

# Do Seed Traits Mediate Plant Community Changes in Wisconsin's Unburned Prairies?

*Senior Honors Thesis*  
*by Christopher Morgan*



# What is a Prairie?

This is!

- Largely made up of grasses, sedges, and flowering plants known as forbs
- Biodiversity Hotspot
- Fire-adapted communities

# Background Information

- Natural fires caused by lightning strikes
- Species require heat to germinate
- Increased fire suppression since 1950s
- Consensus of fire importance
  - more prescribed burns need to be taking place to be ecologically effective



# Current State of Prairies

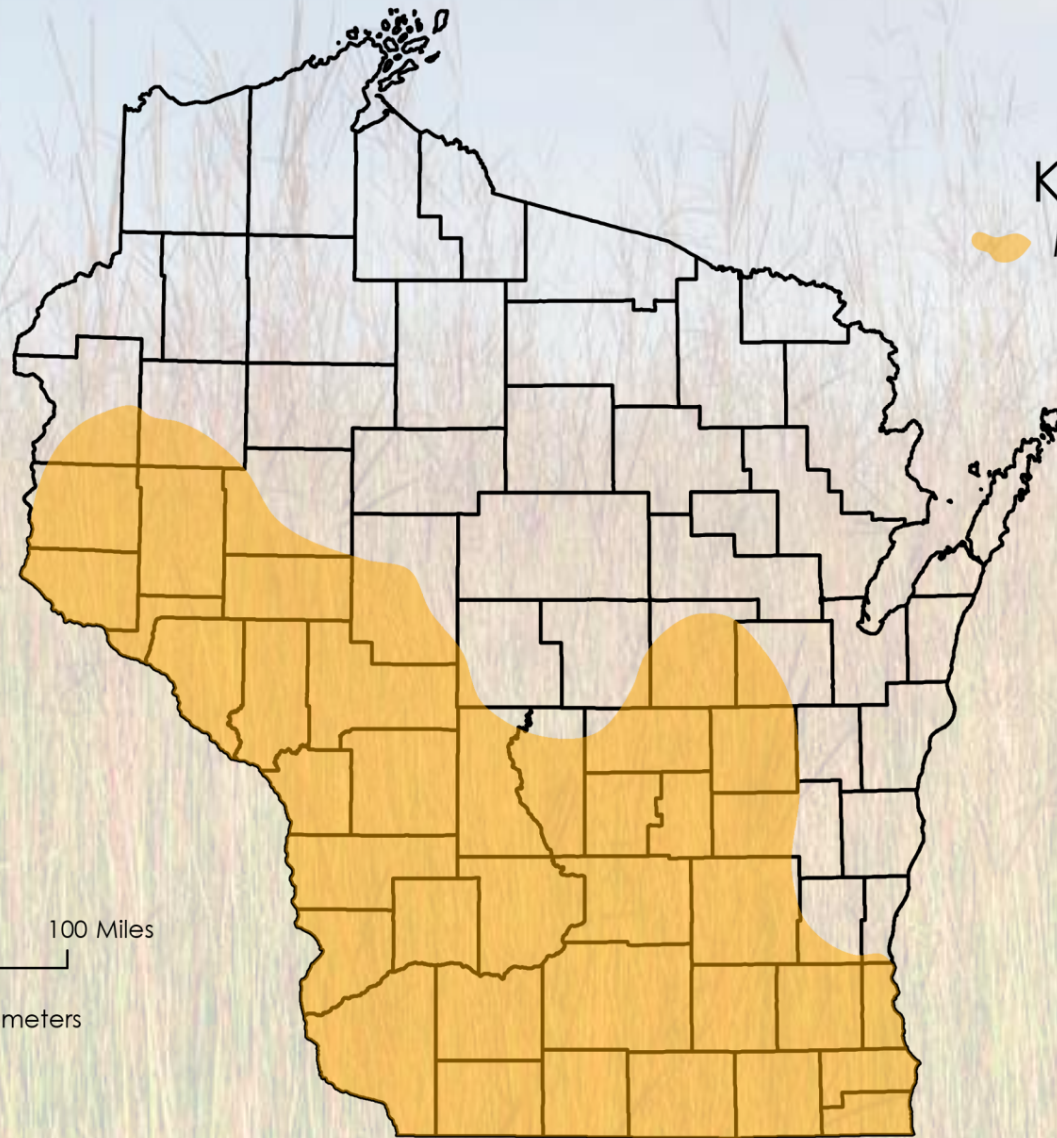
- WI Pre-European Settlement: 2,000,000 acres of prairie – Now: 12,000 scattered acres
- Prairie remnants largely fire suppressed – potential shift in plants best suited to novel ecosystem
- Non-native species up 500% since 1950
  - Make up >60% total species diversity in some cases

# This Study

- Changes to landscape & fire regime raise questions as to how plant (& animal) communities respond to change
- Studying plant traits tells much about change
- Goal: quantify change in species composition and their seed traits as underlying mechanisms of that change

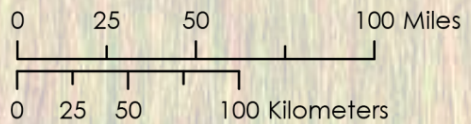
# Hypotheses

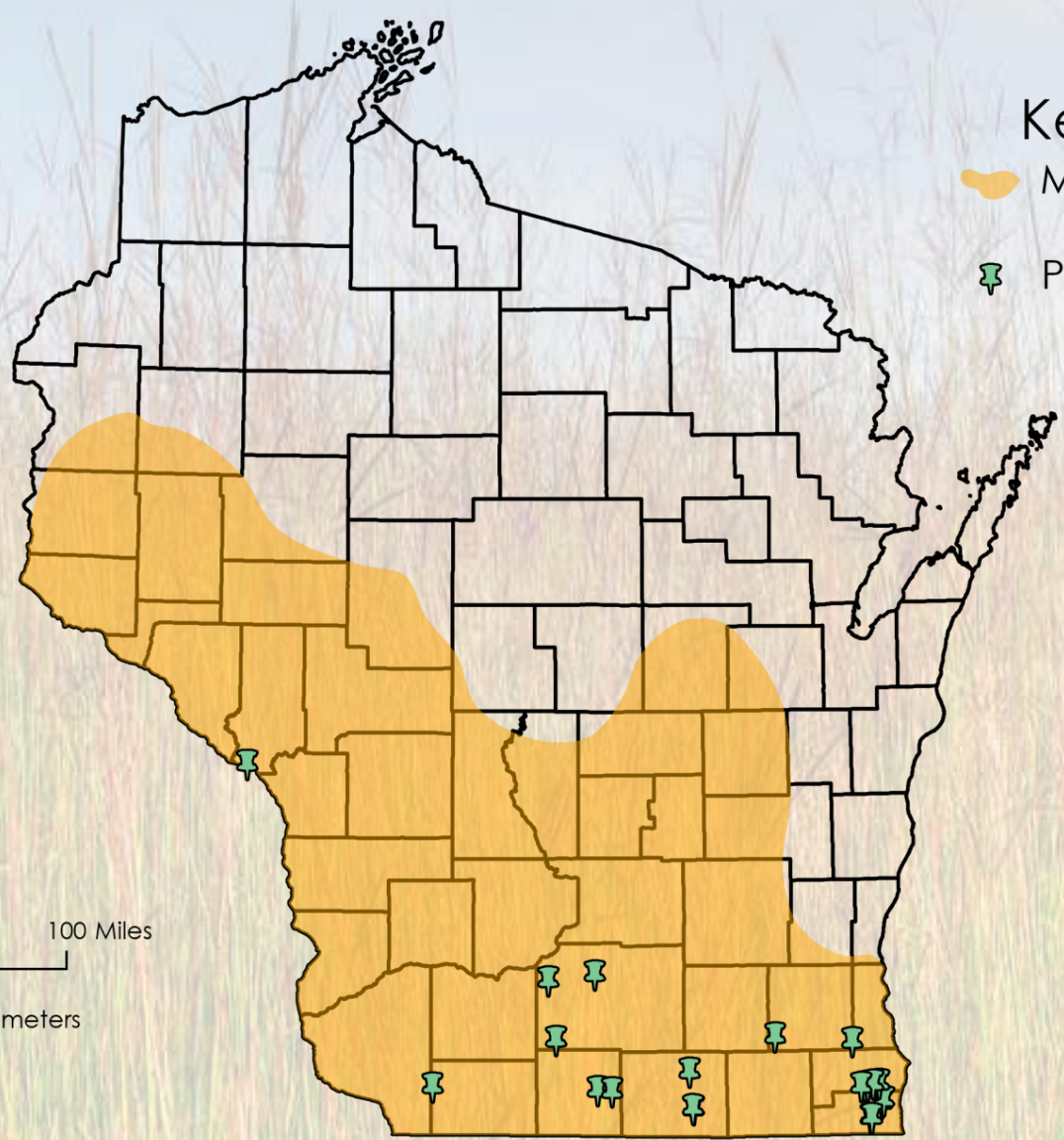
<b>Burned</b>	<b>Ideal sites</b>	<b>Large or expanding patches</b>
	Medium seed coats	
	Low mass	
	High shape index	
<b>Unburned</b>	<b>Less than ideal sites</b>	<b>Small or shrinking patches</b>
	Thick seed coats	
	High mass	
	Low shape index	





### Key

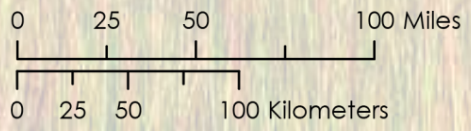
 Maximum Historical Prairie Extent





### Key

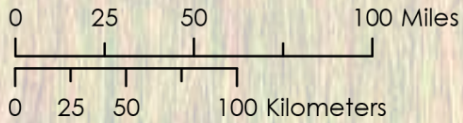
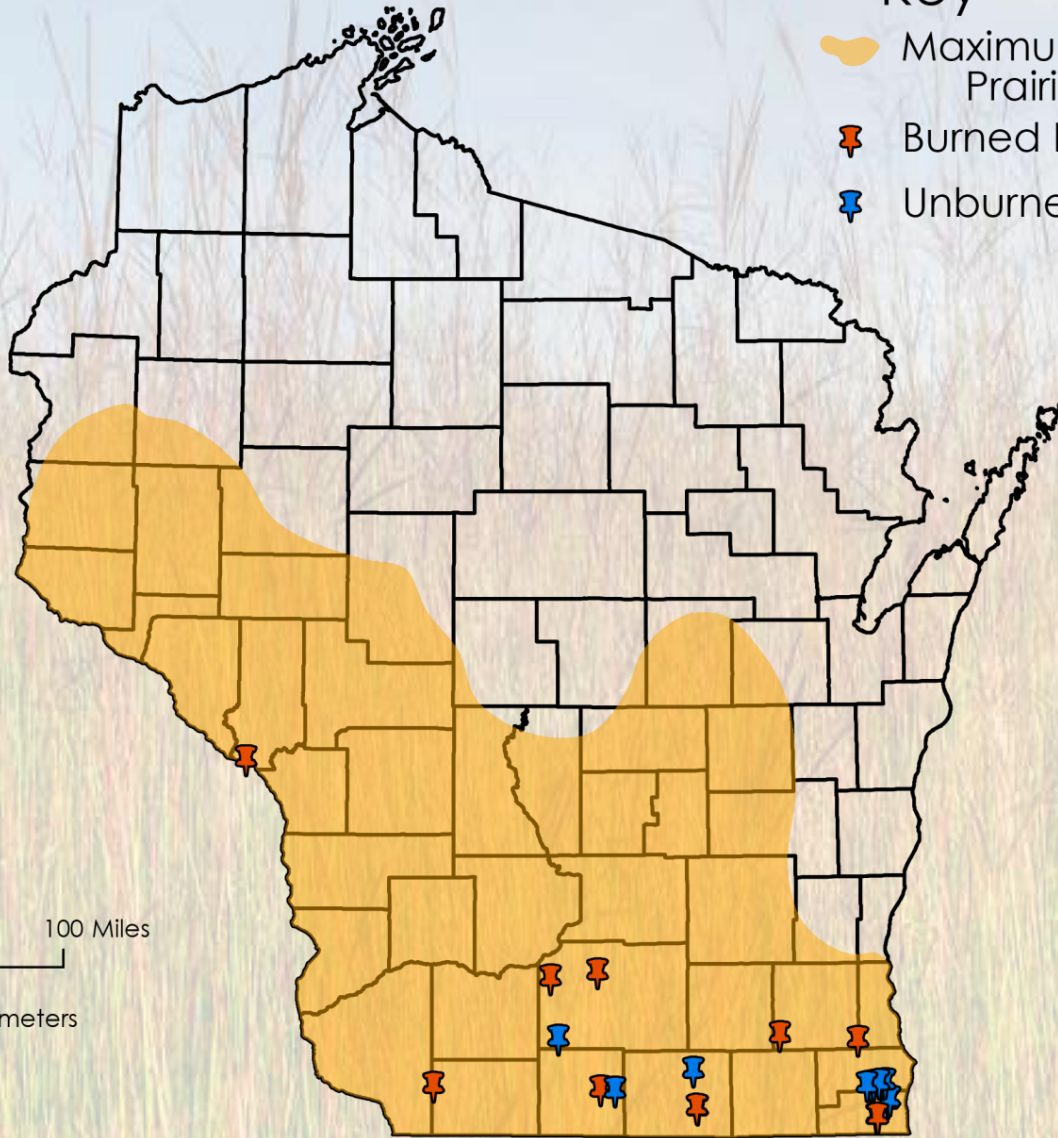
-  Maximum Historical Prairie Extent
-  Prairie Study Sites





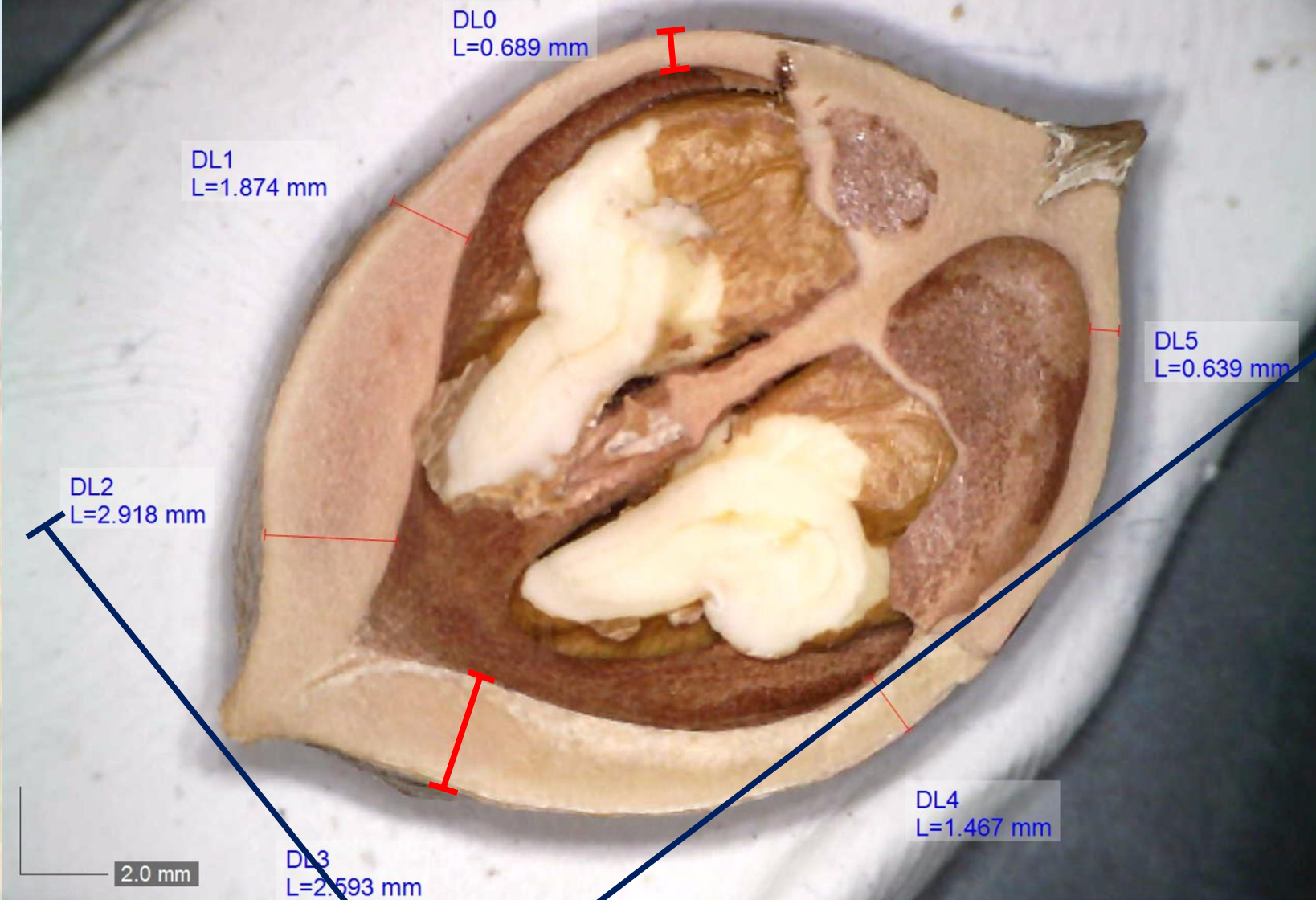
# Key

- Maximum Historical Prairie Extent
- Burned Prairie Study Sites
- Unburned Prairie Study Sites

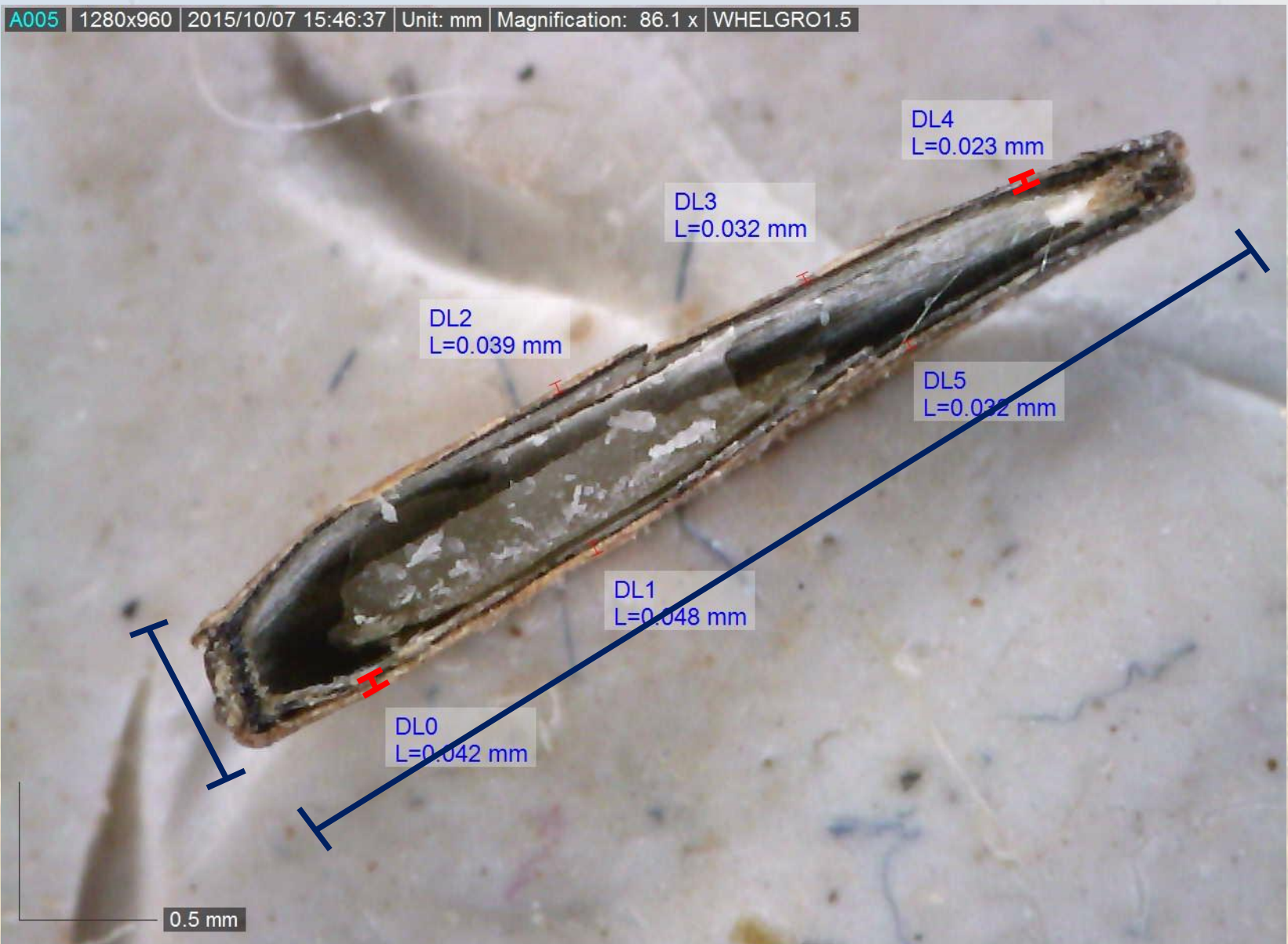


# Methods

- Measure:
  - Seed Mass
  - Seed Coat Thickness
  - Seed Shape Index (0 being perfectly spherical)For each species found at our sites
- Classify
  - Burned
  - Unburned



*Carya ovata* (shagbark hickory)



WHELGR01.5

*Helianthus grosseserratus*  
(sawtooth sunflower)

# Community Averages

- Seed trait means averaged for each site
  - Based on species present
- Seed Mass Example:

Species 1  
2 u



Species 2  
4 u



Species 3  
10 u



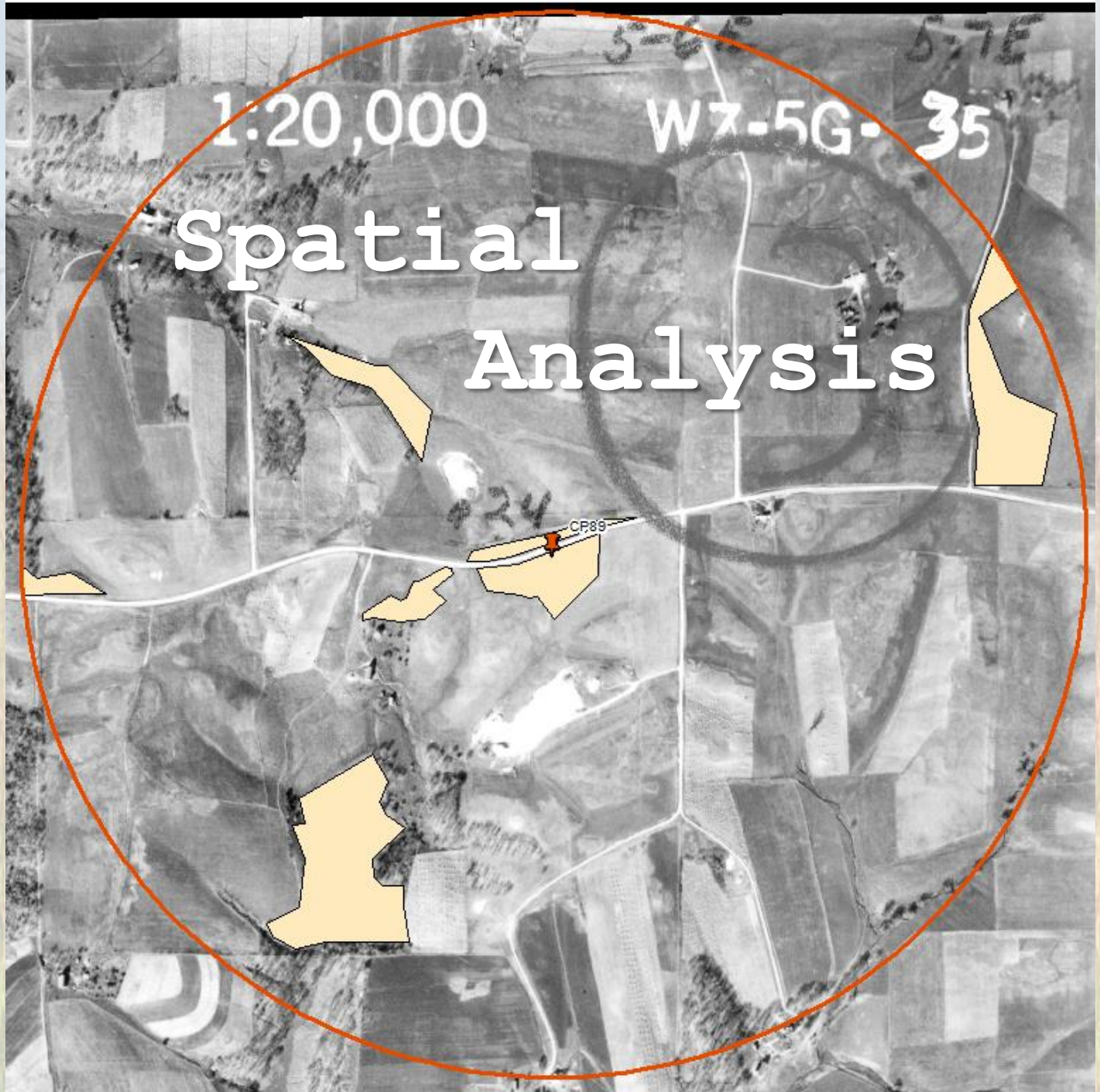
Community  
Average:

5.33 u

1:20,000

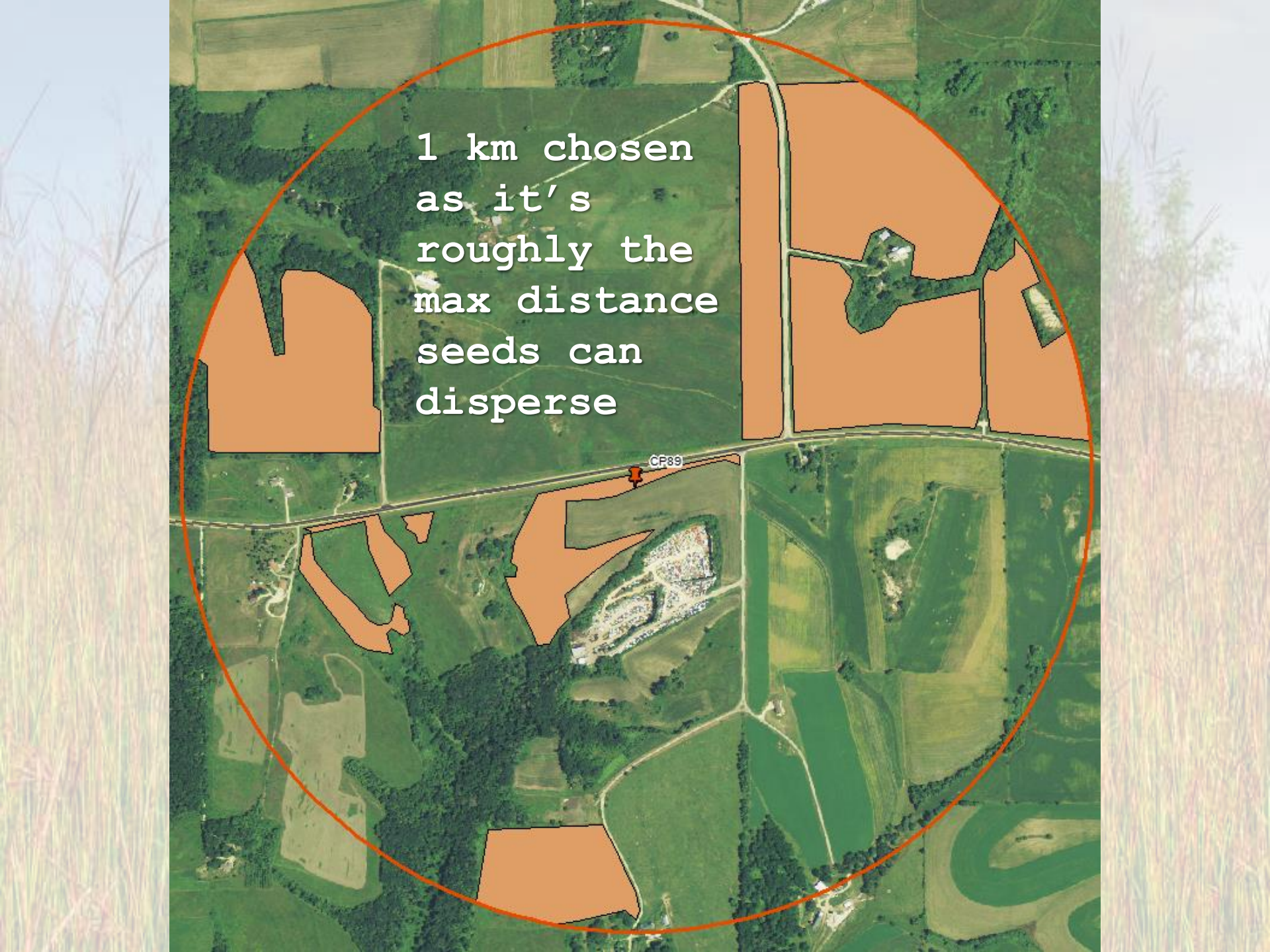
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# Spatial Analysis



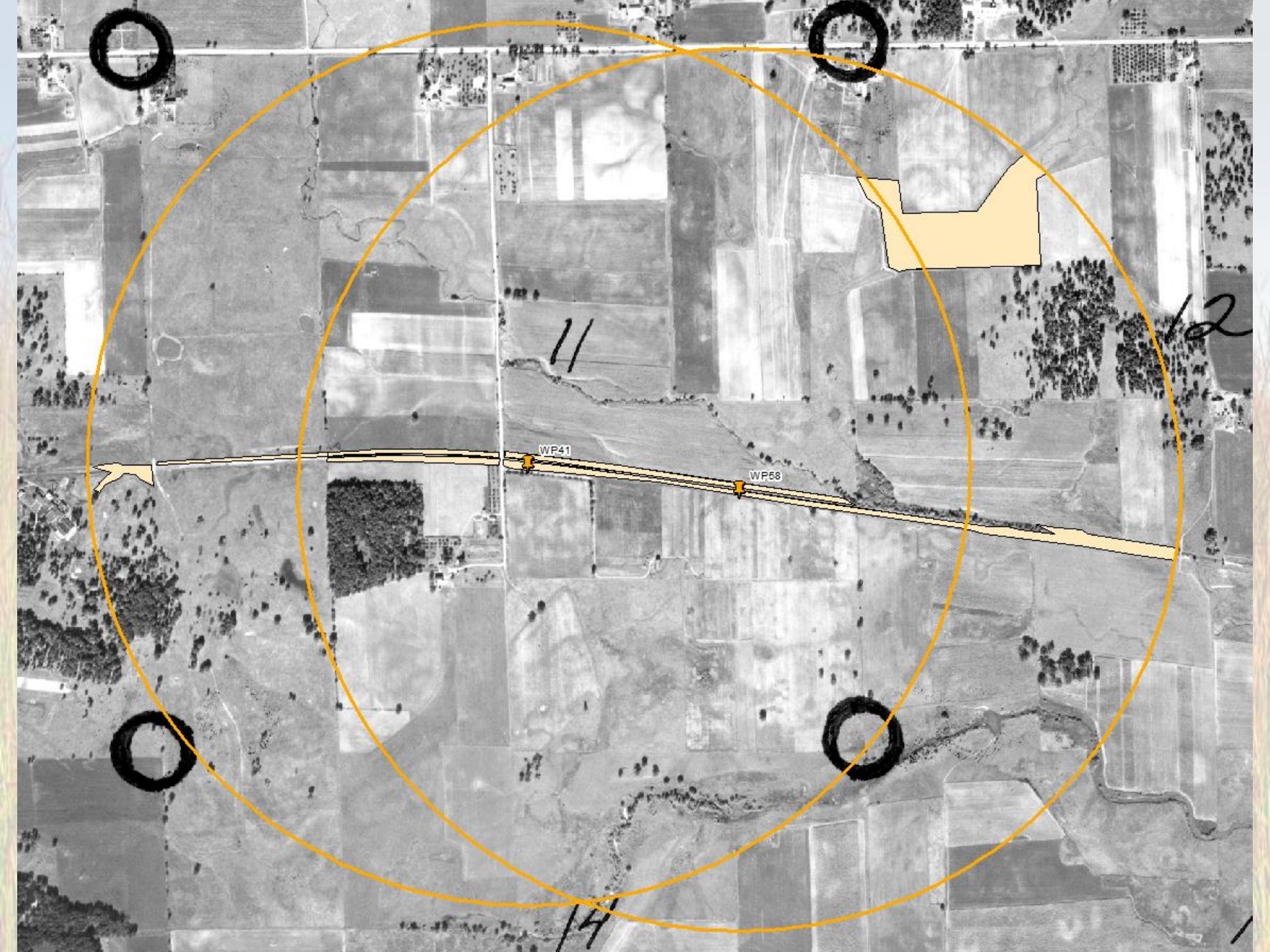
924

CP89

An aerial photograph of a rural landscape, likely a golf course or agricultural area, with various green fields, trees, and a road. A large orange circle is drawn around a central point, representing a 1 km dispersal radius. The text "1 km chosen as it's roughly the max distance seeds can disperse" is overlaid on the image. A road labeled "CP89" is visible near the center of the circle.

1 km chosen  
as it's  
roughly the  
max distance  
seeds can  
disperse

CP89



11

12

WP41

WP68

14

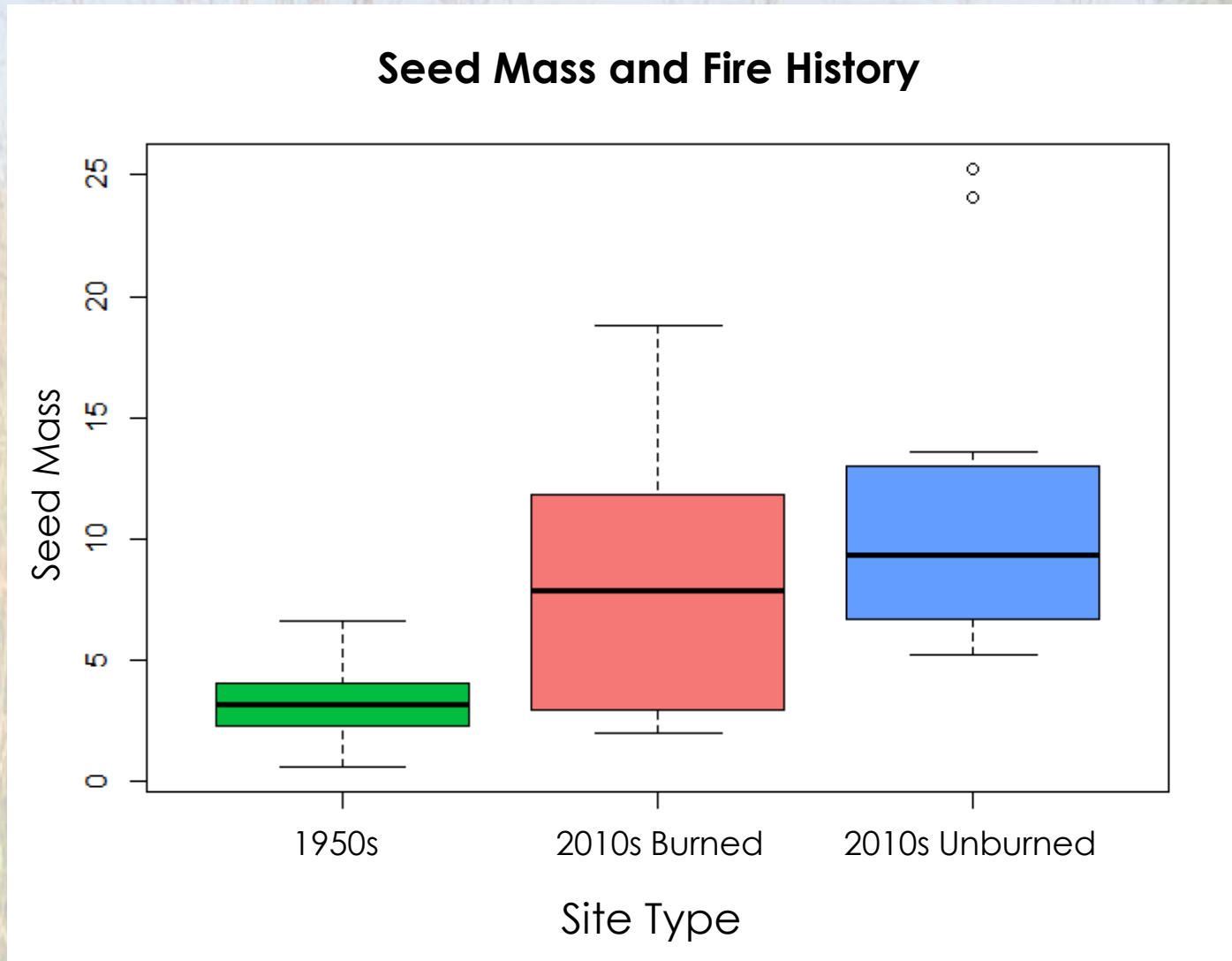




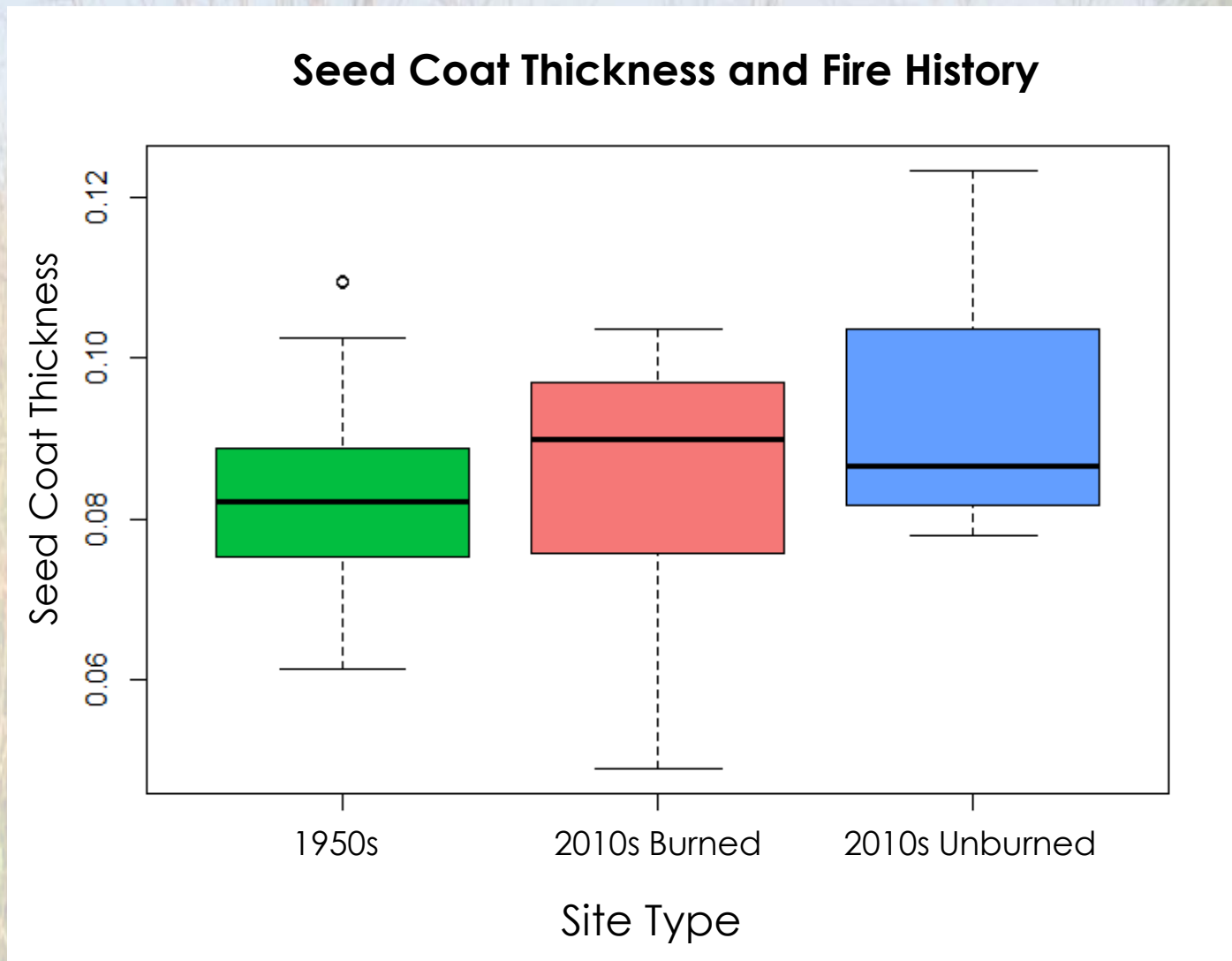
WF41

WF58

# Neat Groupings by Site Type



# Modest Correlation with Mass



# Results

✓ = Correlation Predicted

~ = No significant Correlation

✗ = Correlation Opposite Predicted

Burned	Ideal sites	Large or expanding patches
~	Medium seed coats	~
✓	Low mass	~
✓	High shape index	~

Unburned	Less than ideal sites	Small or shrinking patches
~	Thick seed coats	~
✓	High mass	~
✓	Low shape index	~

# Discussion

- 2010s seed mass considerably higher overall
  - Unburned higher than burned
- Shape, seed mass: strong negative correlation
- Seed coat thickness, mass: somewhat proportional
- No strong relationship between prairie size and seed traits
  - but when paired with fire there is
- Fire the real driver of community composition

# Land Mgmt Implications

- Prescribed burns used, but not widely enough
- Lack of prairie fires even since 1950s has had significant influence on make-up of prairies
  - Ex: larger seeds have disproportionate nutrient reserves – better at penetrating leaf litter layer
- Better effort to remove stigma from burns and return them as a normalized management tool



Questions?