2013-2014 Webinar Series

December 19, 2013 2:00 PM ET (1:00 PM CT)

New Manager – Scientist Relationships

Lessons Learned from the 2013 LSFSC Internships

The Application of Prescribed Fire and Herbicide to Reduce *Carex pensylvanica* Cover at the Newaygo Prairies Research Natural Area, Manistee National Forest, Michigan

Todd A. Aschenbach , Grand Valley State University
with
Pat Ruta-McGhan, Huron-Manistee National Forests, USDA Forest Service
and
Matthew Sands, Huron-Manistee National Forests, USDA Forest Service

Sand Prairie

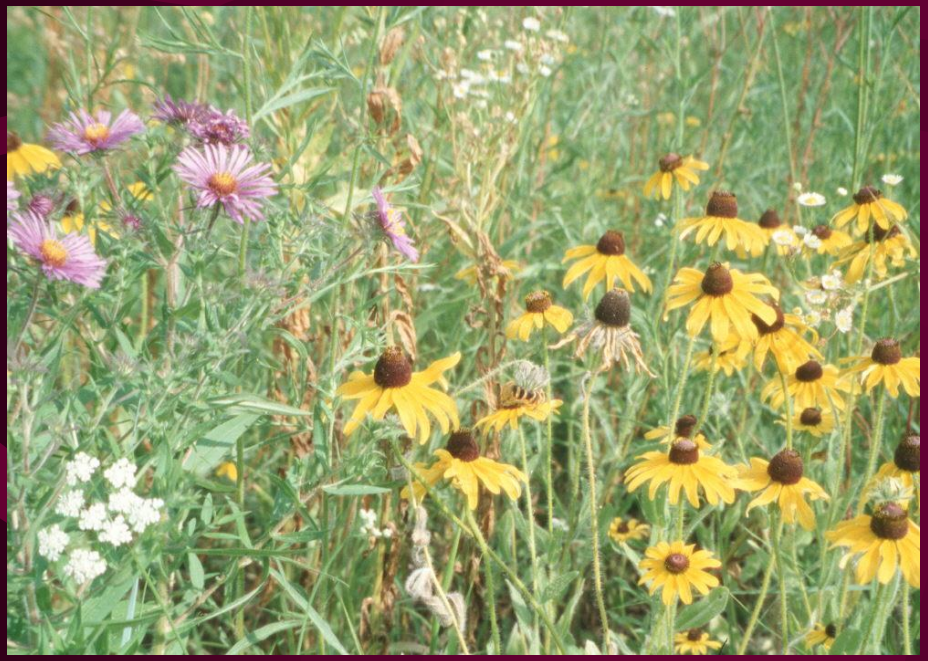
- Community within a grassland/savanna/barren mosaic ($\sum$ = 6%)
- 60 native plant species
- Dry, sandy soils
- Fire dependent
- State Imperiled; Globally Vulnerable
- Important habitat

Photo: MI DNR

Plant Community Assembly

Plant Community Assembly

Regional Filters
(Climate, Dispersal)



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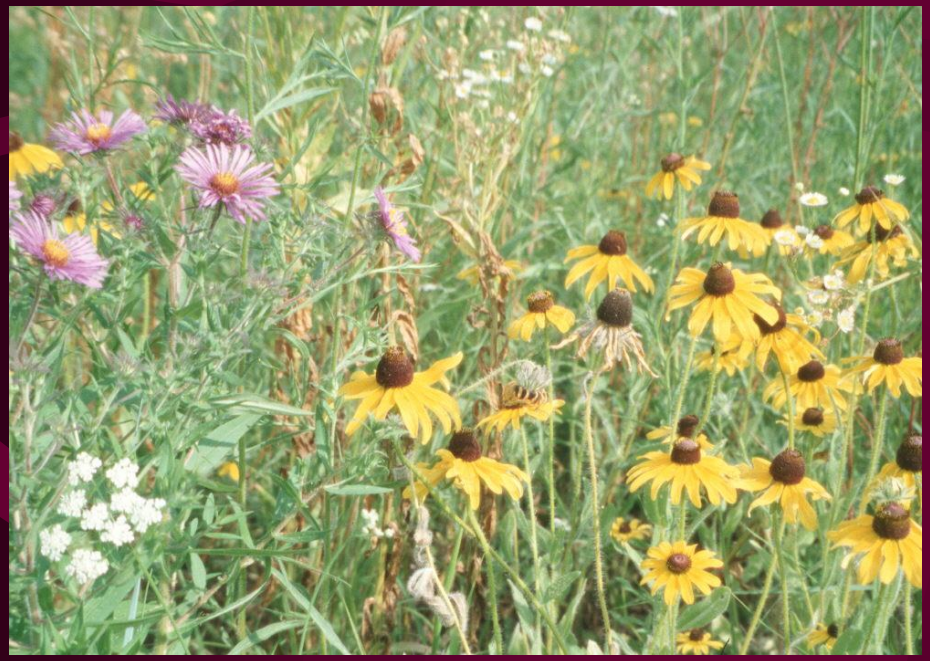
Abiotic Filters

(Soil Nutrients, Water Availability)



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Disturbance
(Fire, Flooding)

Low Plant Diversity

- 4 total species
- 1.35 species/plot

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Pennsylvania Sedge (*Carex pensylvanica*)

- Native, widespread sedge
- 79% of all plant biomass

Photo: RW Smith

Plant Community Assembly

Regional Filters

Abiotic Filters

Plant Community Restoration

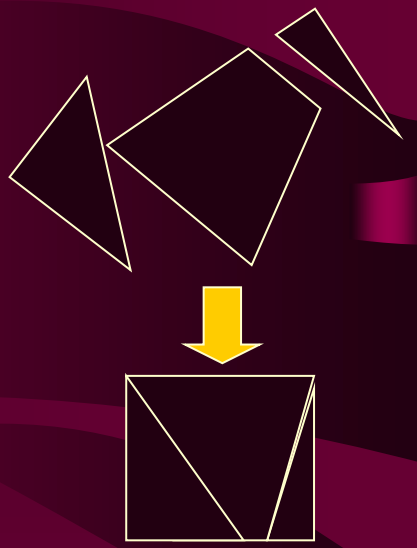
Regional Filters

Abiotic Filters

Disturbance
(Fire, Herbicide)

Plant Community Restoration

Regional Filters



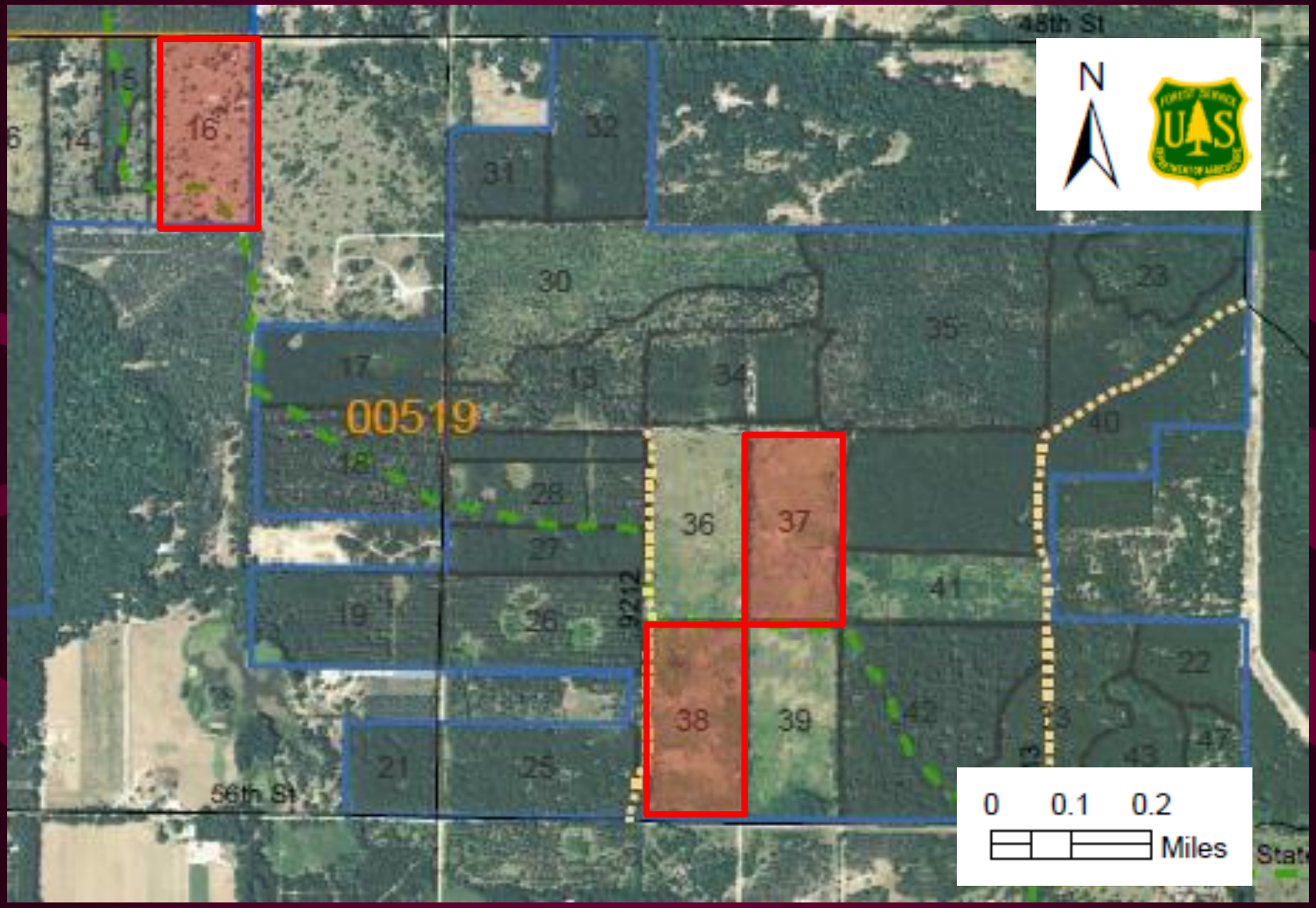
Abiotic Filters

Disturbance
(Fire, Herbicide)

Newaygo Prairies Research Natural Area

- Manistee National Forest, Newaygo County, MI
- 180 Acres
- Est. 1988
- Managed by the U.S. Forest Service
- Small-scale restoration experiment for large-scale restoration projects
  - 1800 acres to be restored

Newaygo Prairies Research Natural Area



Experimental Design

- 5 Fire/Herbicide Treatments
  - Fire only (early June 2013)
  - Fire followed by herbicide (early June 2013; late June 2013)
  - Herbicide only (early June 2013)
  - Herbicide followed by fire (early June 2013; September 2013)
  - Control (no fire or herbicide)
- Herbicide: Glyphosate (1.8 kg a.i./ha)

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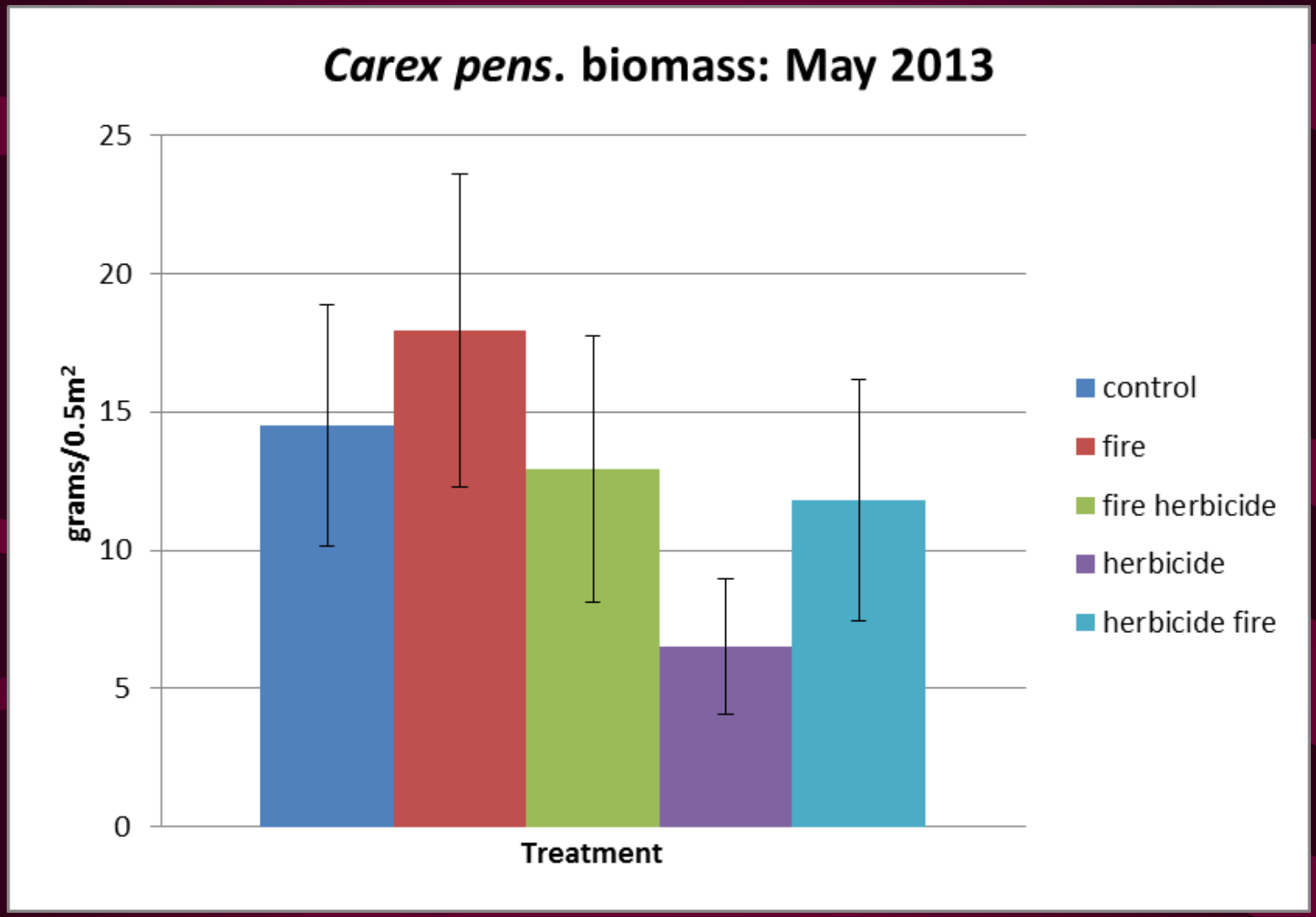
- Herbicide: Glyphosate (1.8 kg a.i./ha)
- 5 replicates per treatment x 5 treatments x 3 fields = 75 total plots
  - Each plot = $4m^2$
- Sampled in May 2013 (pre-treatment) and September 2013 (post-treatment)
  - Vegetative cover estimates
  - Biomass collection

May 15, 2013

May 15, 2013: Pre-treatment Data



- Mean *Carex pens*. biomass = 12.7 g/0.5m^2
- No significant difference in *Carex* biomass among treatments

June 4, 2013: Fire Application

June 4, 2013: Fire Application

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June 4, 2013: Herbicide Application

June 27, 2013: Herbicide Plots

June 27, 2013: Fire Plots

*Herbicide Applied to Fire-Herbicide Plots

September 4, 2013: Fire Application

September 8, 2013: Post-treatment Data

September 8, 2013: Post-treatment Data

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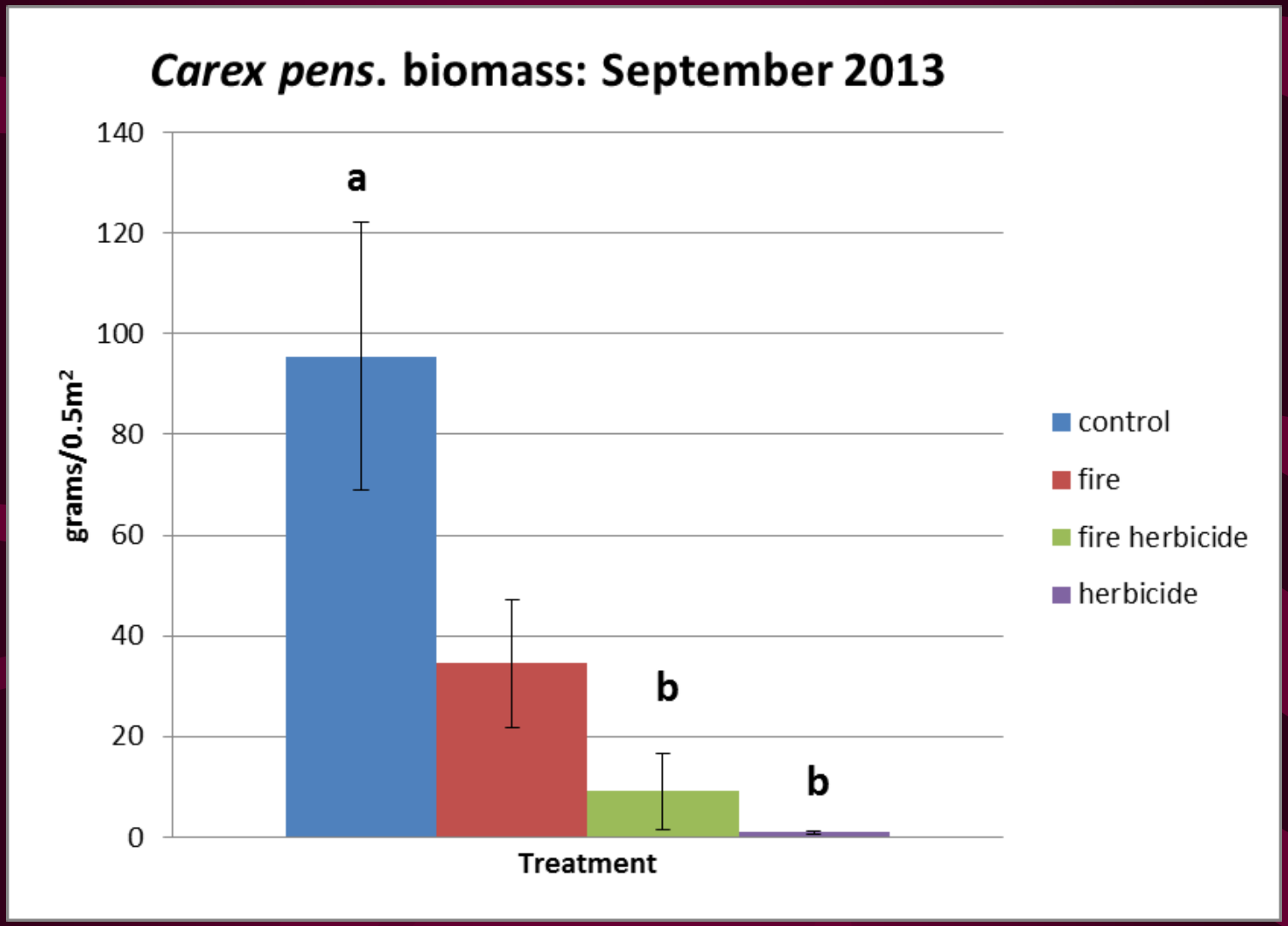
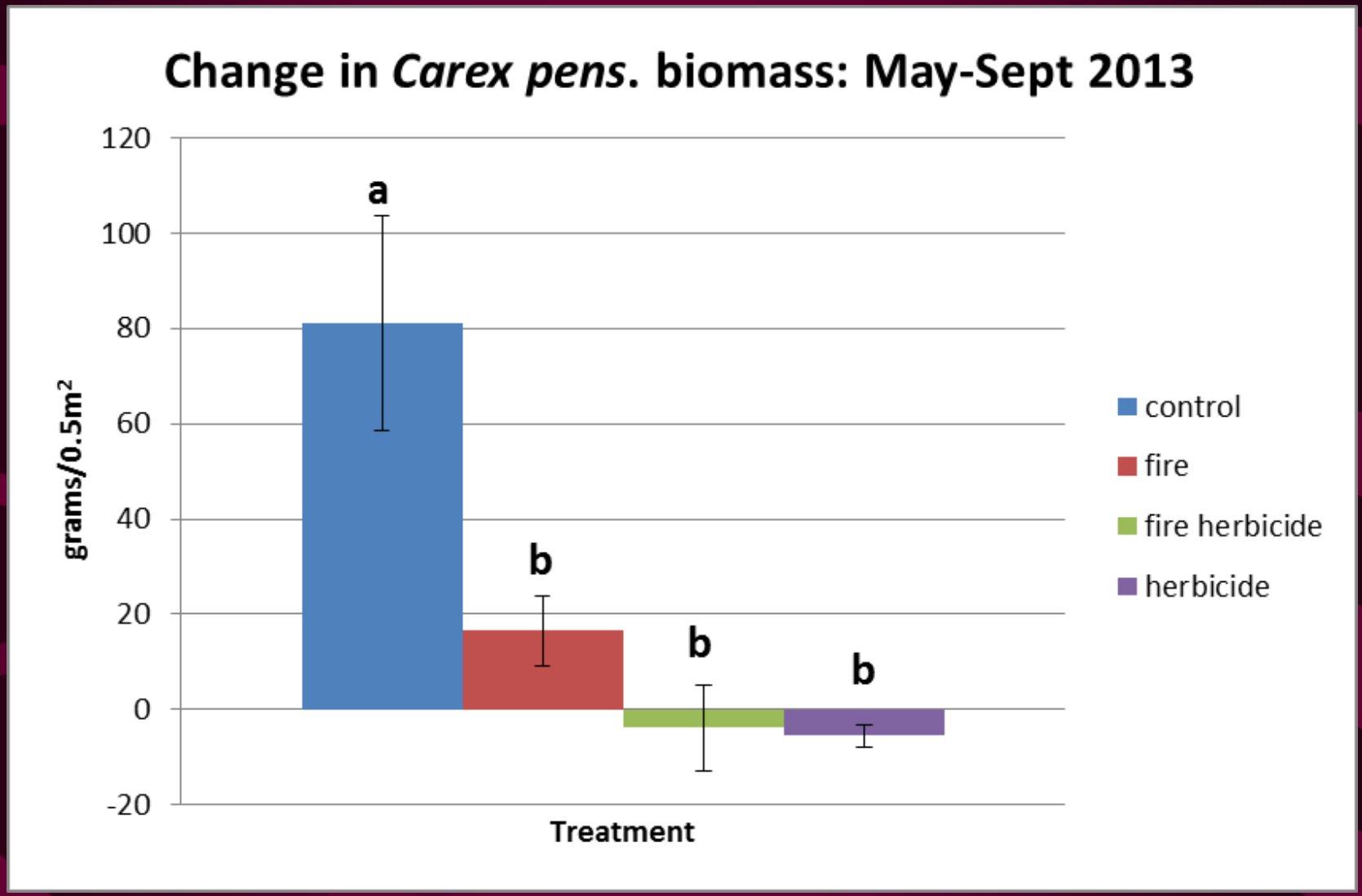
*No Data Collected on Herbicide-Fire Plots



- Mean *Carex pens*. biomass = 22.0 g/0.5m^2
- Different letters denote a statistically significant difference at $p<0.05$



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Summary and Discussion

- **Any combination of fire and/or herbicide reduces *Carex pens*. biomass**
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- **An important first step; Long-term data more valuable**
  - Data collected only 2-3 months post-treatment
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- **Herbicide followed by fire *may* have the greatest impact**
  - Speculation based on herbicide only results
- **An important first step; Long-term data more valuable**
  - Data collected only 2-3 months post-treatment
  - Data to be collected in summer 2014
- **Results important for large-scale restoration efforts**
  - Restoration in Manistee National Forest to begin in 2016

Acknowledgements

- US Forest Service – Manistee-Huron National Forest
- Lake States Fire Science Consortium
- Grand Valley State University
- Research Assistants: Katie Aschenbach, Samantha Brodley, Danielle Smith, Connor Wojtowicz

Mapping post-fire jack pine regeneration across a recently-burned area in northern Lower Michigan to inform Kirtland's warbler management

Dan Kashian
Wayne State University

Phil Huber
Mio Ranger District
Huron-Manistee NF

Julia Sosin
Wayne State University

Jack pine-dominated landscapes in northern Lower Michigan are heavily influenced by management for Kirtland's warbler

- Federally endangered species
- Most nest in northern Lower Michigan (also UP, WI, Ont.)
- Population once as low as 201 singing males (1971).

- Nest in young, dense jack pine stands 5-20 feet tall
- KW is habitat limited; habitat was historically fire-regenerated.

KW management in northern Lower Michigan today is dominated by jack pine plantations

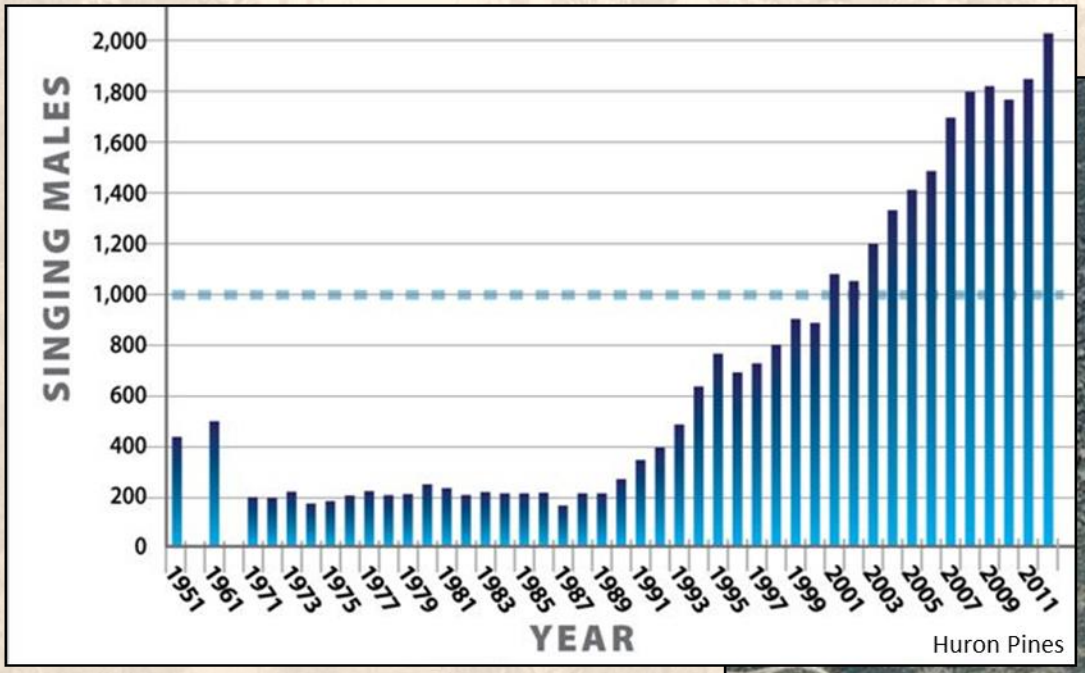
- Management goal is to maintain 38,000 acres of suitable KW habitat on the landscape
- Plantations are managed on a 50 year rotation; requires constant management of 190,000 acres

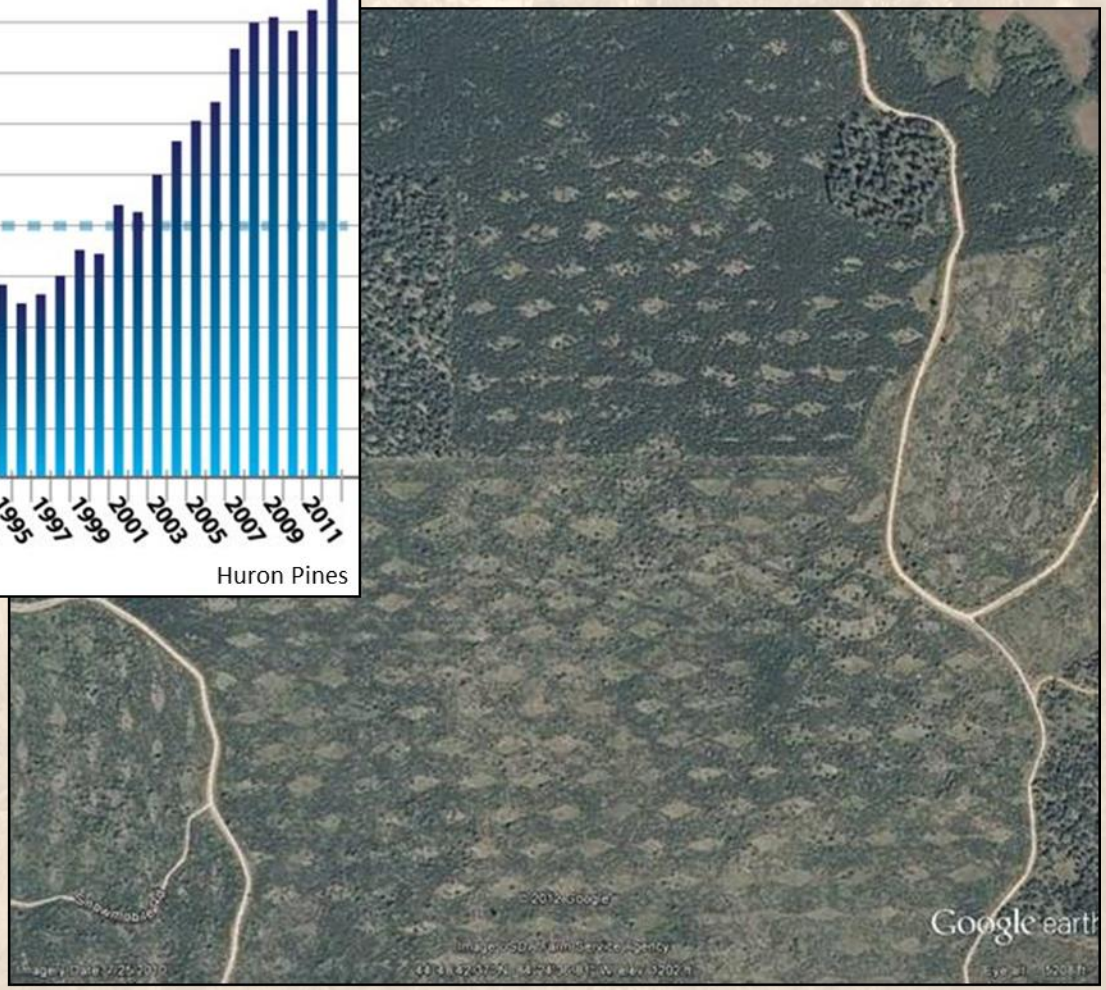
- Trees are planted in a opposing wave pattern to "mimic" wildfire patterns
- Approximately 2,000 acres are planted each year

KW management leaves a significant imprint on jack pine-dominated landscapes in this region

- Jack pine planted for KW management appears very different in structure from fire-regenerated stands

KW management using plantations has been extremely successful in aiding KW recovery

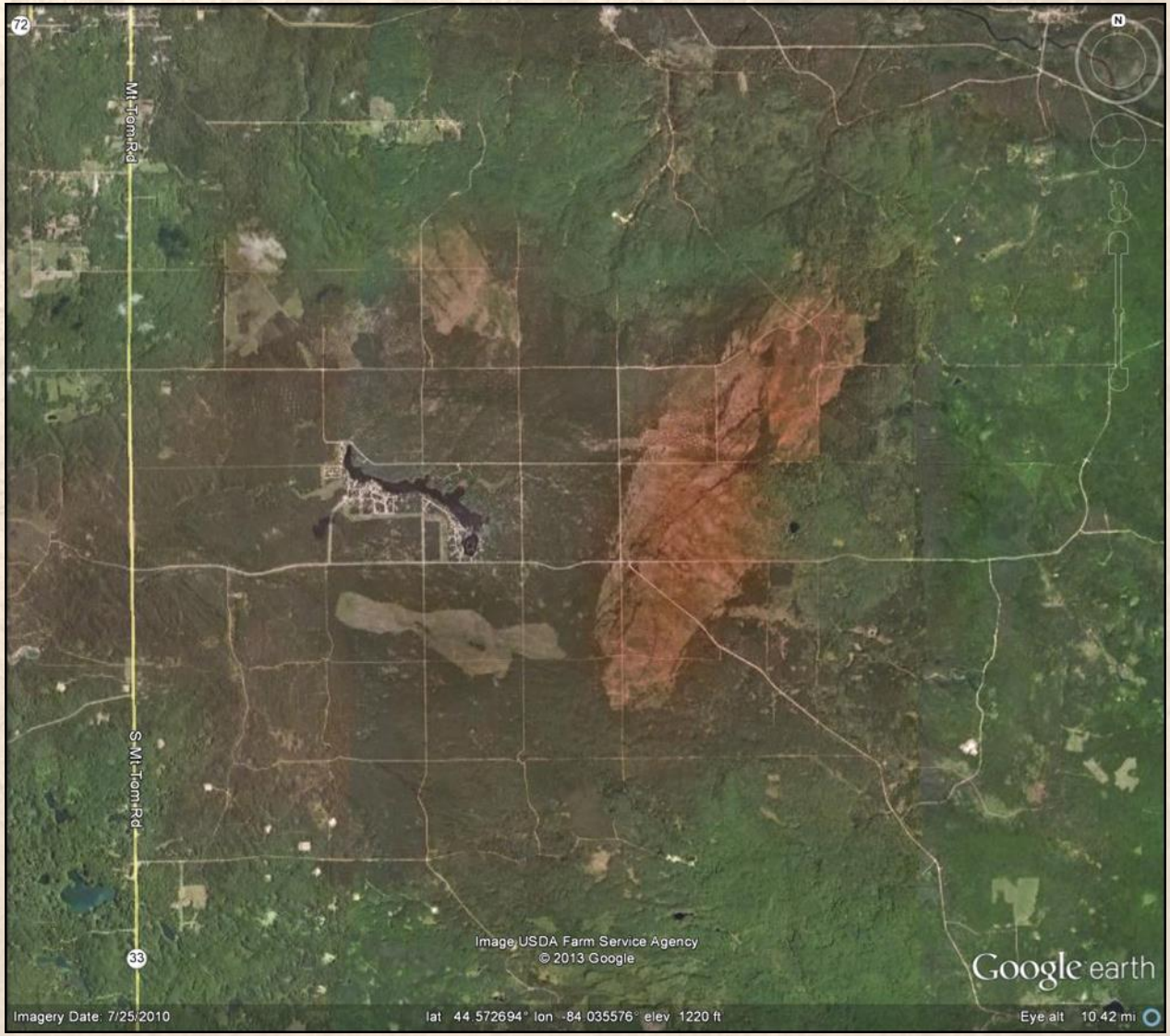




- KW have exceeded the original management goal since 2001
- 2,004 singing males in 2013 (2,063 in 2012)

Wildfires are still common in northern Lower Michigan despite the dominance of plantations

- No Pablo Burn burned about 4,000 acres through 20-year old jack pine in 2000.
- Much was never salvaged or otherwise altered.
- Has been productive habitat for KW (181 singing males in 2012)



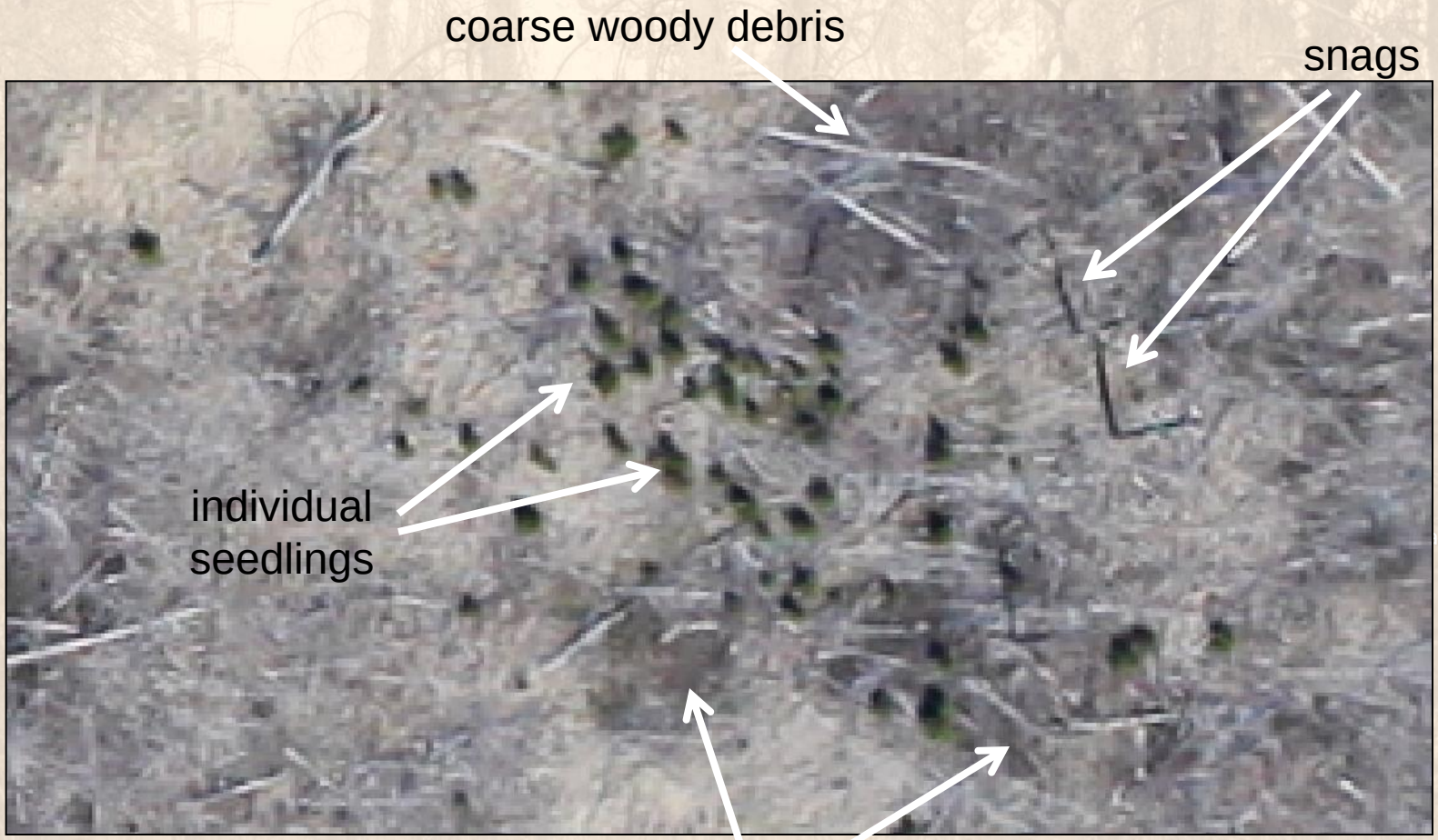
Justification

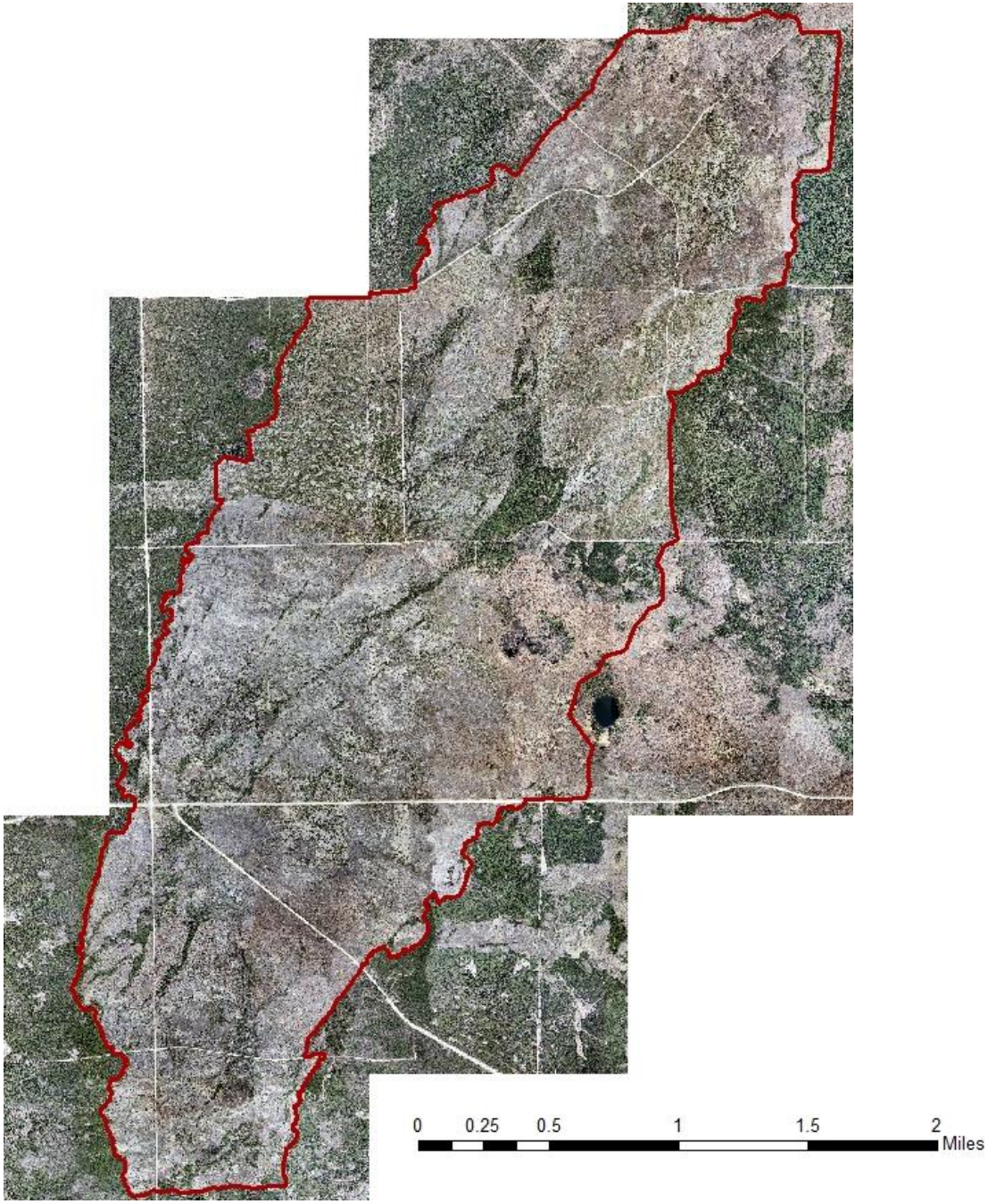
1. Stand-replacing wildfires create considerable variability in regenerating vegetation, even within the same successional stage.

2. No detailed description of variability of jack pine regeneration currently exists for post-wildfire areas in Michigan.

3. Quantifying the post-fire variation in jack pine regeneration is crucial for understanding system parameters and may be useful for developing alternative KW management strategies.

Super Photography!

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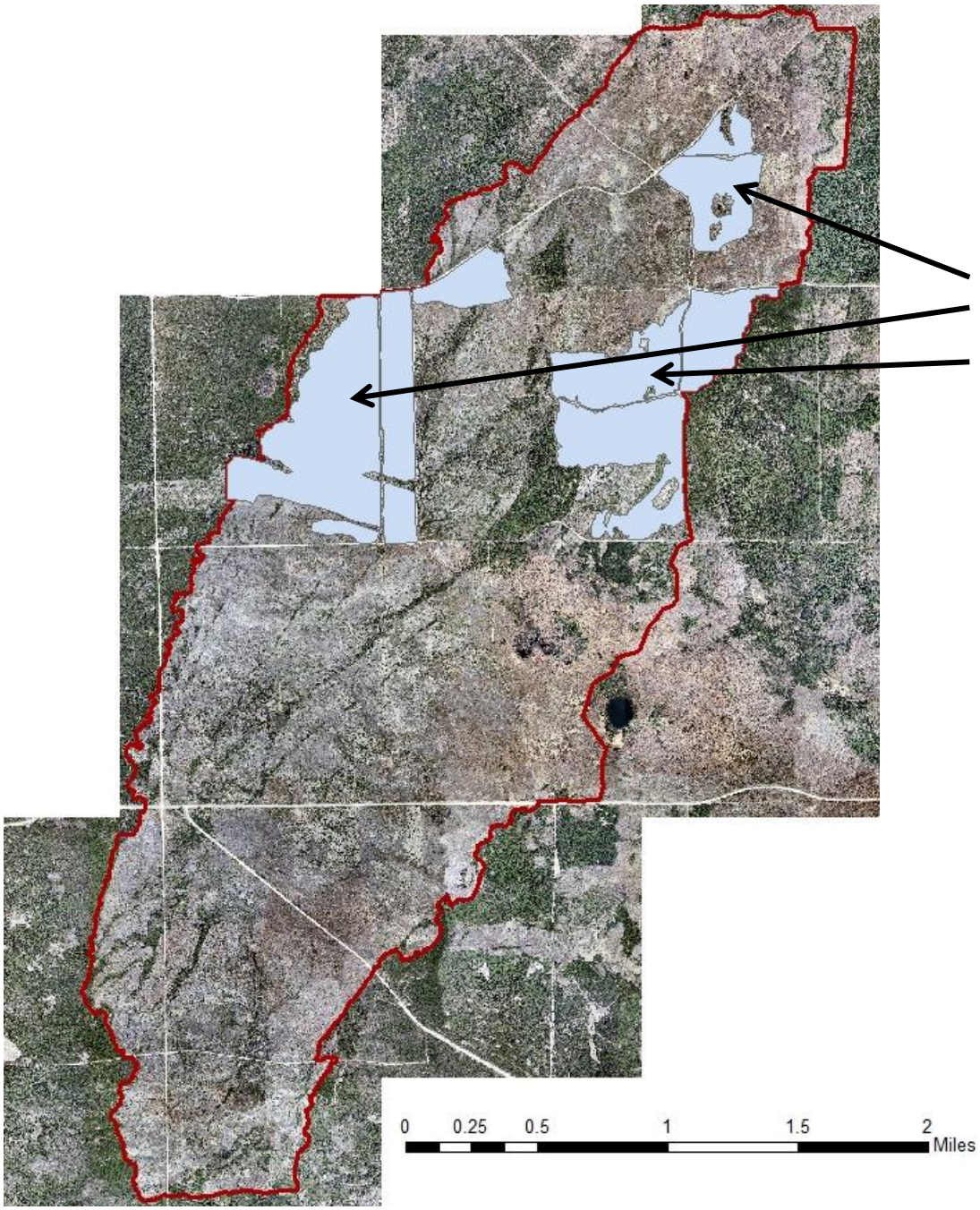
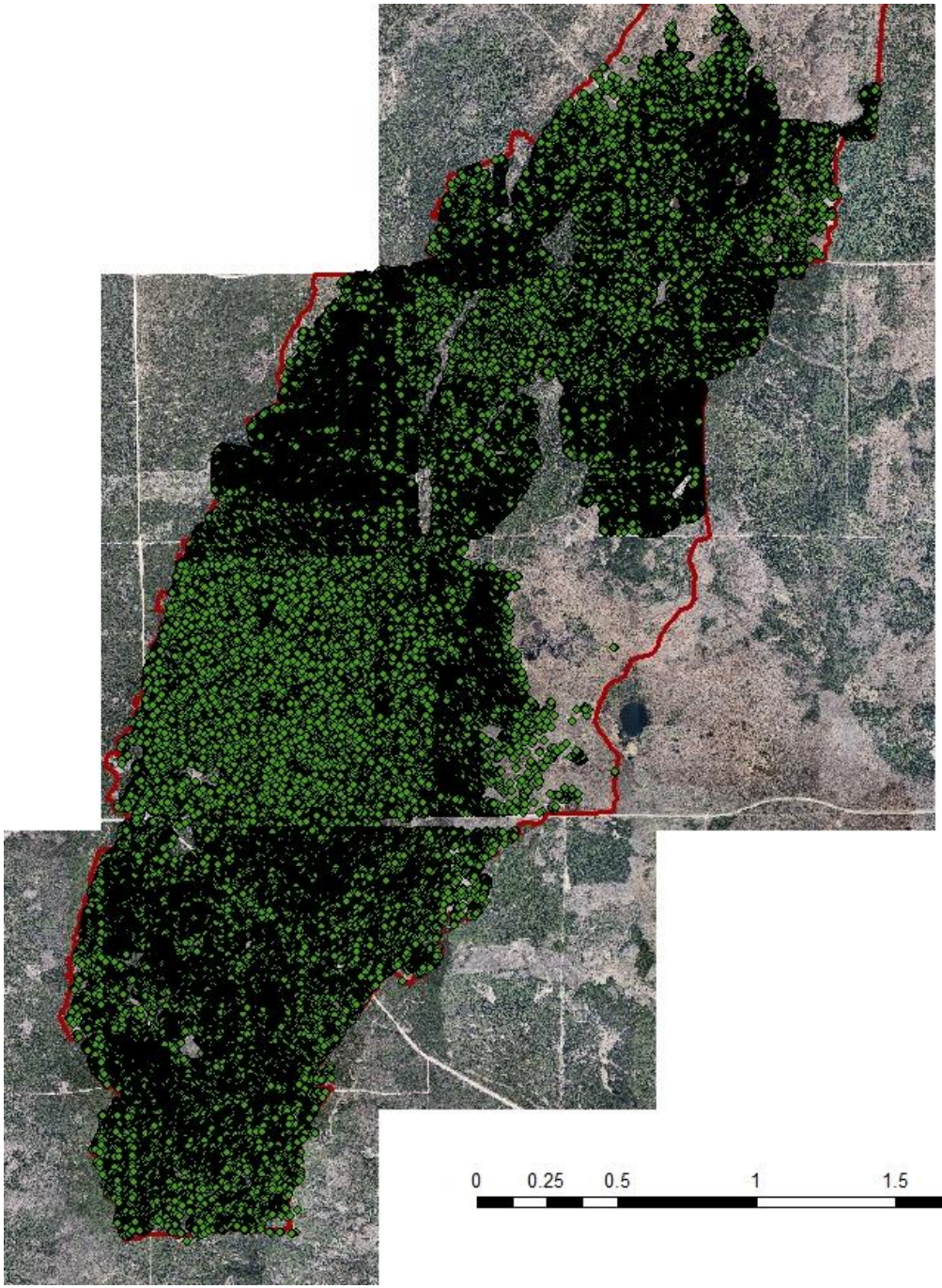


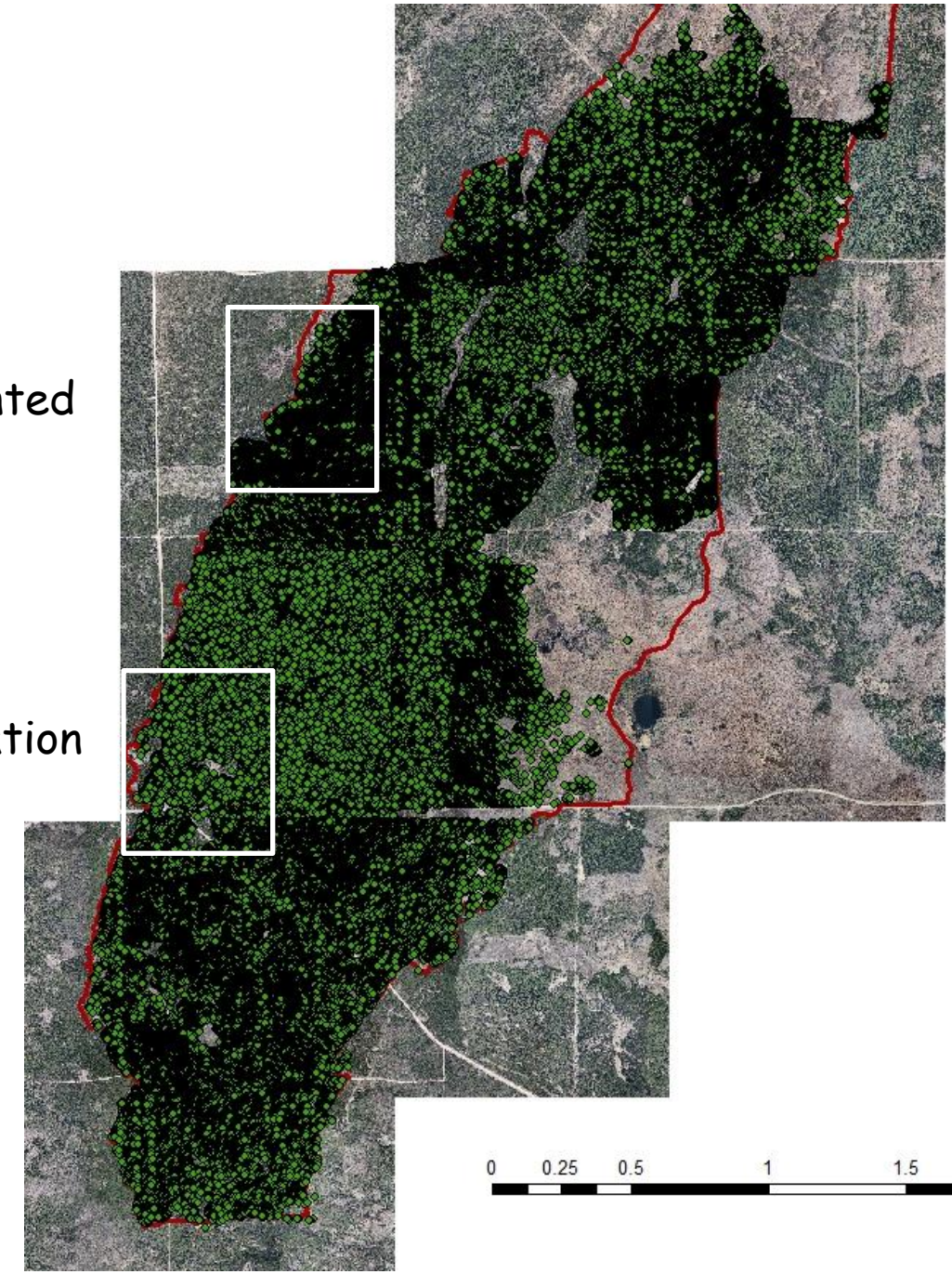
Approximately 15% of the area of the No Pablo Burn has been planted into KW-style plantations.

Natural Regeneration

Planted



- We mapped a total of 1,065,979 individual seedlings across the No Pablo Burn.
- The planted areas alone included 396,101 of these seedlings.
- Plantations included 37% of the seedlings but only 15% of the area.



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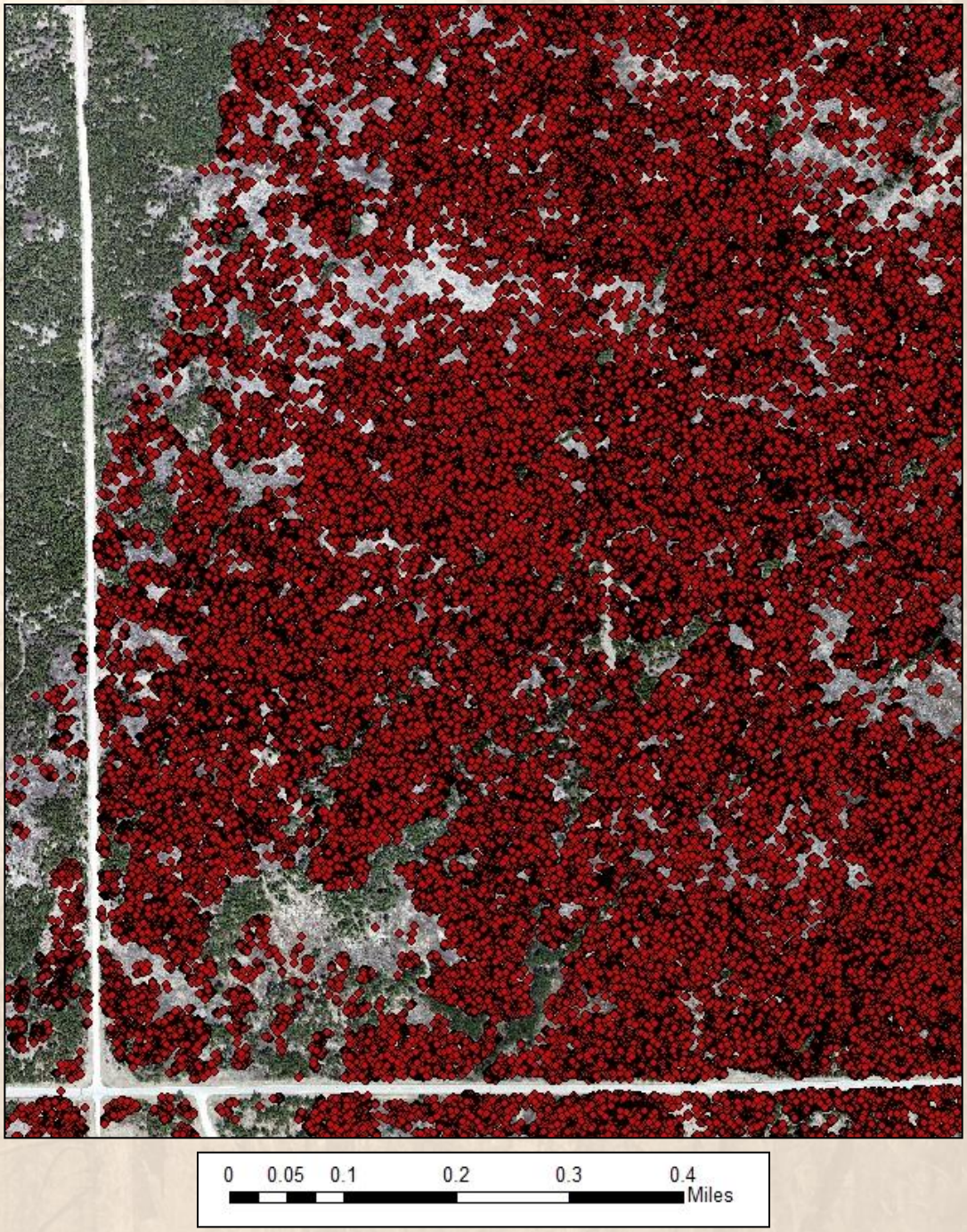
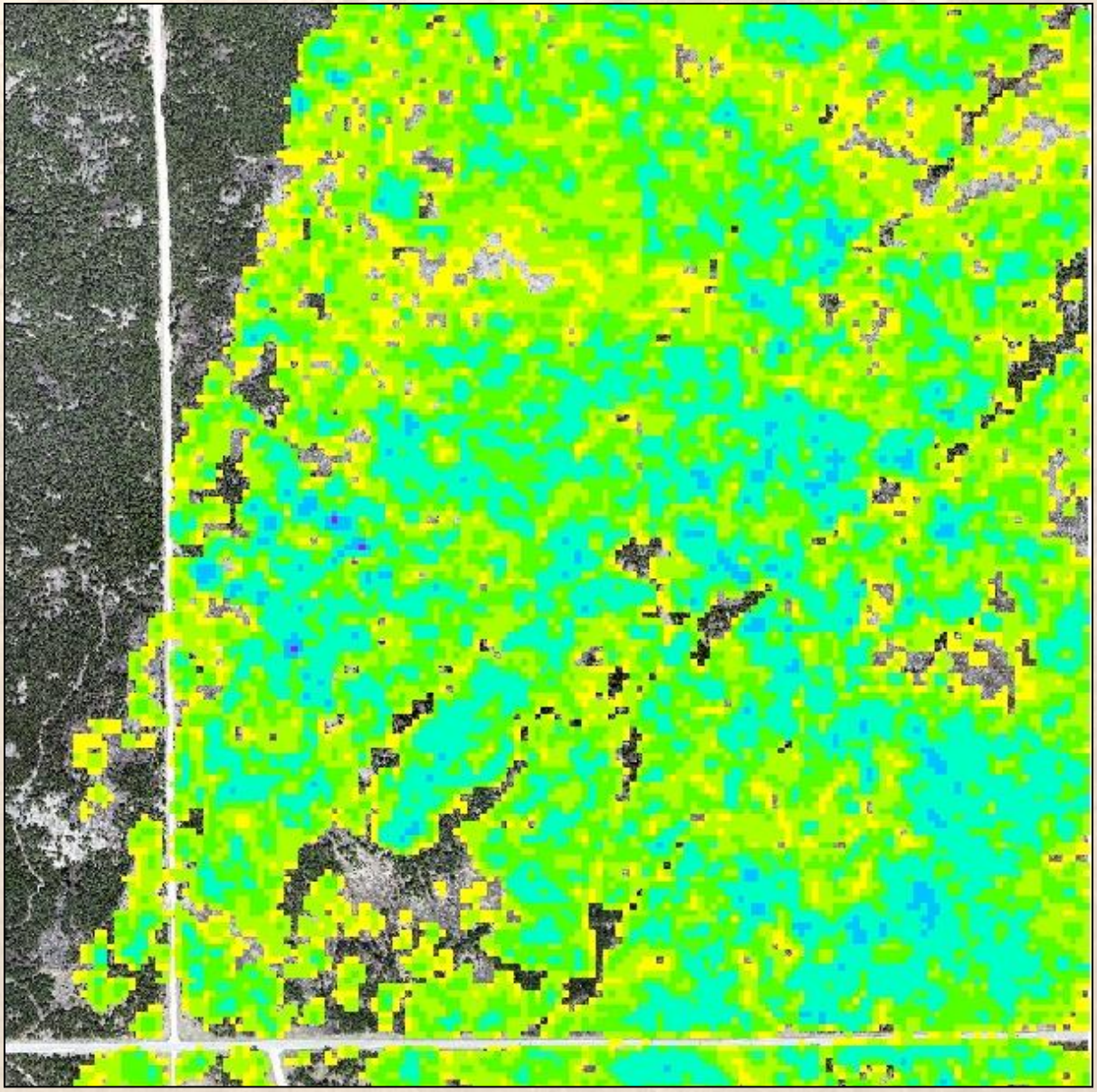
Characteristic natural regeneration

- We mapped a total of 155,694 individual seedlings in a 550 acre area across the photo
- We utilized the point density function in ArcGIS to convert these points to polygons



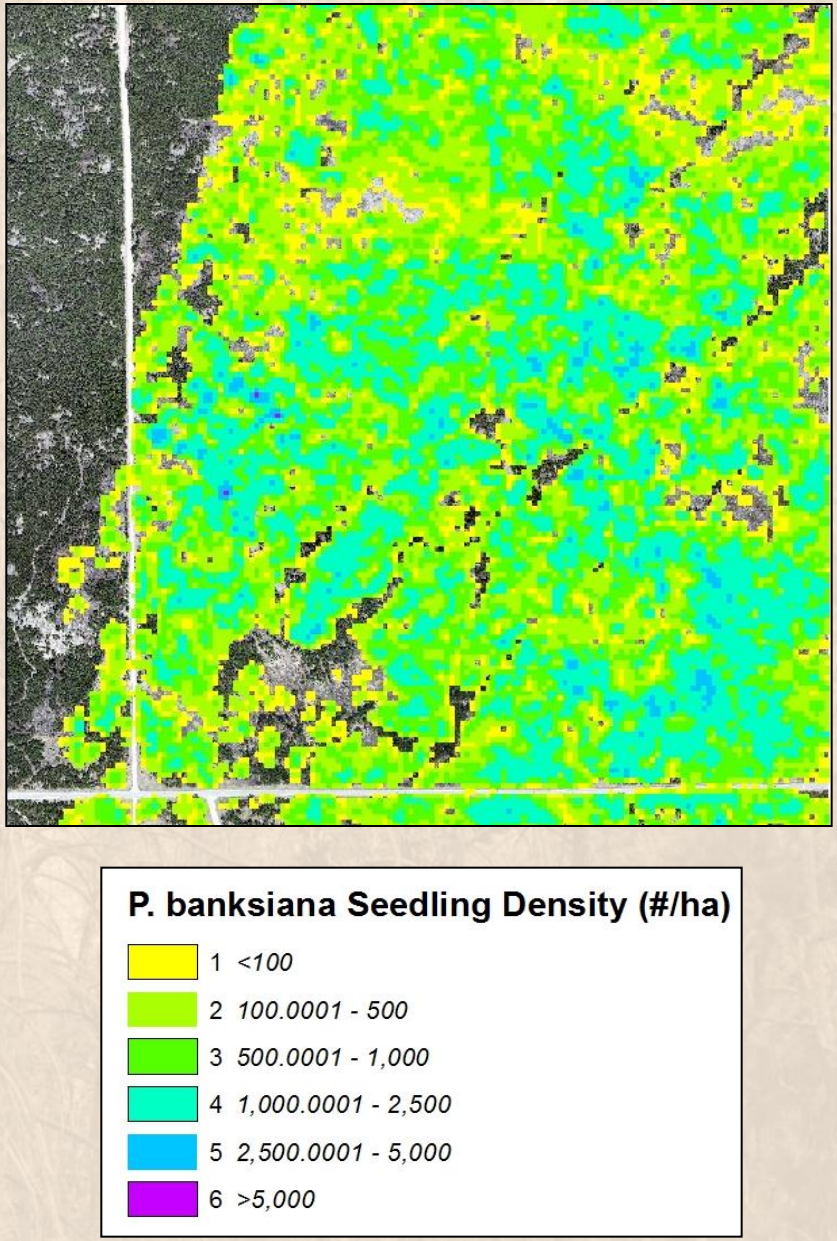
Characteristic natural regeneration

- Landscape features a few small patches of very dense seedlings (> 2,500/ha) surrounded by a matrix of low to moderate density (100-500/ha)



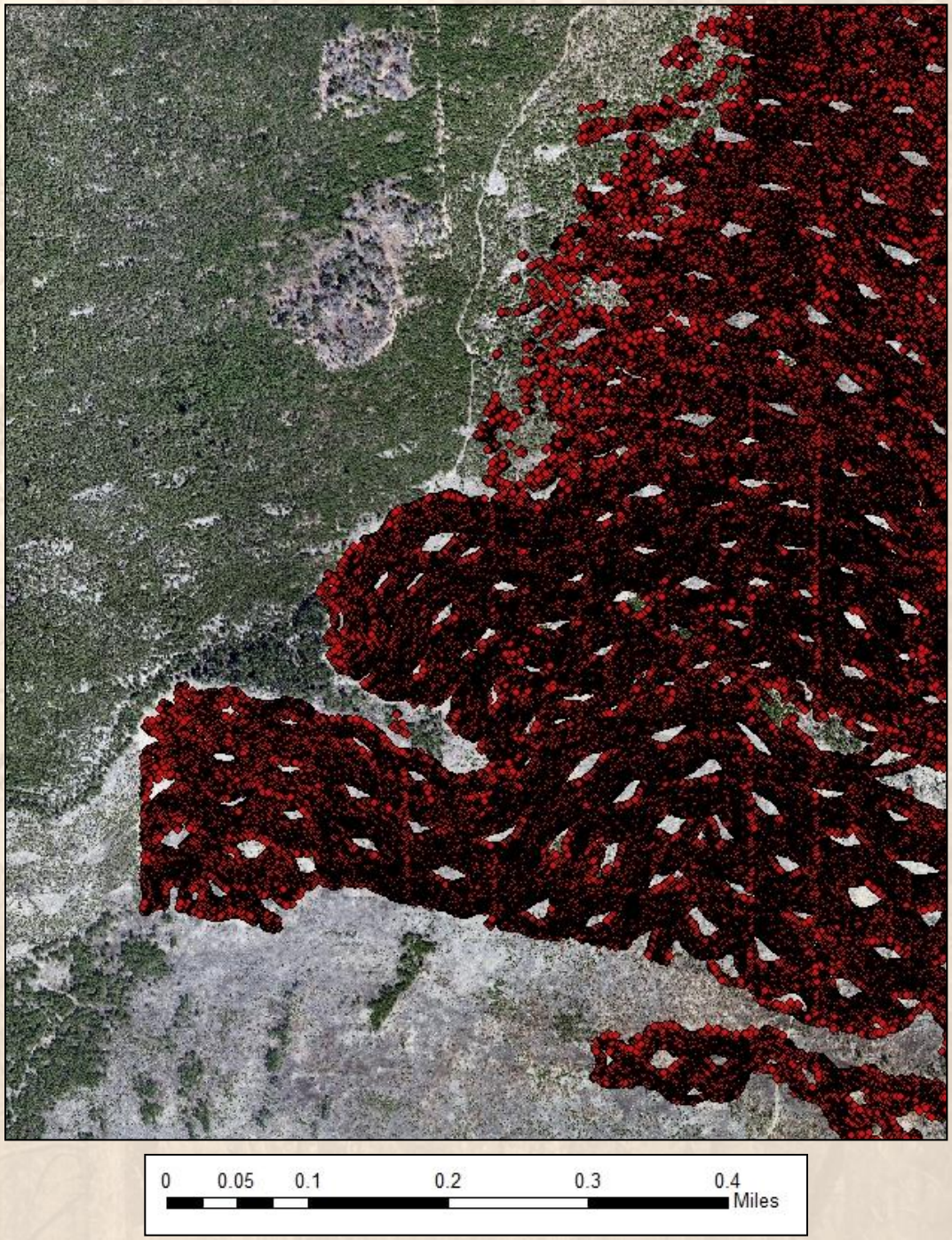
Characteristic natural regeneration

Dens. Class	Mean Area (ac)	% of Landsc.	Patch Density	NN Dist. (ft)
1	0.07	10.8	340	85
2	0.35	32.3	223	75
3	0.27	29.1	260	74
4	0.47	26.4	143	91
5	0.07	1.4	48	165
6	0.02	0.02	2	321
Land.	0.24	--	1015	85



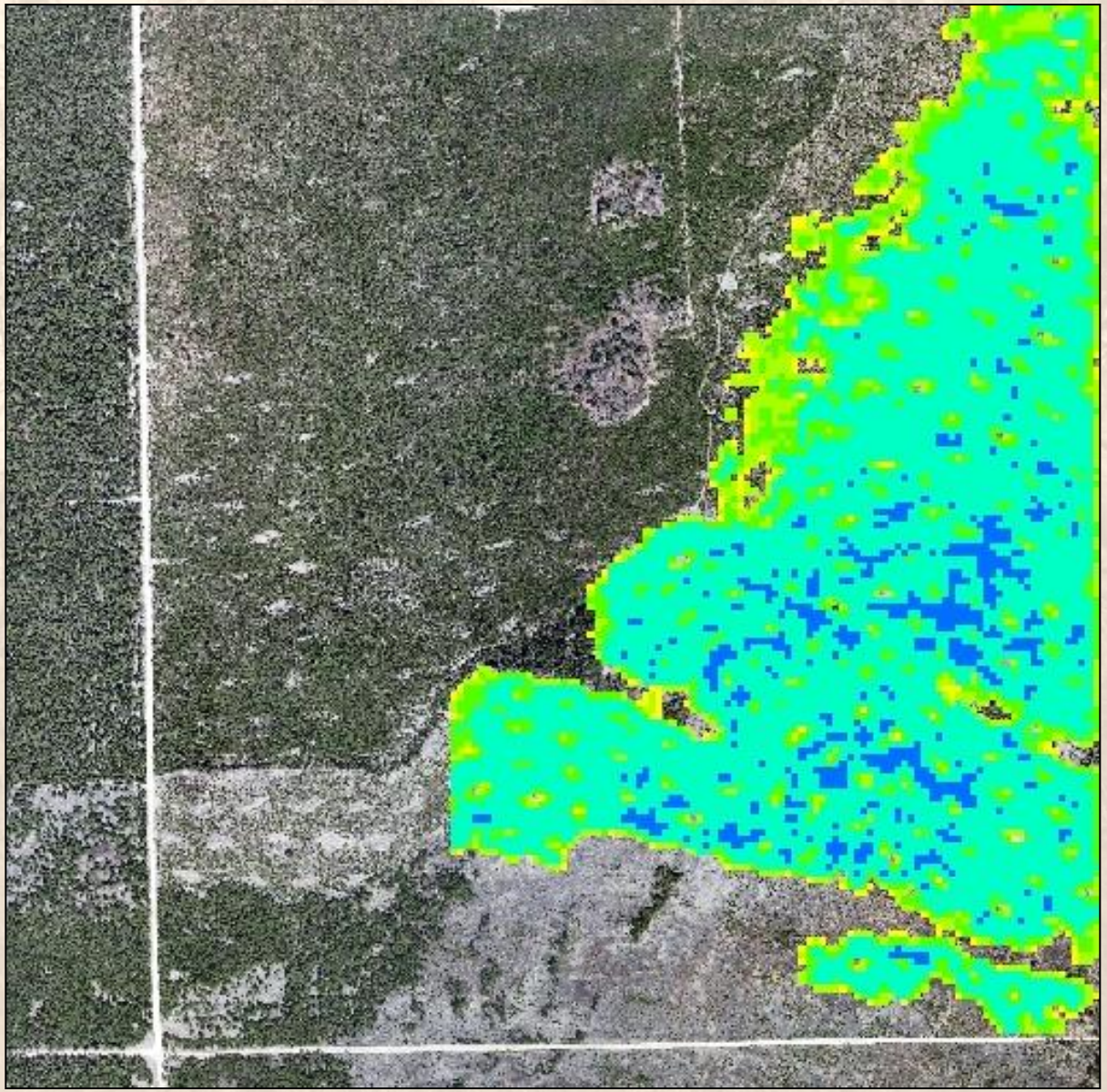
Characteristic planted area

- We mapped a total of 124,297 individual seedlings in a 182 acre area across the photo
- Seedlings in plantation area are much denser than in naturally regenerated areas
- Openings are regular in size and distribution



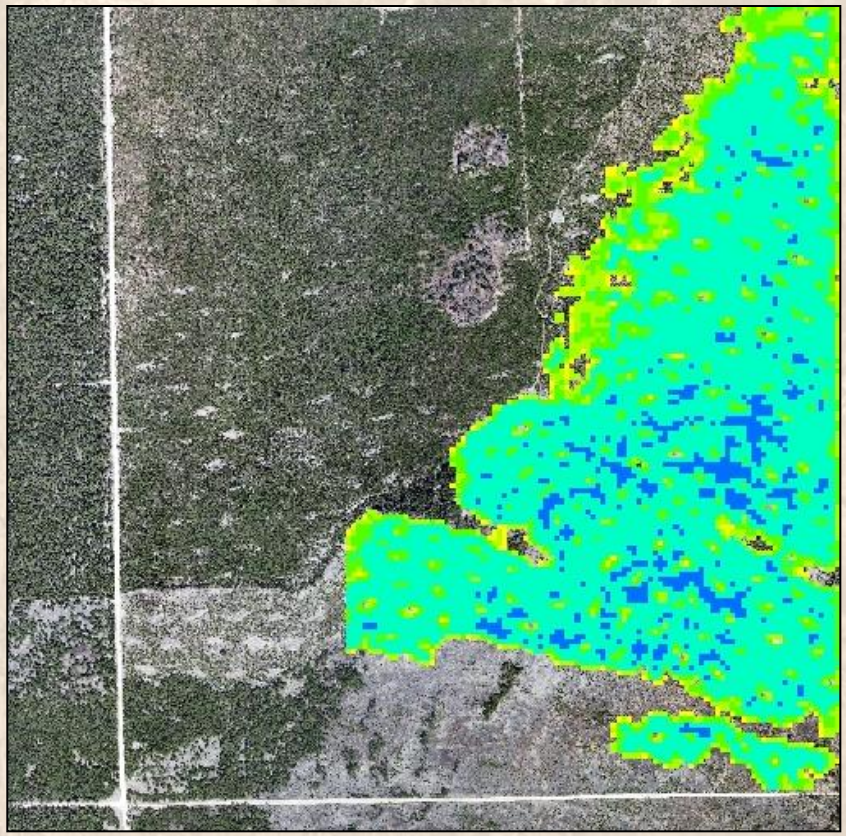
Characteristic planted area

- Landscape is dominated by dense seedlings (1000-2,500/ha) with little variation within
- Resembles a "Swiss cheese" pattern rather than a natural one



Characteristic planted area

Dens. Class	Mean Area (ac)	% of Landsc.	Patch Density	NN Dist. (ft)
1	0.05	2.4	143	122
2	0.1	9.4	248	110
3	0.1	13.3	355	92
4	13.1	67.3	13	103
5	0.12	7.7	168	103
Land.	0.27	--	919	104



Conclusions

- The spatial distribution of seedlings in naturally regenerated areas is quite different than that of planted areas.
  - Planted areas are dominated by a dense matrix of seedlings
  - Burned areas are much finer-grained, with scattered patches of dense seedlings in a matrix of sparser seedlings.

- There is much opportunity for experimentation in planting patterns and densities for KW management.
  - Productivity of many burned areas is high
  - Patterns of density is quantifiable and may be catalogued.

Next Steps

- Complete the burn-wide point density classification of individual seedlings and conduct spatial analyses for entire No Pablo Burn

- Validate mapping with field data collected in summer 2013.

- Examine the spatial point pattern of seedlings across the burn using spatial statistics to estimate patterns at a series of spatial scales

- Examine the correspondence of singing male KWs to polygons of specific seedling density classes

- Compare to image classification techniques and attempt to expand to other burns in the region.

Lessons learned

1. Manager-scientist relationships are more easily facilitated when each side is familiar with each other prior to developing a partnership.

2. Manager-scientist relationships can be relatively easily facilitated with clear communication and empathy about the needs of each side.
   - Manager requires a useable product; scientist requires publication
   - Manager requires a product in a timely fashion; academic may prefer student training
   - Manager should be kept abreast of progress at all times

3. Manager may be much more supportive of student interns than one might expect, especially if they are supervised elsewhere

4. Be aware of the constraints on the student intern in completing the project in the context of the rest of their life!

Many Thanks

Funding: Lake States Fire Science Consortium
Joint Fire Science Program
Wayne State University

Mapping help: Jake Dombrowski
Aimee Faloppa

Technical help: Madelyn Tucker
Gianluca Sperone

Other: Kirtland's Warbler Recovery Team
(esp. Steve Sjogren)

Jake Dombrowski

Impacts of Forest Fire on Mercury Concentrations in Fish from Northern Minnesota Lakes: Implications for Management

LSFSC Webinar Series

December 19, 2012

Emma Witt

University of Minnesota

Brianna Mattson

Featured Intern

Trent Wickman

USFS-Superior National Forest

Randy Kolka

USFS-Northern Research Station

Ed Nater

University of Minnesota

OBJECTIVE

- Assess the impact of forest fire on fish mercury concentrations in northern Minnesota lakes

Overview of Mercury in the Environment

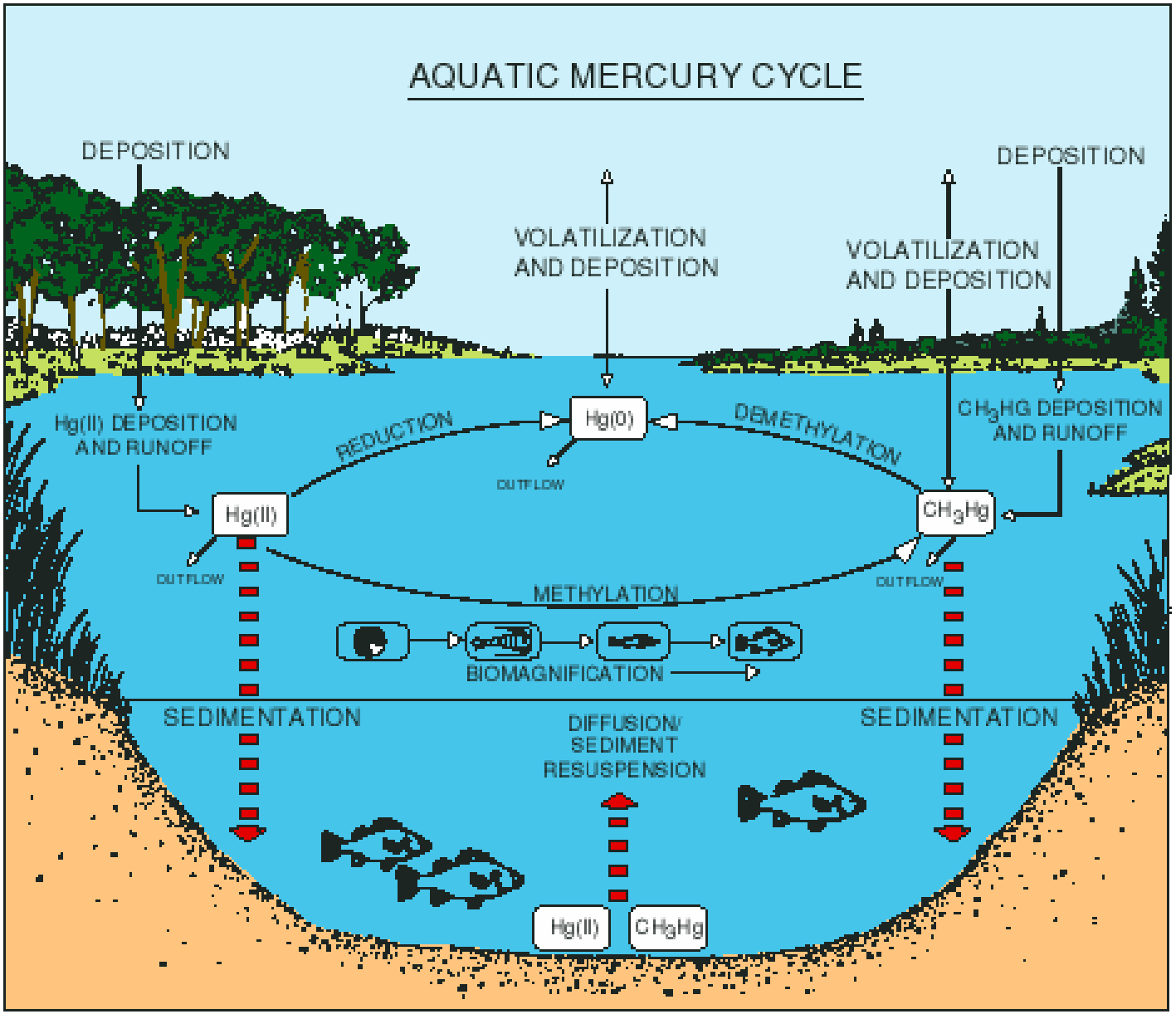
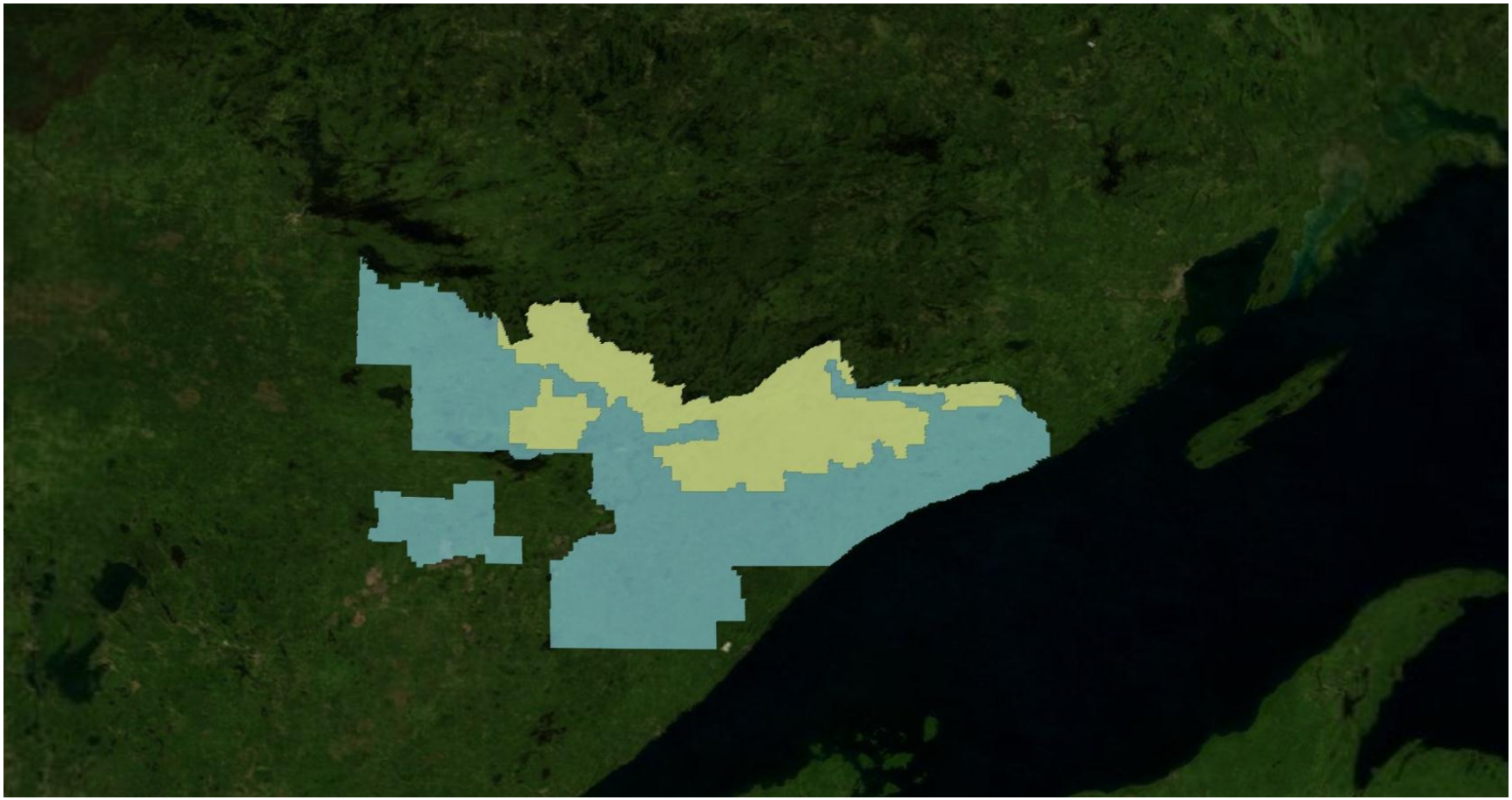


Figure 6. *Mercury cycling pathways in aquatic environments are very complex. The various forms of mercury can be converted from one to the next; most important is the conversion to methylmercury (CH_3Hg^+), the most toxic form. Ultimately, mercury ends up in the sediments, fish and wildlife, or evades back to the atmosphere by volatilization. Reprinted with permission from Mercury Pollution: Integration and Synthesis. Copyright Lewis Publishers, an imprint of CRC Press.*

http://wi.water.usgs.gov/mercury/mercury-cycling.html

Study Location



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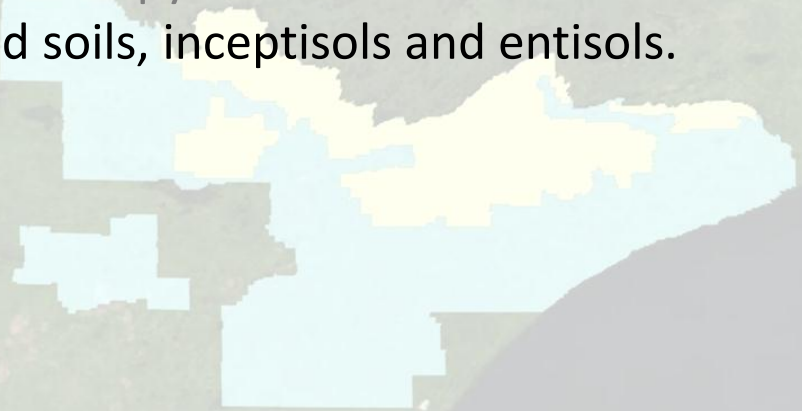

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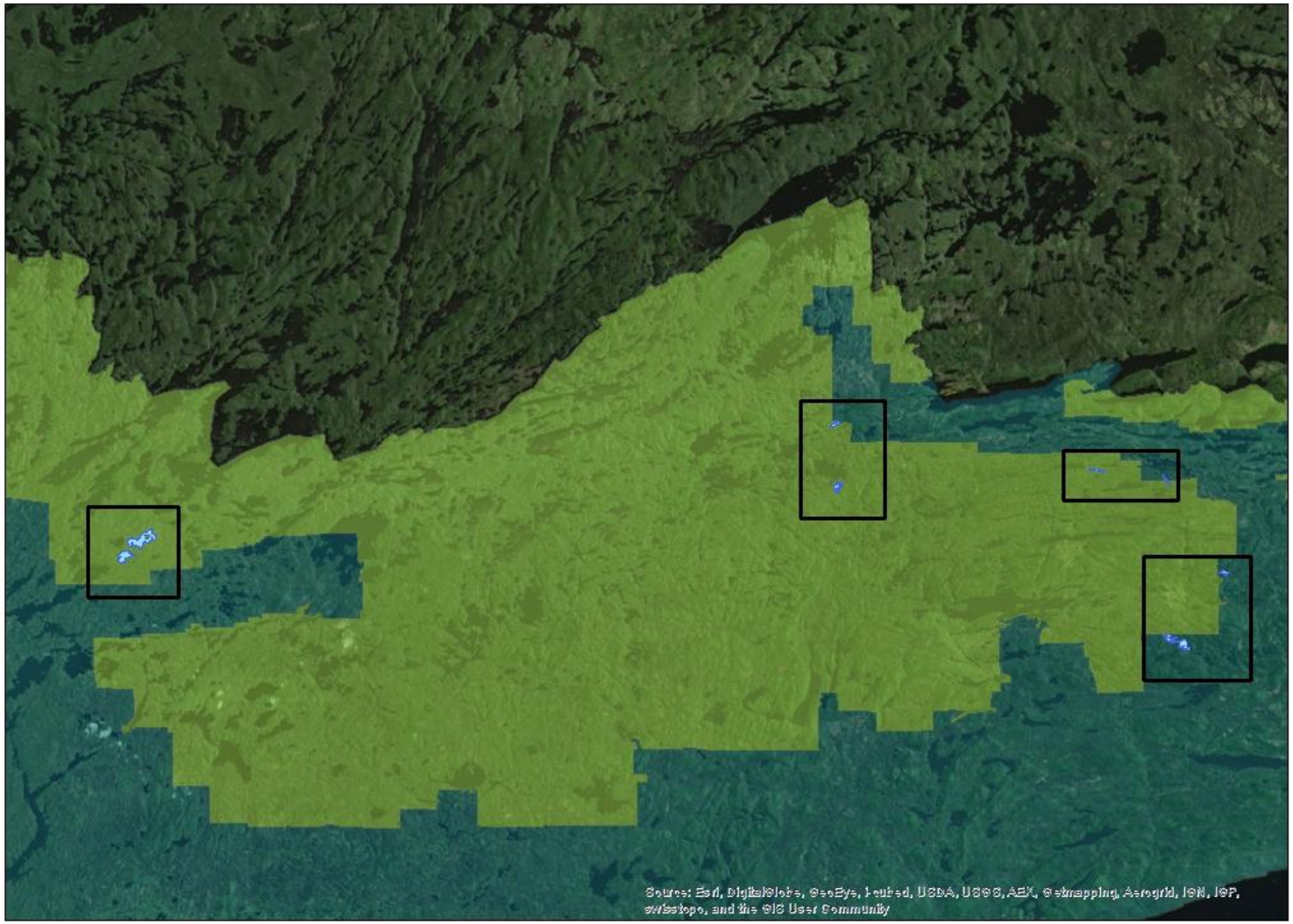
- Glacially derived soils, inceptisols and entisols.

- A large blowdown event in 1999 resulted in heavy fuel loads across the forest, elevating the risk for a large, uncontrollable fire.
- Prescribed fire is one tool used by the Forest Service to reduce this risk.

Lake Monitoring



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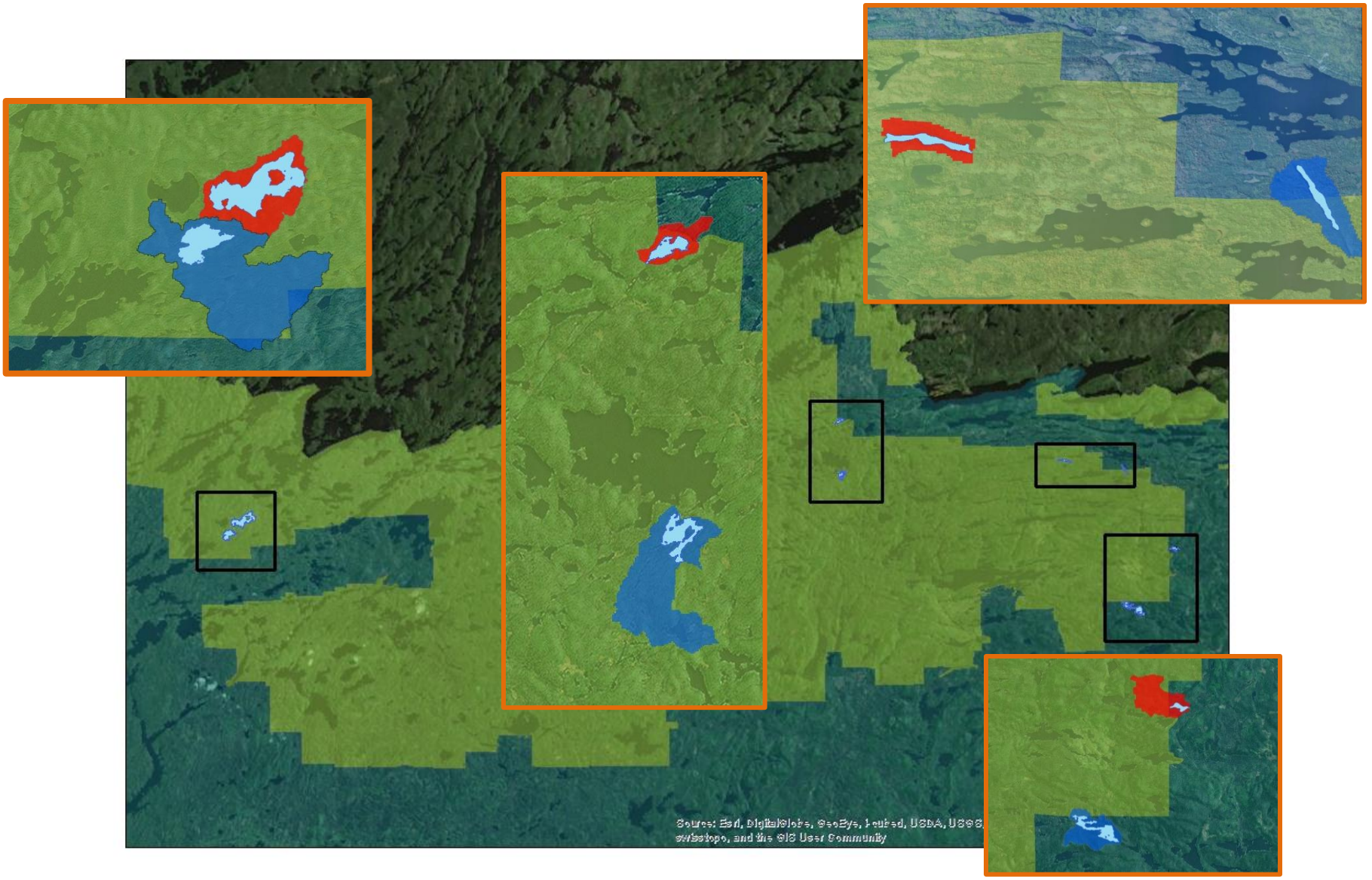
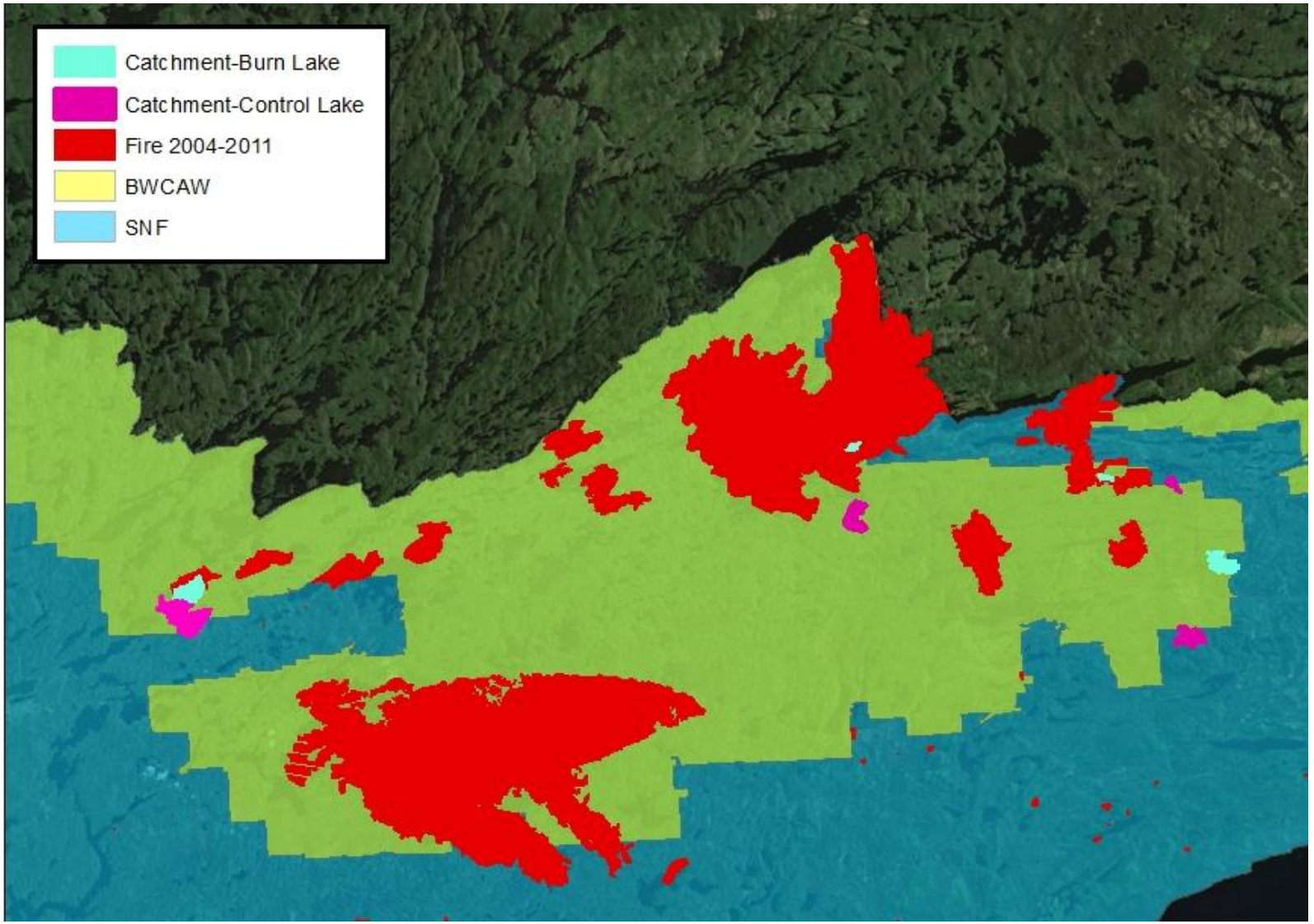


Lake Monitoring

- Water sampled monthly during the ice-free period
- Lake water analyzed for:
  - Total mercury
  - Methyl mercury
  - Cations, nutrients, depth profile
- Fish sampled annually
- Fish analyzed for total mercury
  - Aged
  - Weighed and measured

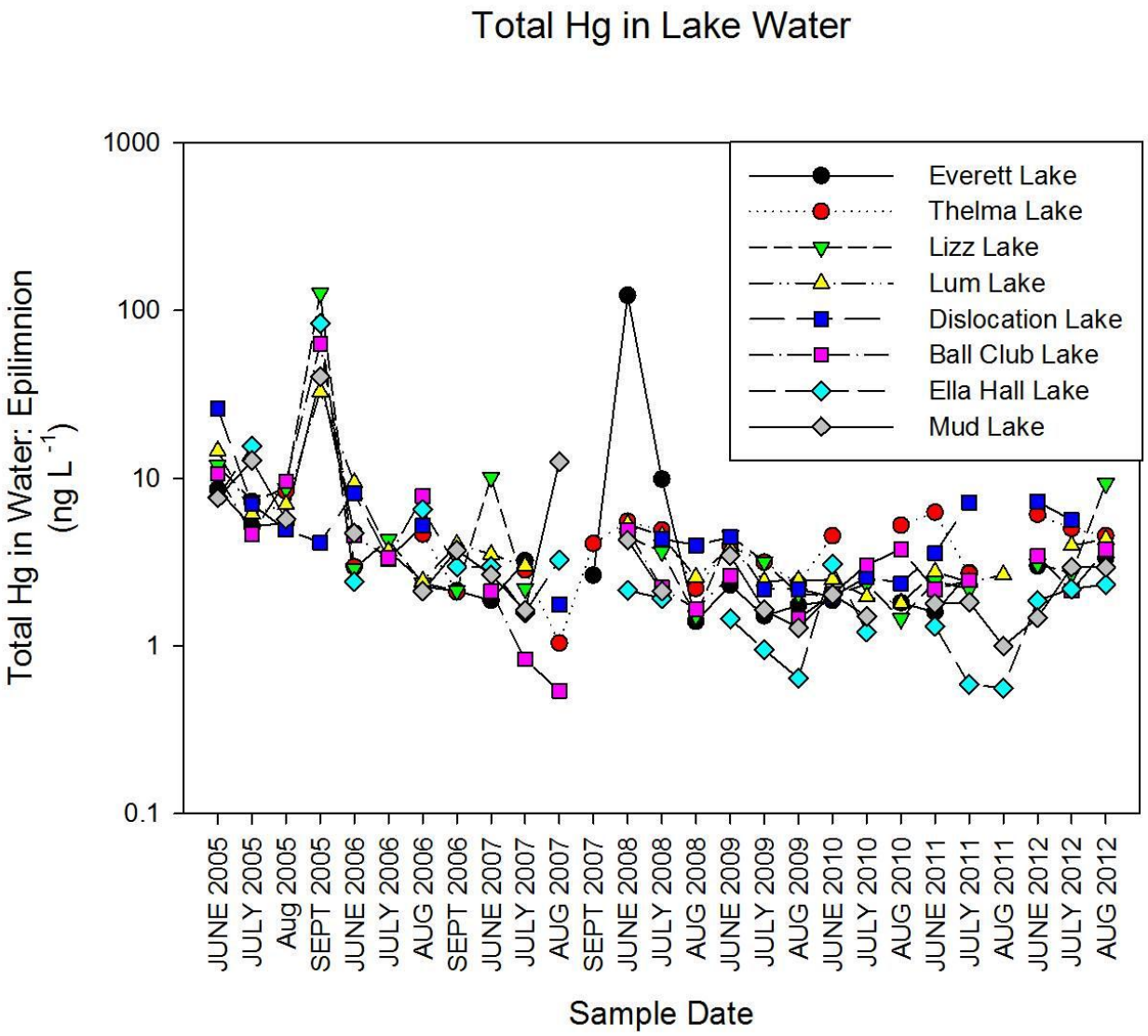
Fires 2004-2011



Fires

Fire ID	Year	Burn Lake Impacted	Fire Size (ha)	Percent of Study Watershed Affected
Tuscarora Rx Burn	2004	Everett	~1200	74%
Ham Lake Wildfire	2007	Everett	28,600	100%
Four Mile Rx Burn	2009	Ella Hall	380	100%
Meeds Lake Rx Burn	2010	Lum	460	21%

Results-Total Mercury in Water



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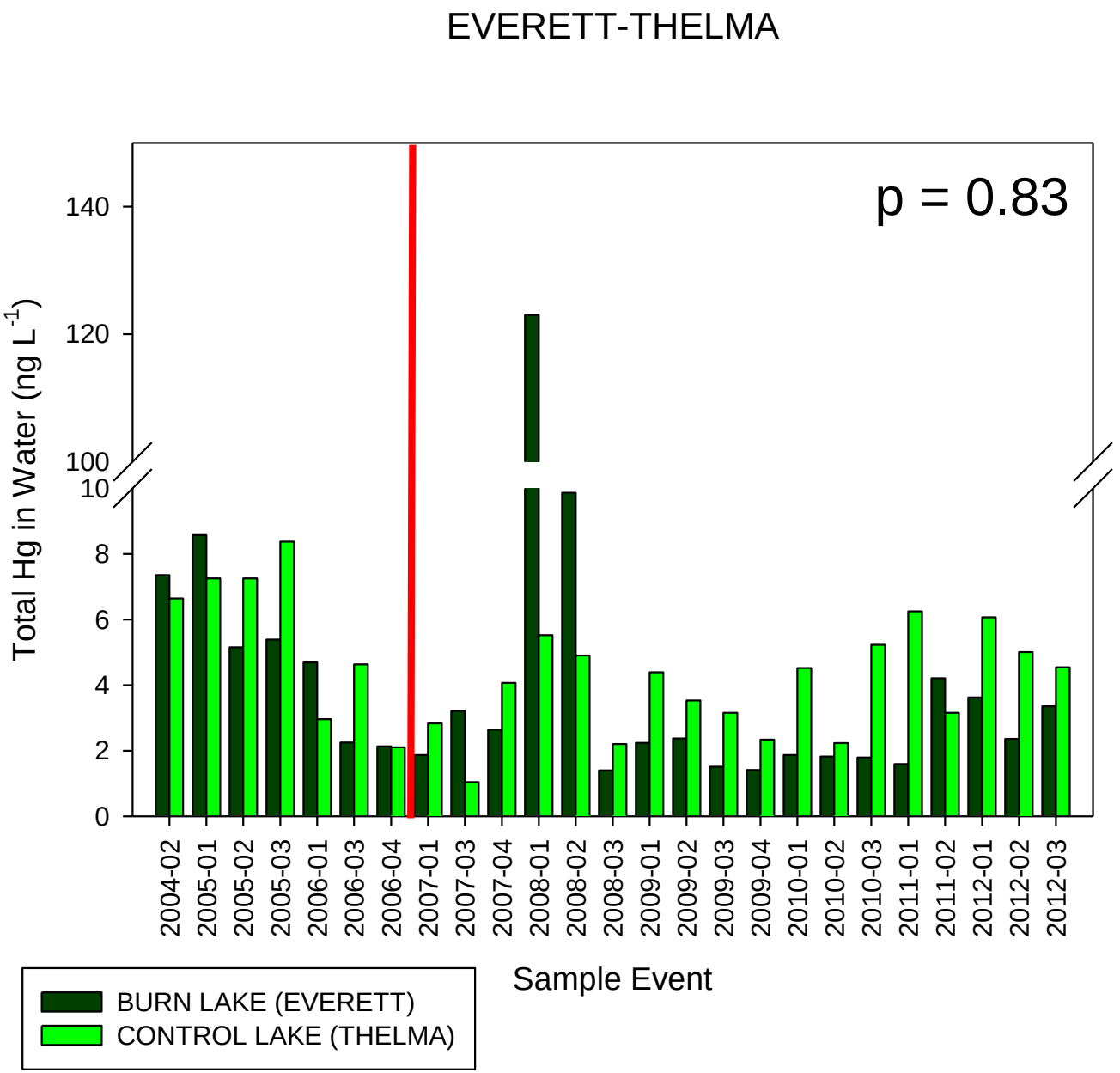

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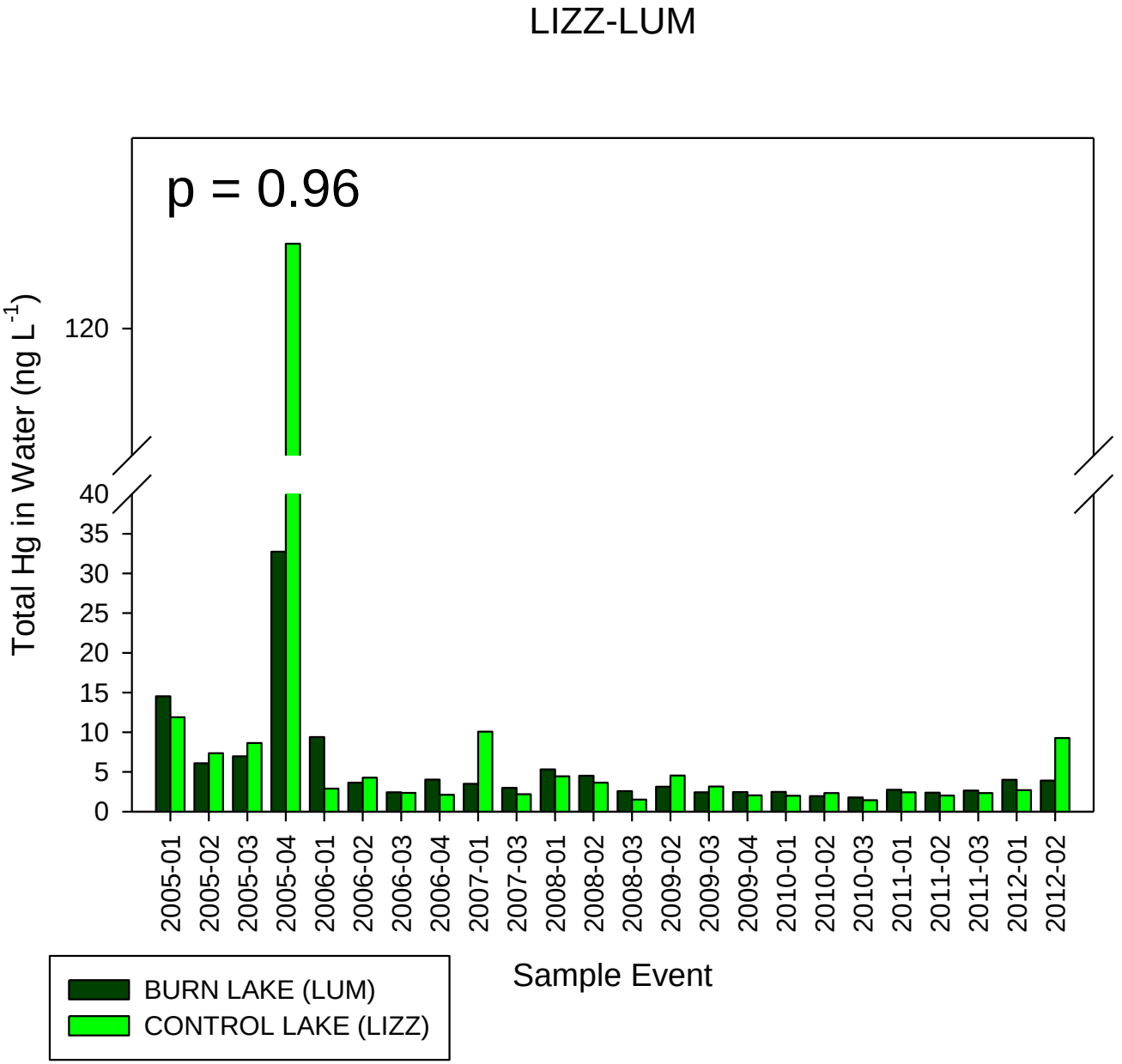
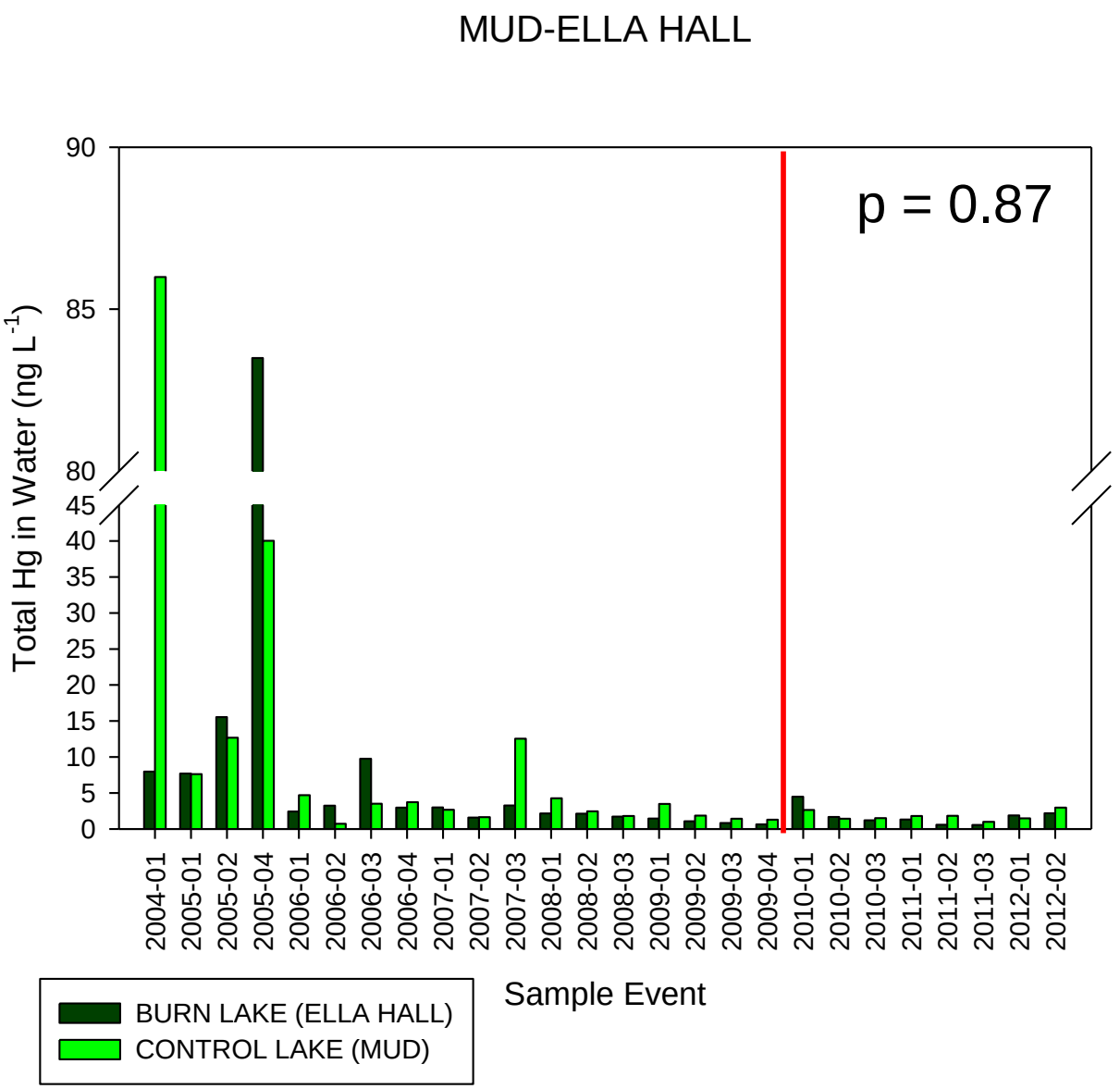
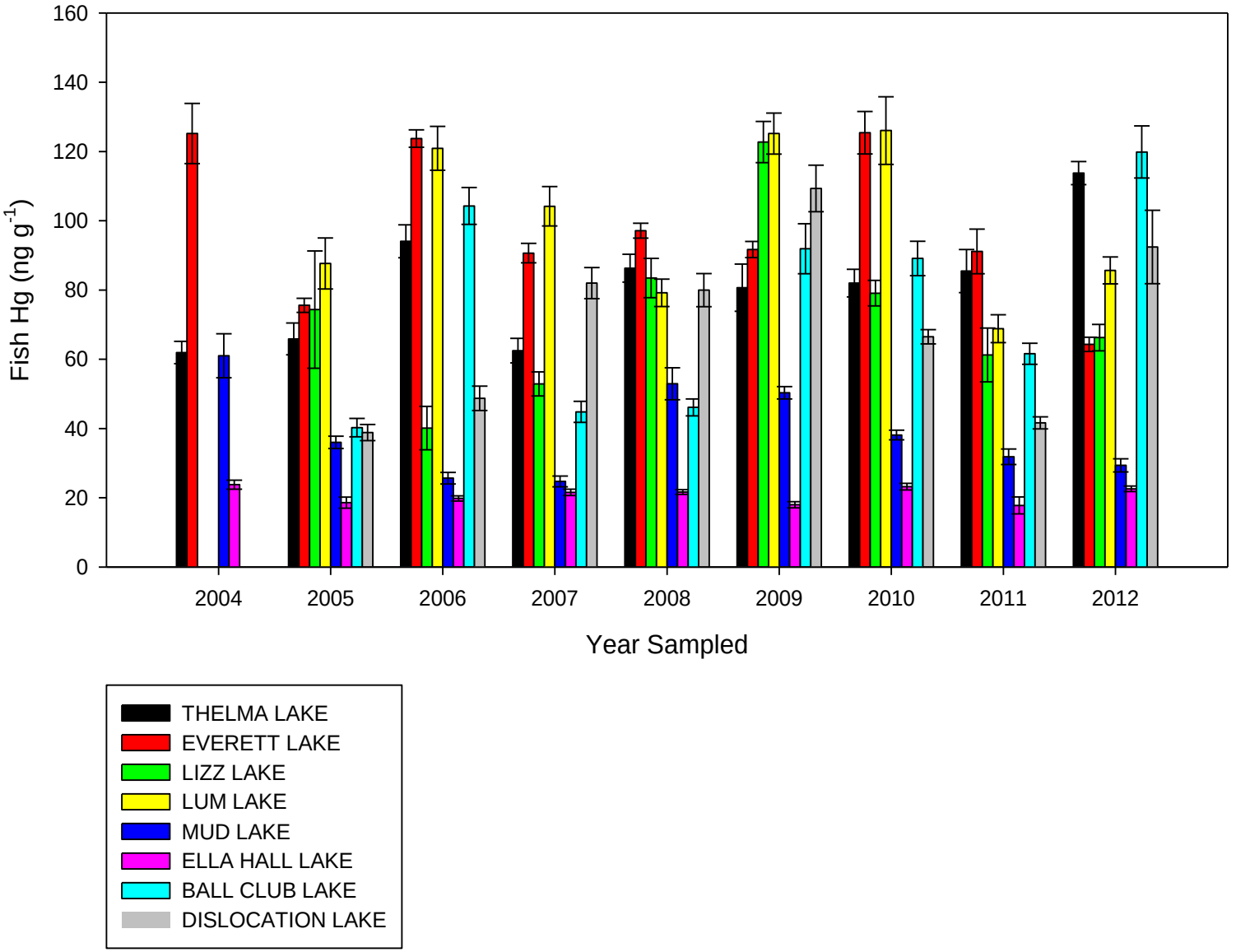


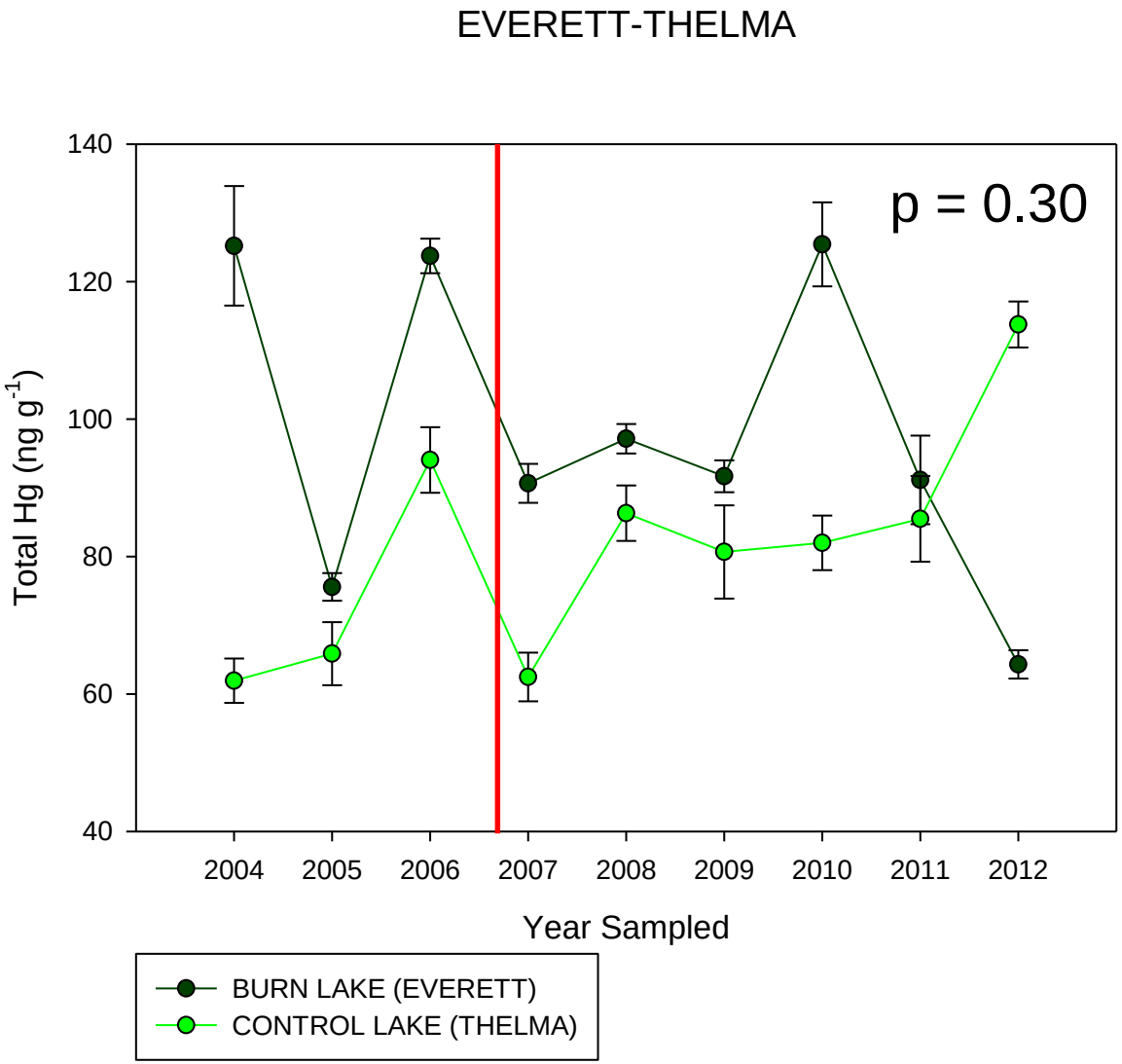
Results-Total Mercury in Water



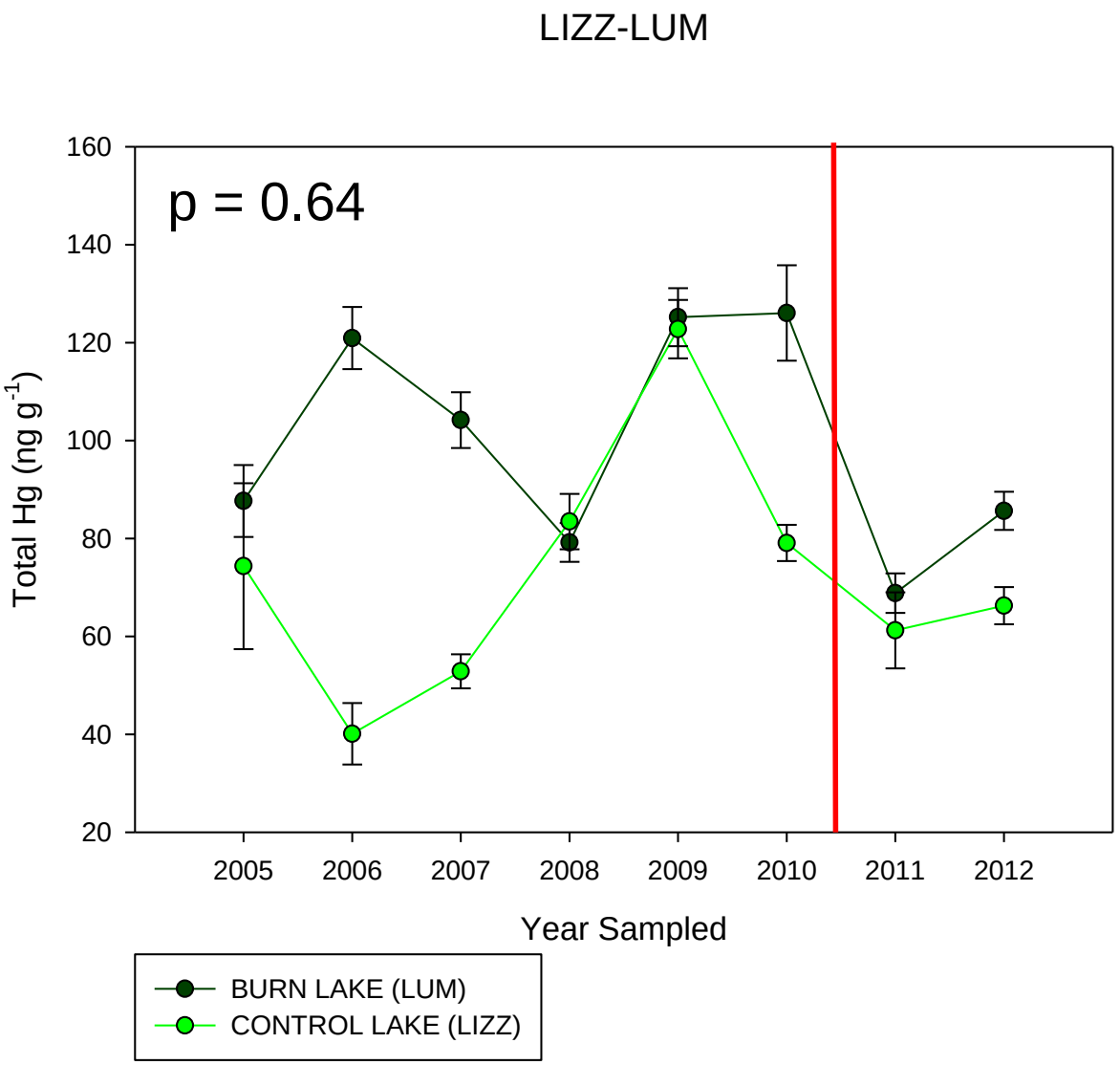
Fish Mercury



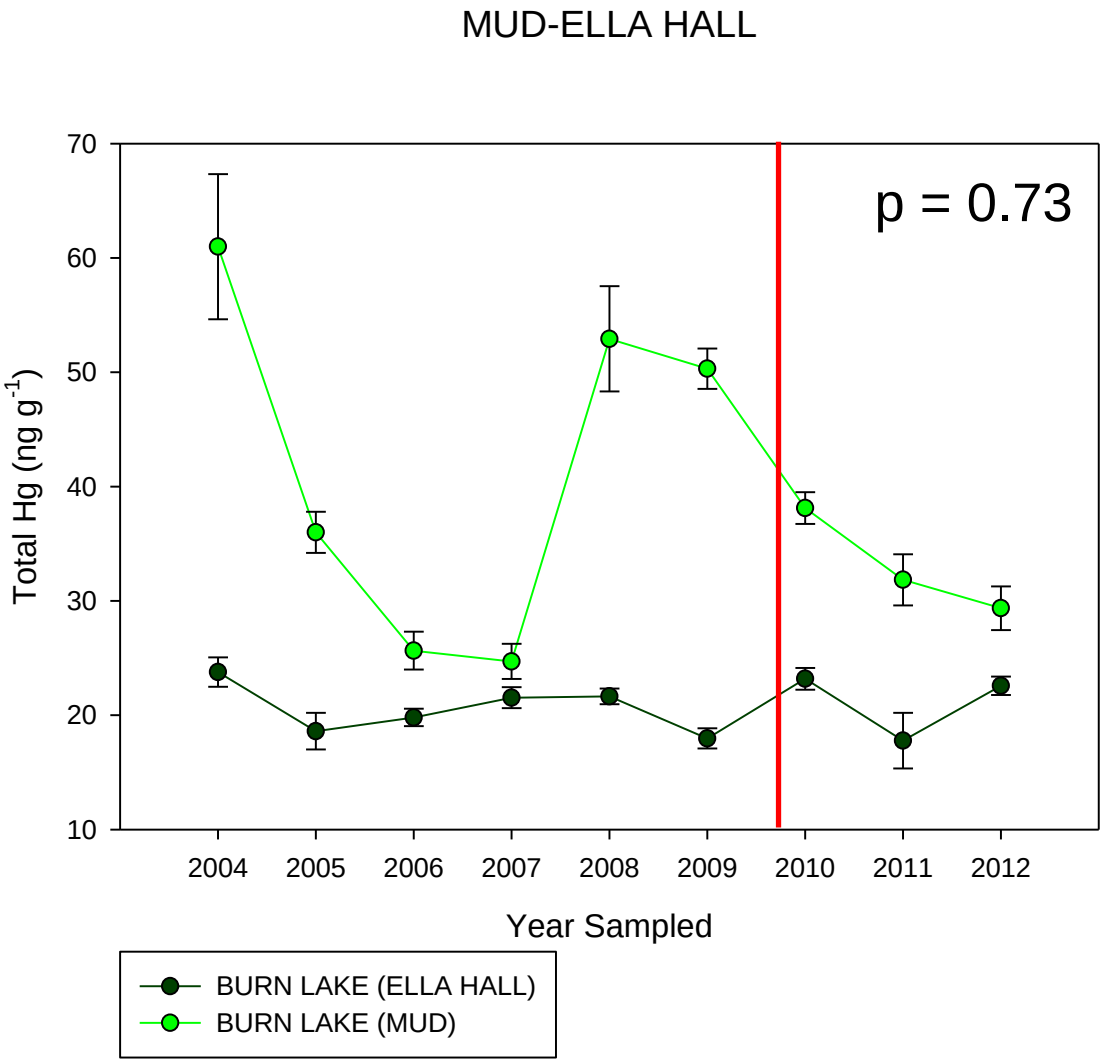
Results-Fish Mercury



Results-Fish Mercury



Results-Fish Mercury



Future Directions

- Future analysis will incorporate lake water quality variables to evaluate influences of fire, and determine if any may impact longer term mercury dynamics in the study lakes.

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- Future analysis will incorporate lake water quality variables to evaluate influences of fire, and determine if any may impact longer term mercury dynamics in the study lakes.
- Additionally, analysis of methyl Hg concentrations in lake water will be performed to further evaluate the influence of fire on aqueous methyl mercury concentrations.

Internship Objectives

- Apply knowledge of GIS principles to evaluate burn severity for each study watershed.
- Assist with laboratory analysis of fish, and gain experience in analytical methods for mercury
- Collaborate on database development

Contact Information:

Emma Witt

witt0287@umn.edu

January 16, 2014 at 2:00 PM Eastern (1:00 PM Central)

Climate and Fire in the Great Lakes Region

Chris Hoving (Michigan Department of Natural Resources)

Co-Hosting with Tallgrass Prairie and Oak Savanna Fire Science Consortium
January 30, 2014 at 2:00 PM Eastern (1:00 PM Central)

When is a Grassland Restoration Truly Restored?
Examining Microbial Community Responses to Fire in Remnant and Restored Grasslands

Kathryn Docherty (Western Michigan University)
Ryan Koziatek (Kalamazoo Nature Center)
Ashley Anne Wick (Kalamazoo Nature Center)