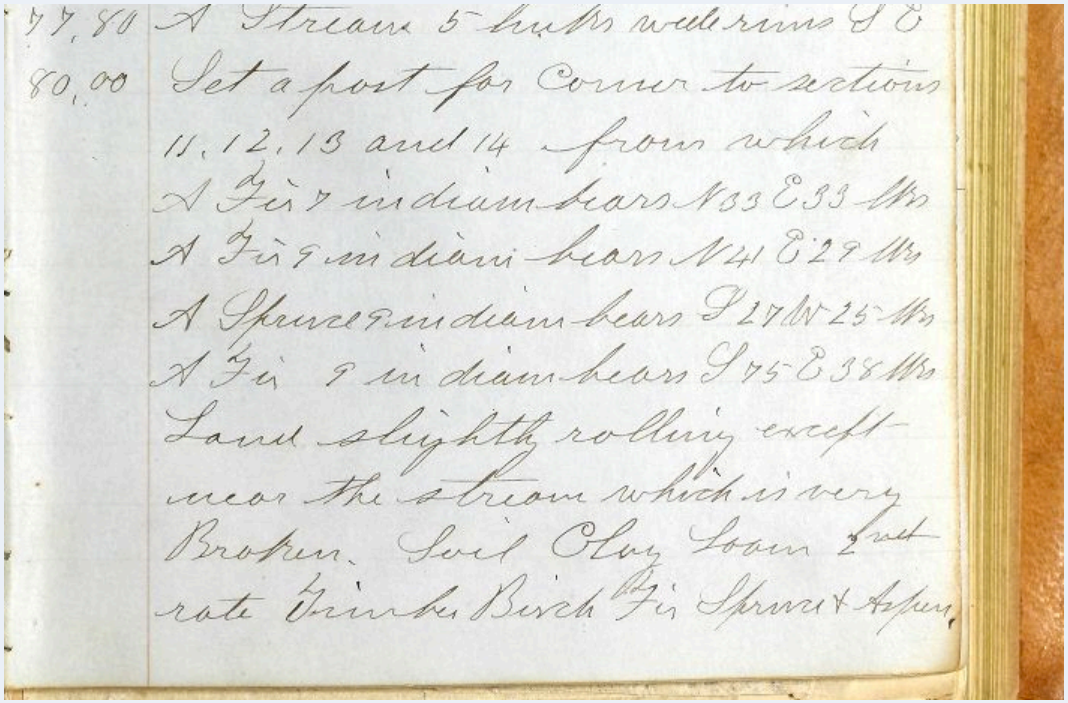
Compare the modern National Park Service vegetation data with the Public Land Survey data to assess how forest composition has shifted from presettlement times to the present.

Public Land Survey



Schulte and Mladenoff 2001

http://www.glorecords.blm.gov/search/

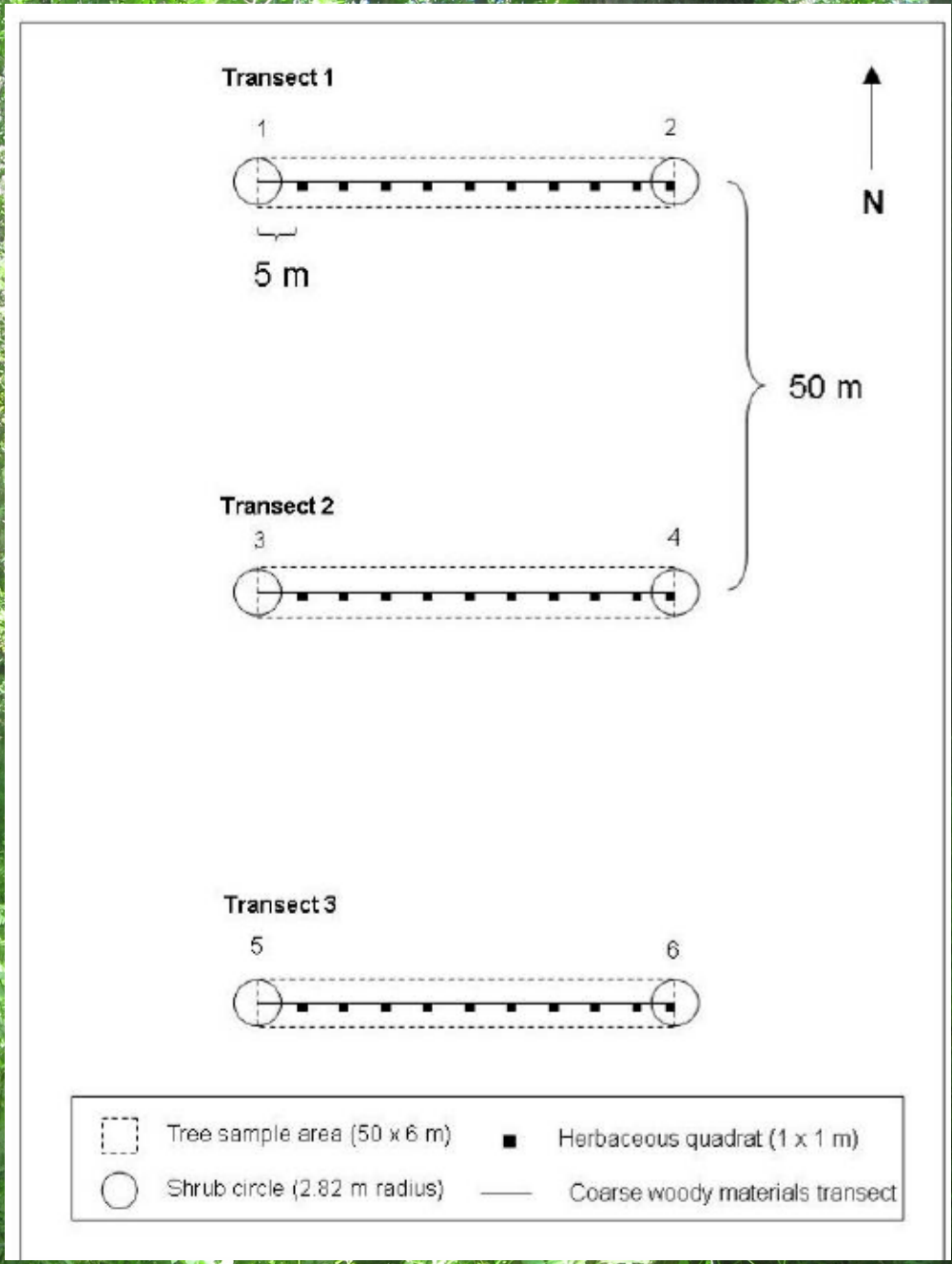


- A Fir 7 in diam bears N33E 33 links
- A Fir 9 in diam bears N41E 29 links
- A Spruce 9 in diam bears S27W 25 links
- A Fir 9 in diam bears S75E 38 links

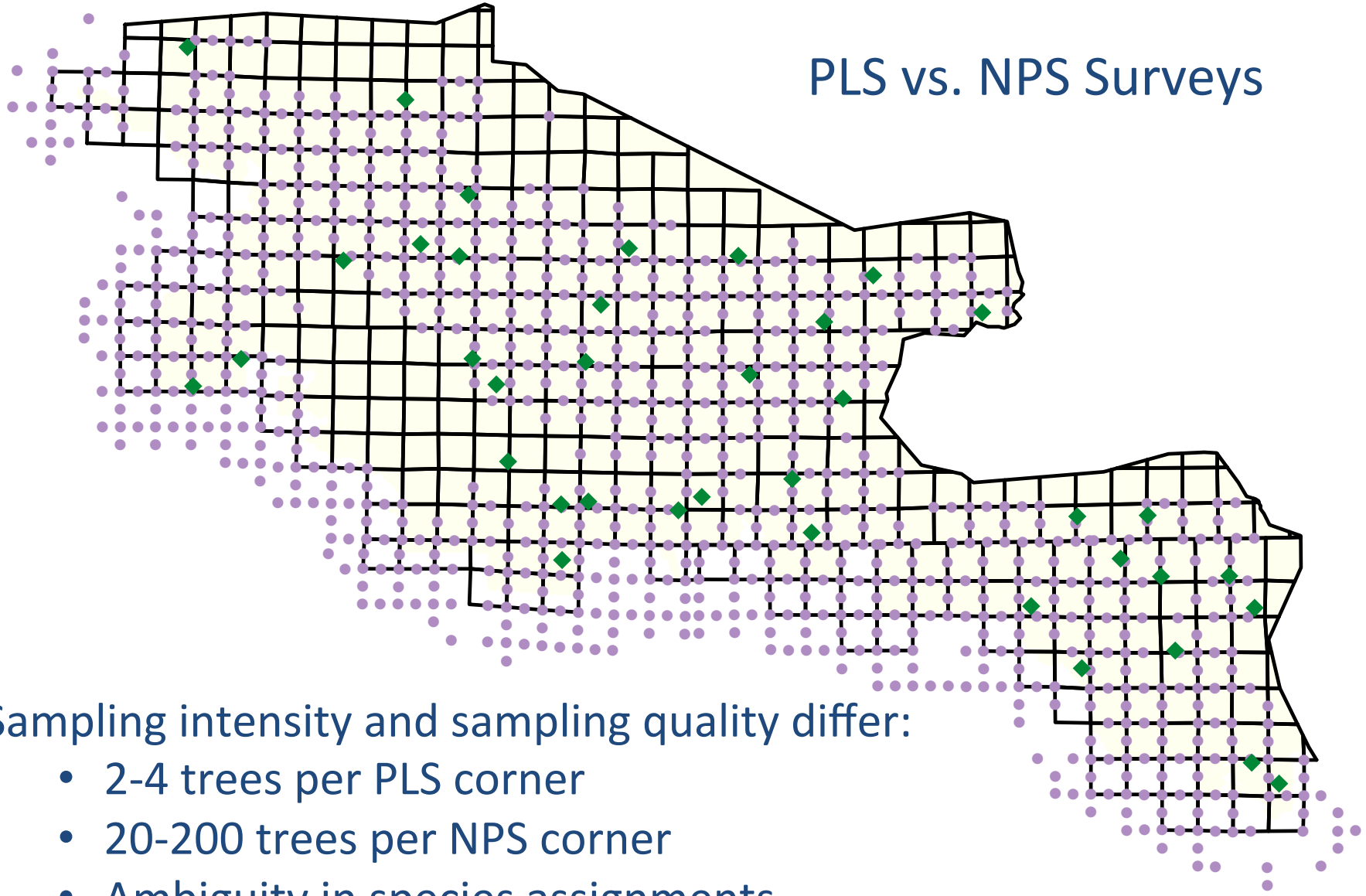
Review of biases in the Public Land Survey data:
Bourdo, EA. (1956). *Ecology* 37(4): 754-768.

Methods: NPS Vegetation Surveys

- 402 plots across 9 parks (30-50 per park)
- All trees >2.5 cm DBH measured within three 6 m x 50 m belt transects



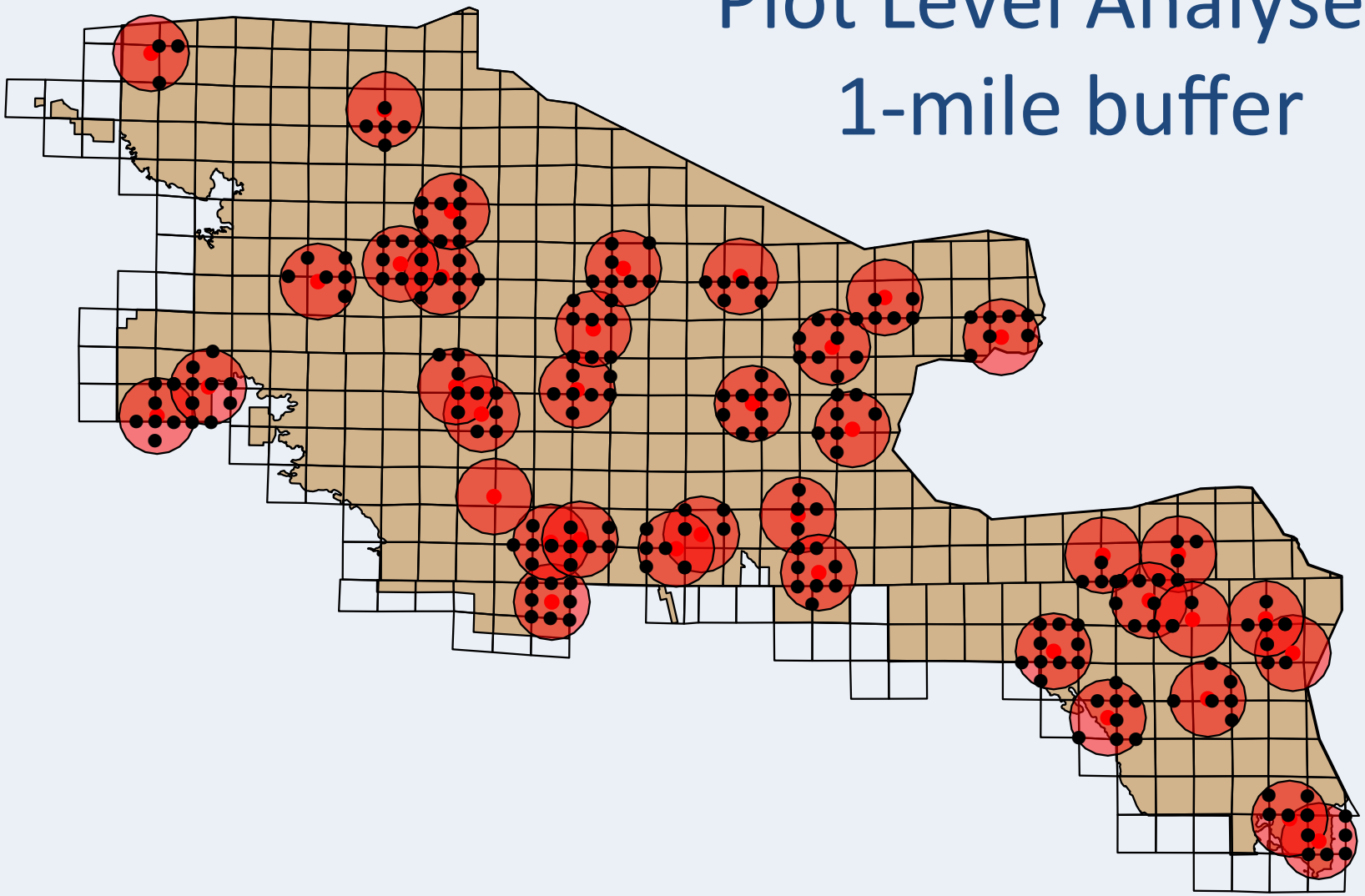
PLS vs. NPS Surveys



Sampling intensity and sampling quality differ:

- 2-4 trees per PLS corner
- 20-200 trees per NPS corner
- Ambiguity in species assignments
- Undersampling of both small and large trees in the PLS surveys

Plot Level Analyses: 1-mile buffer



Analyses

- Relative basal area (Curtis and McIntosh 1950, 1951):

$$\frac{BasalArea_{(i)}}{BasalArea_{(allspecies)}} \times 100$$

- Compared PLS vs. NPS surveys at the plot level and across the each park

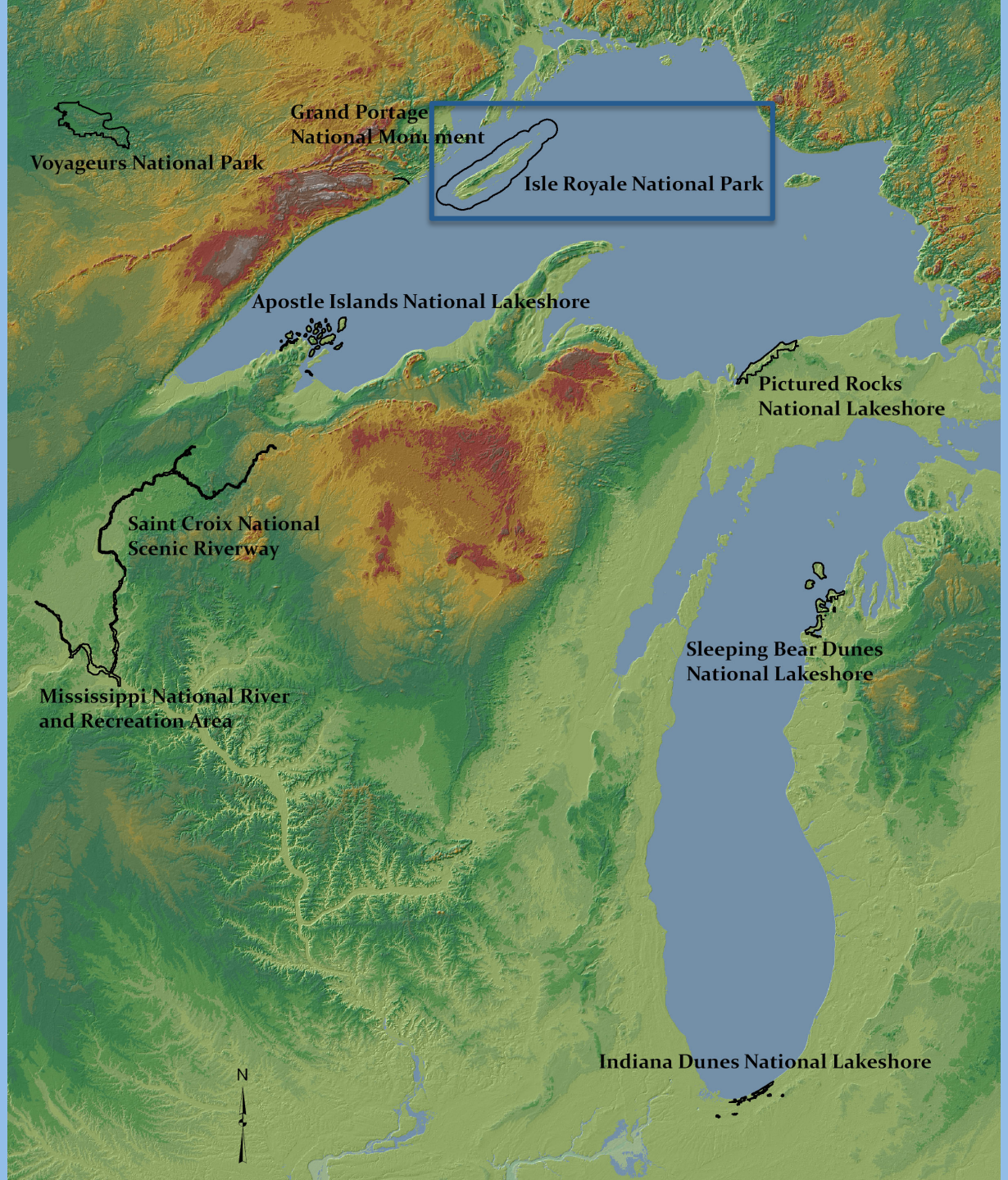
Analyses

- Pyrophilic Percentage
  - Uses the ecological characteristics of trees and their classification as “pyrophobic” or “pyrophillic” as indicators of fire prevalence
  - Calculate the “pyrophilic percentage” for each plot

$$100 \times \left(\frac{\#\ Pyrophilic\ Trees}{\#\ Total\ Trees} \right)$$

  - Randomization procedure to subsample trees from NPS surveys

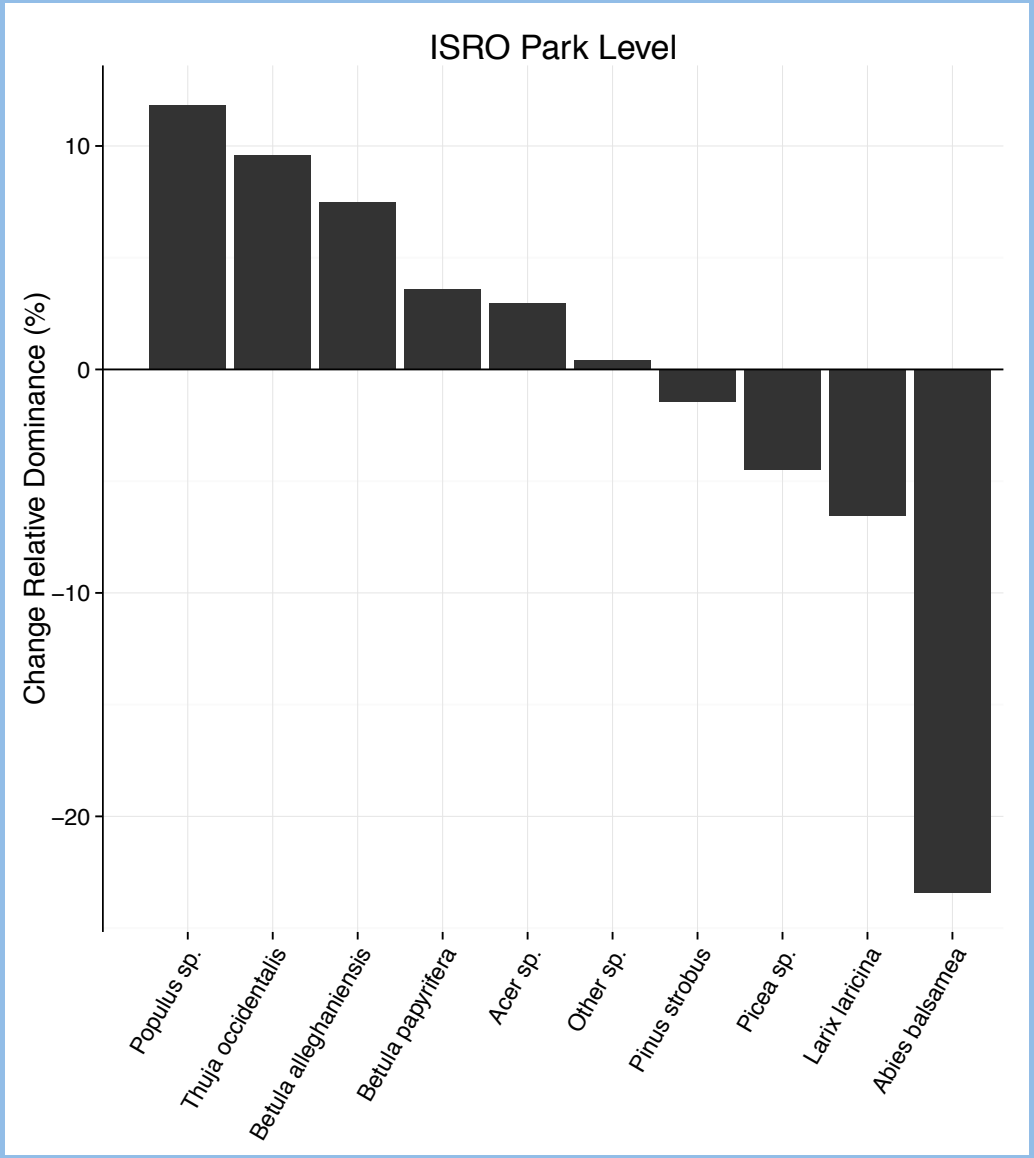
(Thomas-Van Gundy and Nowacki 2013)

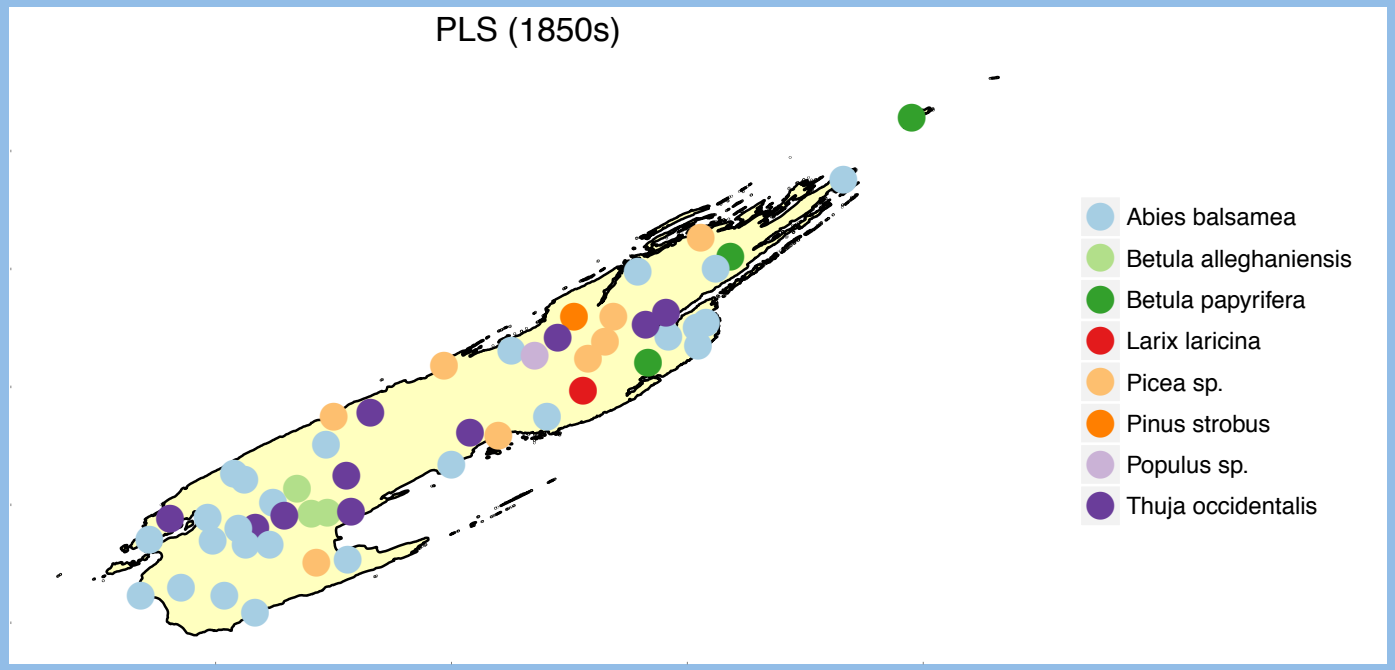

Grand Portage
National Monument
Voyageurs National Park
Isle Royale National Park
Apostle Islands National Lakeshore
Pictured Rocks
National Lakeshore
Saint Croix National
Scenic Riverway
Sleeping Bear Dunes
National Lakeshore
Mississippi National River
and Recreation Area
Indiana Dunes National Lakeshore
N

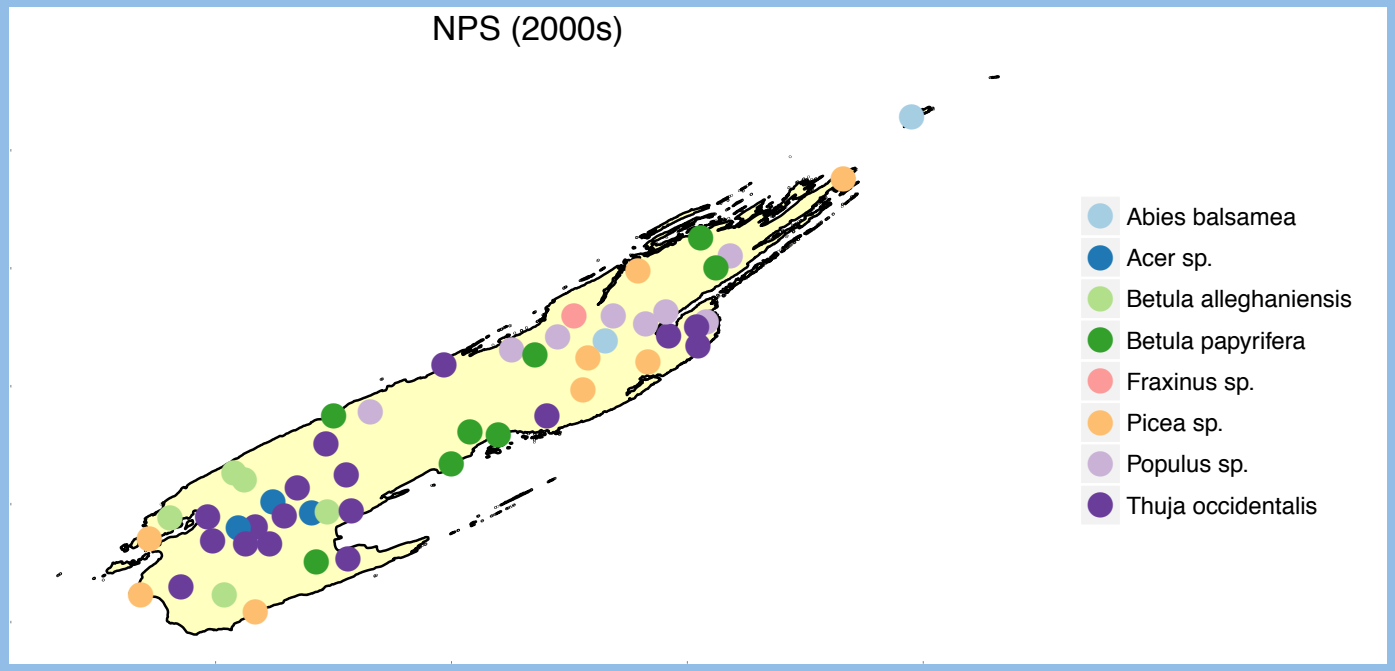
Isle Royale National Park (Est. 1940)

Photo: http://www.nps.gov/isro/learn/index.htm

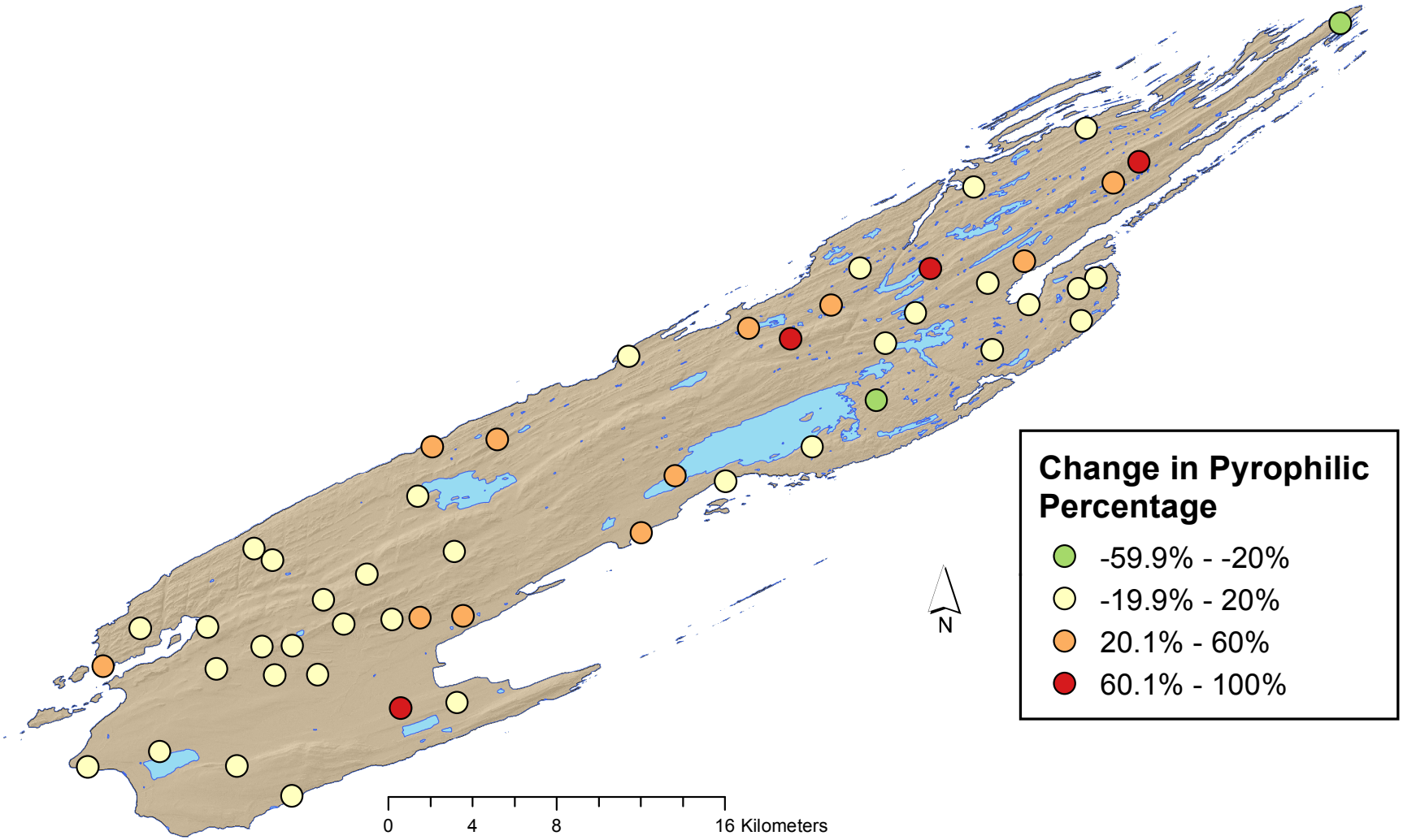
Isle Royale – Absolute Change in Relative Basal Area

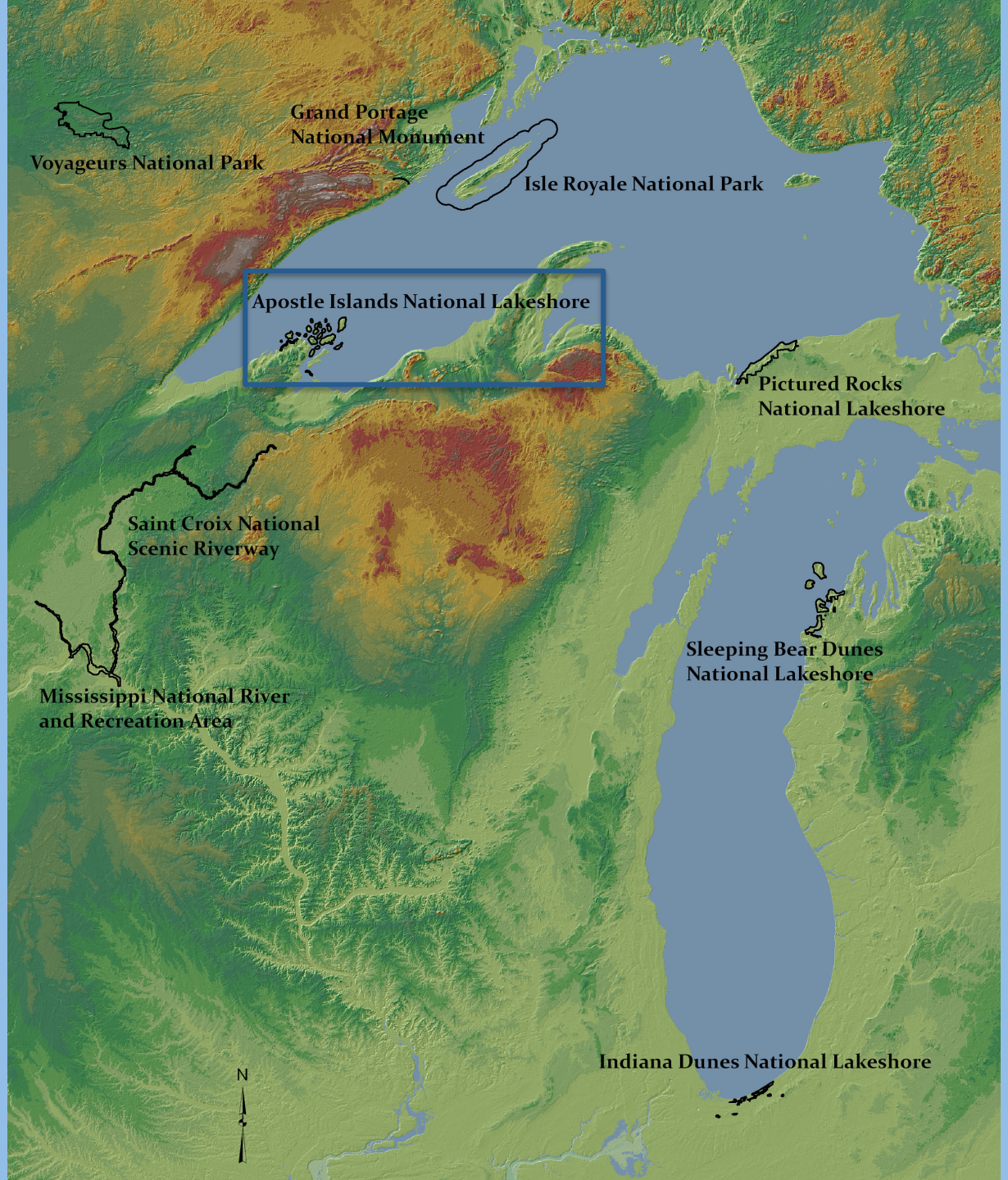



PLS (1850s)
Abies balsamea
Betula alleghaniensis
Betula papyrifera
Larix laricina
Picea sp.
Pinus strobus
Populus sp.
Thuja occidentalis


NPS (2000s)
Abies balsamea
Acer sp.
Betula alleghaniensis
Betula papyrifera
Fraxinus sp.
Picea sp.
Populus sp.
Thuja occidentalis

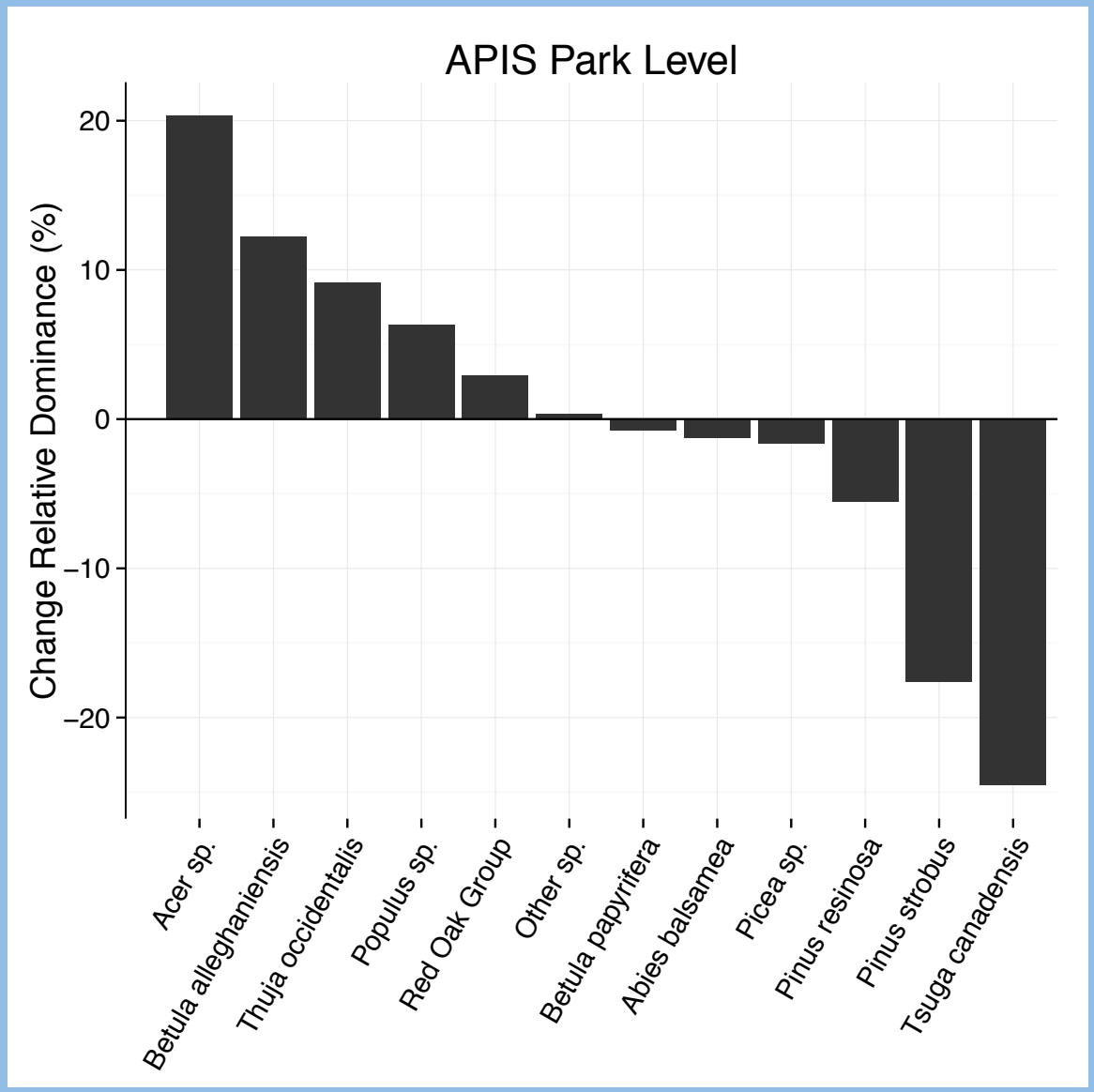
Isle Royale National Park

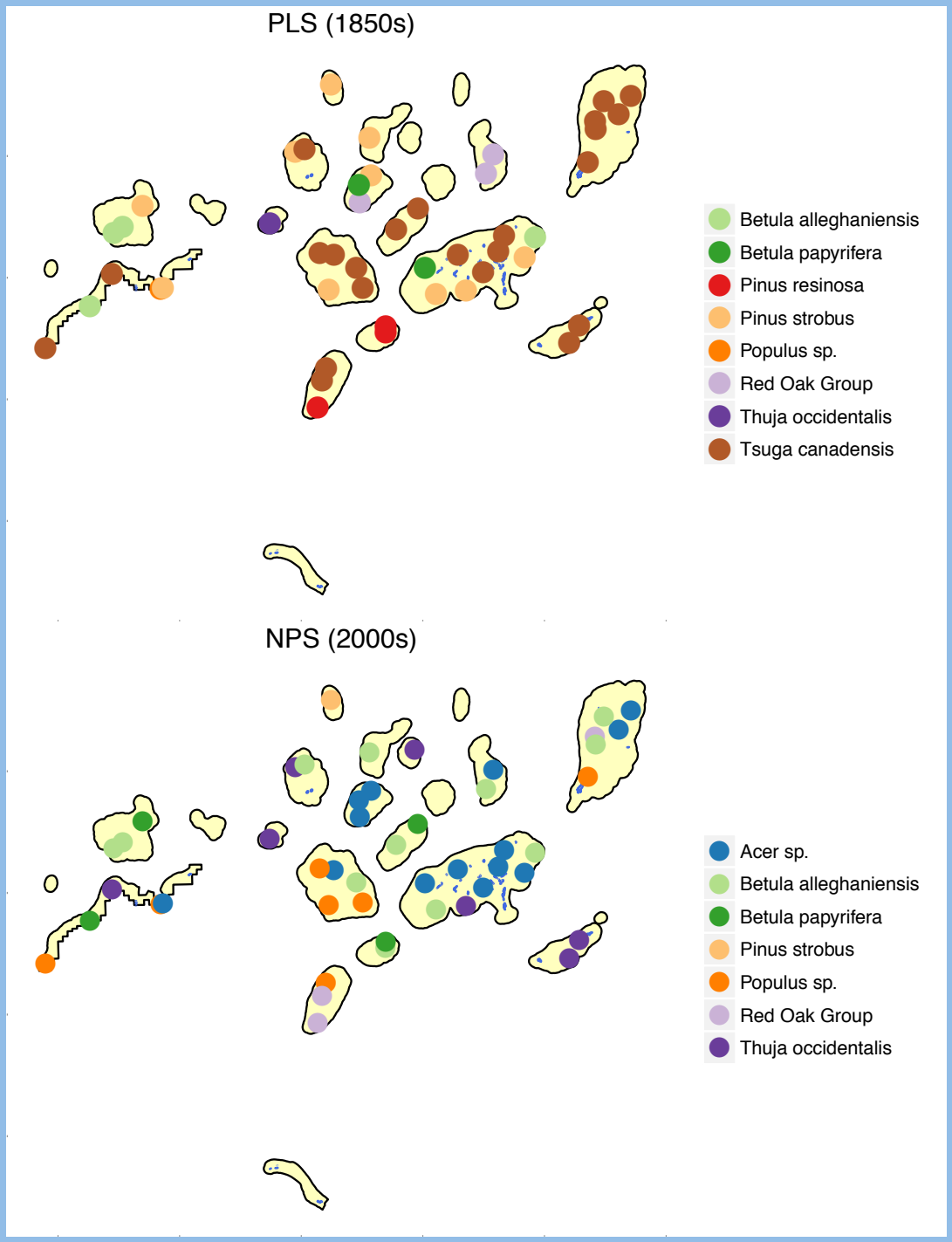


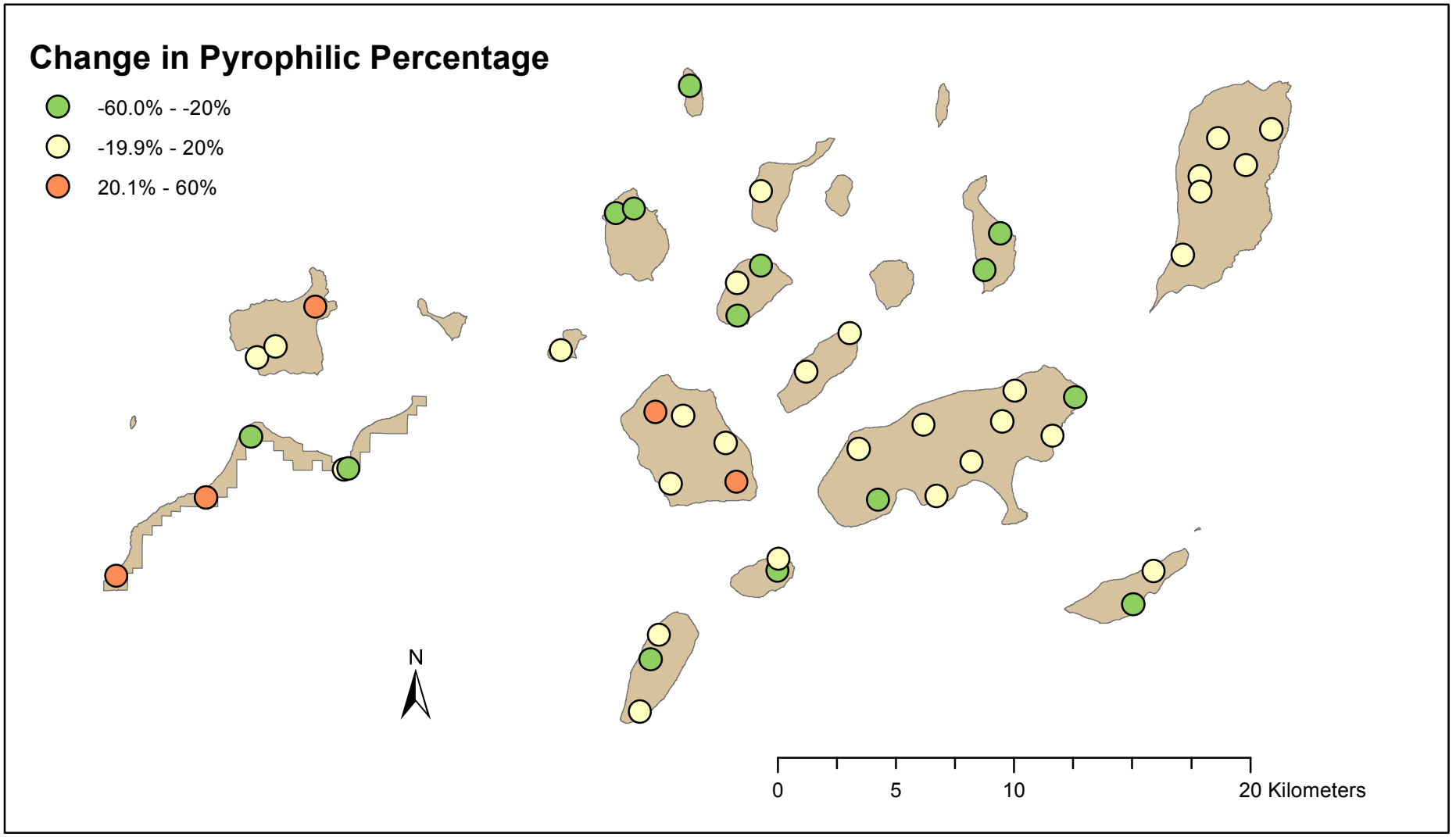

Grand Portage
National Monument
Voyageurs National Park
Isle Royale National Park
Apostle Islands National Lakeshore
Pictured Rocks
National Lakeshore
Saint Croix National
Scenic Riverway
Sleeping Bear Dunes
National Lakeshore
Mississippi National River
and Recreation Area
Indiana Dunes National Lakeshore
N

Apostle Islands National Lakeshore (Est. 1970)

Apostle Islands – Absolute Change in Relative Basal Area




PLS (1850s)
Betula alleghaniensis
Betula papyrifera
Pinus resinosa
Pinus strobus
Populus sp.
Red Oak Group
Thuja occidentalis
Tsuga canadensis
NPS (2000s)
Acer sp.
Betula alleghaniensis
Betula papyrifera
Pinus strobus
Populus sp.
Red Oak Group
Thuja occidentalis


Change in Pyrophilic Percentage
-60.0% - -20%
-19.9% - 20%
20.1% - 60%
N
0
5
10
20 Kilometers

Conclusions

- Forest composition has changed a lot!
- Across all parks, see declines in pines, oaks, and hemlock, concurrent with increases in aspen, maple, paper birch
- Changes can be tied to fire, logging, herbivory
- Ongoing monitoring by the Great Lakes Inventory and Monitoring Network will provide further understanding of these drivers of change

Acknowledgements

- Lake States Fire Science Consortium
- Great Lakes Inventory and Monitoring Network, particularly Rebecca Key and Ulf Gafvert
- Scout Kirby

GREAT LAKES INVENTORY AND MONITORING NETWORK

NATIONAL PARK SERVICE

WISCONSIN
UNIVERSITY OF WISCONSIN–MADISON


Thanks for listening!

Response of insectivore pollinators, plant diversity, and fuel loads to a large-scale barren and northern dry forest restoration project in northeastern Wisconsin

Deahn Donner, Brian Sturtevant, Christel Kern, & Heather Jensen

Northern Research Station

Land Management Partners

John Lampeurer, Scott Anderson, Jay Saunders, Scott Linn, Tym Sauter, Mark Gilley , Jeff Seefeldt

Internship

Goal:
Provide student with exposure to fire science, management and forest restoration

Approach:
Part of a field team collecting pre-treatment data

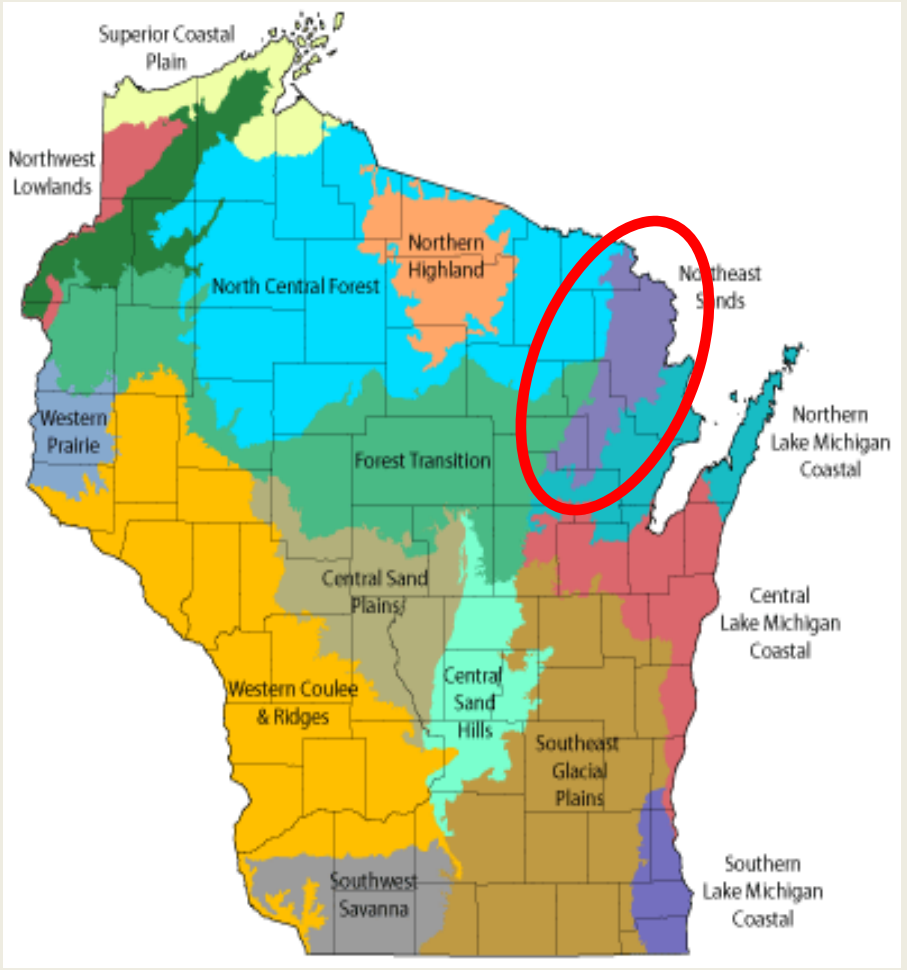
Vince Schmitz
University of Wisconsin Madison

Kaitlin Lacek
Drake University

Northern Dry Forest Restoration
Lakewood Southeast Project

Glacial Landform

- Primarily excessively drained, sandy loam
- More than half the land surface is outwash sand and gravel
- Glacial deposits can be thin enough to expose bedrock and affect vegetation



(Data from WI Land Legacy Report, 111-117 and WI DNR Northeast Sands Ecological Landscape webpage)

Socio-Ecological History

Source: LKSE Forest Vegetation Resource Report (p 10-17; Appendix A, Fig.8, pg. 3 and Fig.16, pg. 6); Photo credits: USDA Forest Service

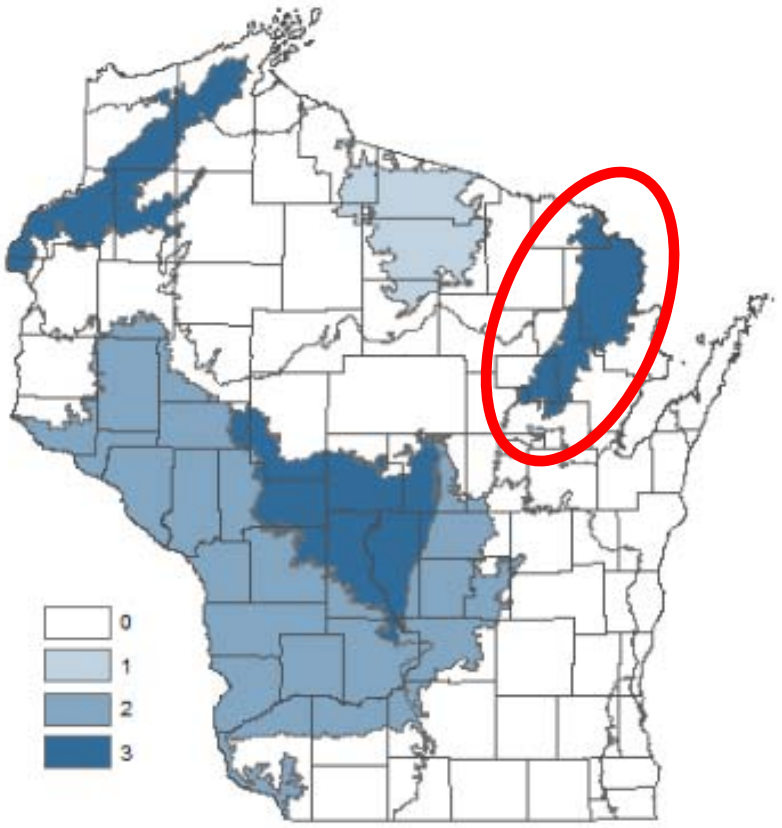
Management - Research Goal

Evaluate gradient of restoration ‘phases’ of northern dry forests based on the combination of four treatment factors:

1. degree of openness - seral stage (forest-woodland-savannah-barren)
2. burn or no burn
3. treatment severity (harvested or non-harvested)
4. forest type (conifer, deciduous, open).

Open pine barren and savannah systems have been greatly reduced in Wisconsin

Ecological Landscape	Opportunity
Central Sand Plains	Major
Northeast Sands	Major
Northwest Sands	Major
Central Sand Hills	Important
Western Coulee and Ridges	Important
Northern Highland	Present



Spread Eagle Barrens, Florence Co.

(Data from WI DNR Ecological Landscape webpage)

LKSE Management Direction- Barrens Restoration Area Example

EXISTING CONDITION

Existing over mature jack pine stand in the Airport Road barrens/savanna restoration area

Treatment: Special Cut, removal of ~75% of trees followed by prescribed fire.

Photo credit: USDA Forest Service
Source: LKSE Vegetation Resource Report, Appendix A (Fig. 9)

DESIRED FUTURE CONDITION

Desired result of special cut and prescribed fire treatment resulting in a "sparsely stocked" stand / pine savanna

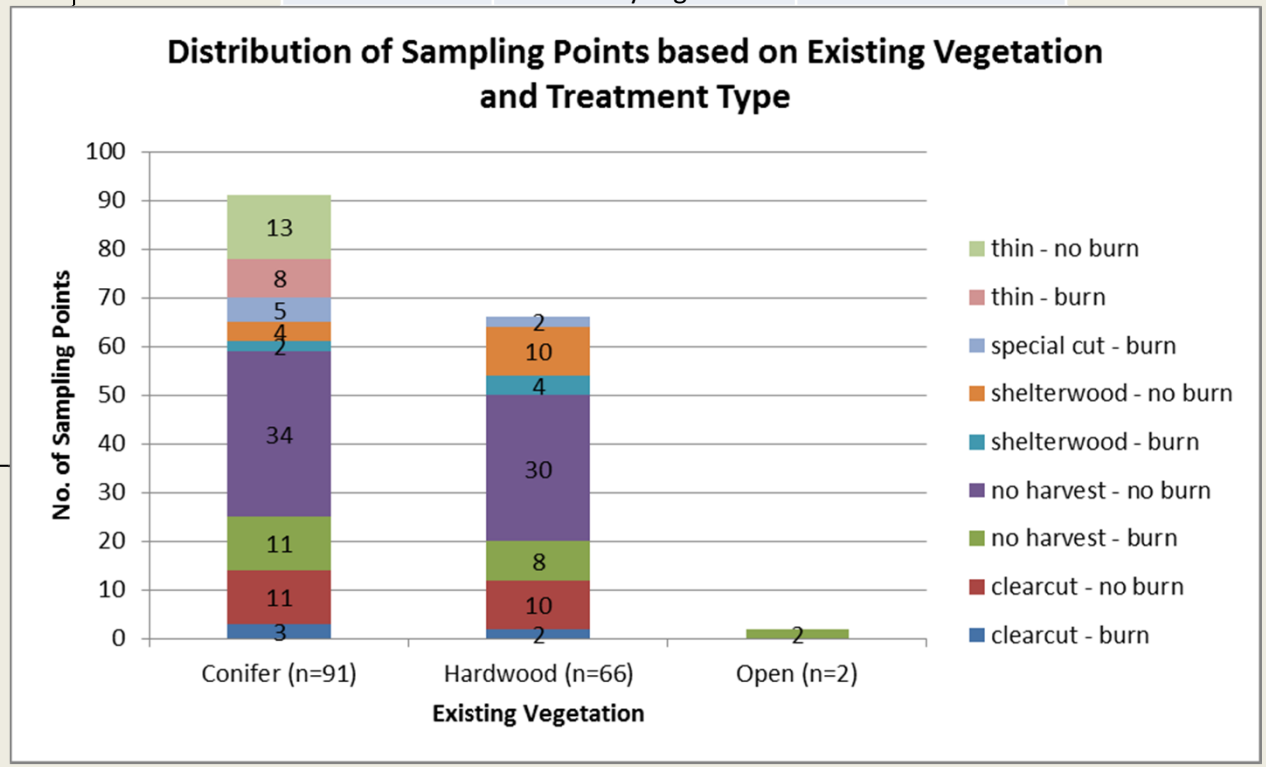
Photo credit: USDA Forest Service
Source: LKSE Vegetation Resource Report, Appendix A (Fig. 7)

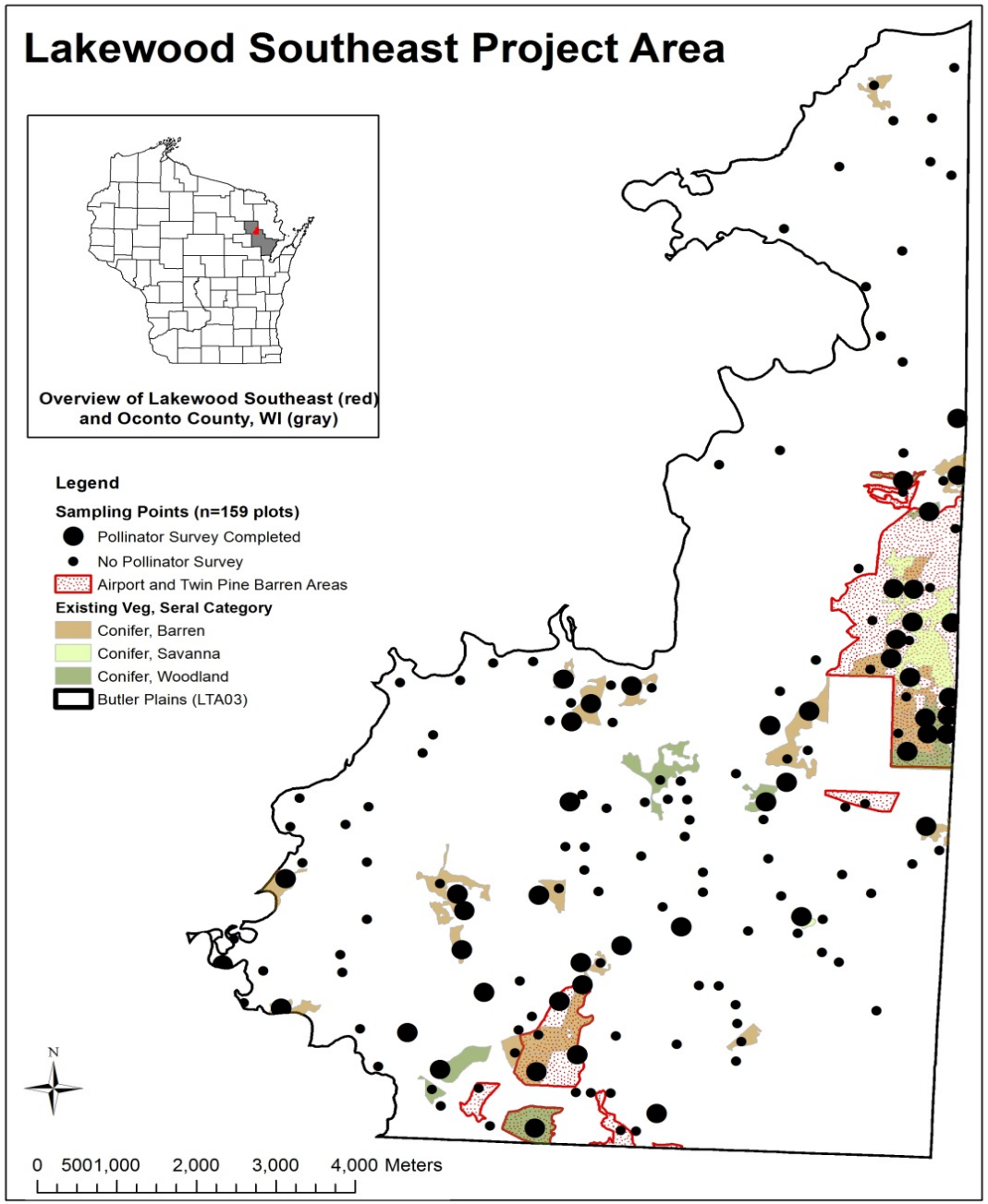
Study Design

Criteria for random selection of sampling points:

- Upland stands within LTA 03 approximately 10 acres or greater
- 1 sampling point per stand
- Existing Vegetation (Hardwood vs Conifer)
- Harvest Type
- Burn vs. No burn
- Existing Basal Area vs. Desired Basal Area

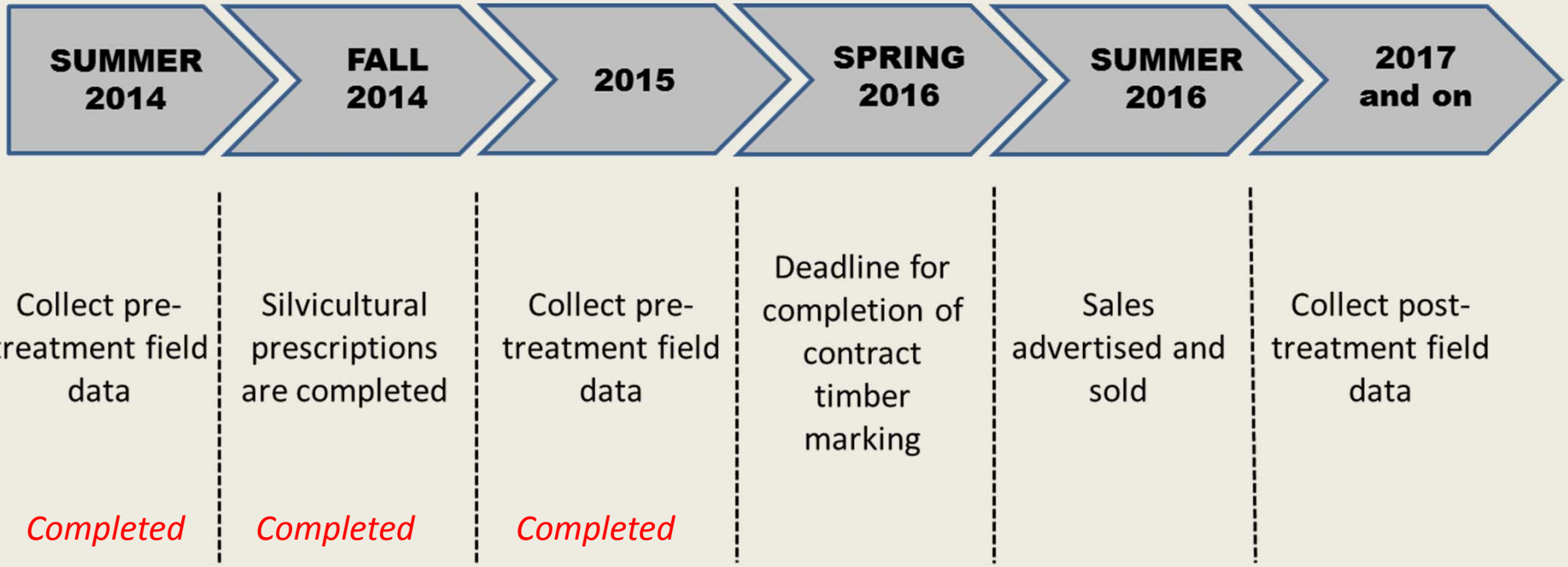
Seral Category	Forest Canopy Cover	Target BA after harvest
Barren	None	0-20
Savanna	Few Trees	21-40
Woodland	Very Low	41-60
Forest	Low	61-80
Forest	Moderate	81-100
Forest	Moderate-High	101-120
Forest	High	121-150
Forest	Very High	151+

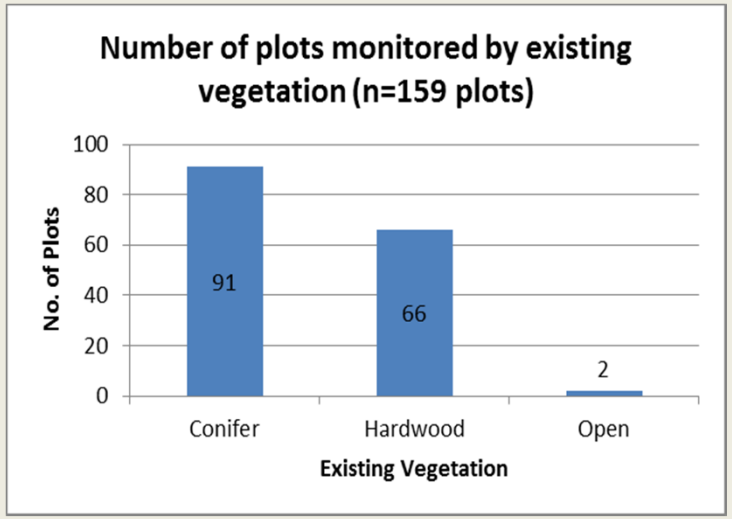


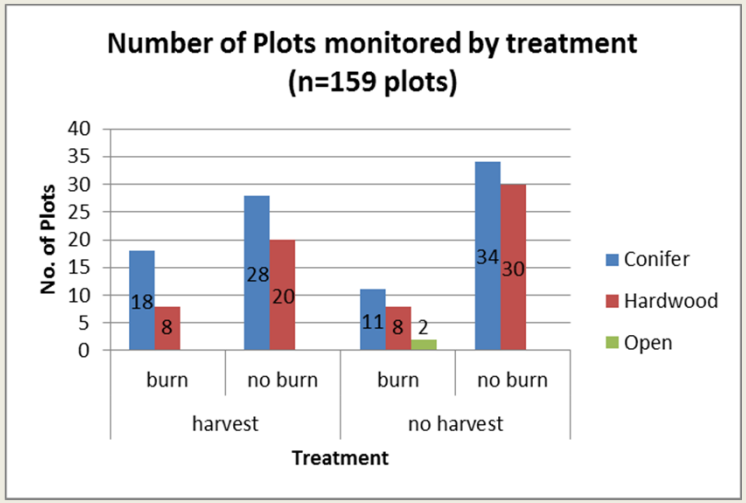


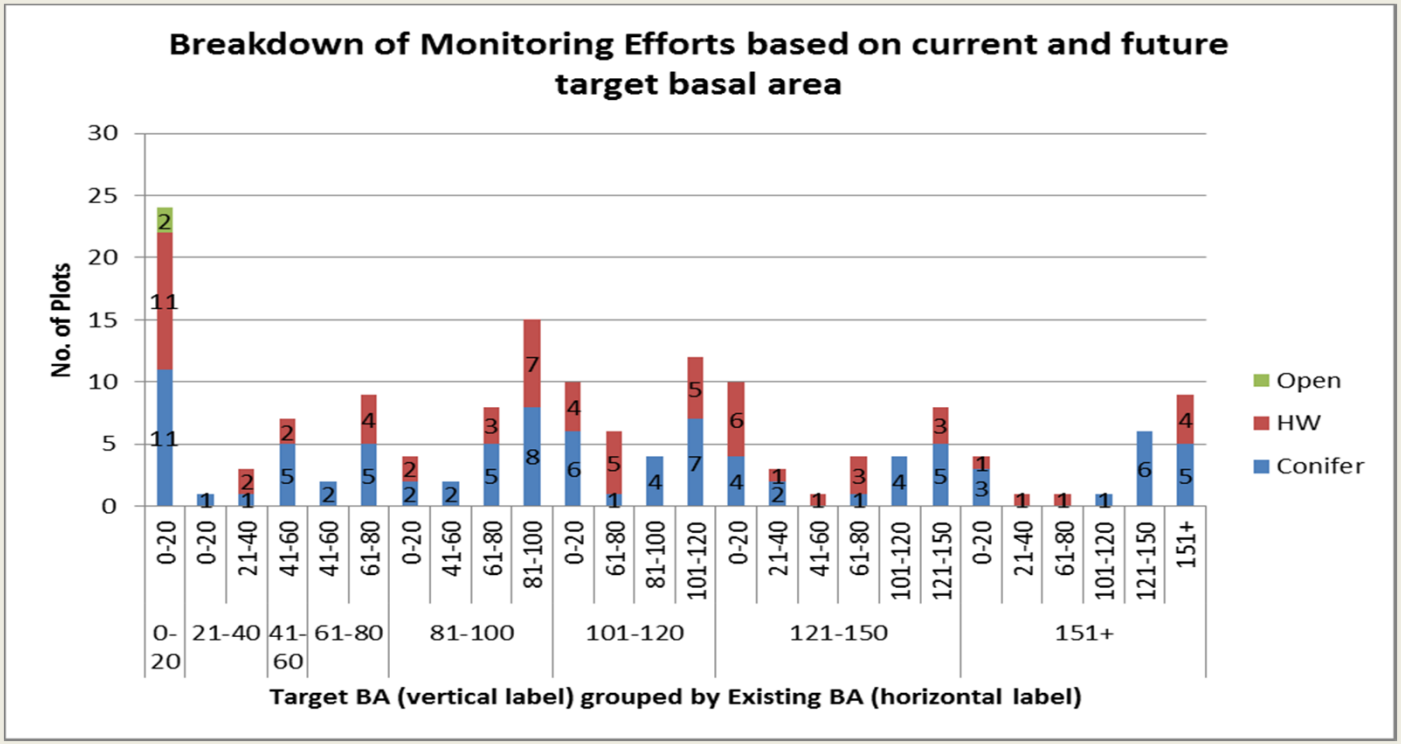
- Restoration project 37,000 acres; Butler Plains (LTA03)
- Several thousand acres of northern dry forest restoration
- 1,000 acres of pine barren / savanna restoration
- Pollinator monitoring occurred at 47 of 159 plots

Timeline for Project Activities




Number of plots monitored by existing vegetation (n=159 plots)
No. of Plots
100
80
60
40
20
0
91
66
2
Conifer
Hardwood
Open
Existing Vegetation

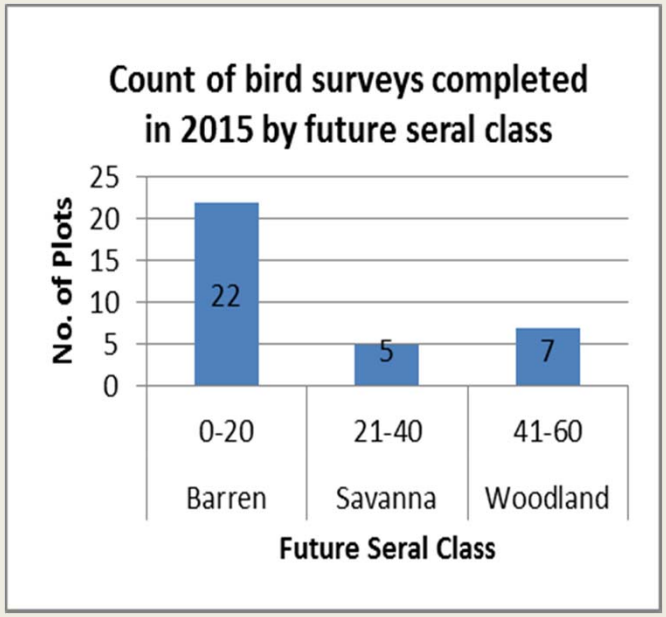

Number of Plots monitored by treatment (n=159 plots)
No. of Plots
40
35
30
25
20
15
10
5
0
18
8
28
20
11
8
2
34
30
burn
no burn
burn
no burn
harvest
no harvest
Treatment
Conifer
Hardwood
Open

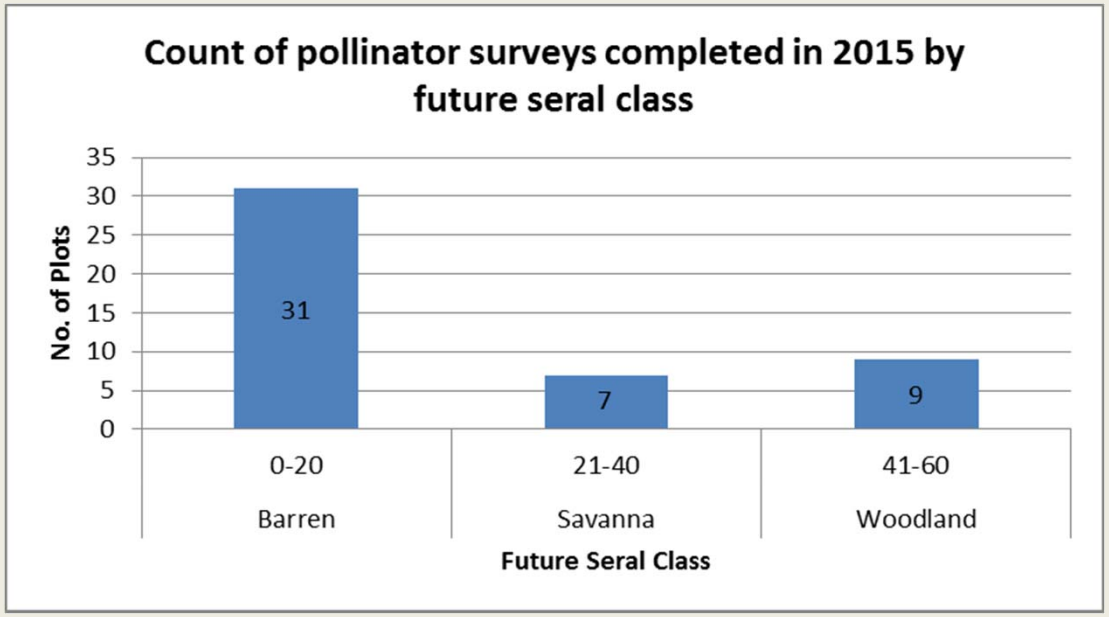

Breakdown of Monitoring Efforts based on current and future target basal area
No. of Plots
30
25
20
15
10
5
0
0-20
21-40
41-60
61-80
81-100
101-120
121-150
151+
Target BA (vertical label) grouped by Existing BA (horizontal label)
Open
HW
Conifer

Little Wood-Satyr *Megisto cymela*

Northern Pearly-eye *Enodia anthedon*

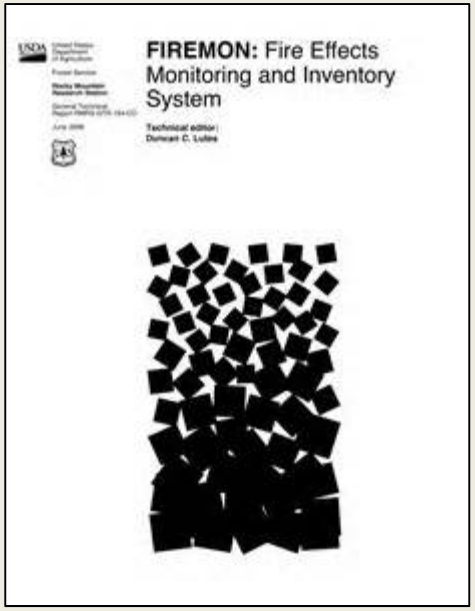
Mustard White *Pieris oleracea*





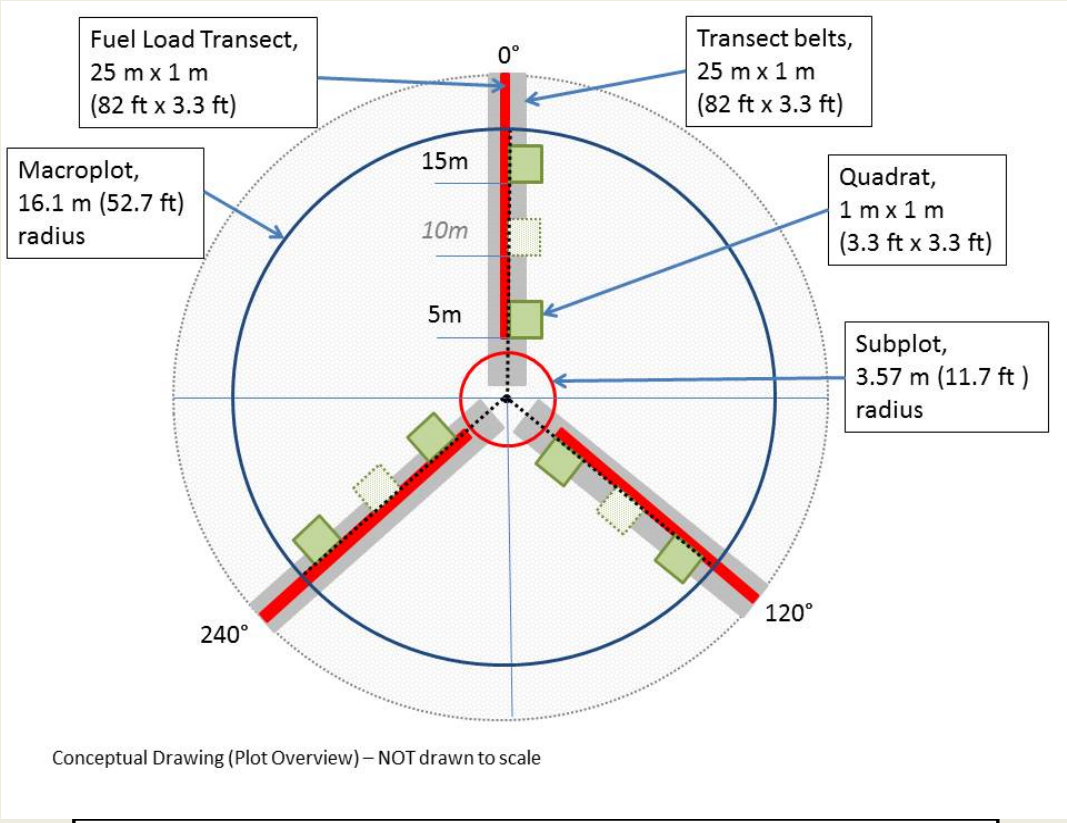
Methodology

Vegetation and Fuels Sampling is based on the National Fire Monitoring Protocol (FIREMON).

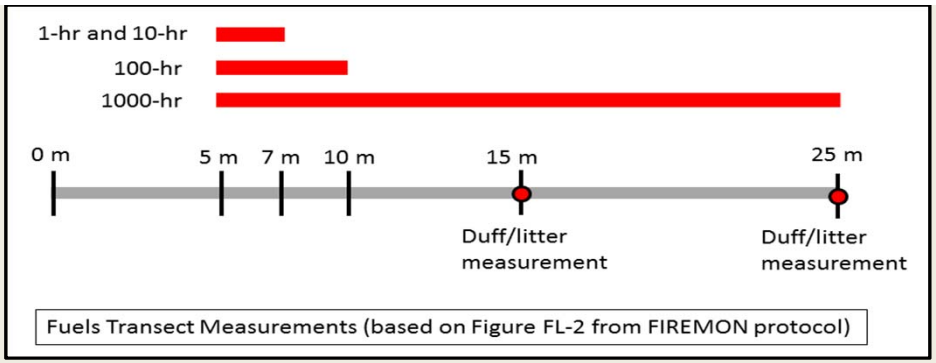


2014 Project Interns: Claire Hillmeyer (top) & Shawna Begay (bottom)

Monitoring Effort - Plot Overview



Conceptual Drawing (Plot Overview) – NOT drawn to scale



Fuels Transect Measurements (based on Figure FL-2 from FIREMON protocol)

Macroplot

- *Trees greater than 11.4 cm (4.5 in) DBH*

Subplot

- *Trees over 1.37 m (4.5 ft) tall and less than 11.4 cm (4.5 in) DBH*

Transect Belt

- *Trees greater than 0.5 m (1.6 ft) to 1.37 m (4.5 ft) tall*
- *Tall shrubs greater than 0.5 m (1.6 ft) tall*
- *Other vascular plants (in larger macroplot)*

Quadrat

- *Vascular plants including trees and shrubs ≤ 0.5 m (1.6 ft) tall*
- *Ground cover*

Fuel Load Transect

- *Fine Woody Debris - 1-hr, 10-hr, 100-hr (<3in / <8cm)*
- *Coarse Woody Debris - 1000-hr fuels (>3in / >8cm)*
- *Duff & Litter*

Butterfly Sampling

Edwards' Hairstreak *Satyrium edwardsii*

Campbell, J.W. and J.L. Hanula. 2007. Efficiency of malaise traps and colored pan traps for collecting flower visiting insects from three forested ecosystems. J. Insect Conservation 11:399-408.

Caldas, A. and R.K. Robbins. 2003. Modified Pollard transects for assessing tropical butterfly abundance and diversity. Biological Conservation 110: 211-219.

Important Aspects of Internship

- Field experience reinforced skills learned at university
  - Navigational skills
  - Importance of data management
- Enhanced plant ID experience and new sampling techniques
- Experience with FIREMON protocol
- "Taste of research fieldwork life"
- Teamwork and friendships
- Connections made with land managers and researchers

" I learned that restoration work takes a lot of time. Results will not be seen right away, but after a lot of monitoring, results can be observed." – Kaitlin Lacek

Why was this experience valuable?

“ It really helped me to get a feel for restoration/field work, as well as helped me to think about potential careers after I graduate. It was very valuable, on a more personal level, because I was surrounded by people with similar interests. The typical daily conversations were about different trees, plants, or anything else related to the field. It was very valuable for an incoming junior in college to be immersed in such a culture, away from technology, and really away from everything, it seemed.” **– Kaitlin Lacek**

“I gained an immense amount of confidence in my abilities. Not only do I believe I can complete the tasks necessary for the FIREMON protocol but I also feel that I am set up for success in other studies and projects that I will come across in the future. I now have an understanding of the scientific process in a real world setting along with the hard work that is necessary to complete it.” **– Vince Schmitz**

Thank you!

Lakewood-Laona District

John Lampereur - District Silviculturist
Jay Saunders –Fire Management Officer
Scott Anderson – Wildlife Biologist
Jeff Seefeldt - District Ranger

Northern Research Station

Sue Lietz
Ben Broquard
Erika Whitney
Casey Flannigan

Brazilian Interns

Brummel Macedo
Gustavo Flores Irber

CONTACT: Deahn Donner, ddonnerwright@fs.fed.us, 715-362-1146

2015-2016 Webinar Series
December 17, 2015

Past and future wildfire as predicted by combustion dynamics and ignition in Lake States ecosystems

Dr. Richard Guyette
Missouri Tree Ring Laboratory