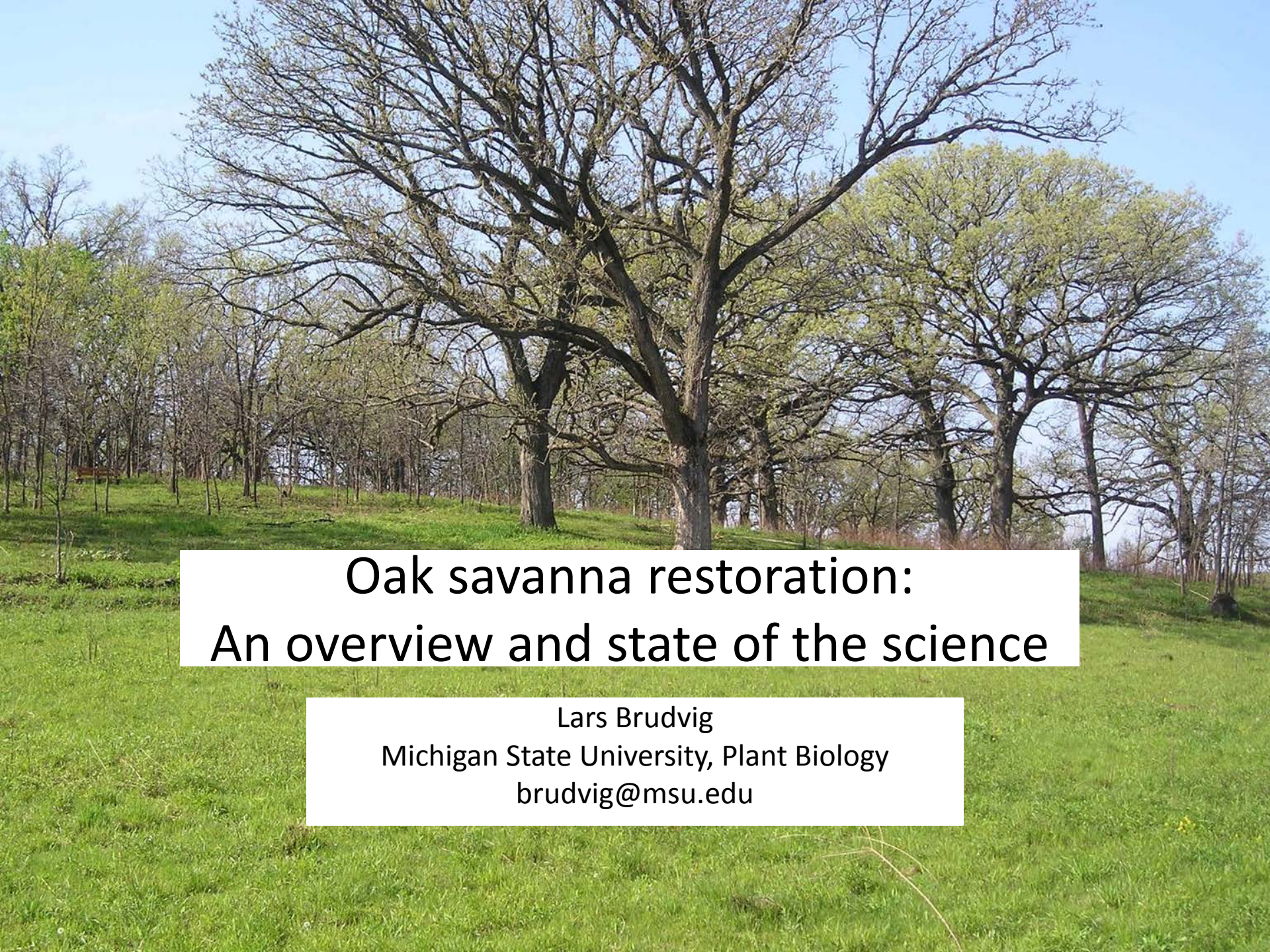

Oak savanna restoration: An overview and state of the science

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Collaborators

- Iowa State University
  - Heidi Asbjornsen, Ryan Atwell, Cathy Mabry-McMullen
- Michigan State University
  - Doug Landis, Mitch Lettow, Greg Kowalewski

- TNC-MI
  - Rodolfo Zuniga Villegas
- Army Corps of Engineers at Saylorville Lake
- Neal Smith NWR

Outline

- An overview of Midwestern oak savannas
  - Ecology, threats, restoration

- Roles of fire and other tools in oak savanna management?
- How do we promote heterogeneity within sites?
- What explains variation in restoration/management outcomes (among sites)?

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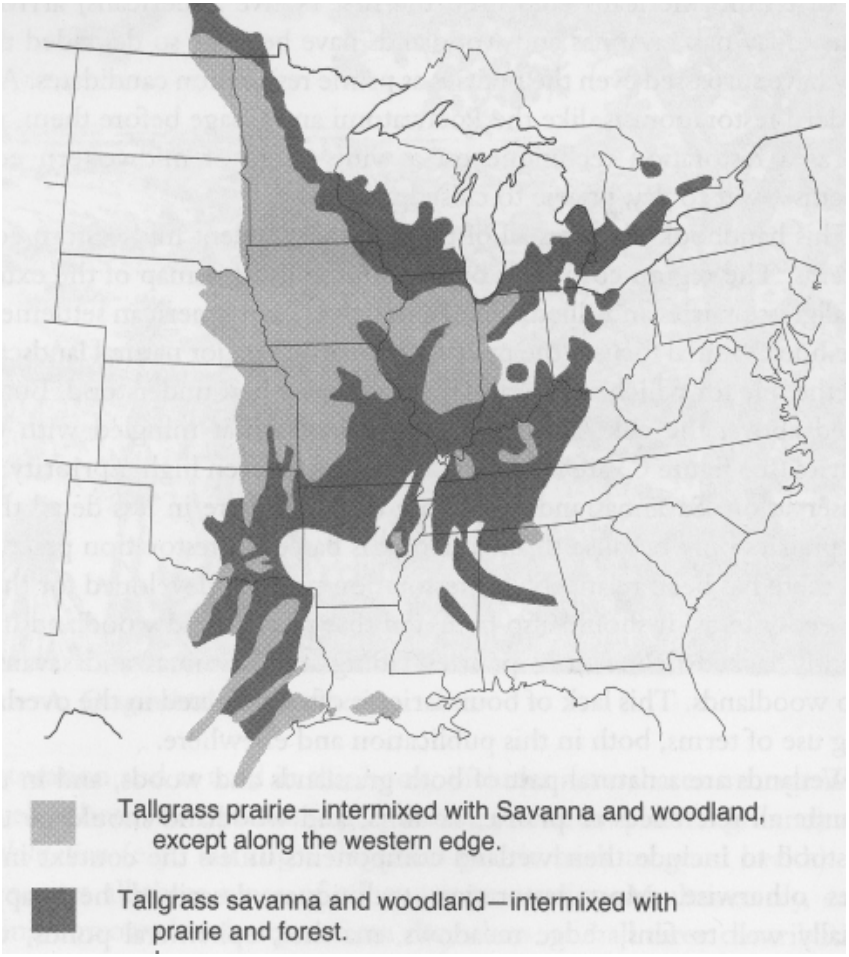
Midwestern savannas – historic distribution



Packard and Mutel (2005)

Gradients

Chicago Wilderness

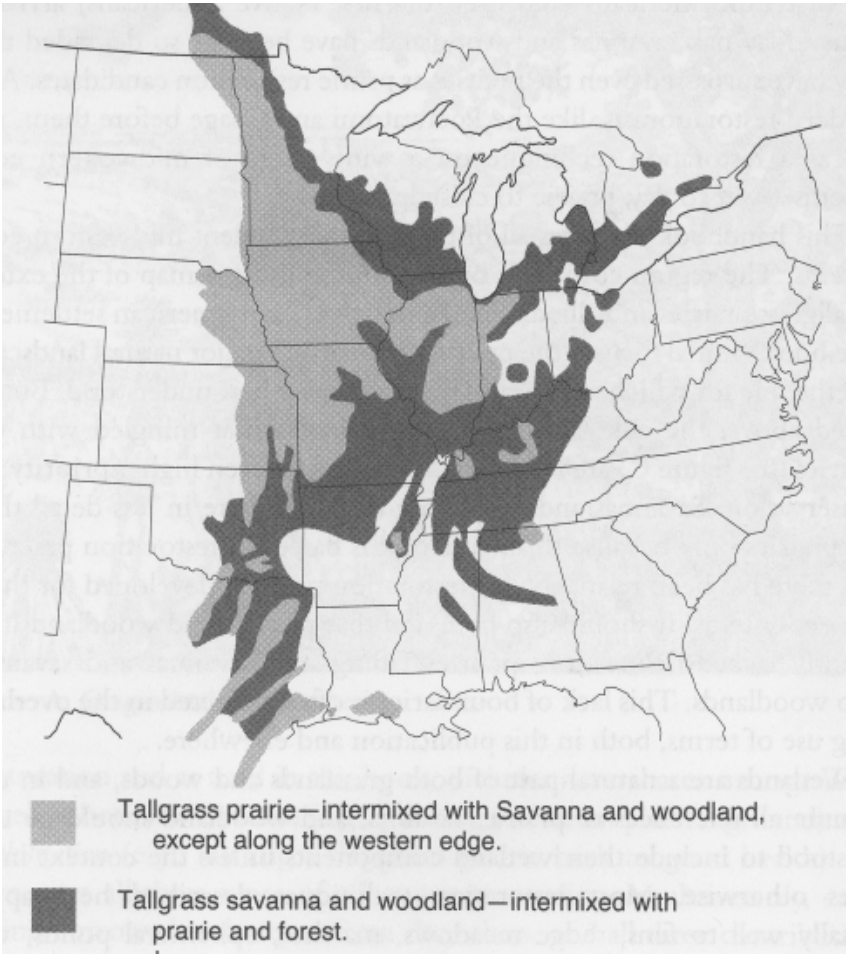
Prairie

Savanna

Woodland

Forest

Midwestern savannas – historic distribution



Packard and Mutel (2005)

The role of fire and other disturbances

Oak savannas: diversity

High species richness

Forest

+

Open

+

Savanna

=

High species richness

(Pruka 1994, Leach and Givnish 1999)

(Au et al. 2008, Davis et al. 2000)

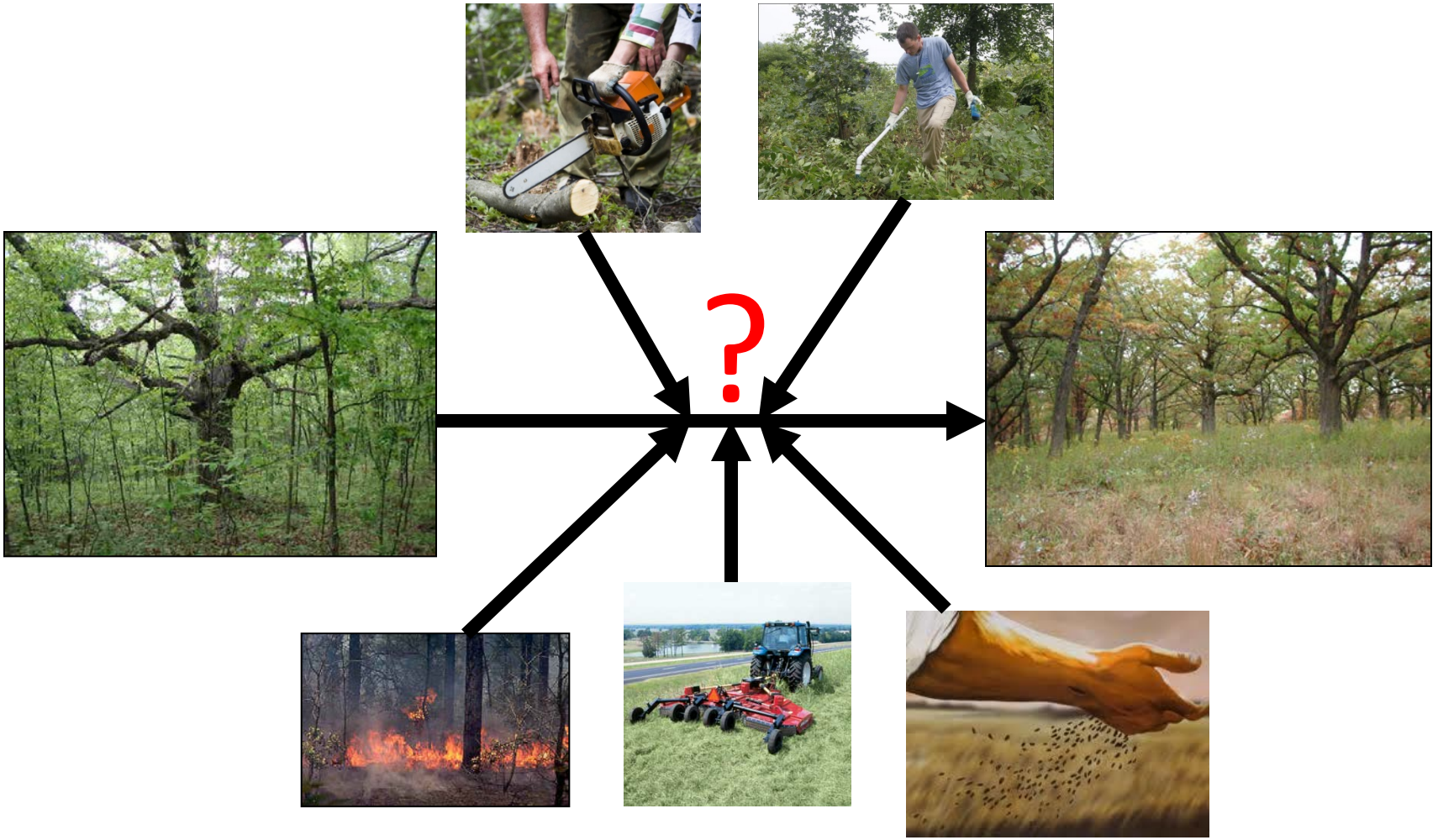
Heterogeneity and variability

Midwestern oak savannas: threats

Pristine

Encroached

What is the best way to restore?



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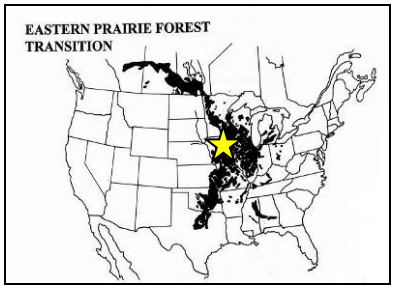
Iowa oak savanna restoration experiment: (2002 – 2010)

Encroached

Encroachment removed



Range image: Nuzzo 1986

Thinning and burning effects on groundlayer plants

Unthinned/unburned

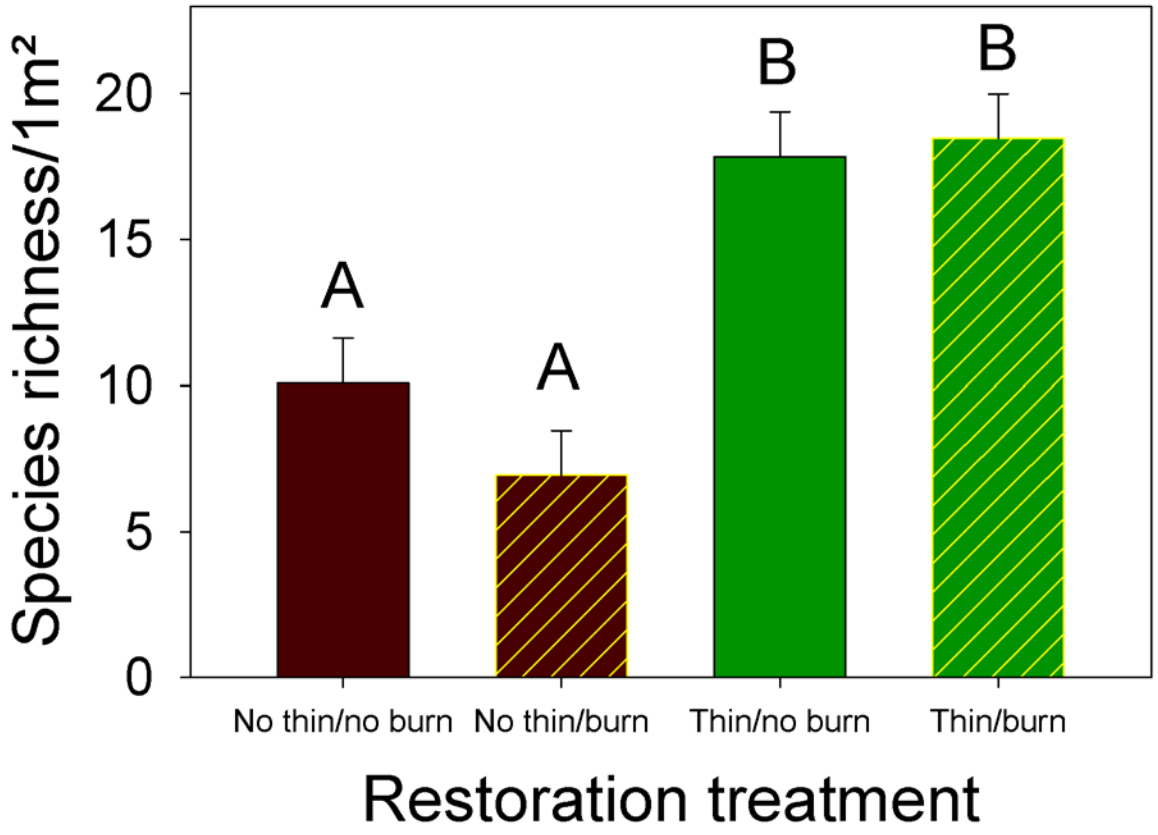
Unthinned/burned

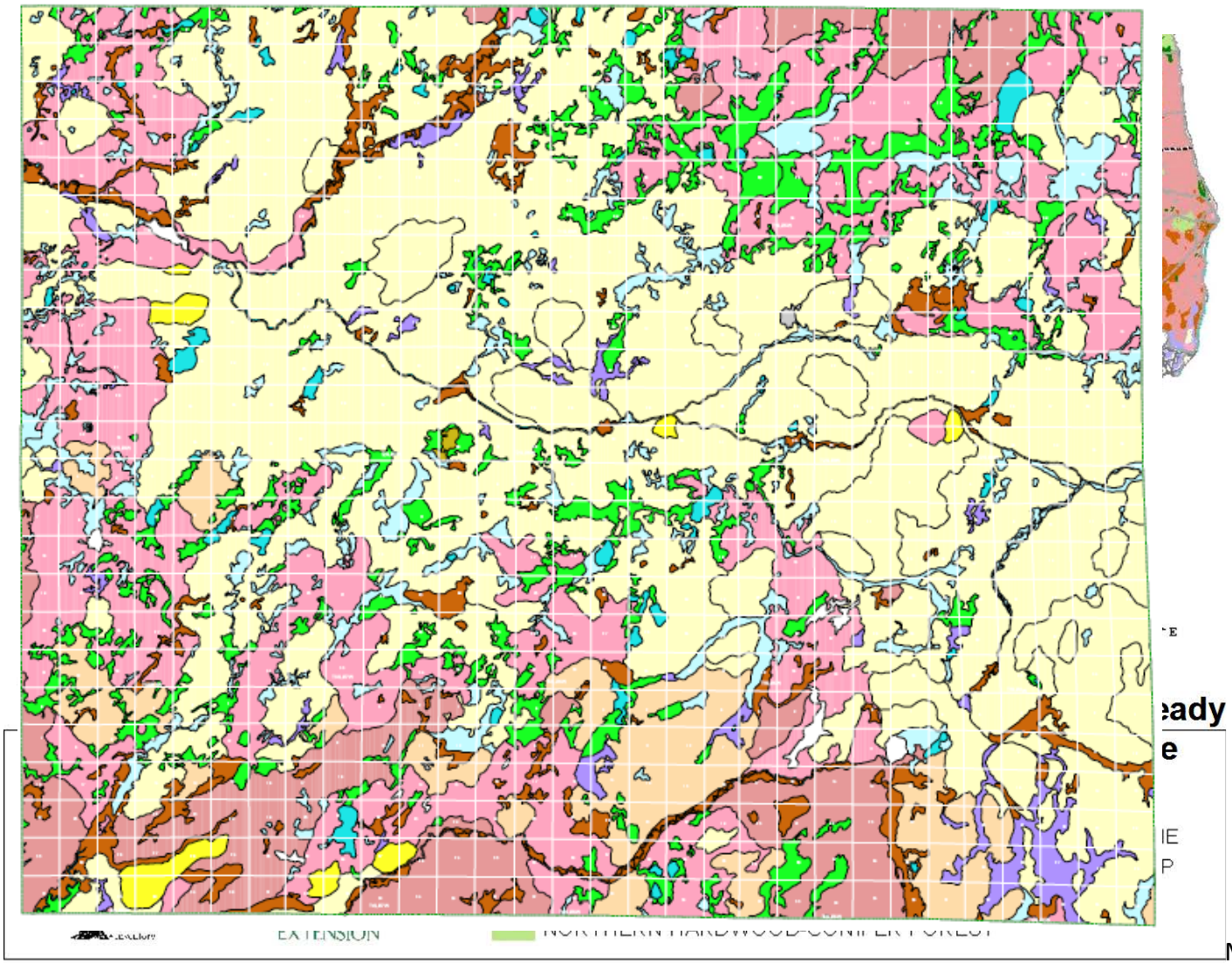
Thinned/unburned

Thinned/burned

Groundlayer plants

Thinning, not burning, increases groundlayer richness





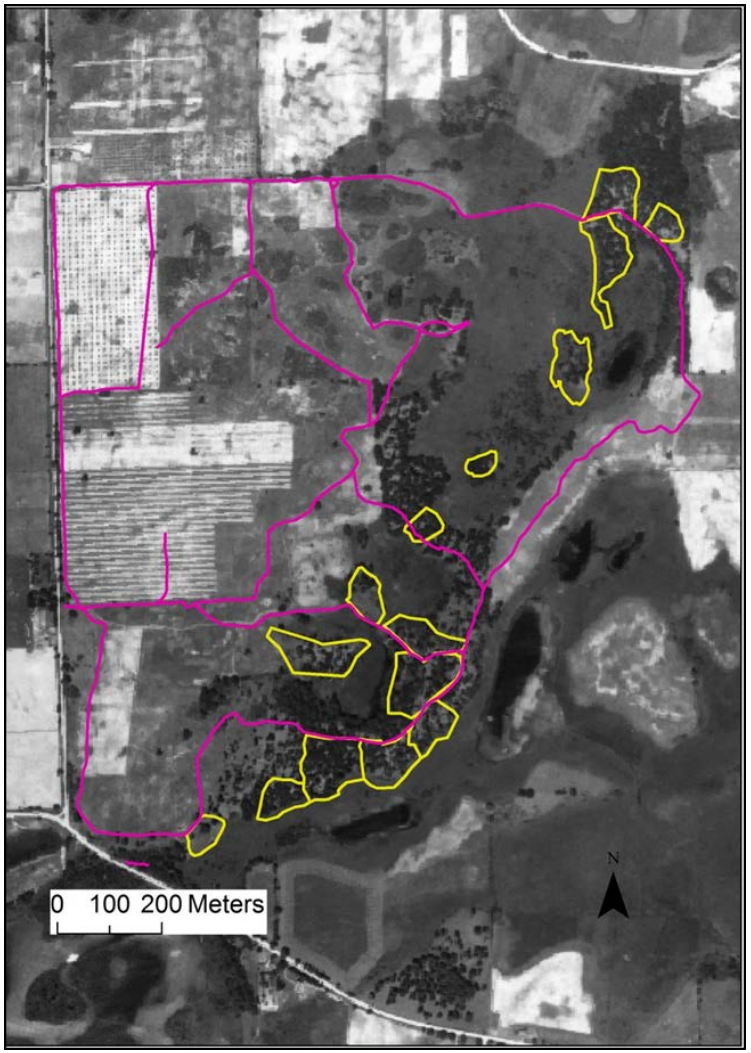
Maps: MNFI

Historical descriptions

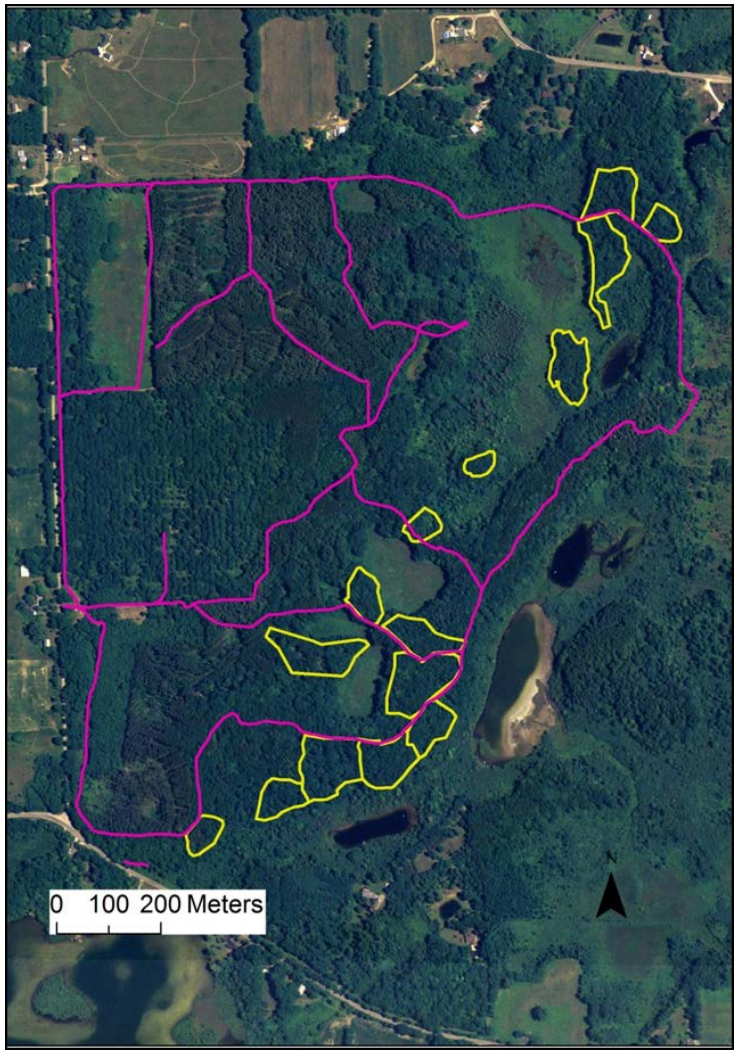
The ordinary character of the “openings” is that of a majestic orchard of stately oaks, which is frequently varied by small prairies… and clear lakes. These magnificent groves, were until a few years a go kept free from underbrush by the passage through them of annual fires.

– Hubbard (1872) recounting his impressions of the (Jackson Interlobate) landscape in 1837

MSU MacCready Reserve



1938



2008

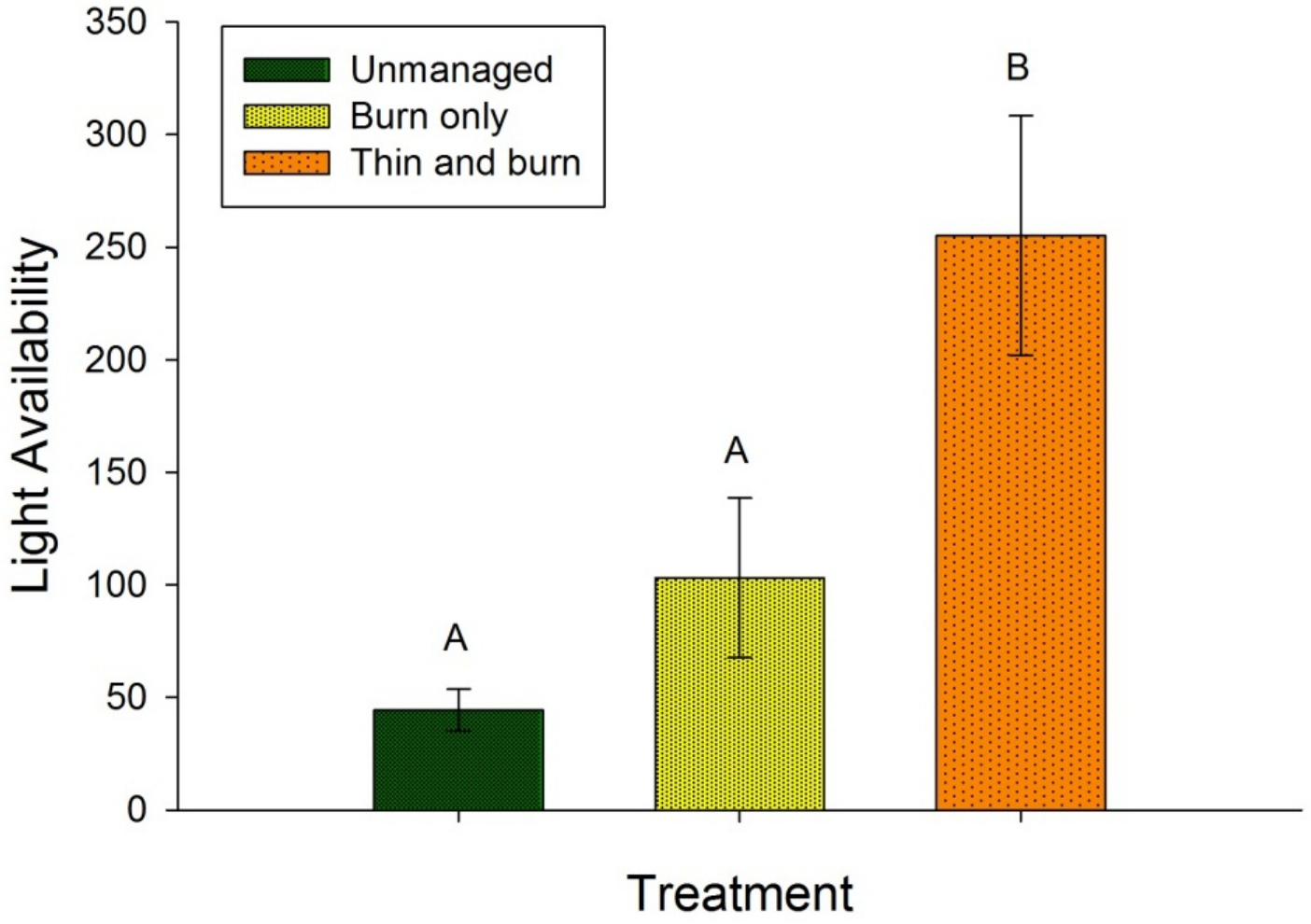
Restoration Methods
Treatments

“Unmanaged”
No mgmt

“Burn only”
Burn every 2 yrs

“Thin + Burn”
Burn every 2 yrs
Successive woody mgmt

Understory light availability









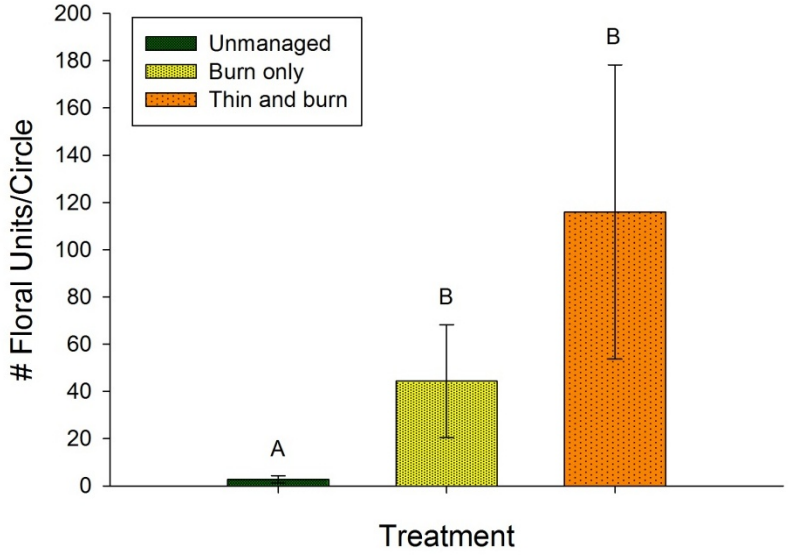


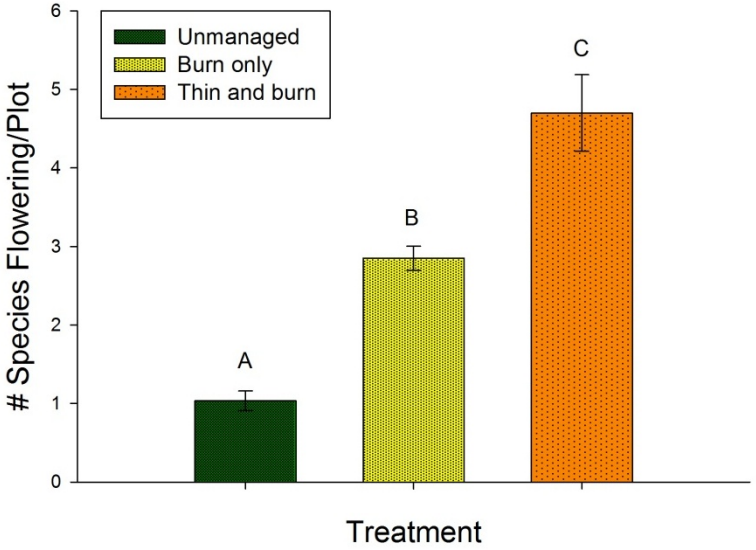






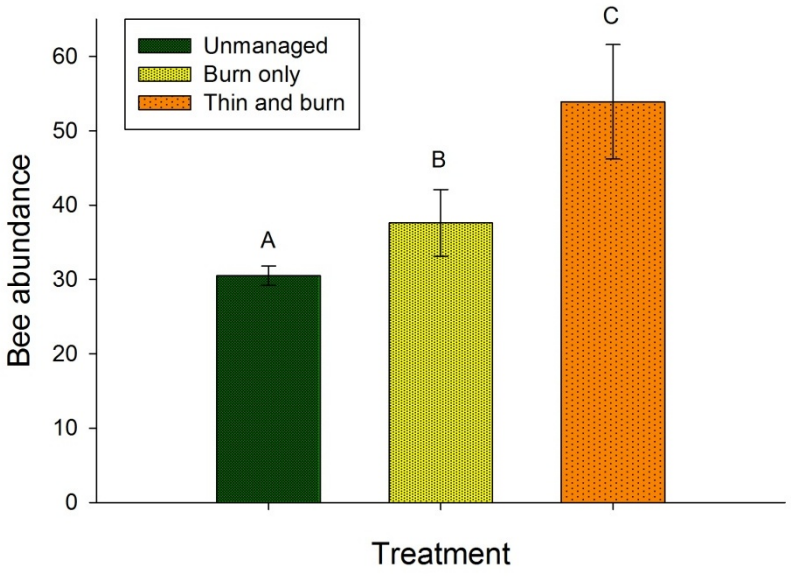

Floral abundance and richness

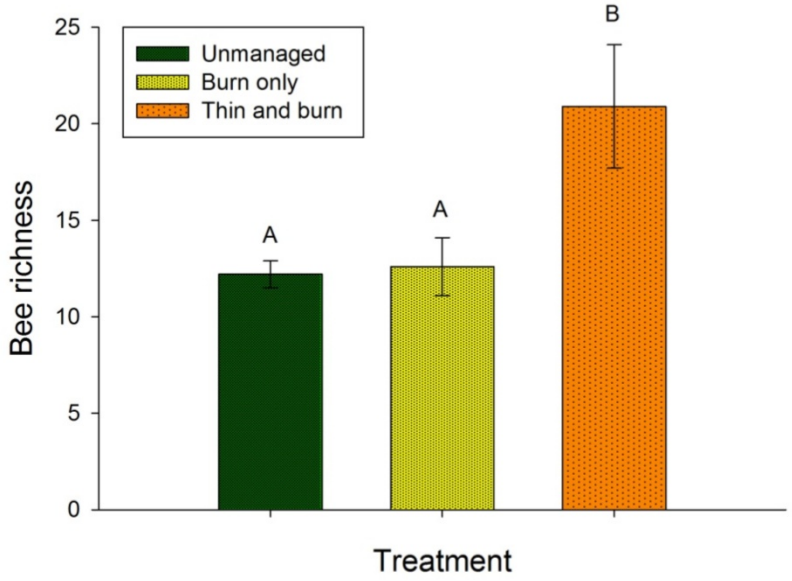


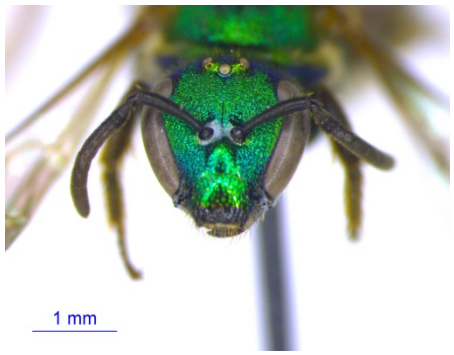



1 mm
1 mm
1 mm
1 mm
1 mm
1 mm
1 mm
1 mm
57 species
5 families
532 individuals

Bee abundance and richness







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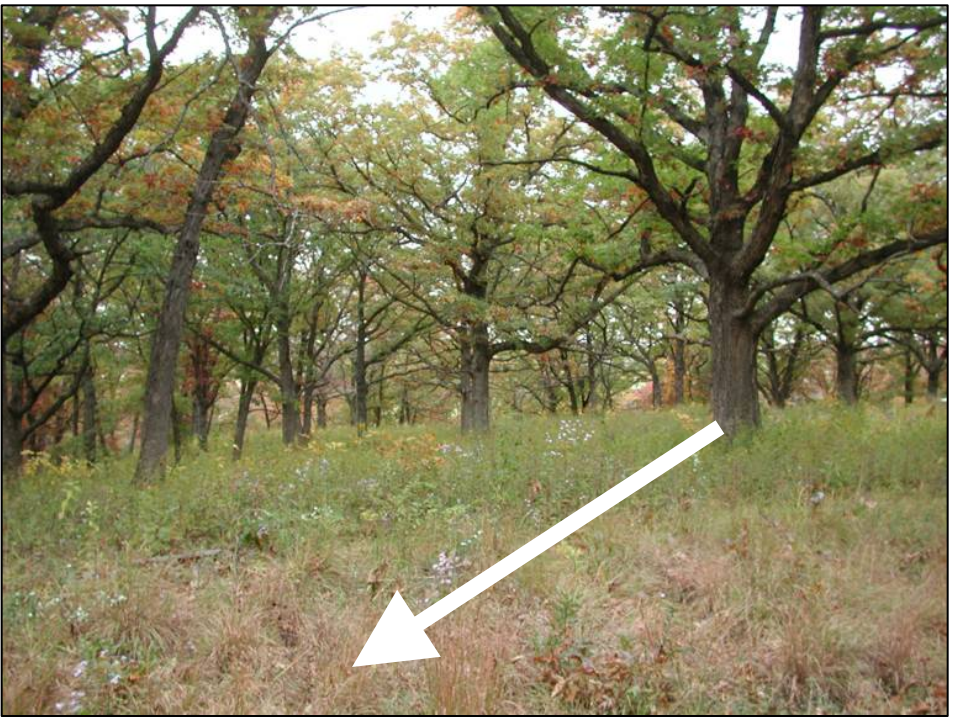
Heterogeneity in oak savannas

Pristine

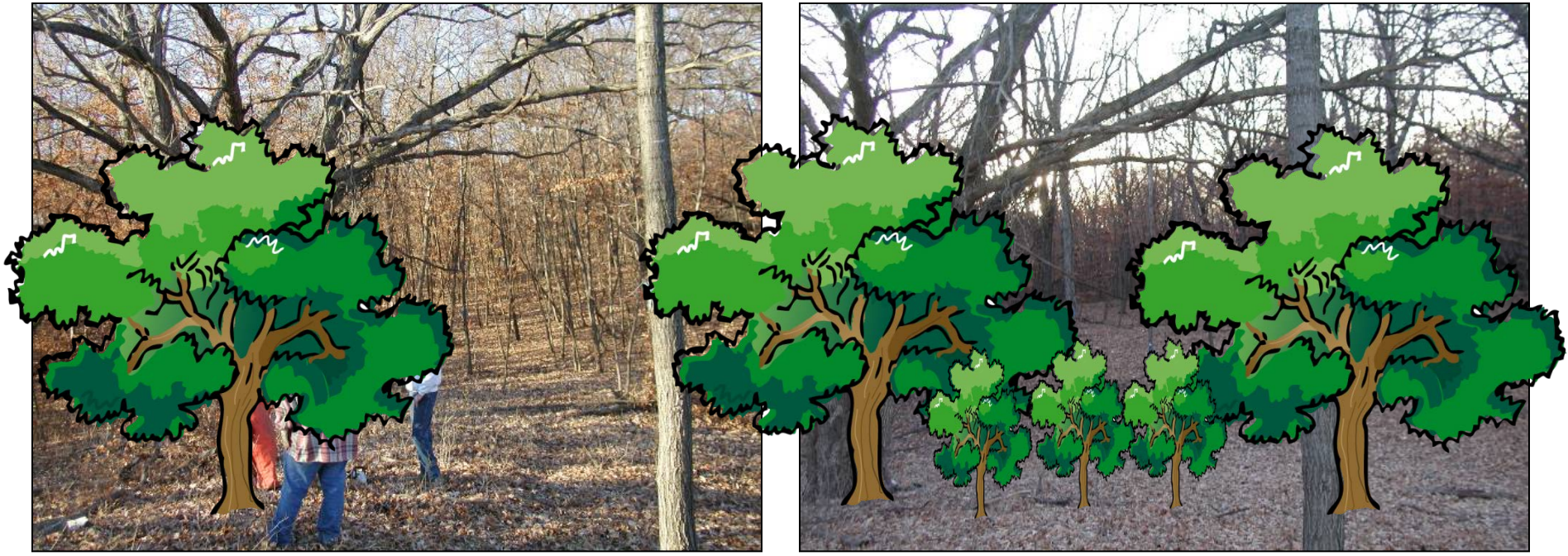


Biophysical gradients intact

Encroached

Biophysical gradients pre- and post encroachment removal?

Encroached vs. encroachment removed



When encroachment removed, trees structured:

Understory light levels

Soil moisture levels

Understory plant cover/diversity/composition

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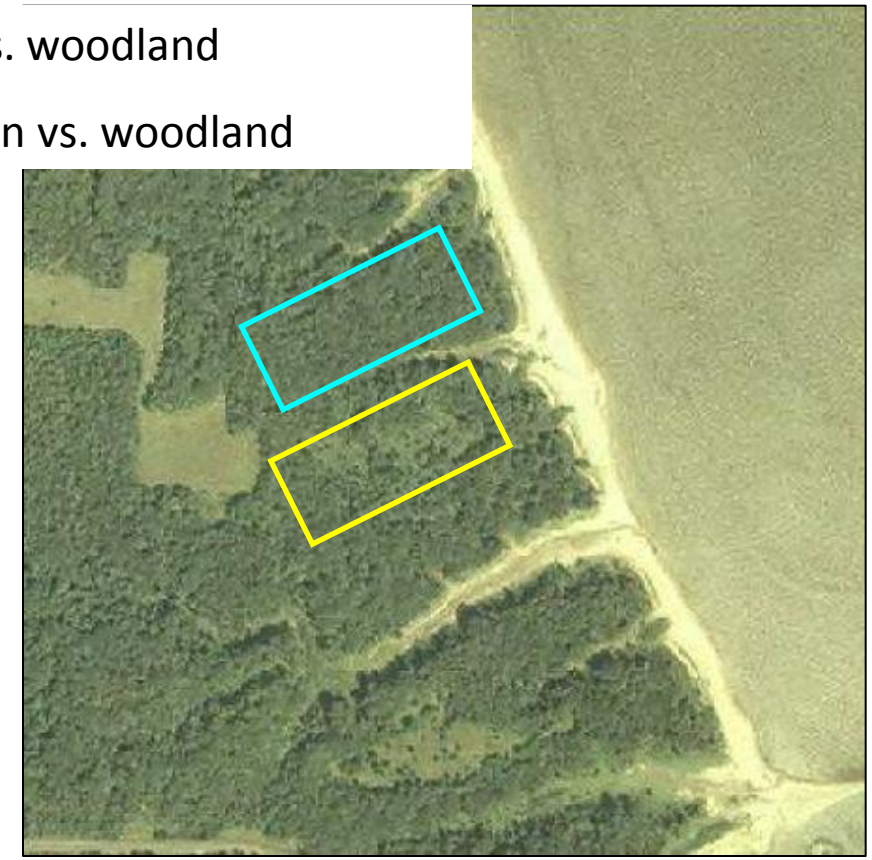
Surrounding landscape during restoration

Site level: savanna vs. woodland

Landscape level: open vs. woodland



Roles of fire and other tools in oak savanna management?

Take home: Fire is a central tool, but thinning effects predominate over burning in the short-term

- Ecosystem structure, groundlayer plants, pollinators

Questions:

- When can we expect fire-alone to be effective…and over what time scales?
- Does thinning + burning accelerate trajectory…or set a different trajectory, relative to burning along?
- Fire surrogates?
- Matching tools to site conditions

How do we promote heterogeneity within sites?

Take home: Restoration can promote heterogeneity

Questions:

- Burn spatial/temporal heterogeneity?
  - Patch vs. complete burns
  - Seasonality
  - Return interval

What explains variation in restoration outcomes (among sites)?

Take home: Site-to-site variation and landscape cont

Questions:

- Soil conditions?
- Management decisions?
- Landscape context?
- Native vs. invasive establishment ?

Questions?