MONTANA STATE UNIVERSITY EXTENSION

Identifying mechanisms of rangeland drought resilience: management strategies for sustainable ecosystem health

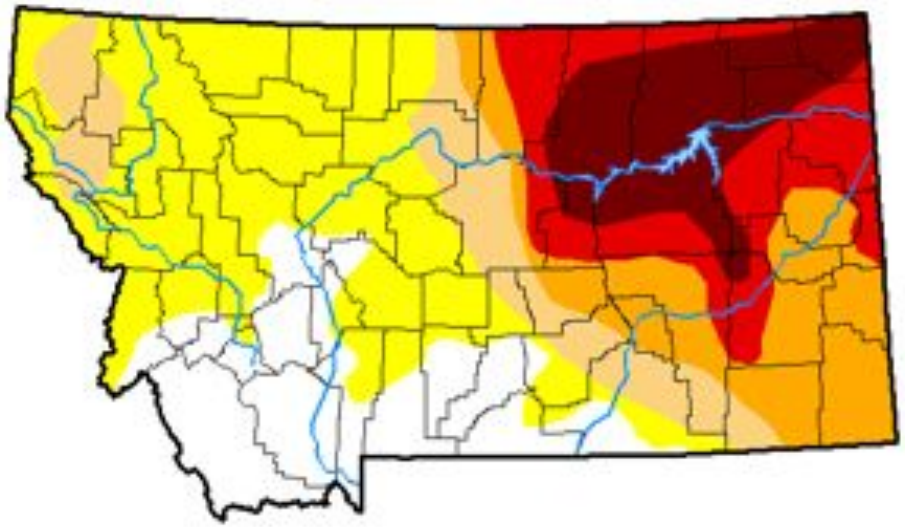
This project was supported by National Initiative Competitive grant No. 2018-68002-27922 from the USDA National Institute of Food and Agriculture.

USDA United States Department of Agriculture

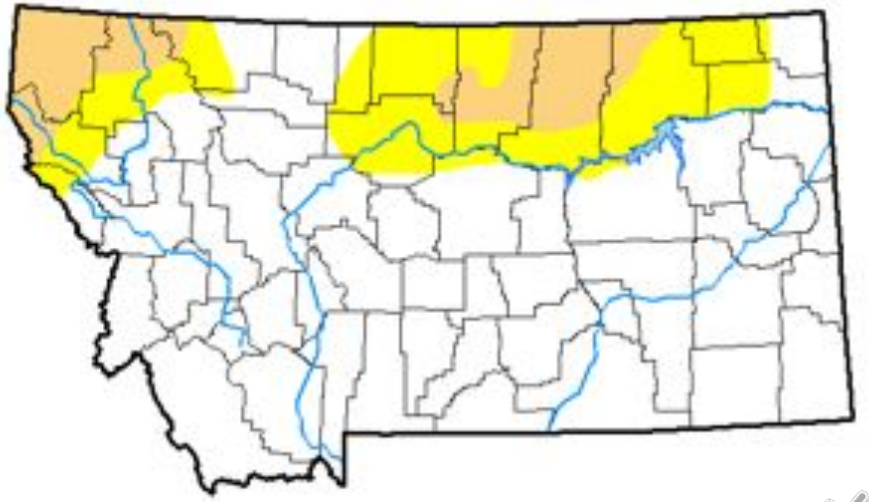
National Institute of Food and Agriculture

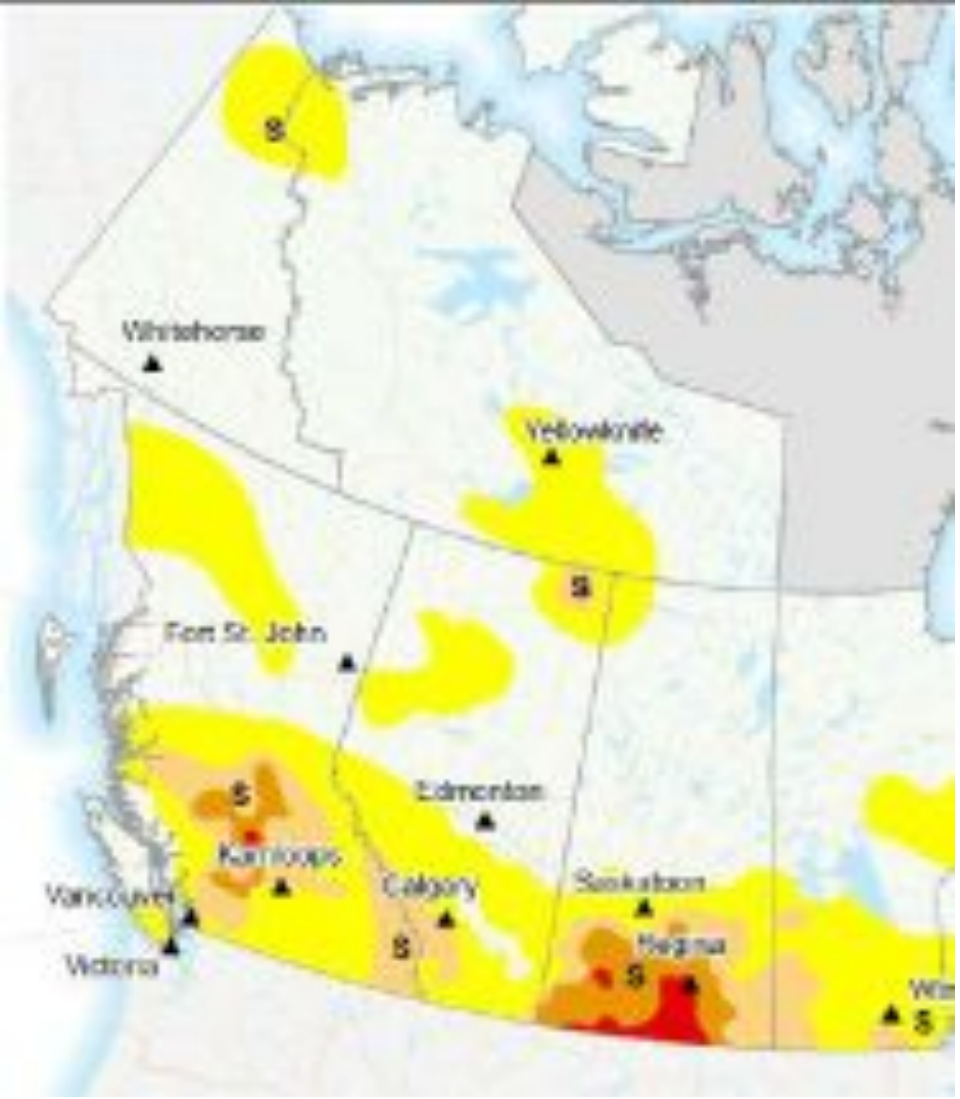
Background

July 2017



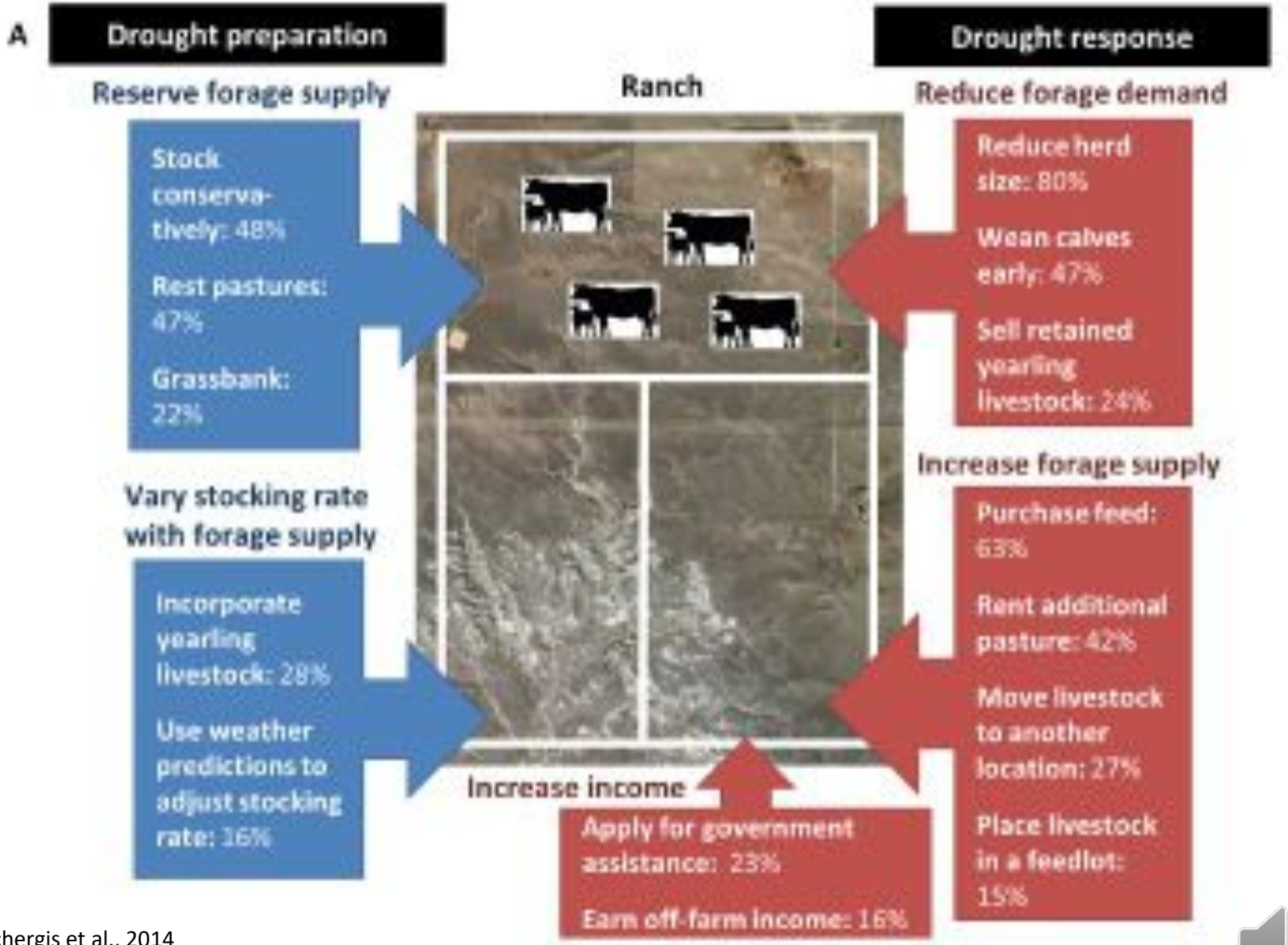
July 2018





July 2017

July 2018



Kachergis et al., 2014

Key Personnel

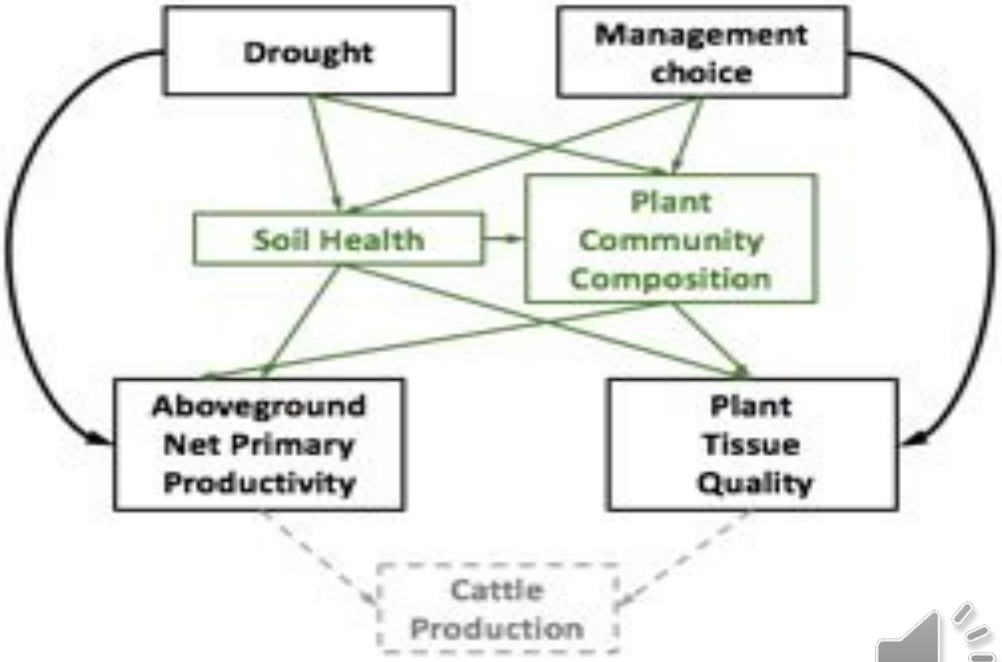
- Sally Koerner
  - Assistant Professor
  - University of North Carolina – Greensboro
- Lauren Porensky
  - Ecologist
  - USDA-ARS Fort Collins
- Kevin Wilcox
  - Ecologist
  - University of Wyoming
- Kim La Pierre
  - Senior Scientist
  - Smithsonian Environmental Research Center
- Kurt Reinhart
  - Ecologist
  - USDA-ARS Fort Keogh
- Megan Van Emon
  - Extension Beef Cattle Specialist/Asst. Professor
  - Montana State University

Long-Term Goals

1. Examine resilience of rangeland function under various magnitudes of drought
   - Multi-year drought
   - Drought intensity
2. Assess grazing strategies on long-term sustainability and rangeland resilience
   - During and after drought
   - Rest duration

Long-Term Goals

3. Provide relevant information and tools for land managers
   - Field days and meetings
   - Web-based tool



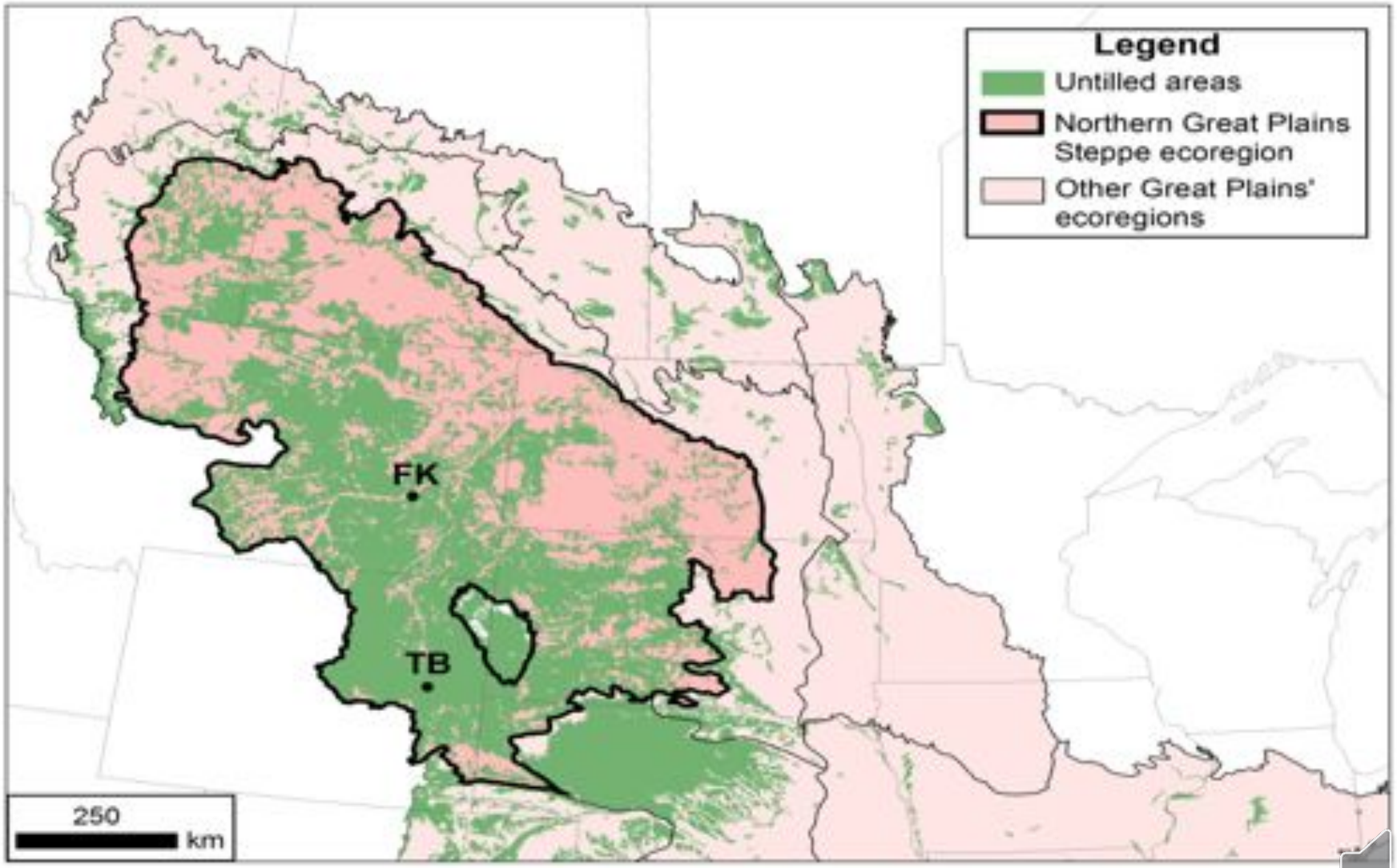
Objectives

1. Identify drought-driven tipping points
   – Forage quality and quantity
2. Quantify drought impacts on plant and soil communities
3. Explore direct and indirect mechanisms controlling forage quality and quantity response to drought

Objectives

4. Assess rancher philosophies on grazing during and after multi-year droughts
5. Examine how grazing strategies during/after drought impact plant and soil communities and forage quality and quantity
6. Promote stakeholder implementation for research findings

Research Sites



Research Sites

- USDA-ARS Fort Keogh Livestock and Range Research Laboratory
  - Miles City, MT
  - Avg. precip: 12.6 inches
  - Avg. temp: 46°F
  - Mixed-grass prairie and sagebrush steppe
    - Needle and thread, western wheatgrass, blue grama
  - Peak production in July

Research Sites

- Thunder Basin National Grasslands
  - Private land
  - Northeastern WY
  - Annual precip: 9.8 – 13.8 inches
  - Average temp: 43°F
  - Mixed-grass understory with sparse sagebrush overstory
    - Blue grama, western wheatgrass, six-weeks fescue

Key Activities

- Drought manipulation
  - Rainfall reduction gradient – 5 levels
    - Example: 0, 25, 50, 75, or 100%
  - Rainout shelters out from April to September
  - Measure impact of reduction of moisture on the mixed-grass prairie ecosystem

Key Activities

- Grazing manipulation
  - Grazing rest – 3 levels
    - Example: graze annually, do not graze in year 2 of drought, do not graze in year 1 of recovery
  - Graze to moderate level?
  - Timing of grazing?

Key Activities

- Field sampling – pre-drought, during drought, and during recovery
  - Forage quality and quantity
  - Soil abiotic factors
  - Soil microbial communities
  - Plant communities

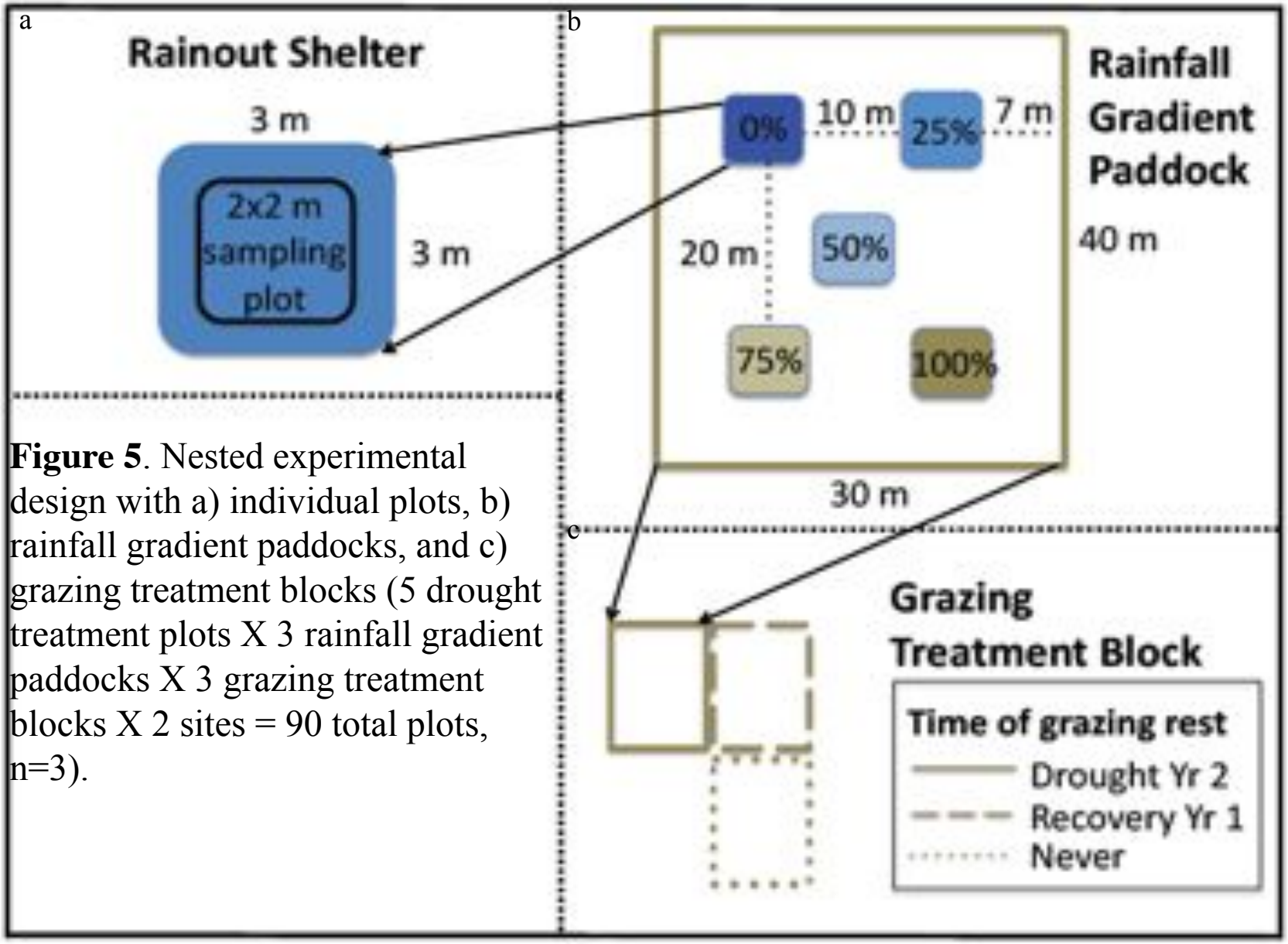


Figure 5. Nested experimental design with a) individual plots, b) rainfall gradient paddocks, and c) grazing treatment blocks (5 drought treatment plots X 3 rainfall gradient paddocks X 3 grazing treatment blocks X 2 sites = 90 total plots, n=3).

Key Activities

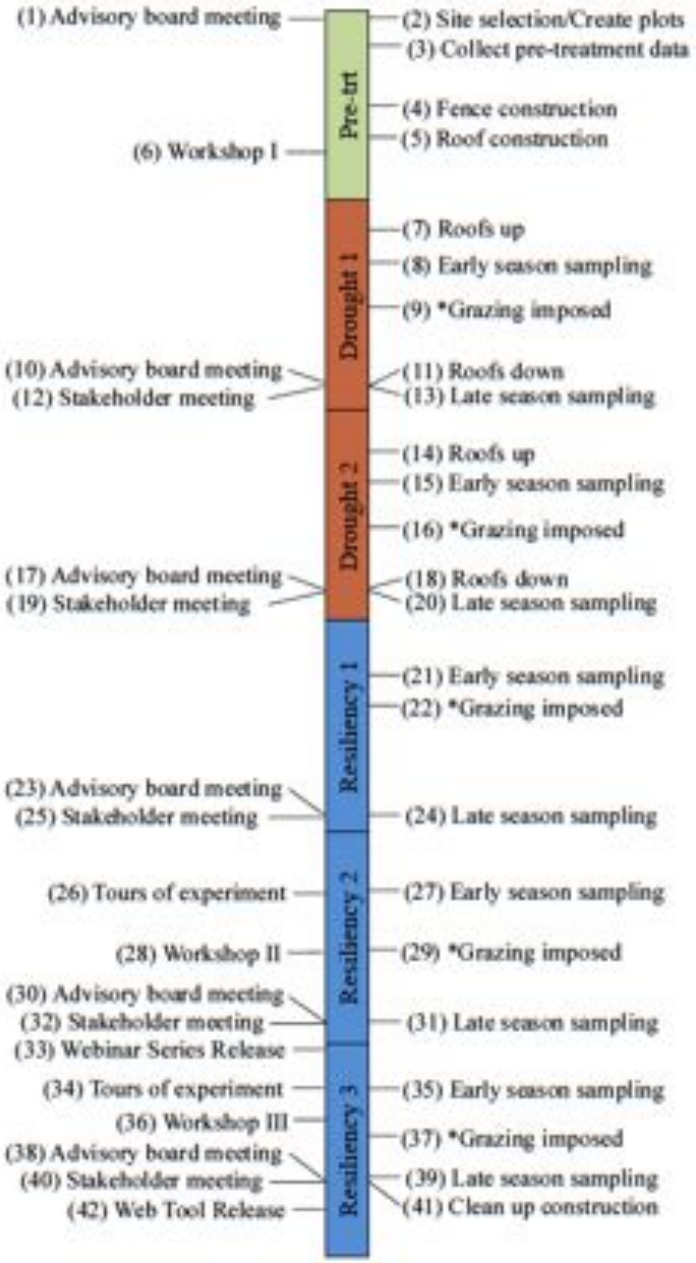
- Management response to drought assessment
  - Rancher grazing strategies
  - Drought management tools and strategies
  - Livestock and plant production
  - Multi-year drought preparedness
  - Field days and meetings

https://montana.qualtrics.com/jfe/form/SV_cTPCYuNvgyg8FNP

Key Activities

- Stakeholder implementation of research findings
  - Develop new and update existing grazing strategies during drought
  - Meetings
  - Web-based tool development

Timeline


(1) Advisory board meeting
(2) Site selection/Create plots
(3) Collect pre-treatment data
Pre-trt
(4) Fence construction
(5) Roof construction
(6) Workshop I
Drought 1
(7) Roofs up
(8) Early season sampling
(9) *Grazing imposed
(10) Advisory board meeting
(12) Stakeholder meeting
(11) Roofs down
(13) Late season sampling
Drought 2
(14) Roofs up
(15) Early season sampling
(16) *Grazing imposed
(17) Advisory board meeting
(19) Stakeholder meeting
(18) Roofs down
(20) Late season sampling
Resiliency 1
(21) Early season sampling
(22) *Grazing imposed
(23) Advisory board meeting
(25) Stakeholder meeting
(24) Late season sampling
Resiliency 2
(26) Tours of experiment
(27) Early season sampling
(28) Workshop II
(29) *Grazing imposed
(30) Advisory board meeting
(32) Stakeholder meeting
(31) Late season sampling
(33) Webinar Series Release
Resiliency 3
(34) Tours of experiment
(35) Early season sampling
(36) Workshop III
(37) *Grazing imposed
(38) Advisory board meeting
(40) Stakeholder meeting
(39) Late season sampling
(42) Web Tool Release
(41) Clean up construction

Cooperating Partners

- Thunder Basin Grasslands Prairie Ecosystem Association
- Thunder Basin Grazing Association
- USDA-ARS Fort Keogh Customer Focus Group

Questions