Reintroduction of the historic fire return interval after grassland-savanna conversion to juniper woodland: long-term analysis

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Methodology

12 Years After Treatment

Background Information

Most fire research suggests that the reintroduction of the historic fire return interval to manage invasive woody species cannot restore the more productive grassland-savanna ecosystems they invade:

- Ansley & Rasmussen (2005)
- Ansley et al. (2006)
- Higgins et al. (2007)
- Briggs et al. (2008)

Fires of greater intensity are required to overcome the resilience of post-grassland and savanna juniper woodlands to promote drivers of stability in alternative, grassland states:

- Fuhlendorf et al. (1996)
- Twidwell et al. (2009 in press)

Objectives and Hypotheses

Objectives

1) To determine the relative role of fire frequency versus fire intensity, as assessed via fire season, in overcoming the resilience of a juniper woodland to restore a grassland-savanna matrix.
2) To compare the effects of restoring the historic fire return interval across different seasons, summer and winter, on plant community characteristics.
3) To assess species specific responses of grasses and woody plants to long-term fire treatments.

Hypotheses

1) Summer fires will reduce juniper and prickly pear density and cover more than winter fire.
2) Summer and winter fires will increase herbaceous production over control (no fire).
3) Summer and winter fire treatments will have greater species diversity compared to control.

Study Area Description

- Site: AgriLIFE Research Station, Sonora, TX, western Edwards Plateau
- Plant community: Quercus savanna invaded heavily by Juniperus spp.
- Woody plant cover: 20%, Juniperus, 40% total
- Surface fuel characteristics: shortgrass and midgrass matrix
- Climate: arid - annual mean precipitation - 600 mm; range from 156 mm - 1096 mm
- Soils: Lithic Haplustolls

Experimental Design

- Two 2-ha units per fire treatment
- Three burning treatments applied randomly to each unit
- Repeated summer burns
- Repeated winter burns
- Control (no burn)

Sampling

- Ten transects were established randomly in each plot
- Quadrats established at 2m intervals along transects to sample
- Graminoid and woody plant species and the presence or absence of woody plants at those locations
- Belt-line transects along transect lines to determine the cover and density of total woody plants, individual woody plant species, and prickly pear

Herbaceous Response to Fire Treatments

- Herbaceous biomass (in g/m²) response before and after 2, 6-year fire cycle (Figure 1)
- Water burned and control show no differences between herbaceous production pre-treatment and after 12 years.
- High-intensity summer burns show significant increase in biomass between 1994 and 2006.
- Summer burn treatments increased herbaceous production from the beginning of the study by 28%,

- Response of plant community characteristics after 12 years of treatment (Figure 2)
  - Cover of grasses and woody overstory were not different among treatments.
  - Cover of woody overstory was reduced 50% in the summer treatment compared to the control (p < 0.05).

Future Research

- Analyze the response of graminoid and woody plant species in response to reintroduction of the historic regime across different seasons.
- Utilize ordination to determine community-level and species-level responses different burn treatments.
- Identify relative levels of resilience of juniper woodlands to fire.
- Identify the relative resilience of this grassland-savanna to change when fire is absent as a driver of state maintenance.

References


Acknowledgements

We thank the fire crews at Sonora AgriLife Research Center.
This project is funded in part by Texas A & M AgriLIFE Research and the Welder Wildlife Refuge.

Background courtesy of The Weather Channel