LANDSCAPES AS MODERATORS OF THERMAL CONDITIONS: IMPLICATIONS FOR ECOLOGICAL PATTERNS AND PROCESSES

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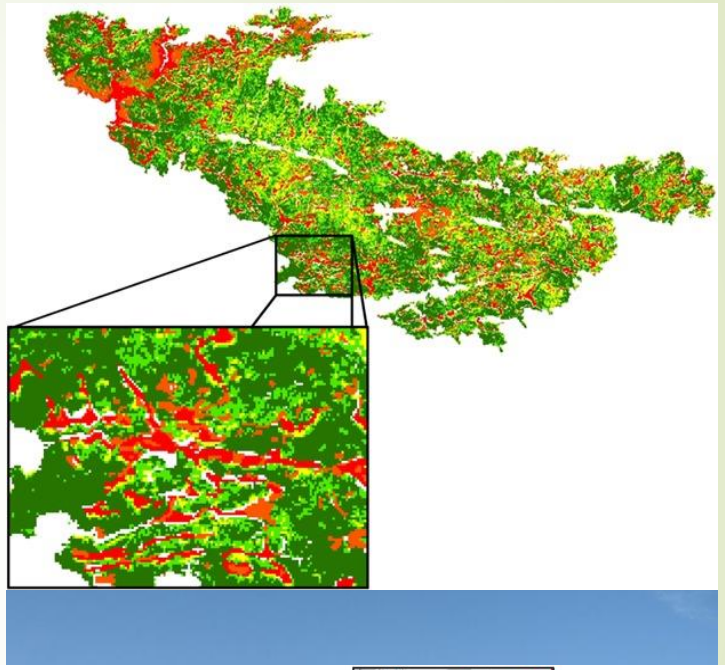
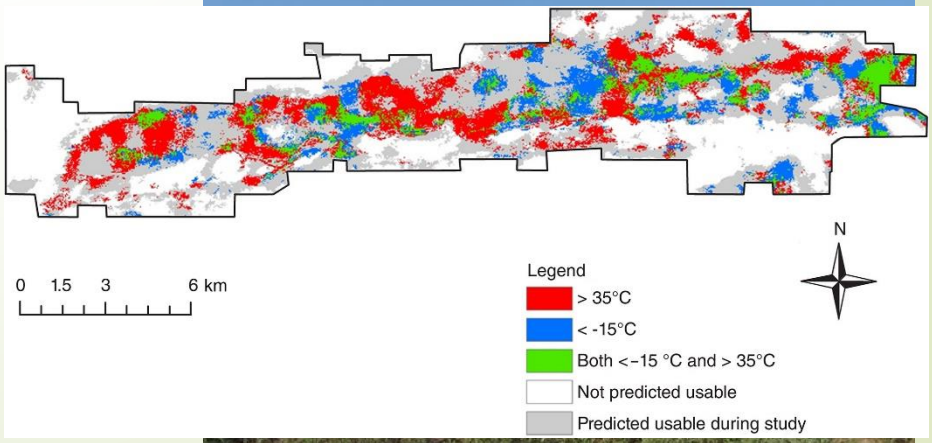
Landscapes Patterns and Environmental Conditions

- Landscape patterns influence ecological processes and patterns
- Structural heterogeneity influences local conditions through both space and time
- Patterns and variability in conditions play important roles in structuring ecological communities at multiple scales

Landscapes as thermal moderators

- Thermal conditions are structured by both ultimate and proximate forces
- Near surface temperatures are governed by interactions between climate patterns of heterogeneity derived from:
  - Vegetation
  - Soil
  - Topoedaphic factors
  - Disturbance events
  - Land use patterns

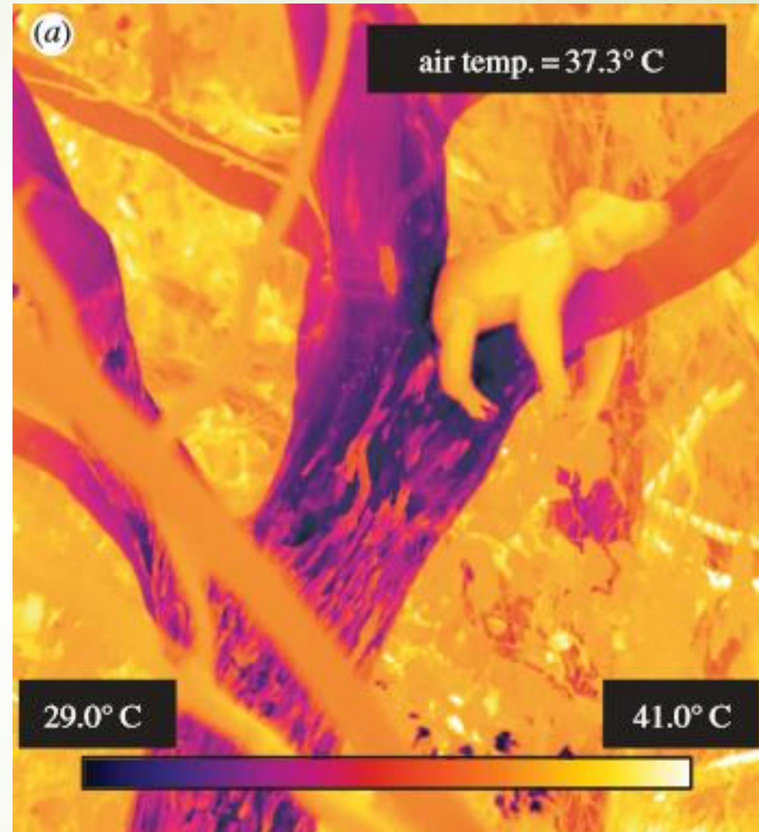




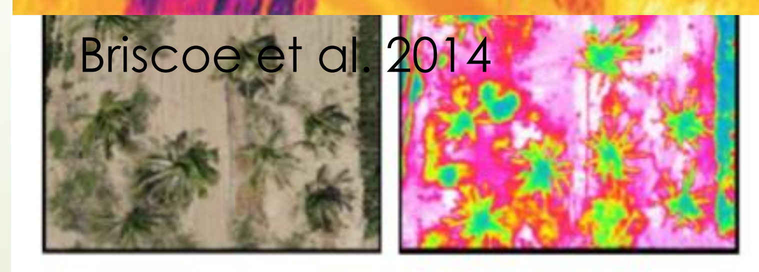
Influence of the Thermal Landscape

- Research has only recently begun to incorporate variability
- Patterns in thermal heterogeneity can influence animal space use patterns

- Thermal conditions long understood as important in ecology
- Variability is the norm, not averages

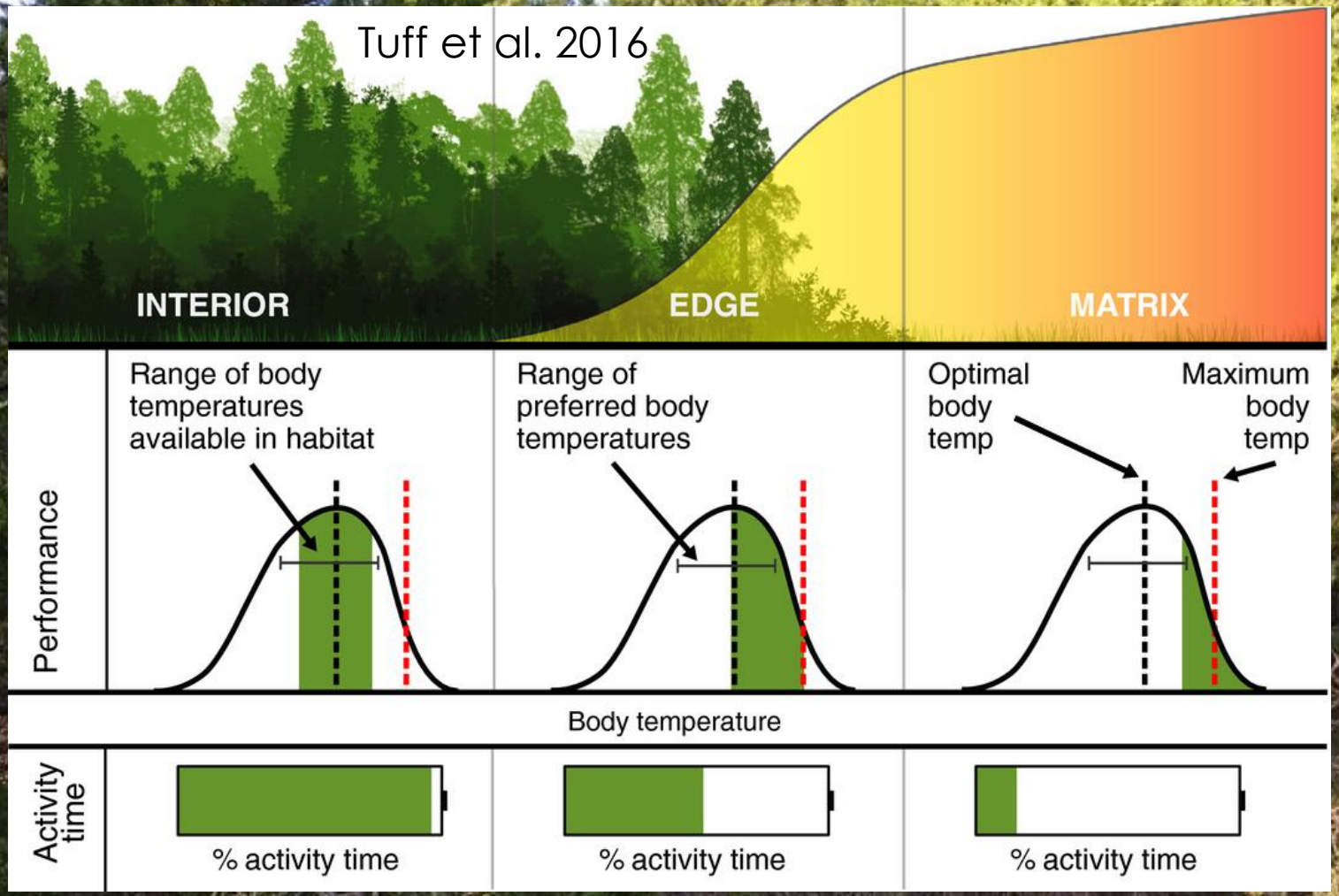


Briscoe et al. 2014



Faye et al. 2015

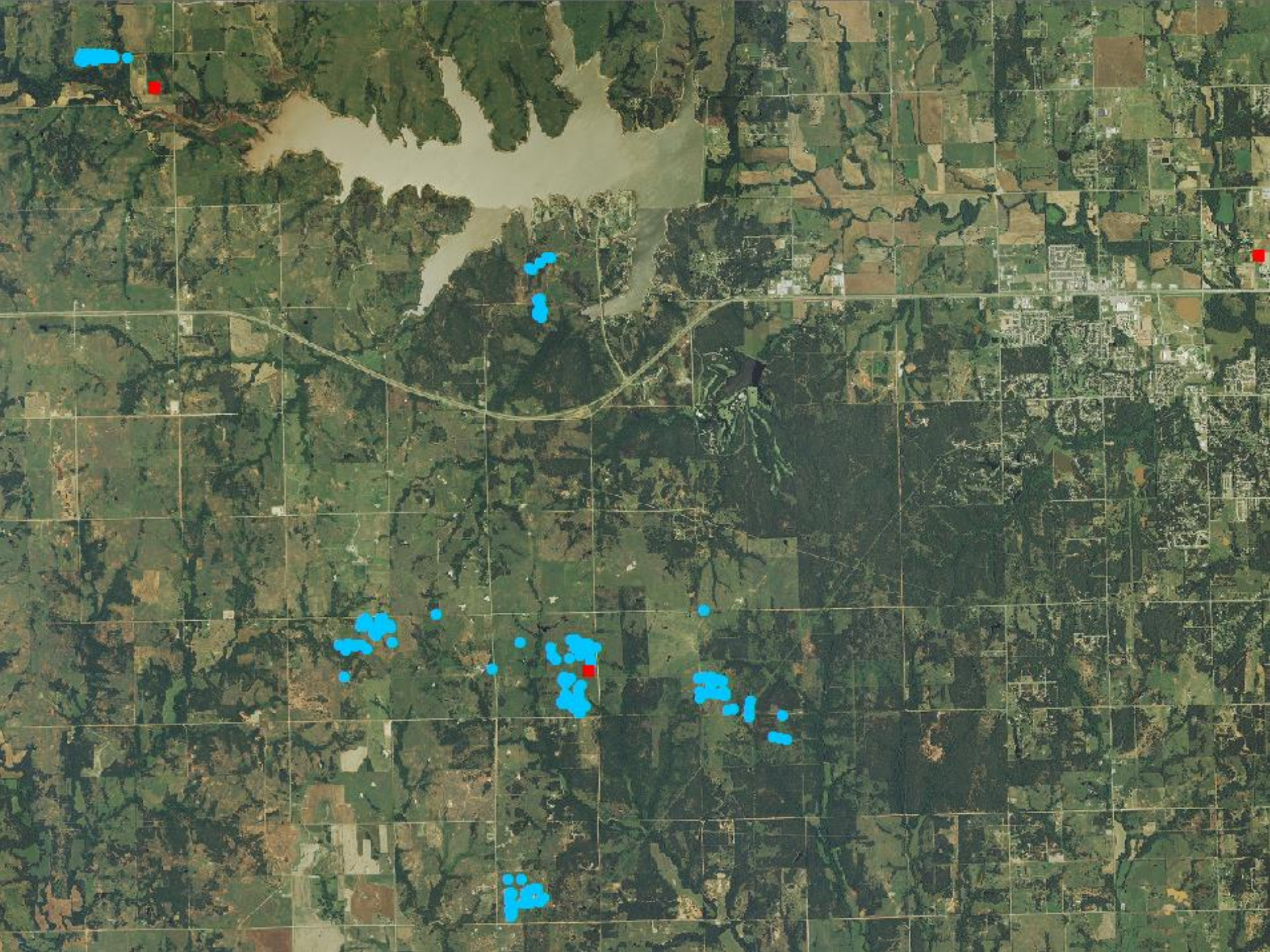
Woody Encroachment and Fragmentation



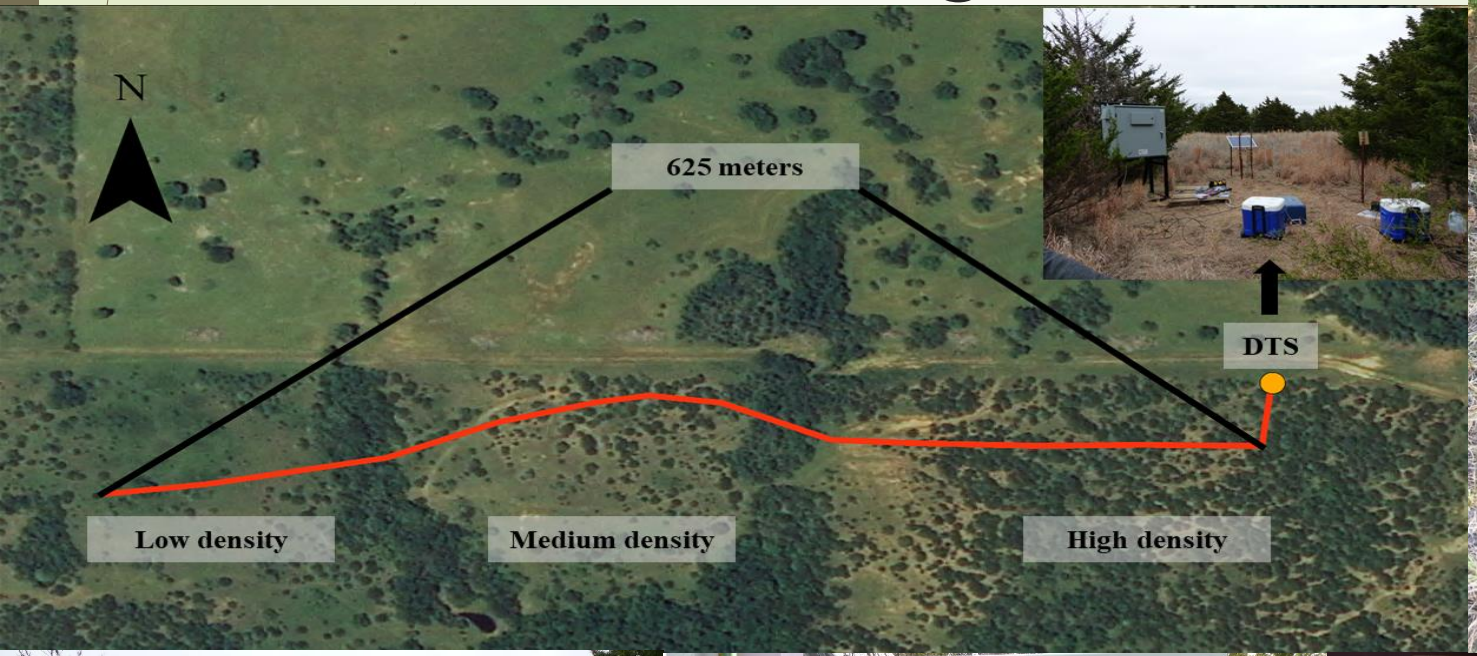
Objectives: 1) Model thermal variability as a function of landscape patterns for comparison to Mesonet stations

2) Model spatio-temporal variability of a thermal landscape to determine how scaling influences predicted thermal landscapes

3) Determine how human policy in changing thermal landscapes of grasslands

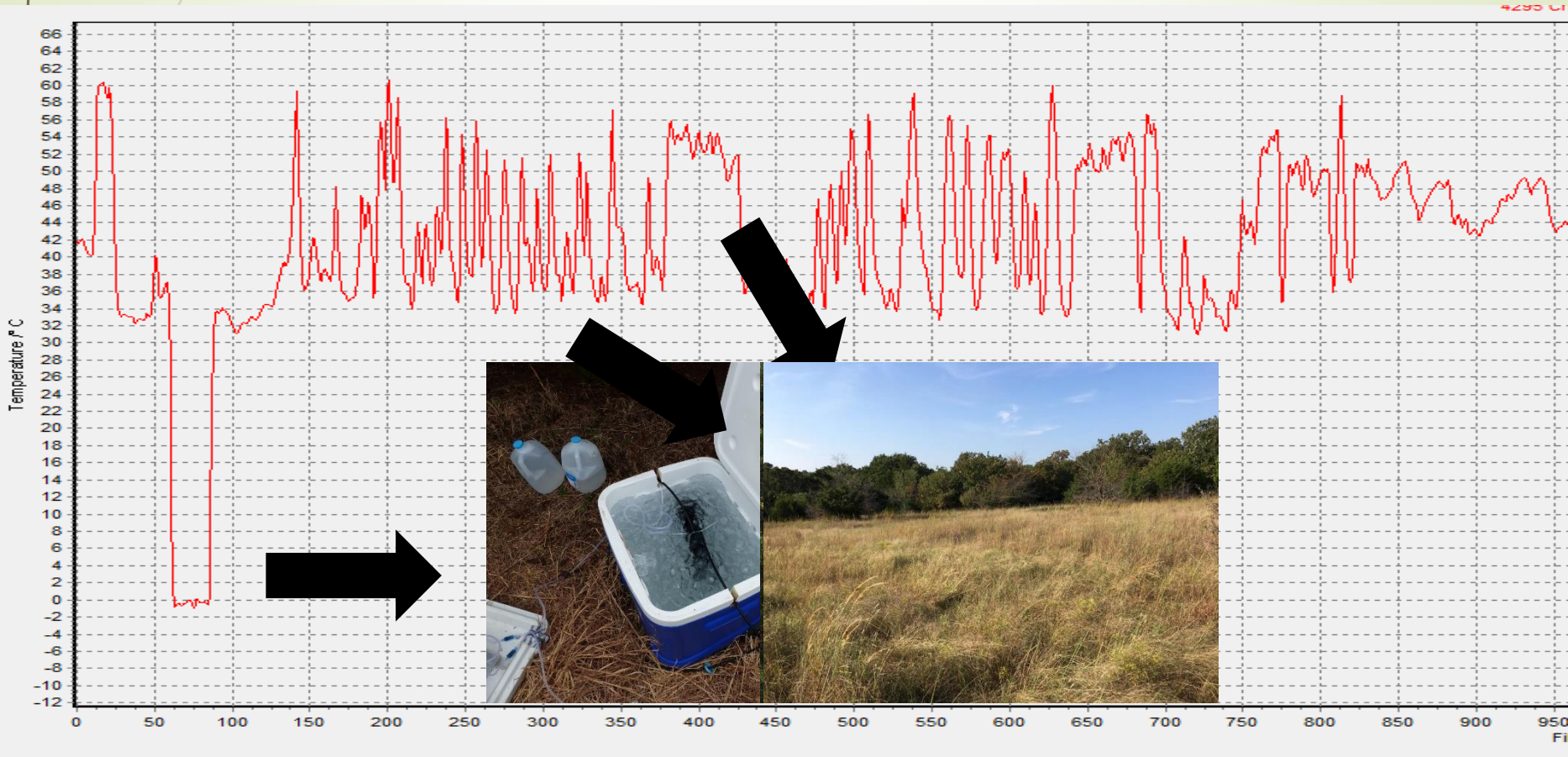


Distributed Temperature Sensing



Results

- DTS data collection from March 15th – August 31st
  - *n* = 114,586,131 thermal data points



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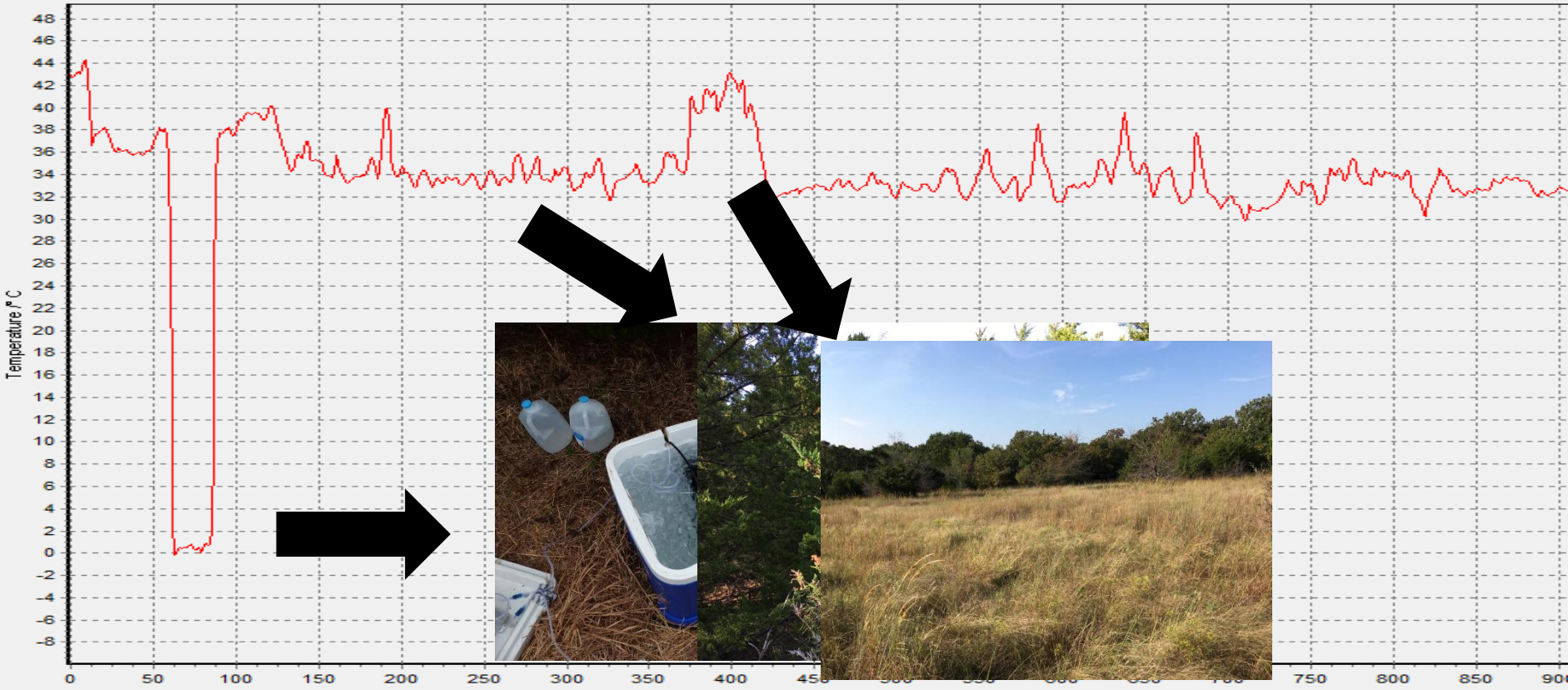

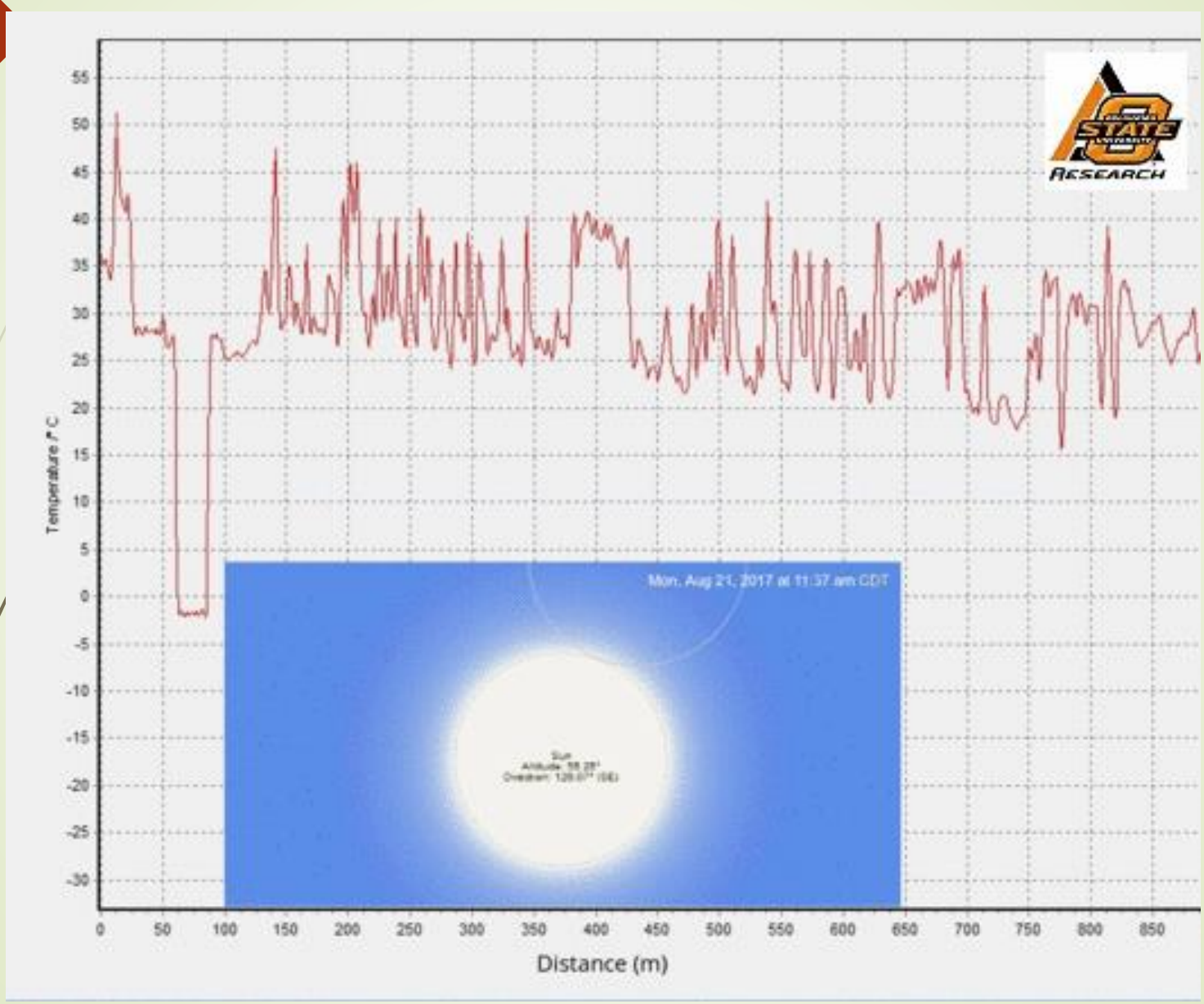
Temperature /° C
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30
25
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15
10
5
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-5
-10
-15
-20
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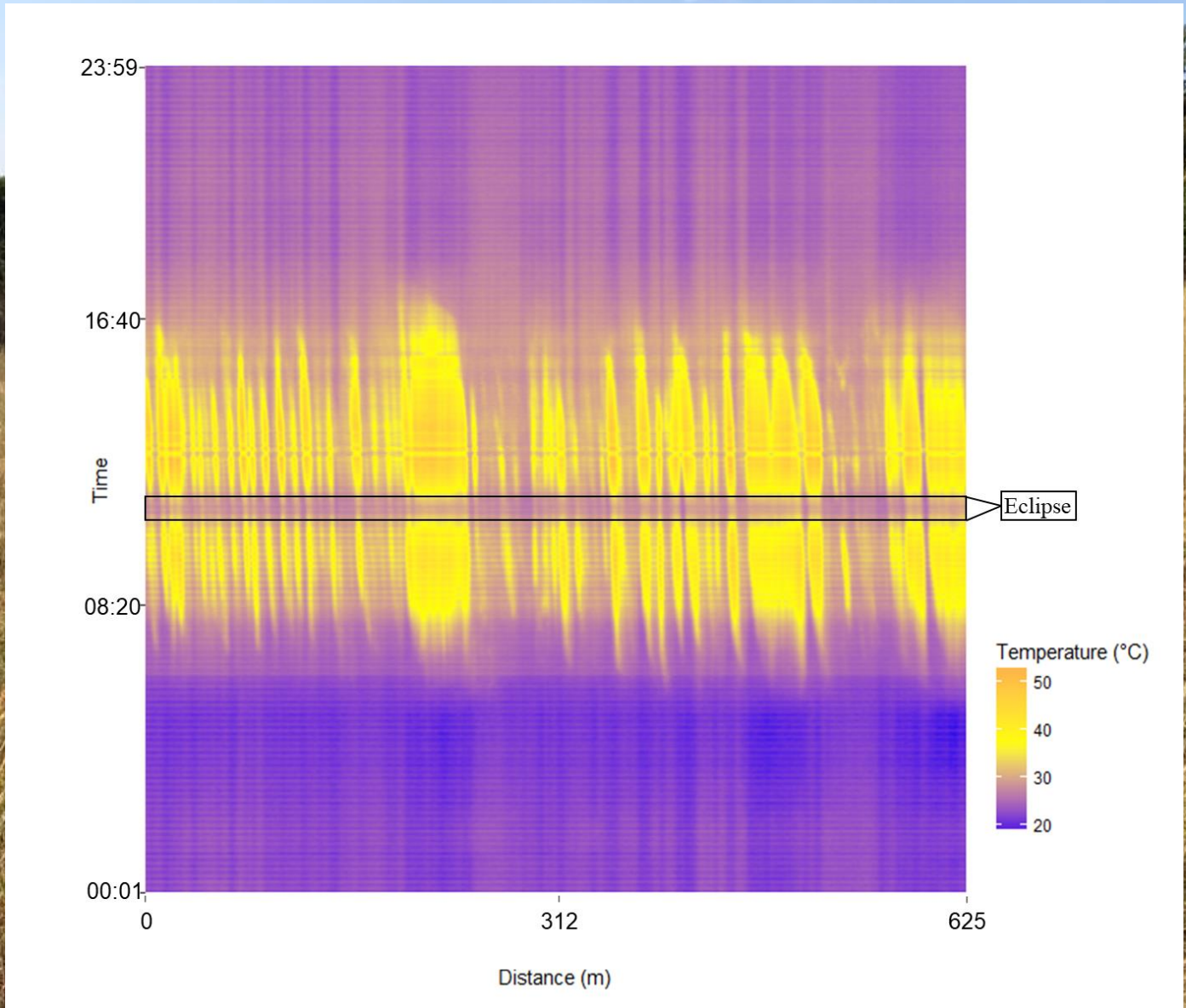
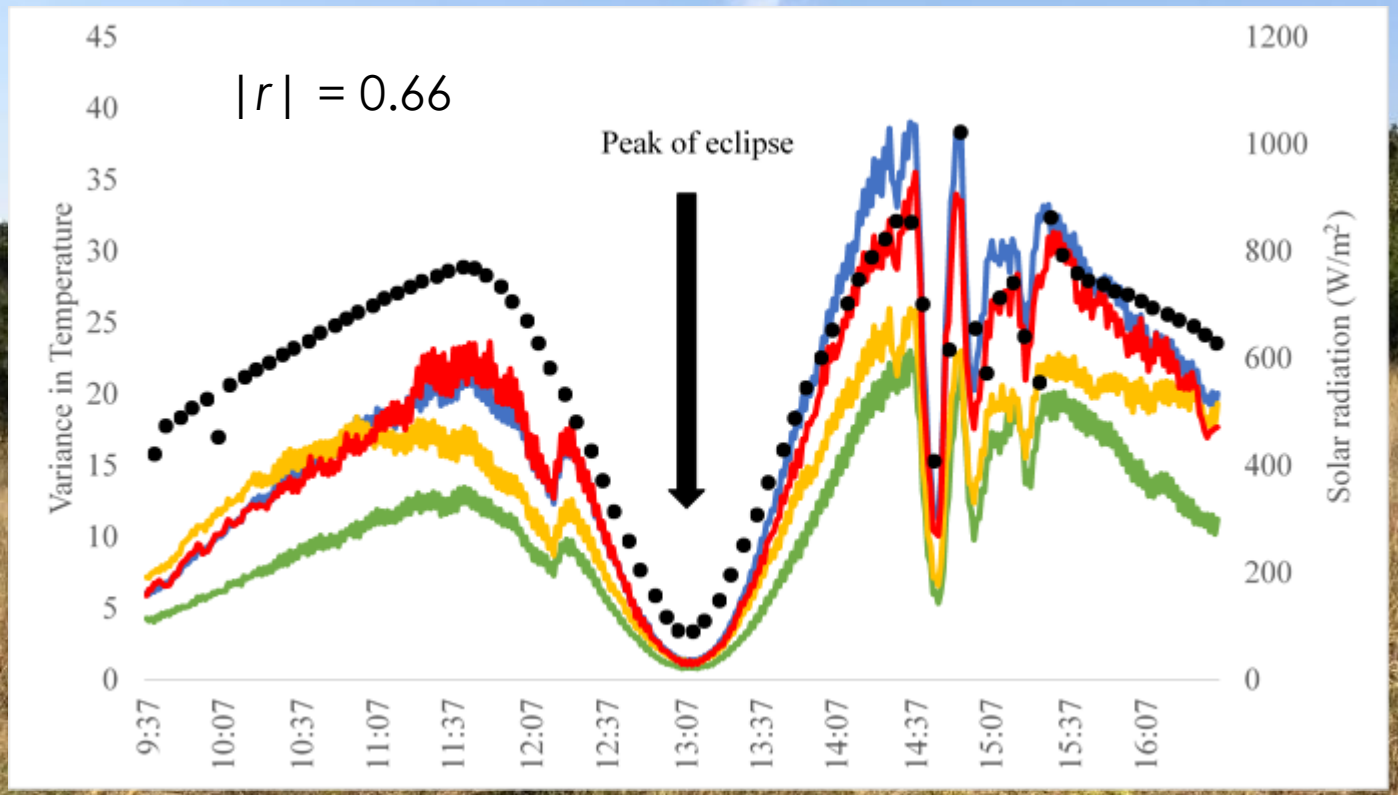
-30
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
Distance (m)
Mon, Aug 21, 2017 at 11:37 am CDT
Sun
RESEARCH

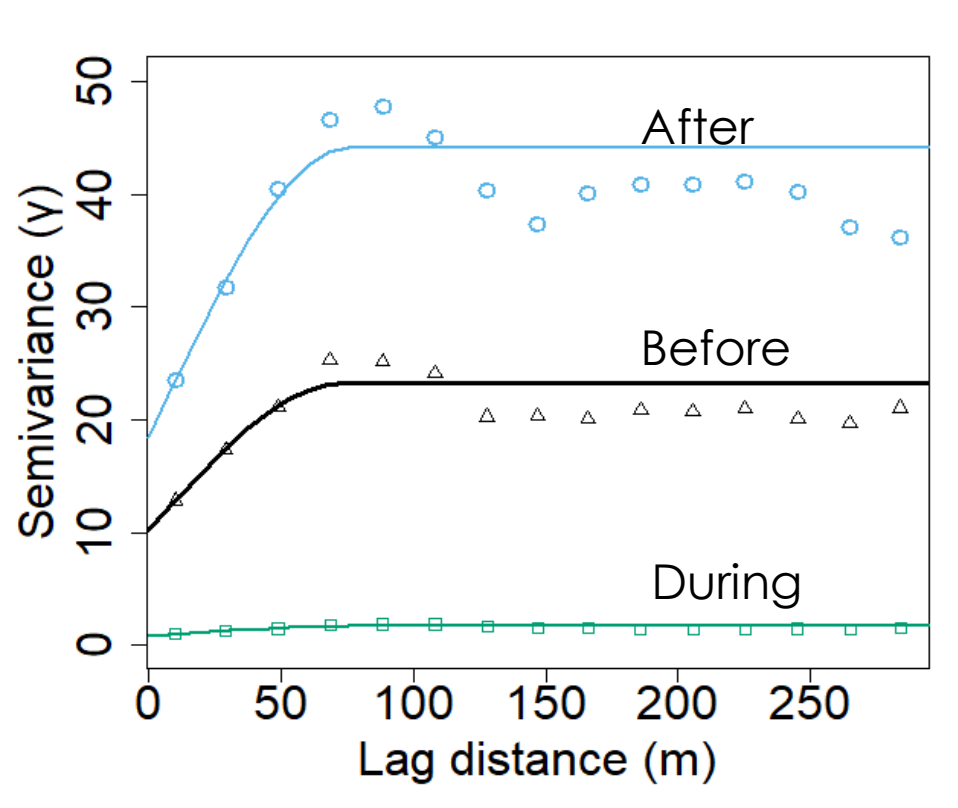
August 2017 Solar Eclipse

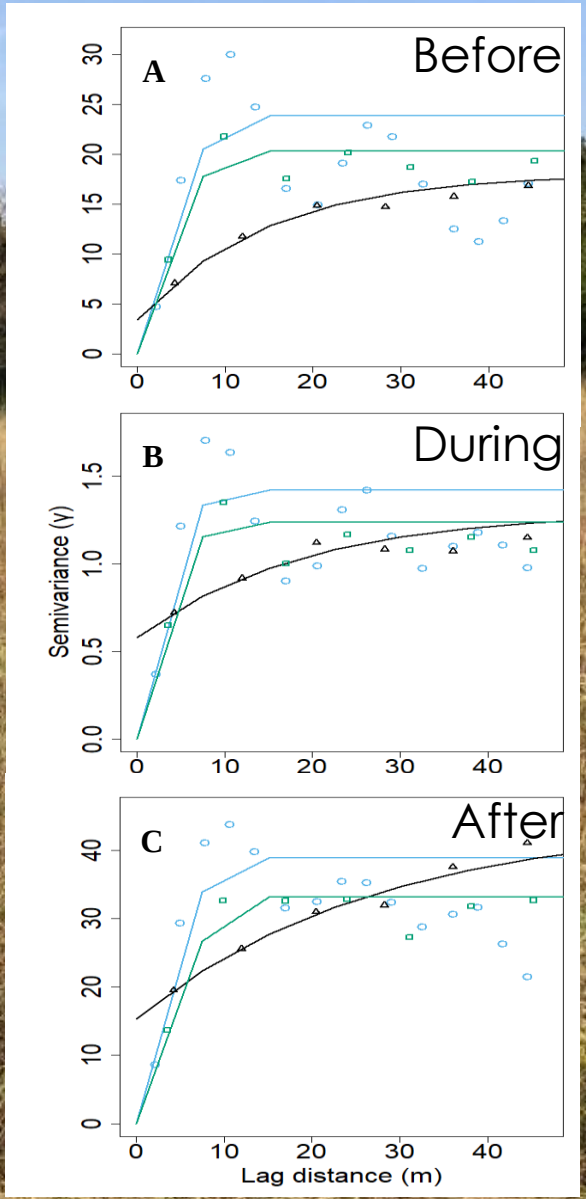


August 2017 Solar Eclipse

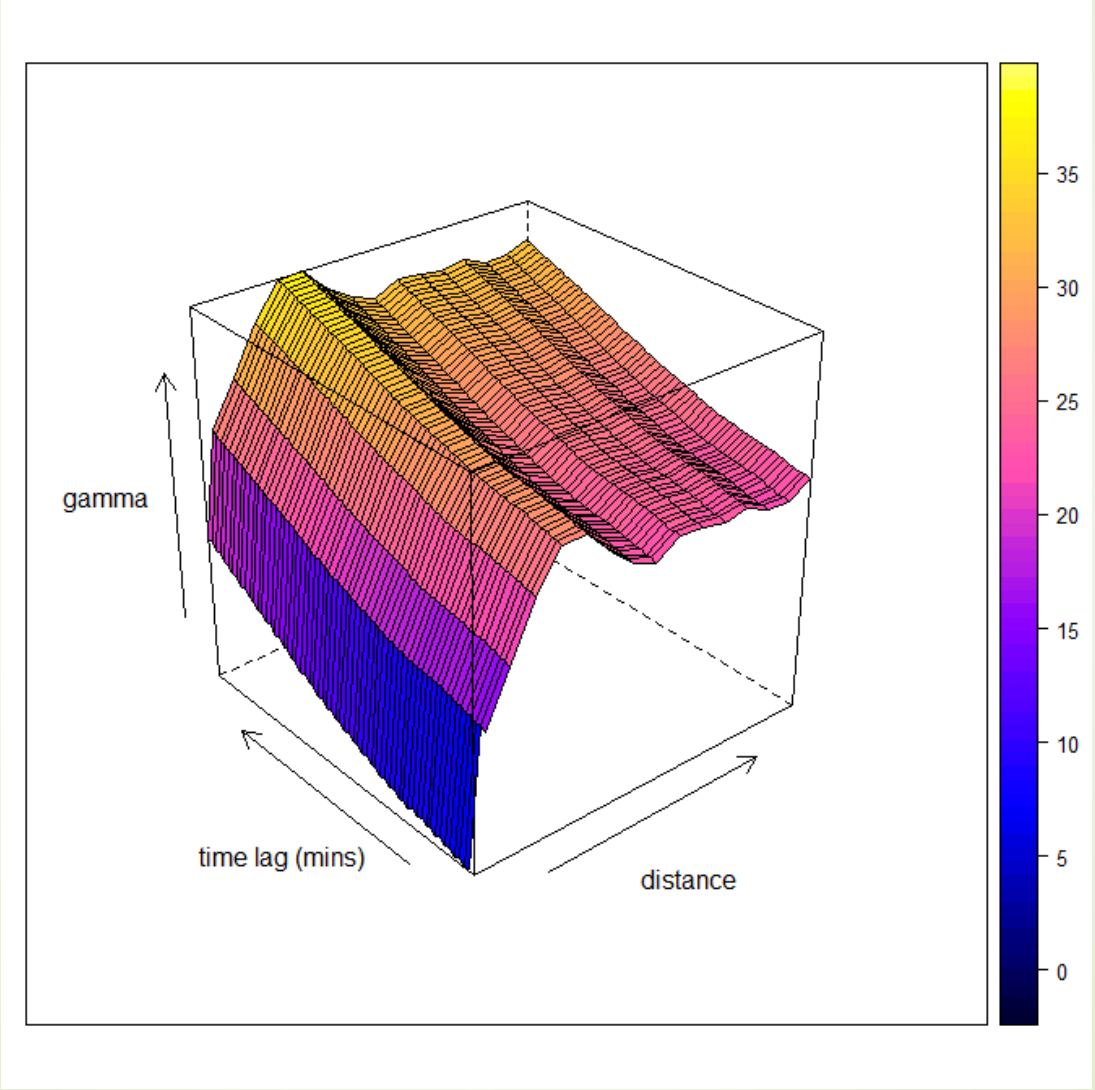


August 2017 Solar Eclipse





Space-time Relationships

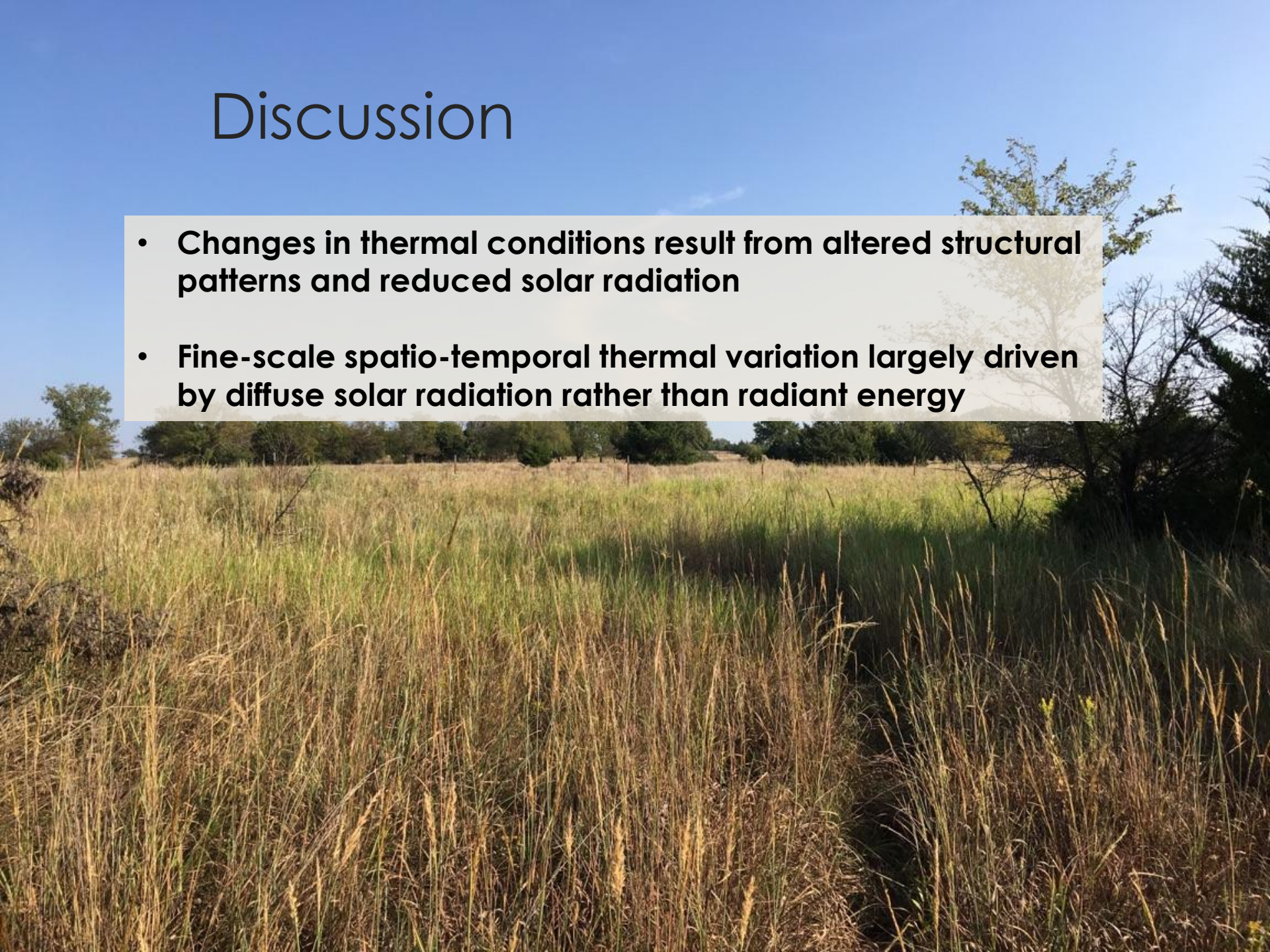


Discussion

- **Solar eclipse acted as unique atmospheric experiment to explore warming/cooling trends across the landscape**
- **Cedar significantly reduces microsite temperatures during peak heat and altered spatial variance within the landscape**
- **Though cedar provide thermal buffers, this isn't always desirable**
  - **i.e., Poikliotherms, decomposition rates, disease vectors**
  - **70% of ticks collected in closed canopy cedar, 3% in grassland**
  - **89% prevalence of *Ehrlichia chaffeensis* and 83% prevalence of *E. ewingii* within closed canopy cedar**

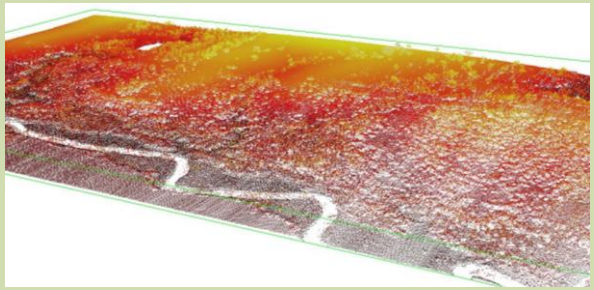
Discussion

- **Changes in thermal conditions result from altered structural patterns and reduced solar radiation**
- **Fine-scale spatio-temporal thermal variation largely driven by diffuse solar radiation rather than radiant energy**



Future Directions and Timeline

- **Complete analysis of long-term DTS thermal dataset by mid-late May**
- **Pathogen lab analysis to be completed by early May. Analysis on thermal characteristics at tick capture sites to be completed by June**
- **Incorporate LIDAR datasets and complete analysis of thermal variation between Mesonet stations by July**
- **Organize results and complete associated manuscripts from mid-June through November**



Acknowledgements

Dr. Sam Fuhlendorf, John Polo, Jacob Peterson, Noel Coté, Dr. Bruce Noden

Oklahoma EPSCoR

Oklahoma State University
Department of Natural Resource Ecology and Management

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LIOS Technology

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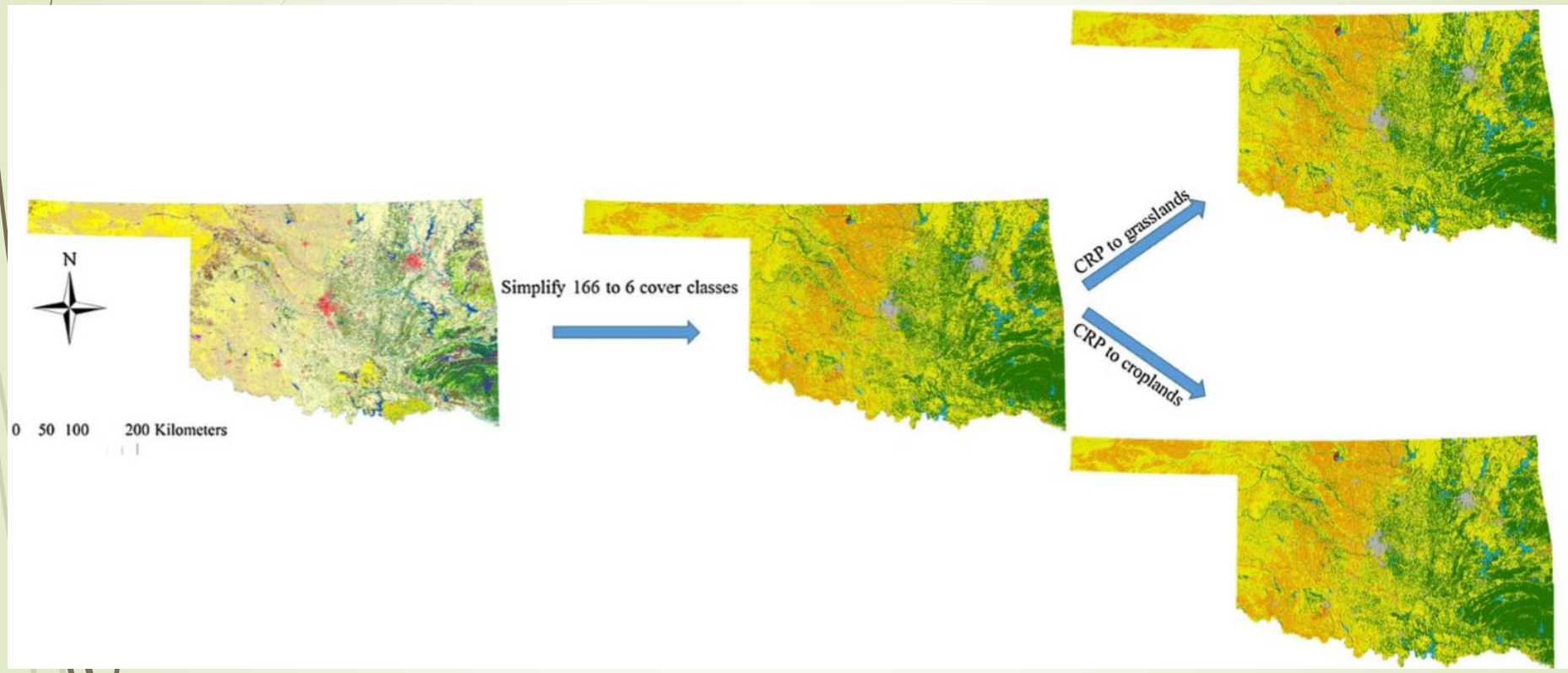
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0 50 100 200 Kilometers
Simplify 166 to 6 cover classes
CRP to grasslands
CRP to croplands