

# Collaborative Adaptive Rangeland Management in Semiarid Ecosystems

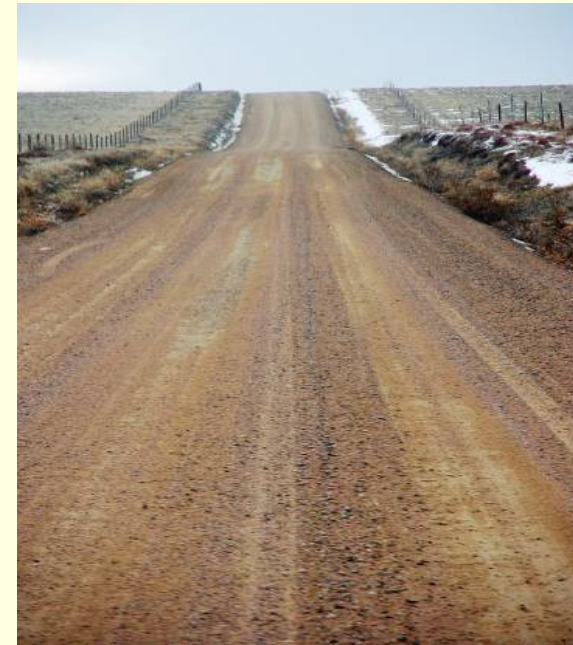


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# Road Map

- Rationale for collaborative adaptive rangeland management
- Dana Bowman – ranching perspective in semiarid ecosystem
- Novel participatory experiment with co-production of knowledge
  - Process
  - Early results



# Why is it Hard to Conduct Management Relevant Science?

- **Conducting replicated experiments at management-applicable scales**
- **Collecting large amounts of monitoring data**
- **Determining triggers for management actions**
- **Maintaining effective communication**





# Why Collaborative Adaptive Rangeland Management is Needed?

- **Explicit inclusion of human dimensions**
- **Economics**
  - Inputs, outputs, costs, time/labor, net present value
  - “value” of non-commodity products/services
- **On the ground, in the field meetings with managers and scientists**

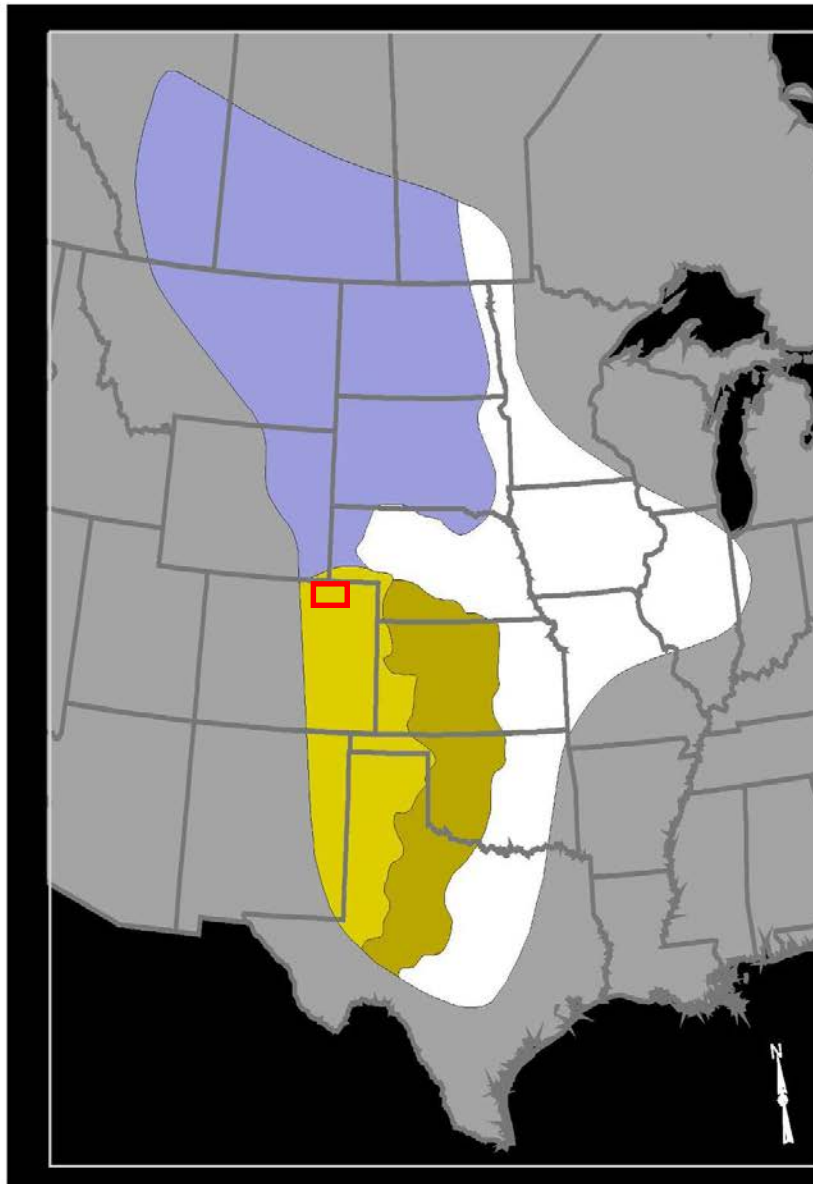


# Dana Bowman: Ranching Perspective in Semiarid Ecosystems

- **Background**
- **Education**
- **Experience**



# Where I Ranch

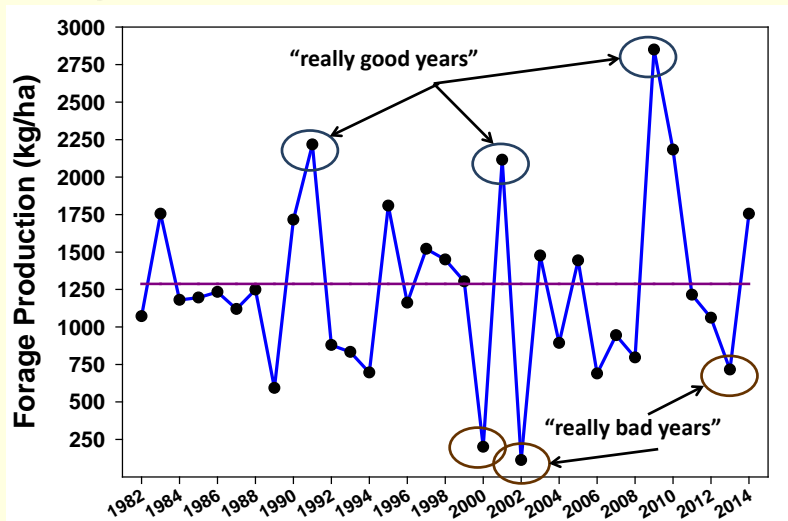


## CENTRAL GRASSLANDS REGION

- Northern Mixed
- Shortgrass Steppe
- Southern Mixed
- Tallgrass Prairie

# Ranching with Variability

- High variability in precipitation and forage production
- Difficult to consistently match animal demand and forage availability





# Ranching History in Region (eastern CO)



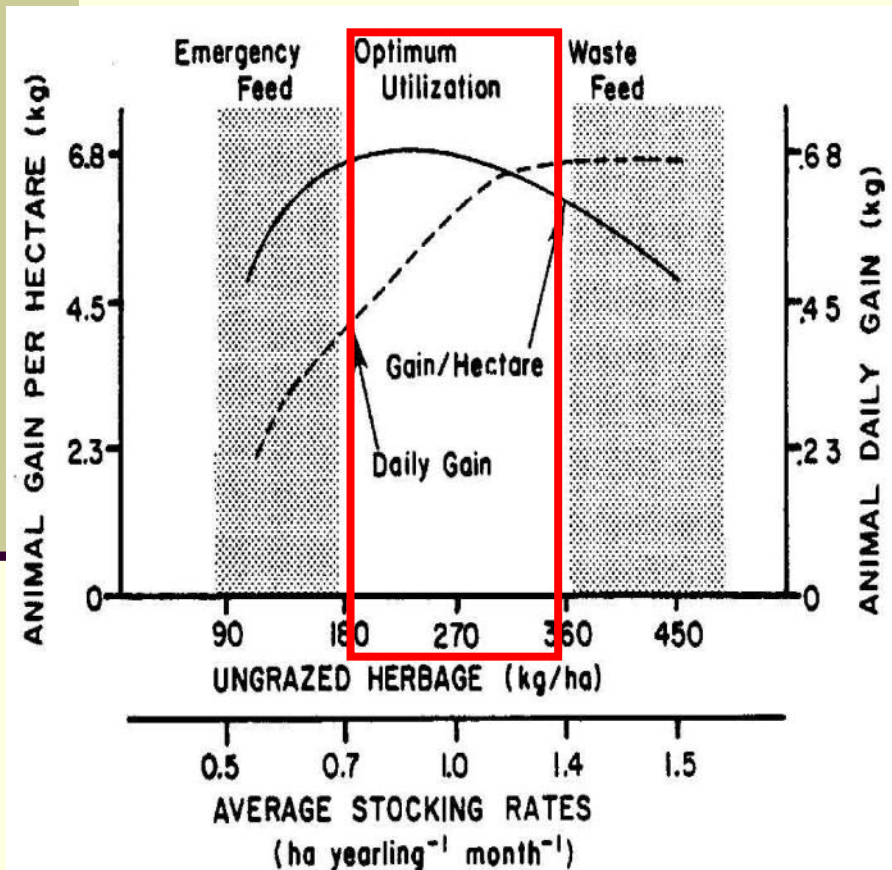


# Crow Valley Livestock Cooperative and USDA-ARS Research History: 78 years

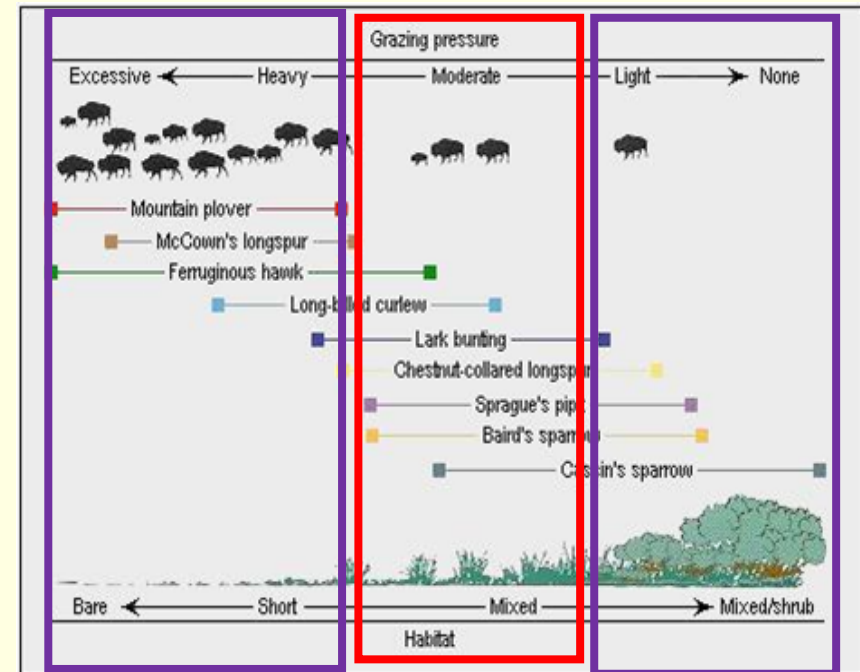


# Changes in late 1990s and 2000s

Management Paradigm → Conservation Concern



Bement 1969



Underrepresented habitats

Knopf 1996

# Production and Conservation Emphases

- Ecosystem goods and services
- Species of concern
- Heterogeneity
- Social-ecological systems



Photo credit-Mike Danzenbaker

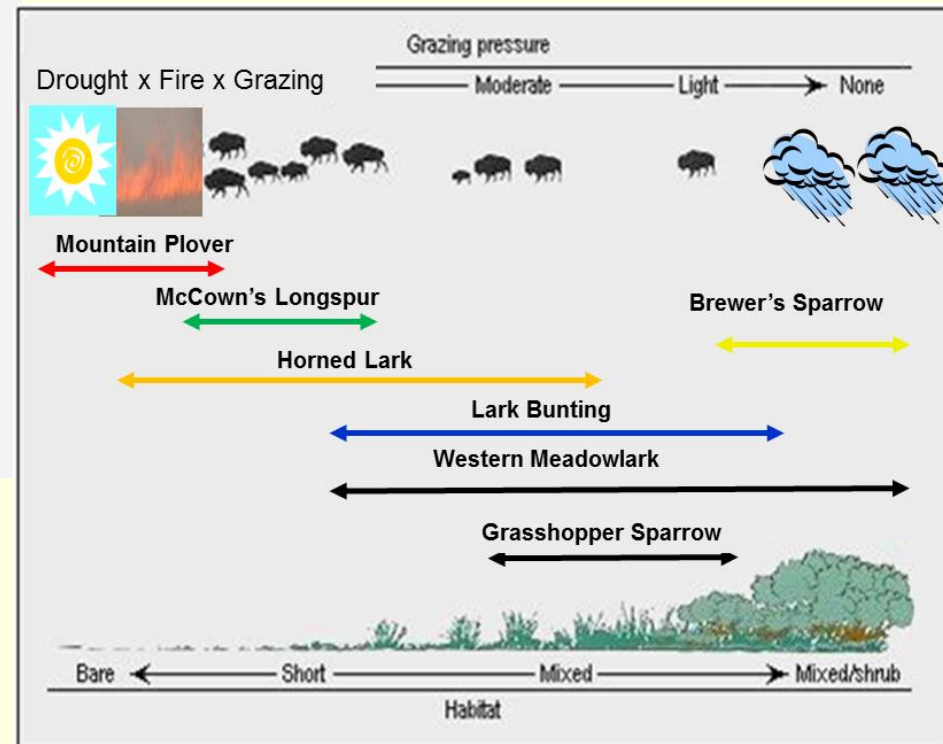




# Management Complexity



**How to manage for multiple objectives with diverse stakeholders?**



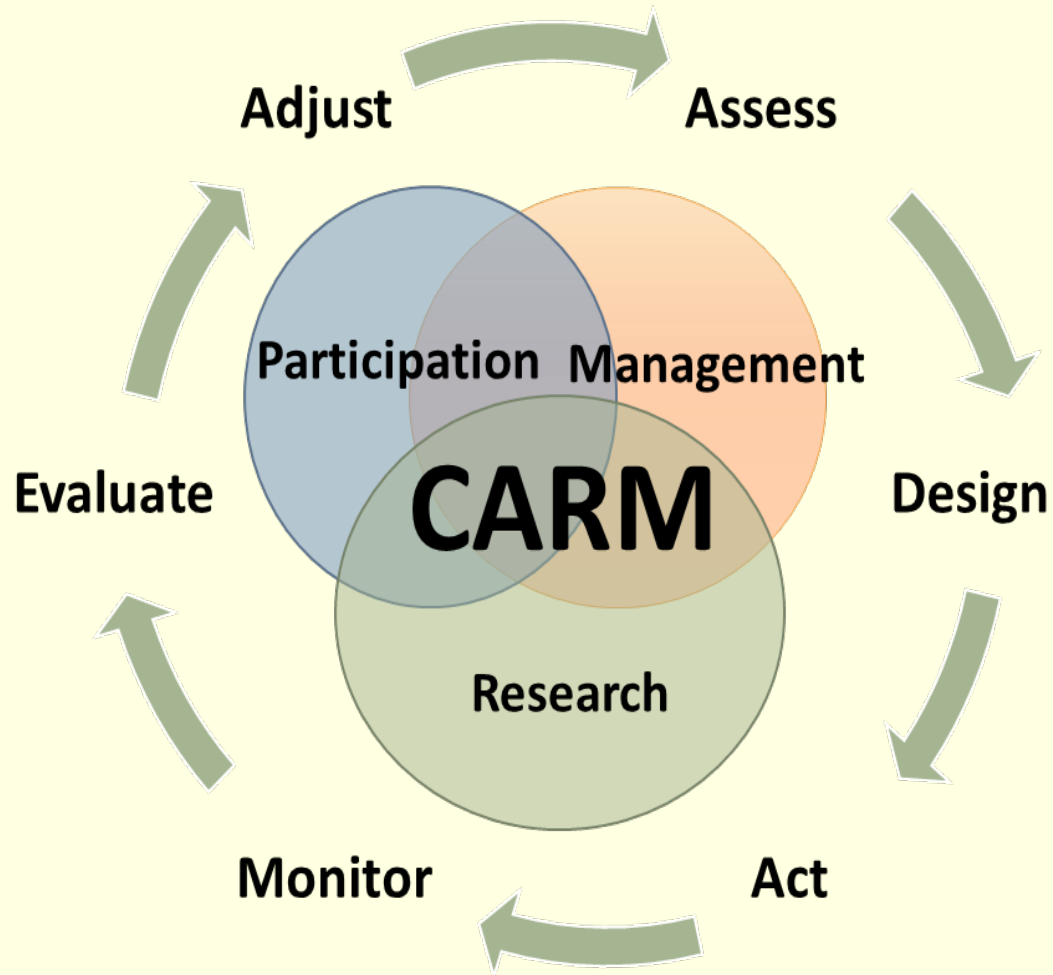
# Collaborative Adaptive Rangeland Management (CARM) for Beef & Birds in the Western Great Plains

- David Augustine & Justin Derner, USDA-ARS; Maria Fernandez-Gimenez & Hailey Wilmer, Colorado State University; David Briske, Texas A&M University



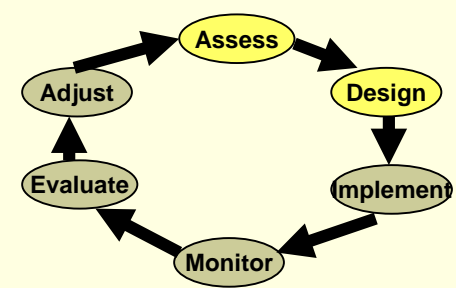
# Keep Calm and CARM On: Collaborative Adaptive Rangeland Management

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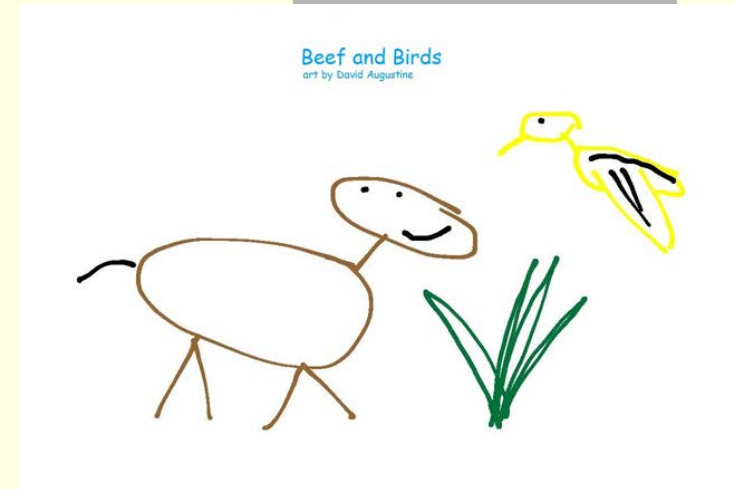




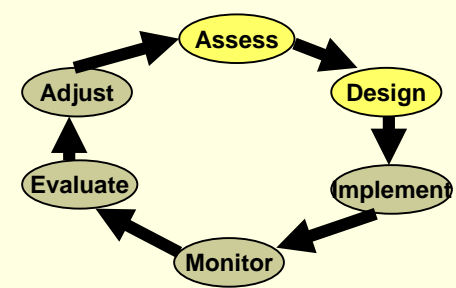
# CARM: The Project



- 10 years
- Co-production of knowledge, building trust, and complexity promotes learning
- Spatial and temporal movement flexibility of livestock
  - Within and across years for adaptation to weather variability



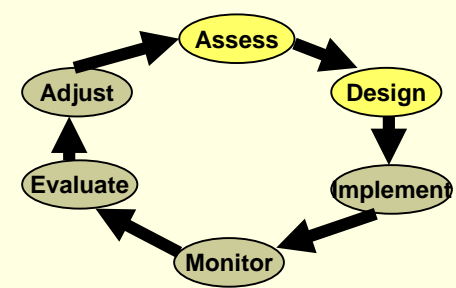
# CARM: The Participants



- **11 member stakeholder group**
  - **4 ranchers**
    - Crow Valley Livestock
  - **3 conservation groups**
    - The Nature Conservancy
    - Environmental Defense Fund
    - Bird Conservancy of the Rockies
  - **4 land management agencies**
    - NRCS, FS, CSU Extension, Colorado State Land Board



# CARM: The Process

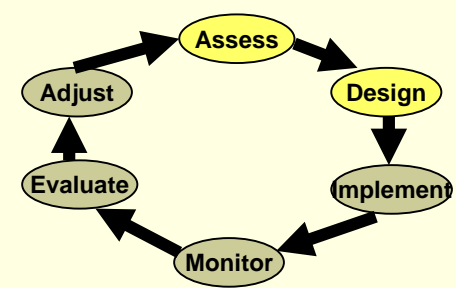


- 3-4 meetings each year
- Goals and objectives
- Decision-making
  - Trust
  - Timelines
  - Triggers for moving cattle
  - Grazing sequence
  - Monitoring
- Feedback loops





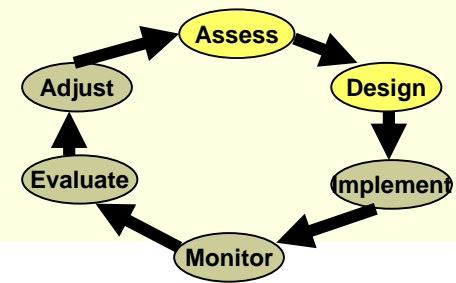
# CARM: Timelines



- **2008-2011**
  - Reflection and planning
- **2012 Drought**
  - 1<sup>st</sup> meeting: September
- **2013 Baseline year**
- **4-5 meetings each year**
  - January: “Data Fest”
  - April: Solidify plans
  - June: Pasture visits
  - October: Reflect/suggest



# CARM: Goals and Objectives



Manage land in order to pass it on to future generations

- Economically
- Ecologically

**GOALS**

Vegetation

Profitable Ranching Operations

Wildlife

**OBJECTIVES**

- A:** Increase percentage of cool season grasses and non-shortgrass native plants, by weight and number of plants
- B:** Increase variation in vegetation structure, composition, and density within and among pastures\*
- C:** Maintain or increase size of fourwing saltbush and winterfat shrubs

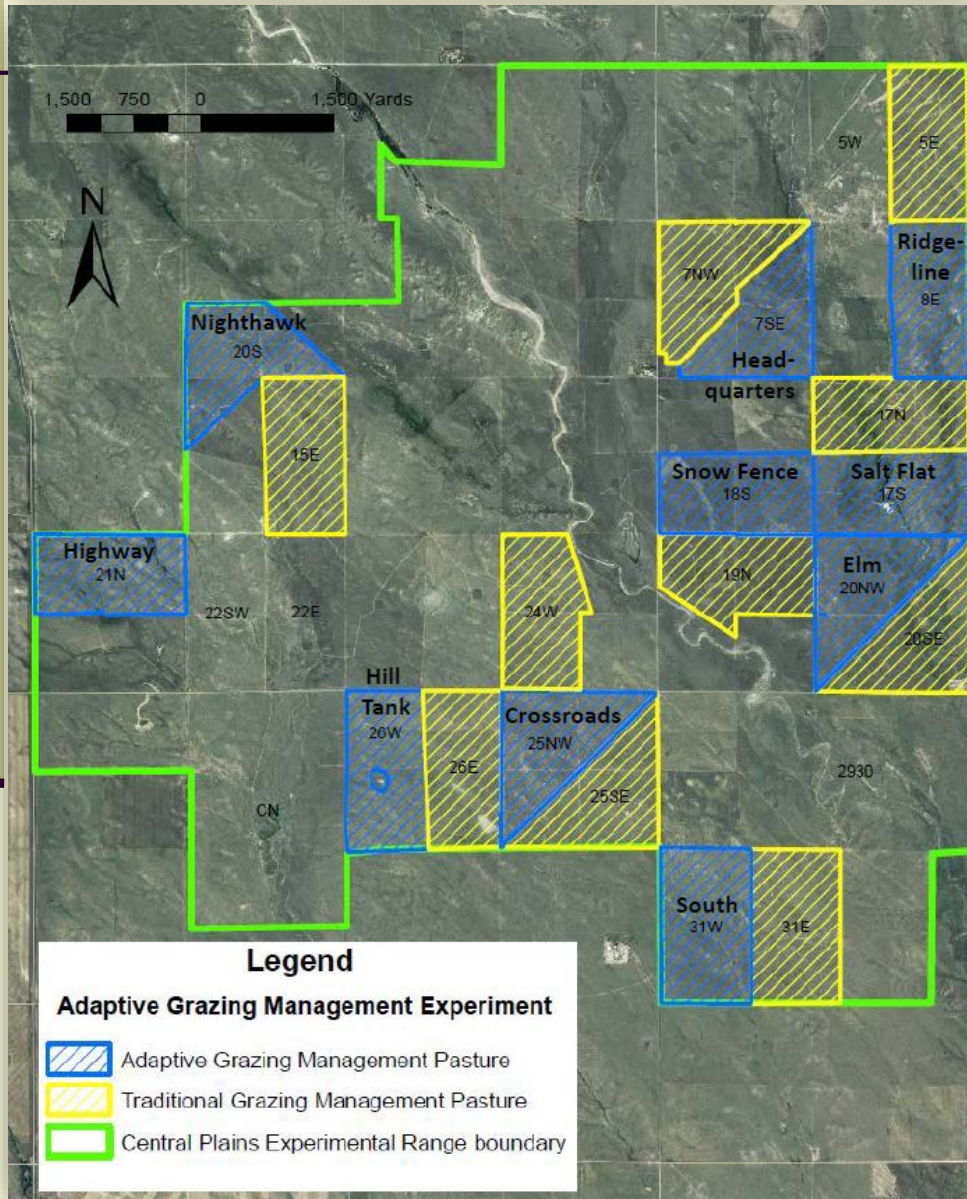
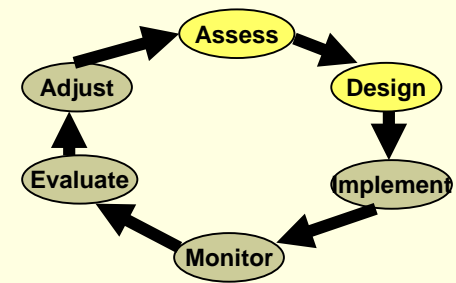
- A:** Maintain or increase livestock weight gain
- B:** Reduce economic impact of drought
- C:** Maintain or reduce operating costs

- A:** Increase populations of mountain plover\*\*
- B:** Maintain populations of McCowns longspur, Western meadowlark, and horned lark
- C:** Increase populations of grasshopper sparrow, Cassin's sparrow, Brewers sparrow, and lark bunting
- D:** Maintain control of prairie dog populations (no prairie dogs)

Note: All vegetation objectives are relative to ecological site potential



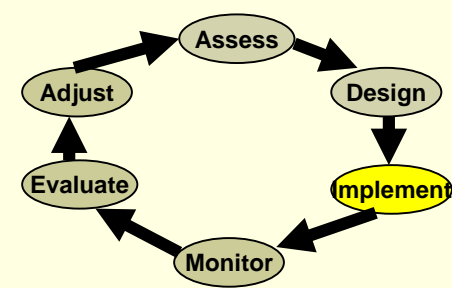
# CARM: Experimental Design



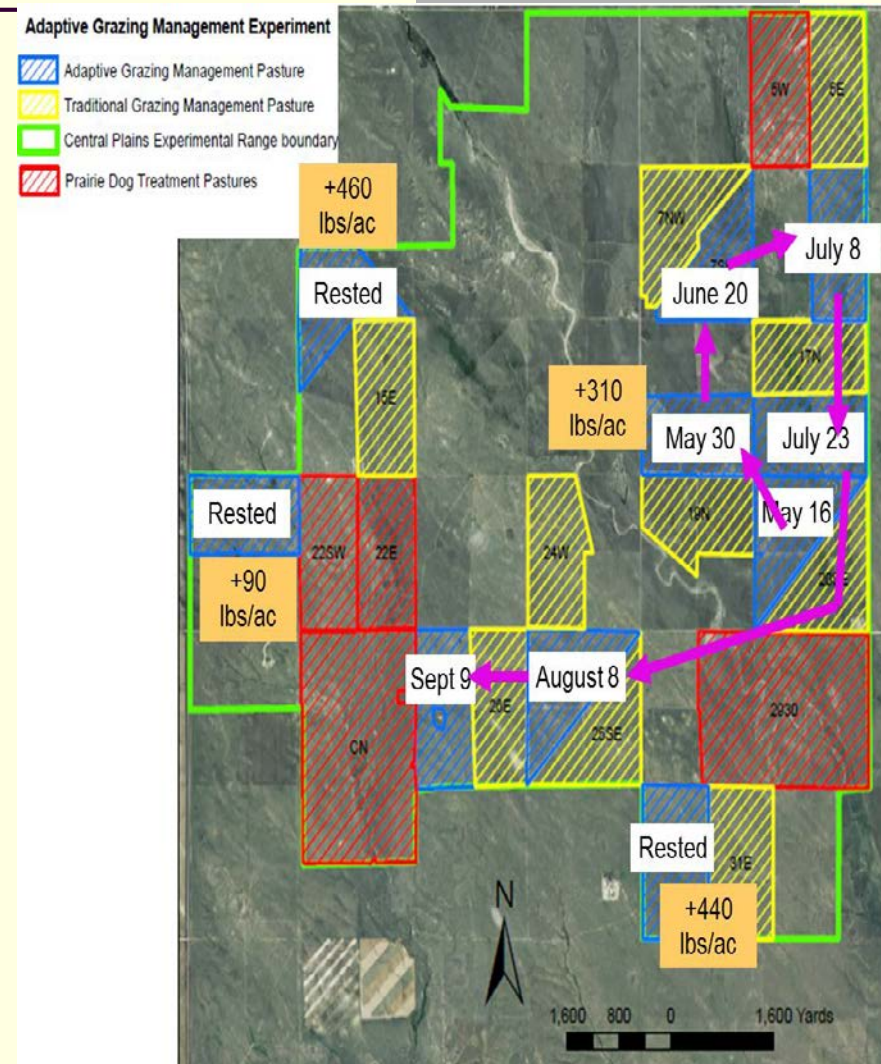
- 1) Single large herd rotated among 10 pastures**
  - High stock density (1.8 steers/ha)
  - Moderate stocking rate (0.18 steers/ha/4.5 months)
- 2) Ten small herds grazing season-long in each of 10 pastures**
  - Moderate stock density (0.18 steers/ha)
  - Moderate stocking rate (0.18 steers/ha/4.5 months)



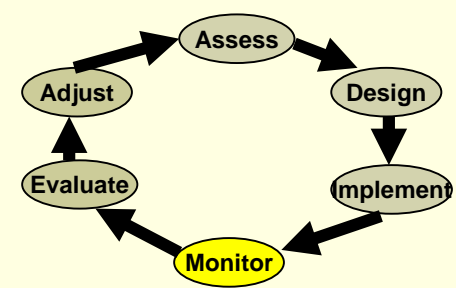
# CARM: Pastures and Cattle



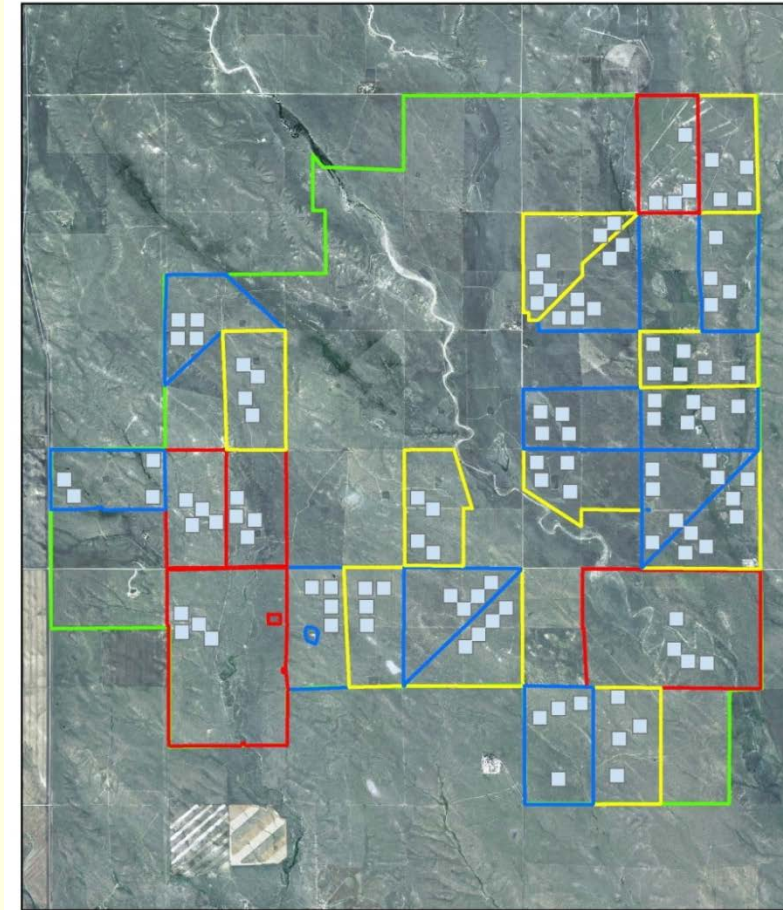
- **10 pairs of 320 acre pastures**
  - Paired based on topography and ecological sites
- **Traditional grazing**
  - 22-26 yearling steers per pasture
- **CARM grazing**
  - 234 steers in one herd



# CARM: Monitoring



- **Birds**
  - Observation points
  - Nest success
- **Vegetation**
  - cover, density
  - Visual obstruction
  - Peak biomass, residue
- **Cattle**
  - Weight gains, fecal quality
  - GPS collars, pedometers



## Legend

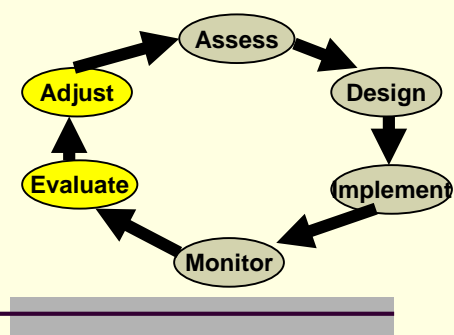
- Point Count Locations
- ▭ Prairie Dog Colony Boundaries
- ▭ CPER Boundary

## Pasture Treatment

- ▭ AGM
- ▭ PrDog
- ▭ TGM



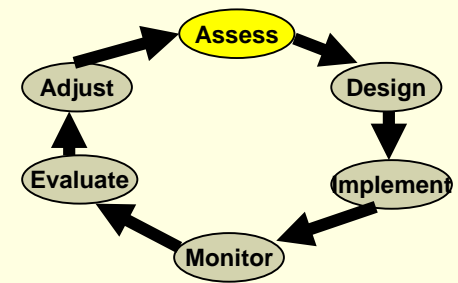
# Adaptive Management Decisions Following 2014 Grazing Season



- **Stocking Rate**
  - Increase of conservative 5% for 2015
- **Patch burns (Nov 2014)**
  - Burn  $\frac{1}{4}$  (or 80 acres) in two different pairs of pastures
    - To increase forage quality
    - Reduce cactus abundance
    - Increase Mountain Plover habitat
    - Alter livestock foraging distribution
- **Rely on vegetation threshold and animal behavior for triggers to move cattle**



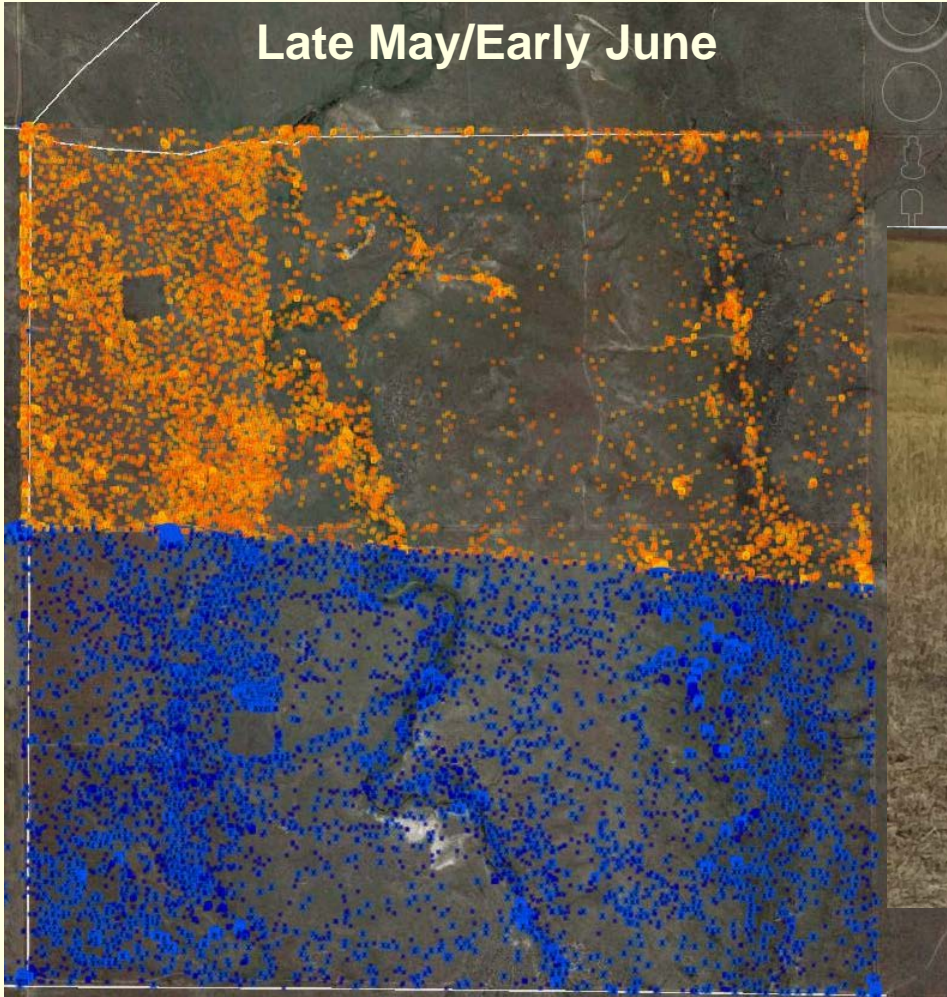
# CARM: Patch Burn Effects on Cattle Distribution in Spring 2015



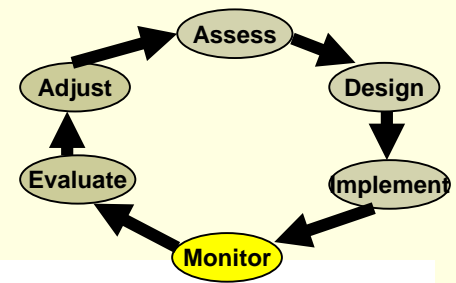
Late May/Early June

TGM

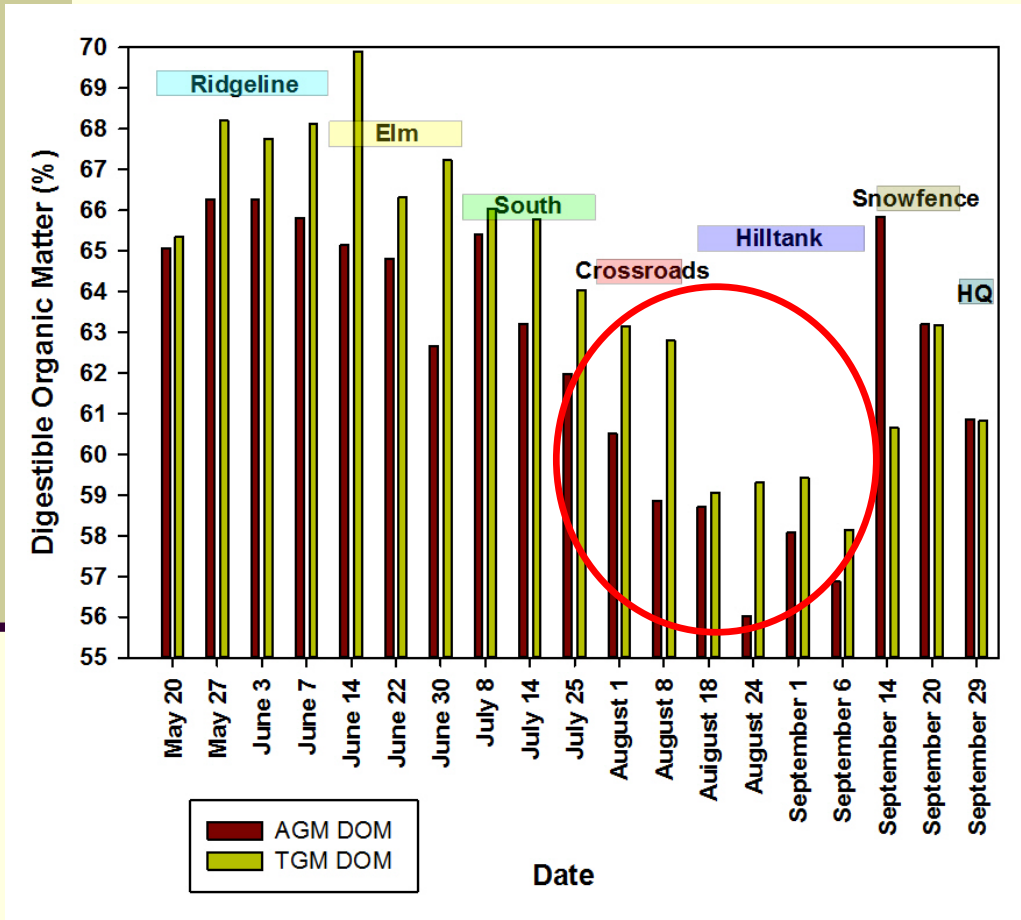
CARM



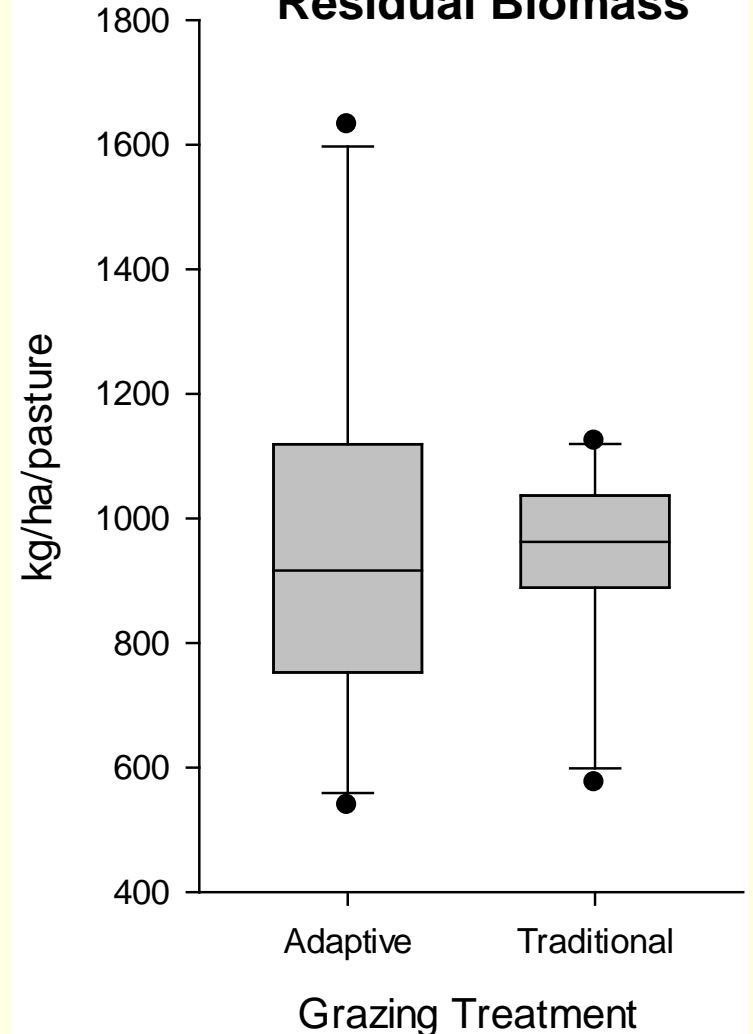
# CARM: Monitoring Data 2015



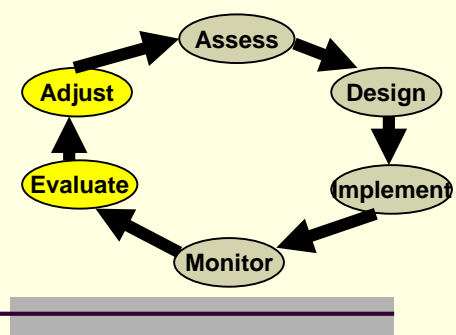
## Digestible Organic Matter



## Residual Biomass



# Adaptive Management Decisions Following 2015 Grazing Season

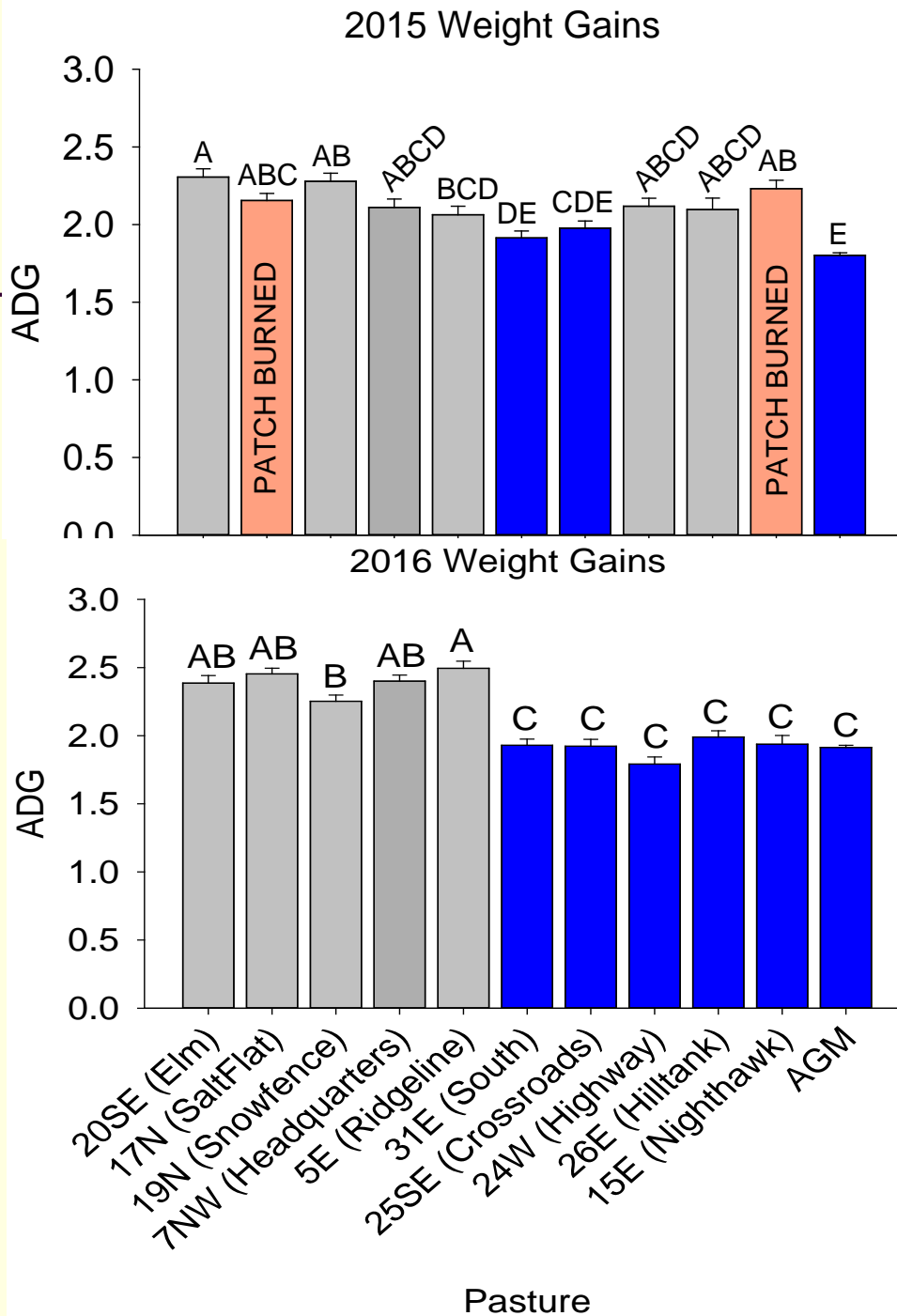


- **Stocking rate**
  - Increase of conservative 5% for 2016
- **No patch burns**
  - Disagreement expressed on utility among Stakeholder Group
- **Stocking density questions raised**
- **Vegetation thresholds increased**  
(contingency for higher thresholds if dry),  
maximum days in pasture added and  
animal behavior for triggers to move  
cattle

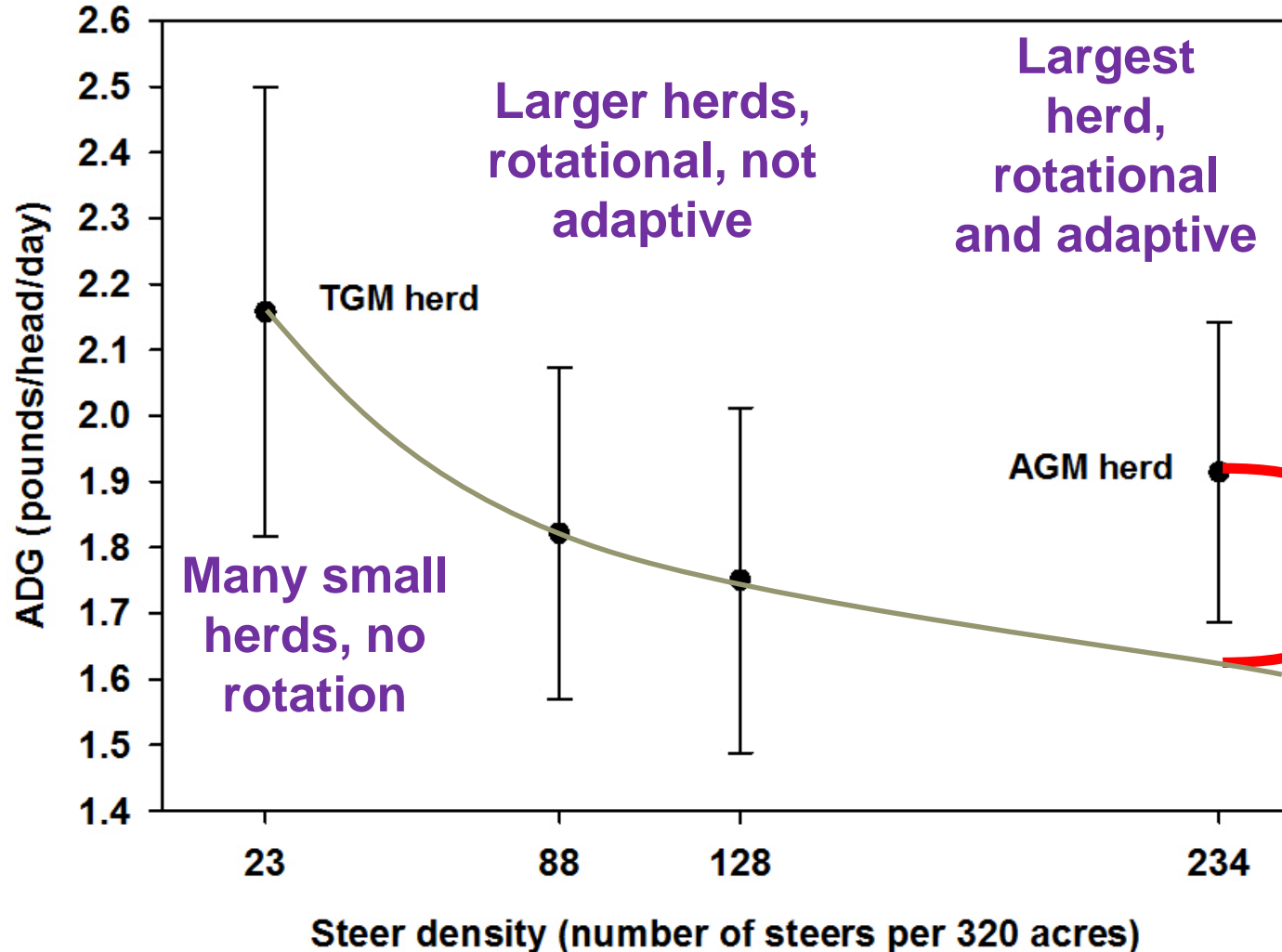
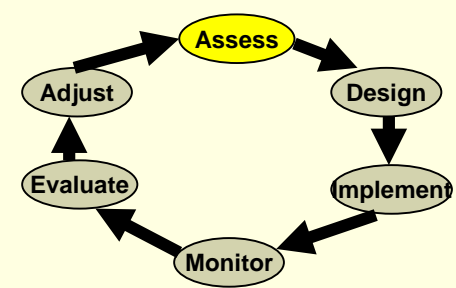


# CARM: Cattle Gains

- **Gain per head**
  - 11-16% less with CARM
  - Gap narrowing with time
- **Gain per unit land area grazed**
  - Much higher in CARM due to rested pastures
  - What is “value” of rested pasture?

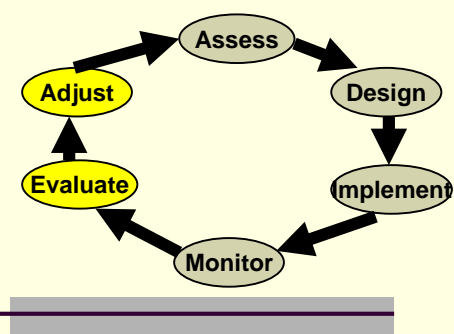


# Adaptive Management Contribution to Livestock Weight Gains



Weight gains  
(approx. 0.25  
pounds/head/day)  
attributed to  
“adaptive  
management”

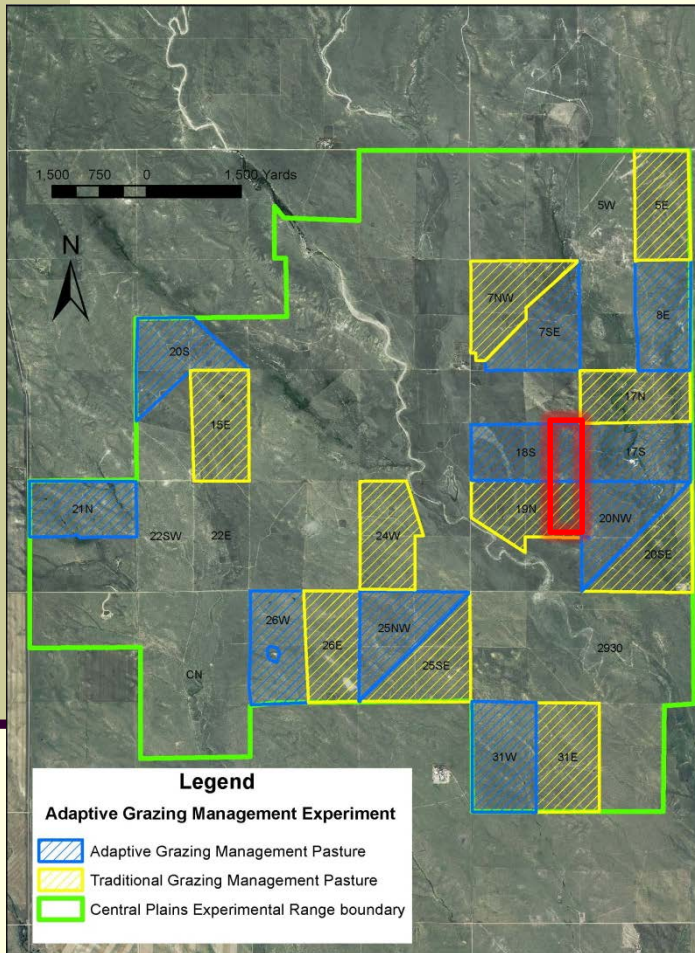
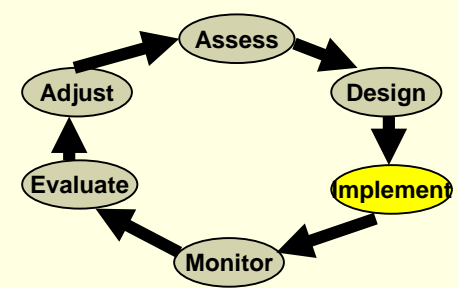
# Adaptive Management Decisions Following 2016 Grazing Season



- **Stocking rate**
  - Keeping stocking rate same
- **Patch burns (Nov 2016)**
  - **Burn  $\frac{1}{4}$  (or 80 acres) in two pairs of pastures**
    - Fall burn for 1st pair, Spring burn for 2<sup>nd</sup> pair if above average soil moisture March 1
    - Increase forage quality
    - Reduce cactus abundance
    - Increase Mountain Plover habitat
- **Vegetation thresholds, maximum days and animal behavior for triggers**



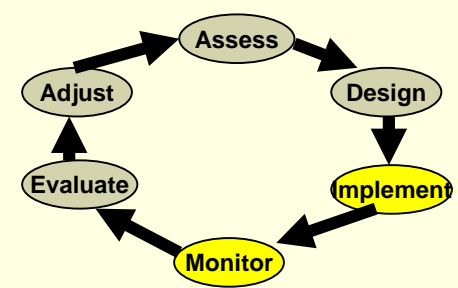
# CARM: Cactus Control with Patch Burn



- Fall Burn 2016
- 80 acres per pasture
- Temperature Max 350<sup>o</sup> - 450<sup>o</sup>C

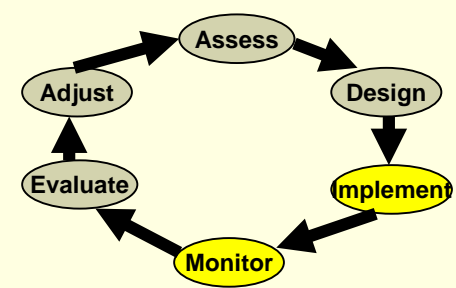


# CARM: Cactus Control with Patch Burn - Direct Mortality



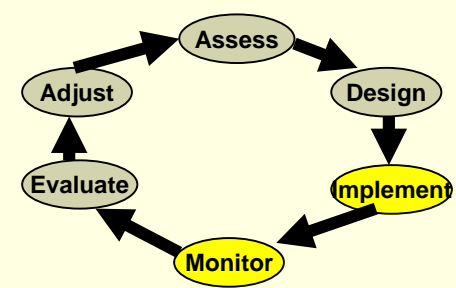


# CARM: Cactus Control with Patch Burn - Indirect Mortality



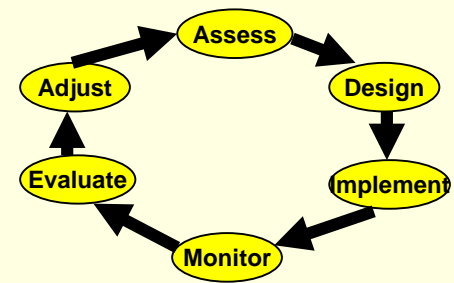


# CARM: Cactus Control with Patch Burn - Indirect Mortality



# Summary

[www.ars.usda.gov/rrsr/agm](http://www.ars.usda.gov/rrsr/agm)



- **Novel, participatory process needs facilitation**
- **Effective communication and field/pasture visits are essential**
- **Opportunistic flexibility and adaptation with weather**
- **Social-ecological-economic framework**



ARS and adaptive grazing management



## Adaptive Grazing Management - USDA ARS

<https://www.ars.usda.gov/Research/docs.htm?docid=25733> ▼

Feb 10, 2017 - To this end, **ARS** scientists and university collaborators have developed an **adaptive grazing management** experiment being implemented at ...



# Questions?

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