Is extreme fire the key to reversing grassland loss due to woody encroachment? A test in the tallgrass prairie.

Kalea Nippert[1,2], Zak Ratajczak[1], and Abby Schmidt[1,3]

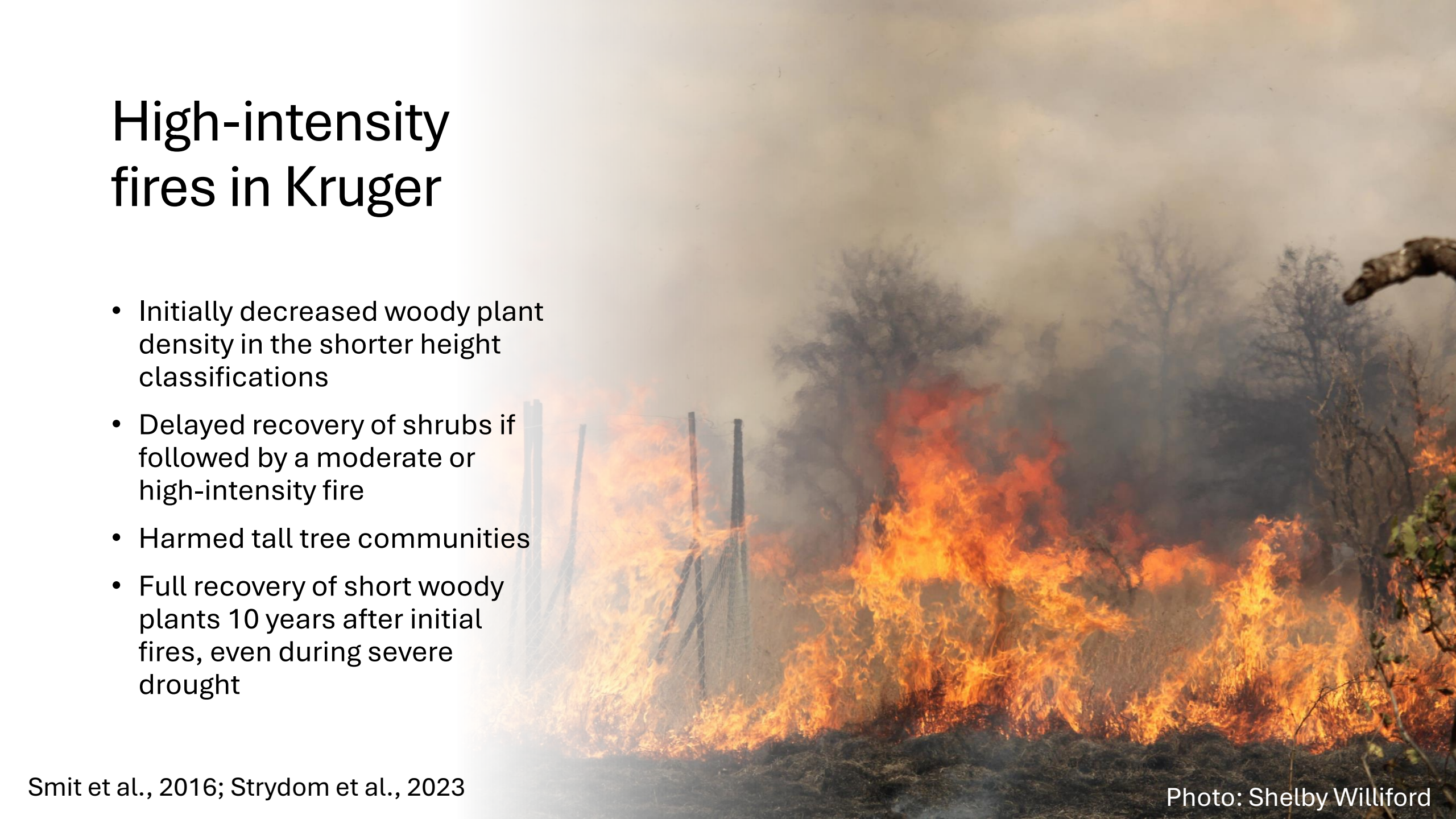
[1]Kansas State University, [2]University of North Carolina – Greensboro, [3]Utah State University

Woody encroachment

- Invasion of native woody plants in grasslands and savannas
- Historically, low-intensity prescribed fire prevented woody encroachment
- Historic return interval (3-5 years) is no longer sufficient to keep woody plants at bay
- People have started turning towards other more “extreme” solutions

High-intensity fires in Kruger

- Initially decreased woody plant density in the shorter height classifications
- Delayed recovery of shrubs if followed by a moderate or high-intensity fire
- Harmed tall tree communities
- Full recovery of short woody plants 10 years after initial fires, even during severe drought



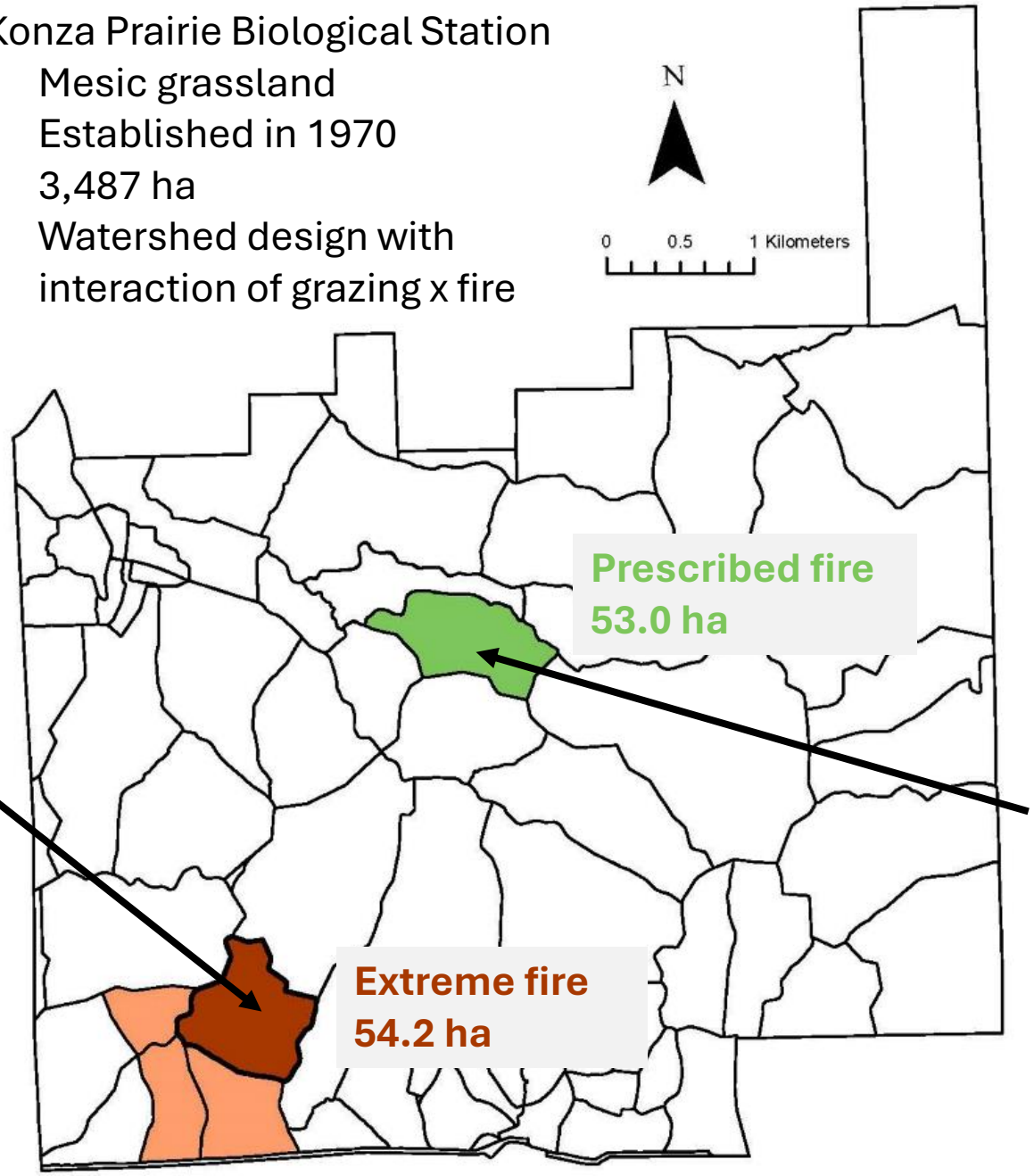
Smit et al., 2016; Strydom et al., 2023

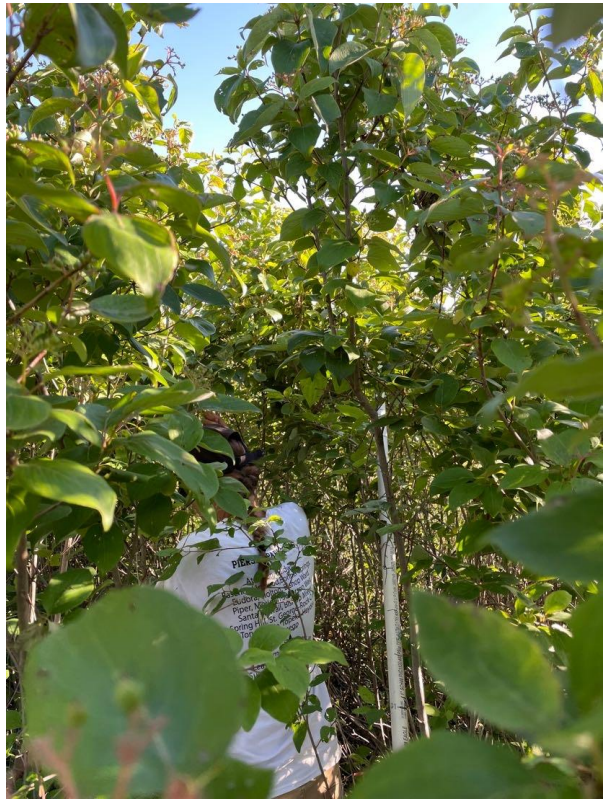
Photo: Shelby Williford


Legend:
Original Tallgrass Prairie (TNC)
Remnant Tallgrass Prairie (TNC)
The Nature Conservancy Ecoregions
The Nature Conservancy
nature.org
Map Created By:
The Nature Conservancy
Geospatial Systems Team
Minneapolis, MN (jslaats@tnc.org)
©2023 The Nature Conservancy.

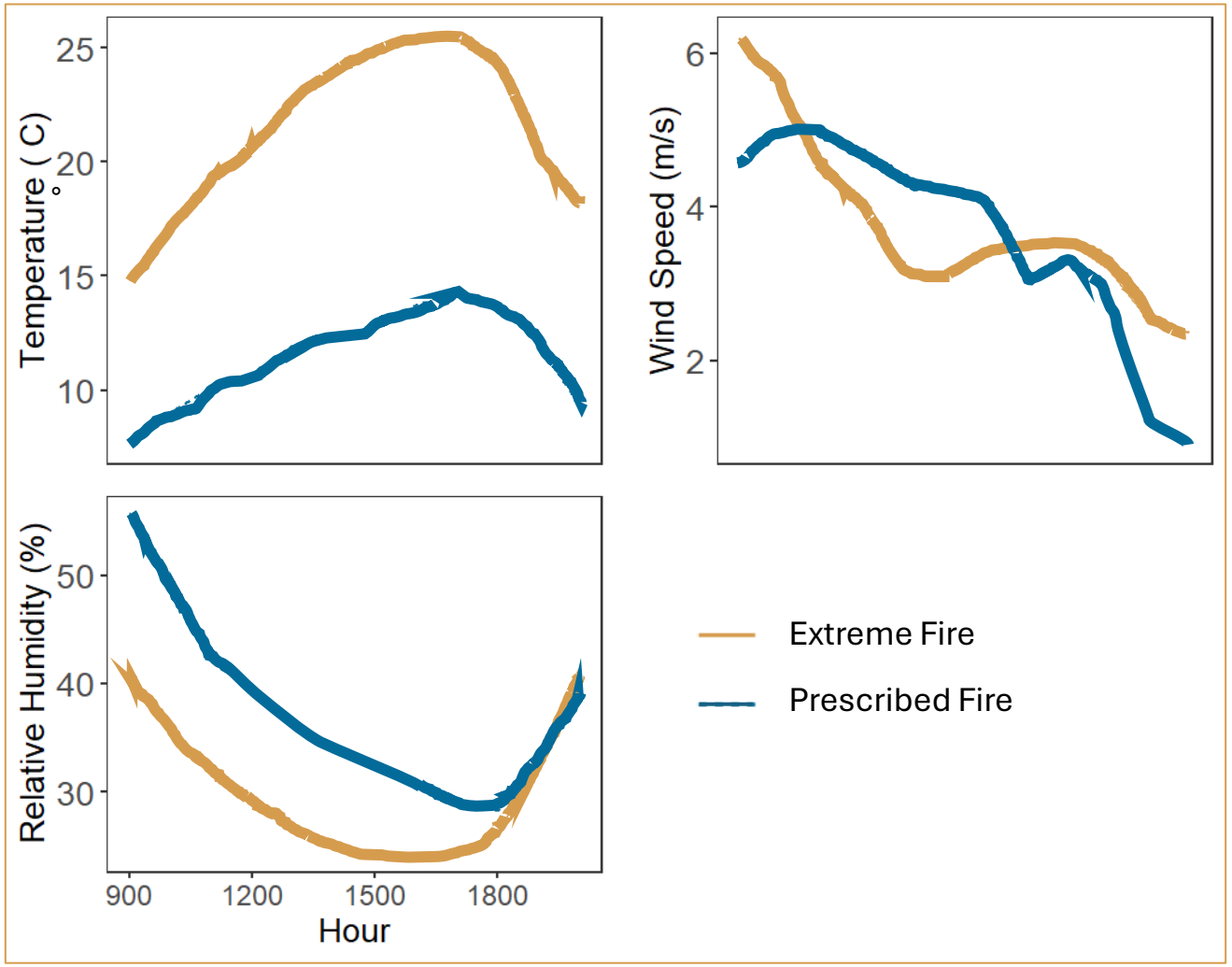
Konza Prairie Biological Station

- Mesic grassland
- Established in 1970
- 3,487 ha
- Watershed design with interaction of grazing x fire





Burn conditions



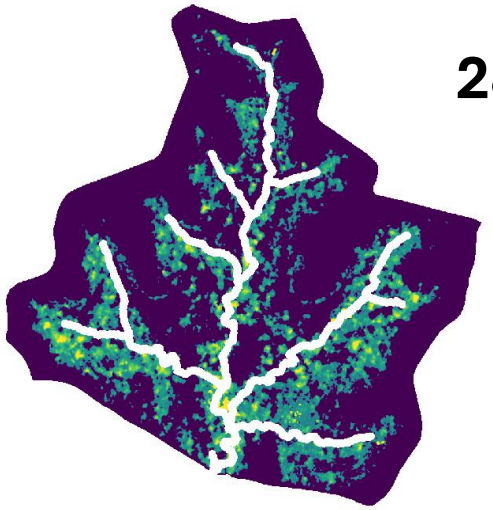
Hourly temperature, wind speed, and relative humidity from the day of each fire

Catchments had relatively similar fuel loads – 700 g/m^2

Both ungrazed and have ~30% woody cover

2020

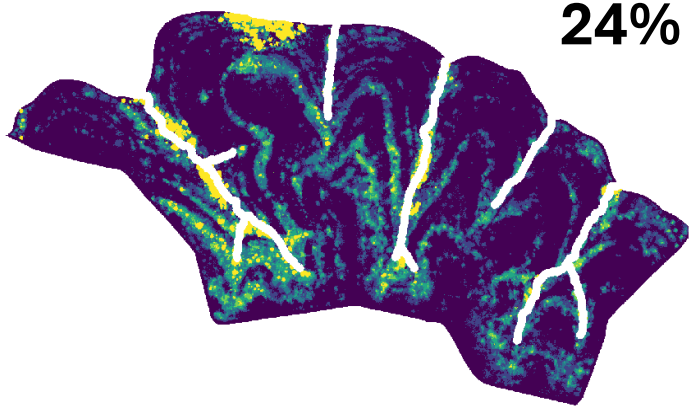
Extreme



28%

54.2 ha

Prescribed



24%

53.0 ha

2021 Fire Events

8%

18%

40%

38%

Woody plant height (m)

5

0

500 m

Implications for Management

- Extreme fire alone cannot control woody encroachment
- Extreme fires can have unintended consequences
- Need multiple compounding stressors
- Best strategy is still prevention

Acknowledgements:

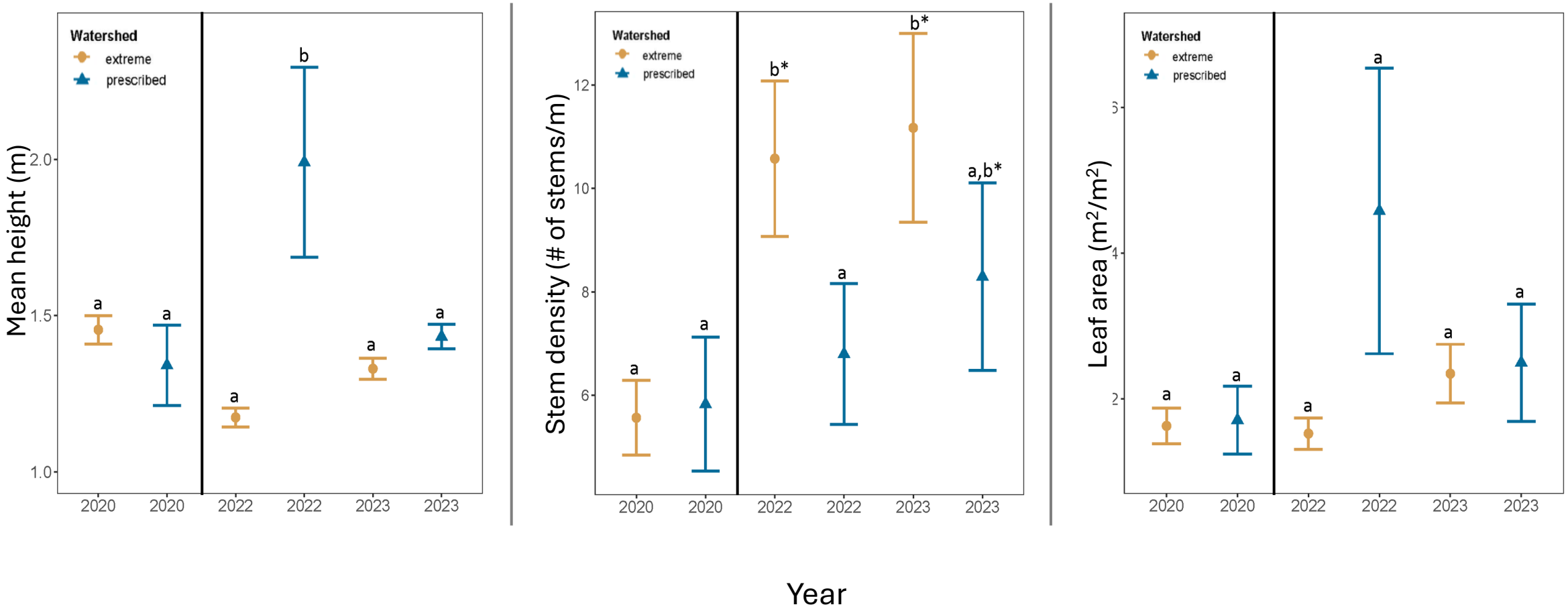
- Dr. Zak Ratajczak
- Abby Schmidt

- Dr. Sally Koerner

Konza Prairie Biological Station and LTER:
- Amanda Kuhl
- Patrick O'Neal
- Jeff Taylor

Funding:
- NSF Research Experience for Undergrads
- Kansas State University

Questions?


Watershed
extreme
prescribed
Mean height (m)
2.0
1.5
1.0
a
a
b
a
a
a
2020
2020
2022
2022
2023
2023
Stem density (# of stems/m)
12
10
8
6
b*
a
b*
a,b*
Leaf area (m²/m²)
a
a
a
a
a
a
Year