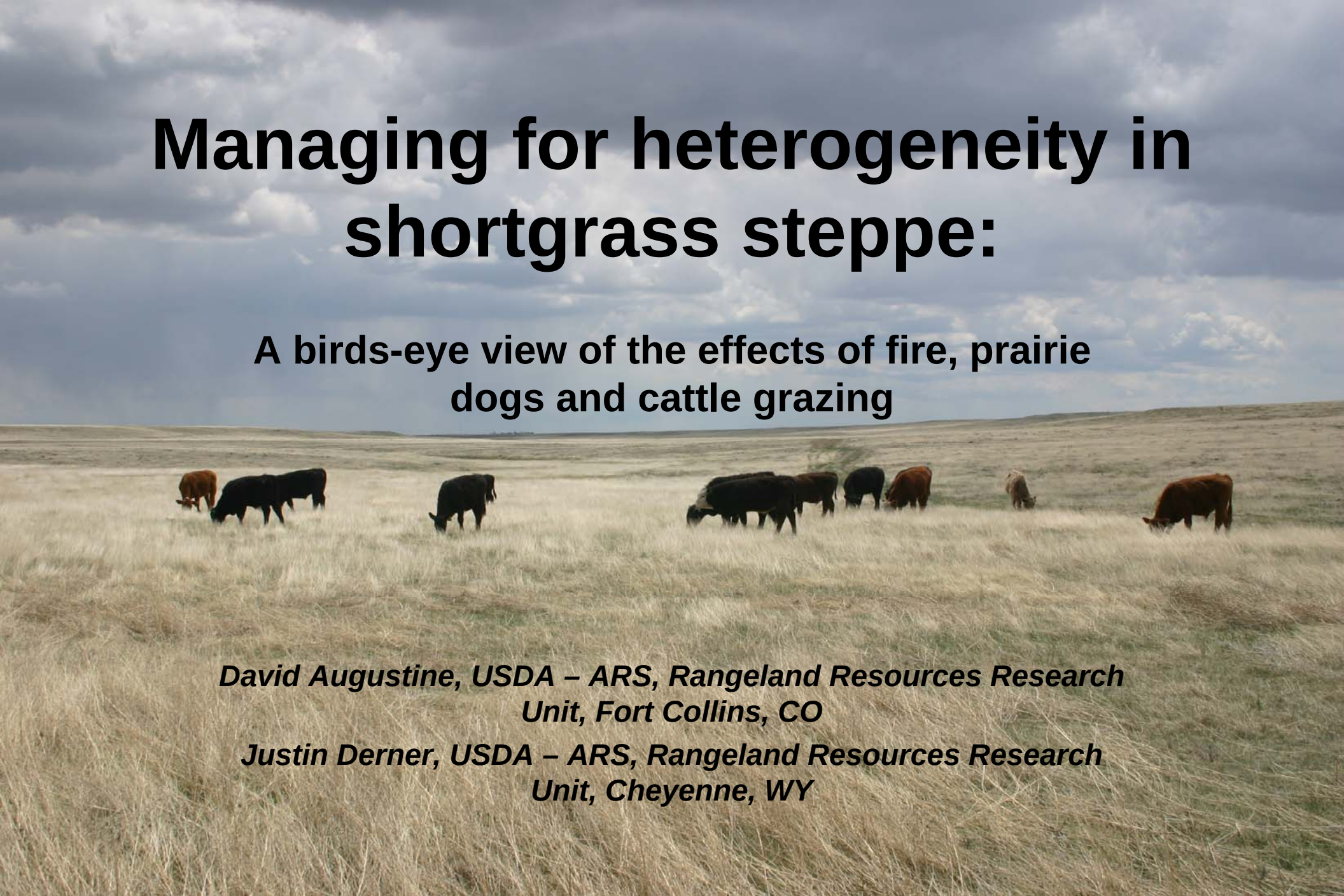
Managing for heterogeneity in shortgrass steppe:

A birds-eye view of the effects of fire, prairie dogs and cattle grazing



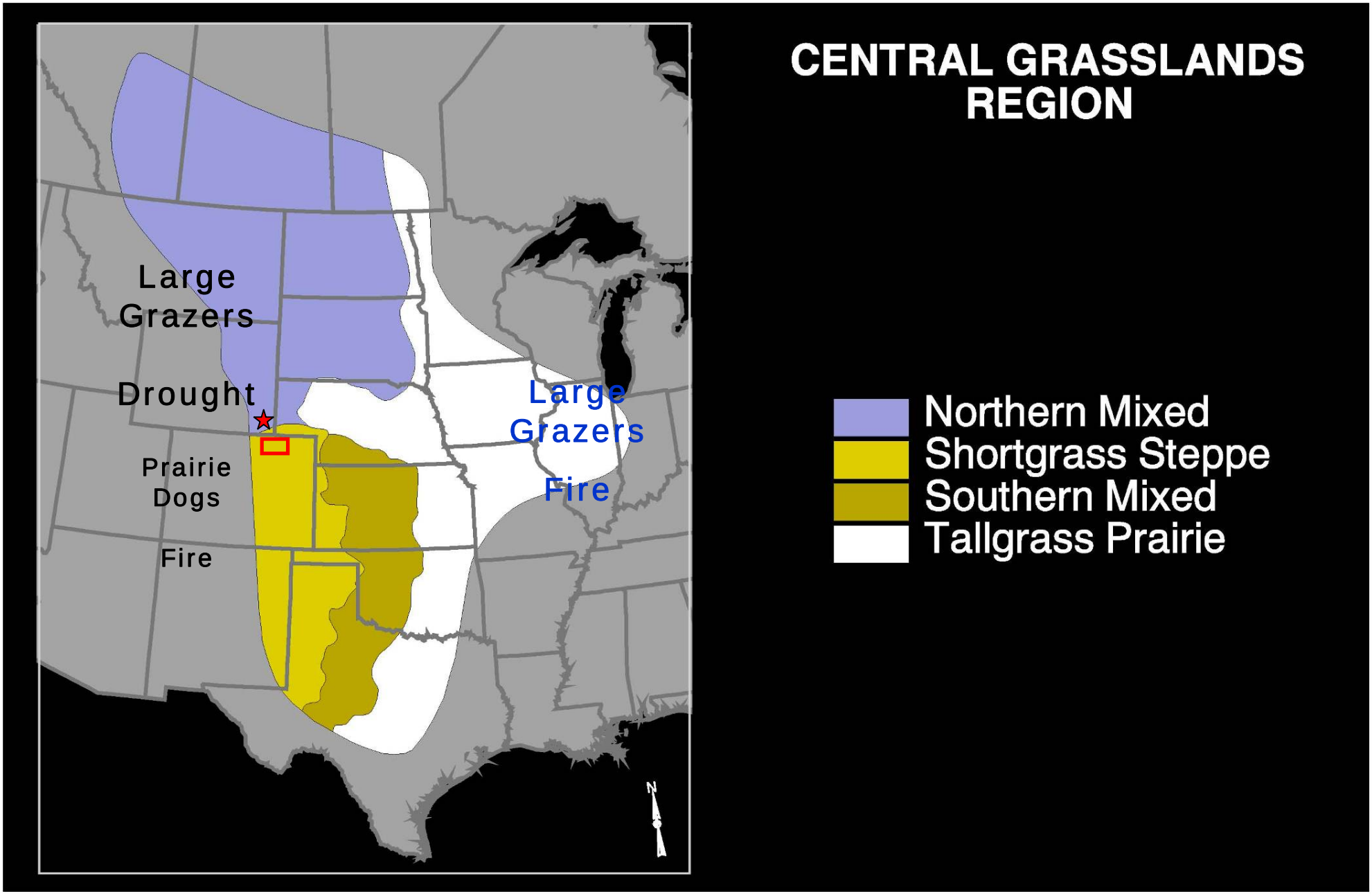
David Augustine, USDA – ARS, Rangeland Resources Research Unit, Fort Collins, CO

Justin Derner, USDA – ARS, Rangeland Resources Research Unit, Cheyenne, WY

Outline

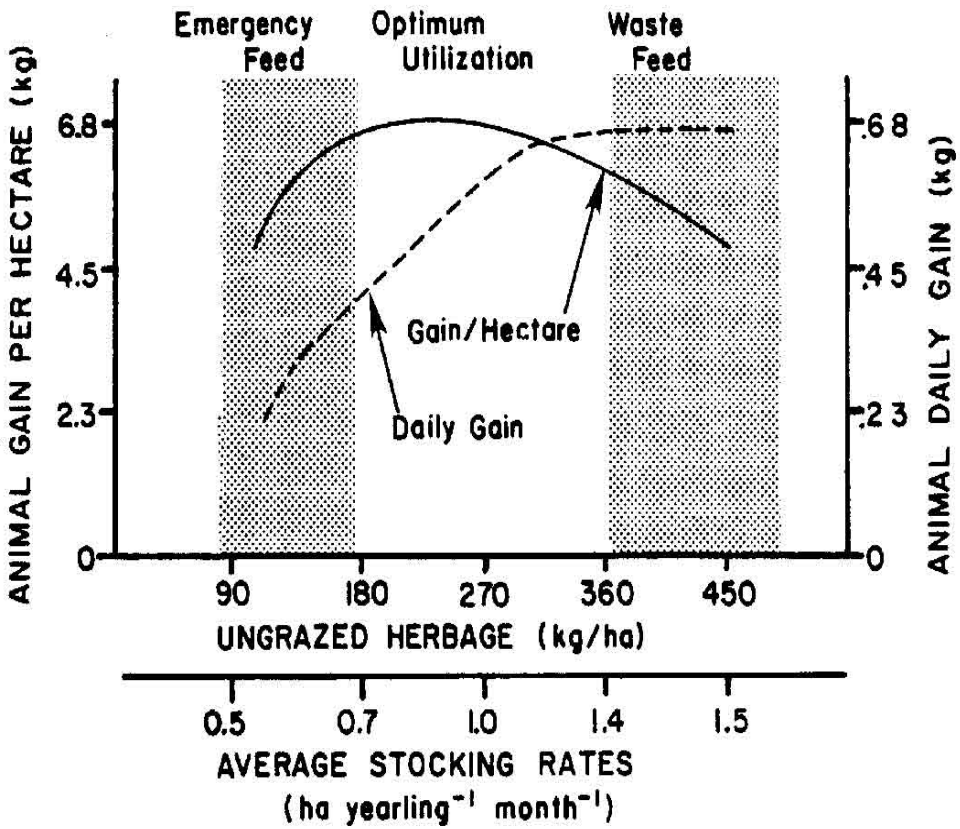
- **Disturbance Ecology & Bird Conservation in the Shortgrass Steppe (SGS)**
  - Role of livestock grazing, prairie dogs, & fire in SGS
  - Mountain Plover breeding habitat in SGS

- **Comparison of livestock grazing, fire, and prairie dog effects on:**
  - Vegetation cover/structure
  - Mountain Plovers

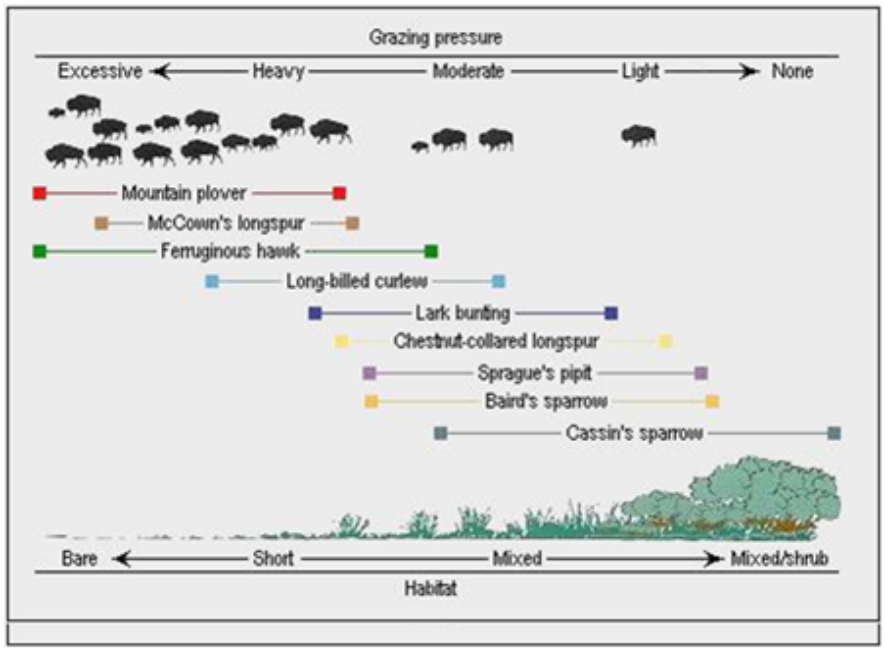

CENTRAL GRASSLANDS REGION
Large Grazers
Drought
Prairie Dogs
Fire
Large Grazers
Fire
Northern Mixed
Shortgrass Steppe
Southern Mixed
Tallgrass Prairie
N

20th Century

Management Paradigm → Conservation Concern



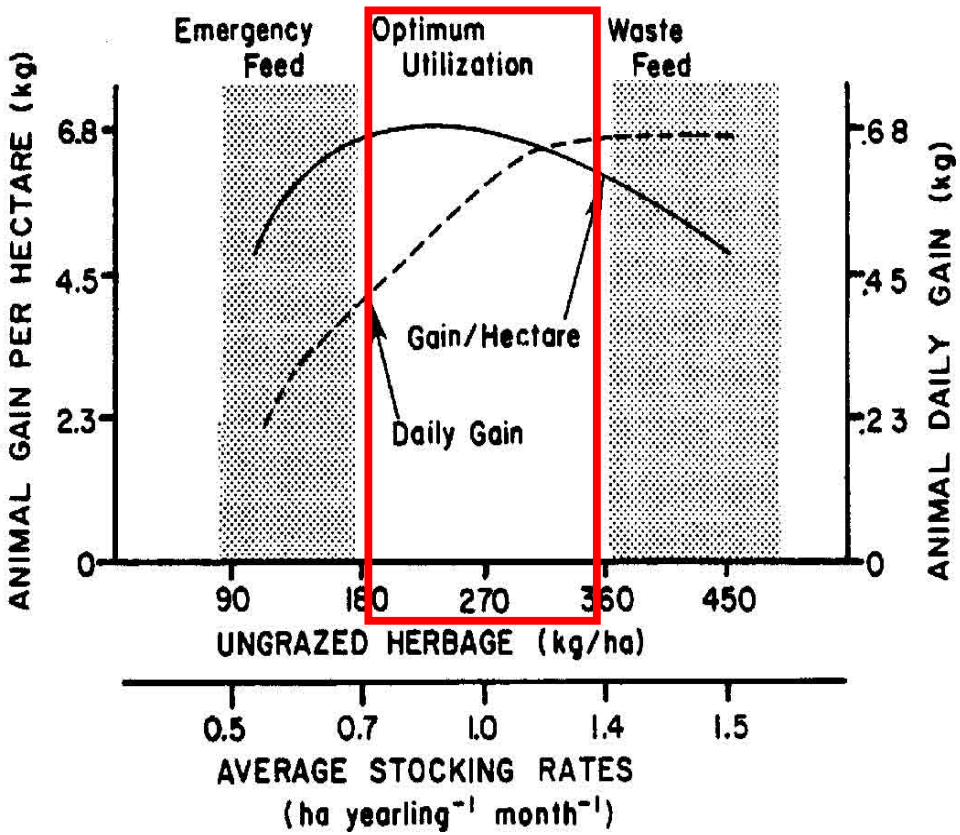
Bement 1969



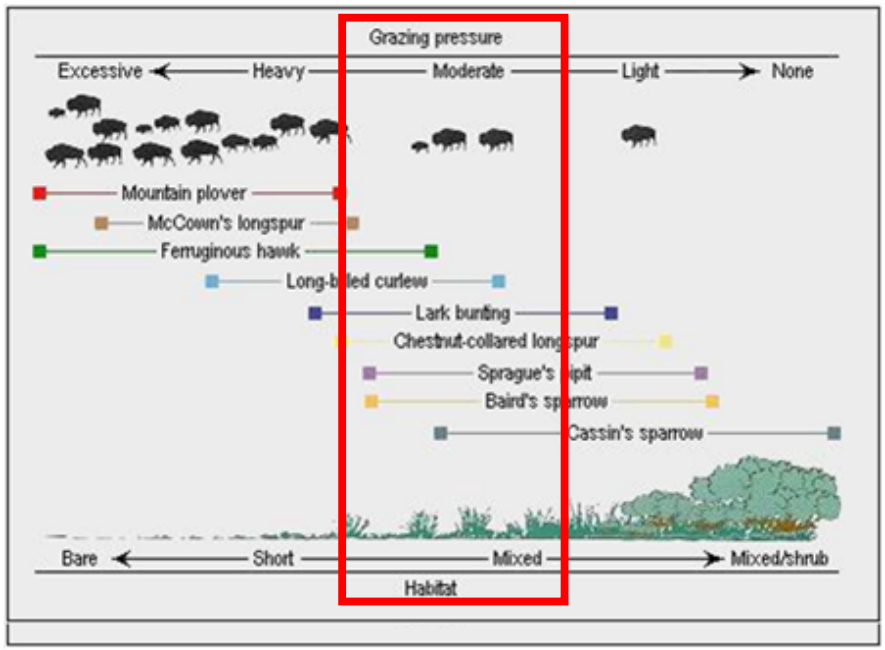
Knopf 1996

20th Century

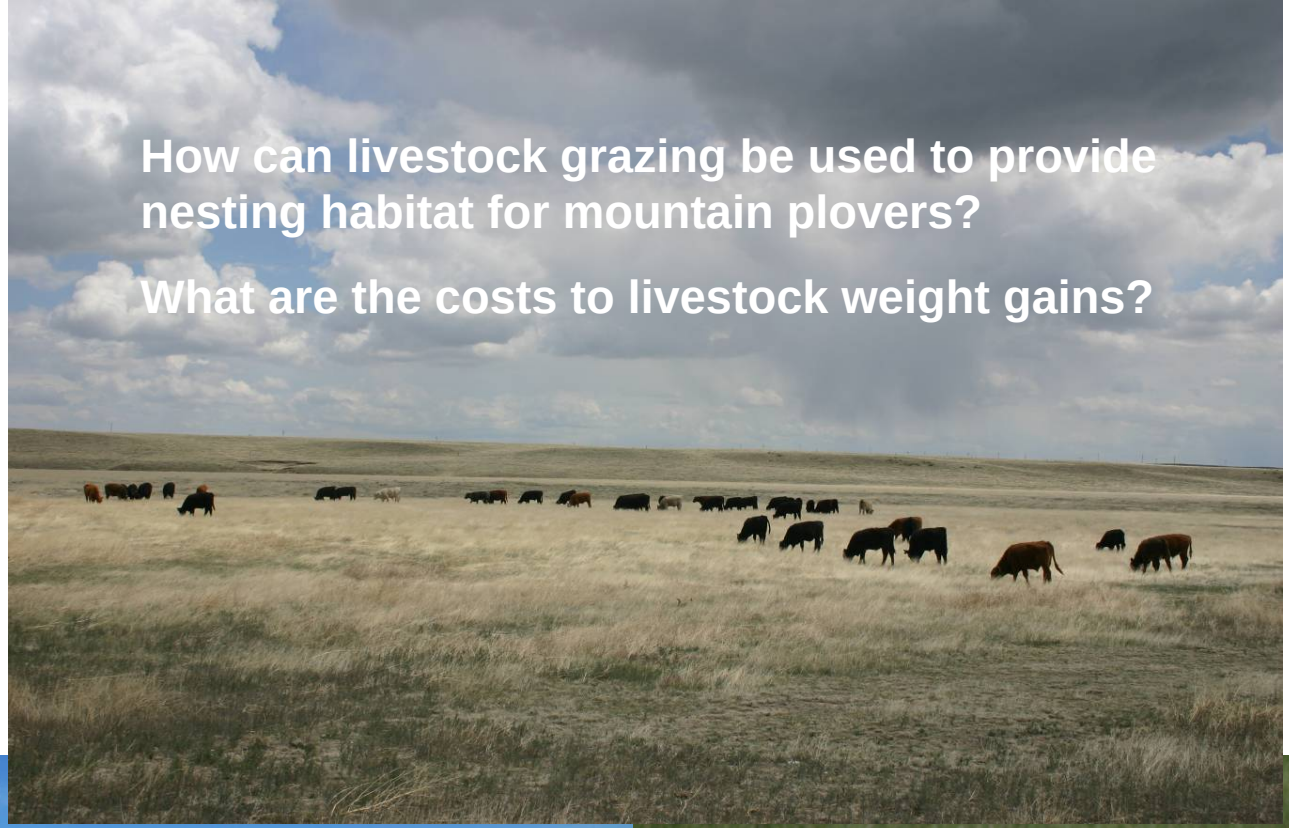
Management Paradigm → Conservation Concern



Bement 1969

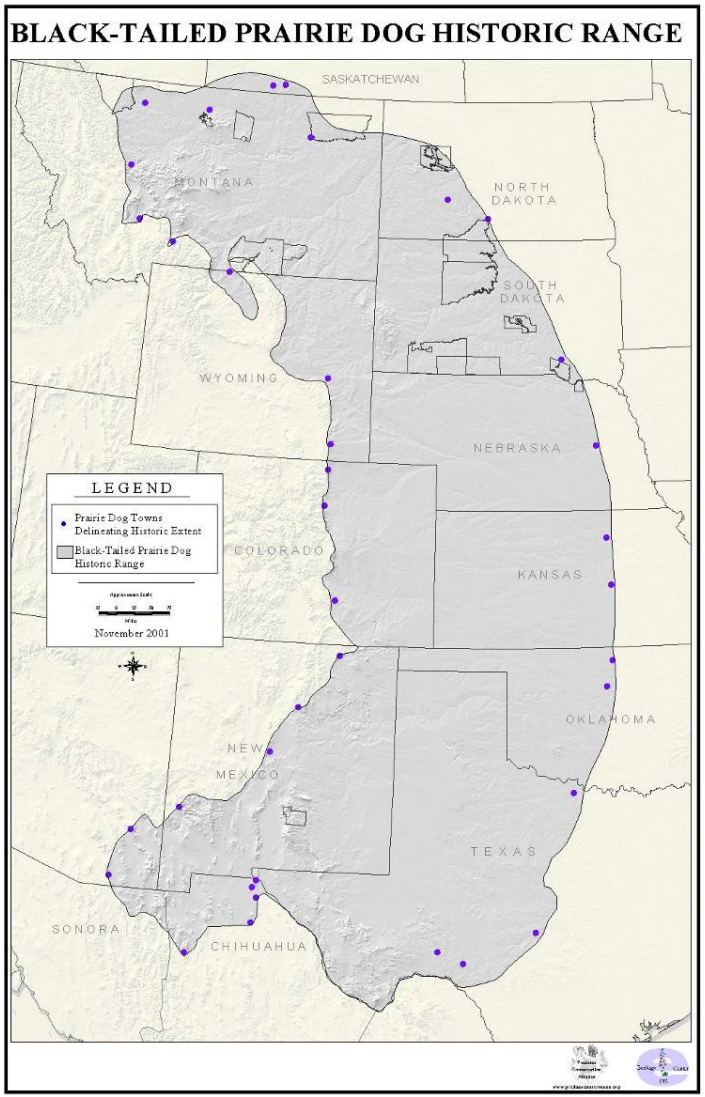


Knopf 1996


How can livestock grazing be used to provide nesting habitat for mountain plovers?
What are the costs to livestock weight gains?

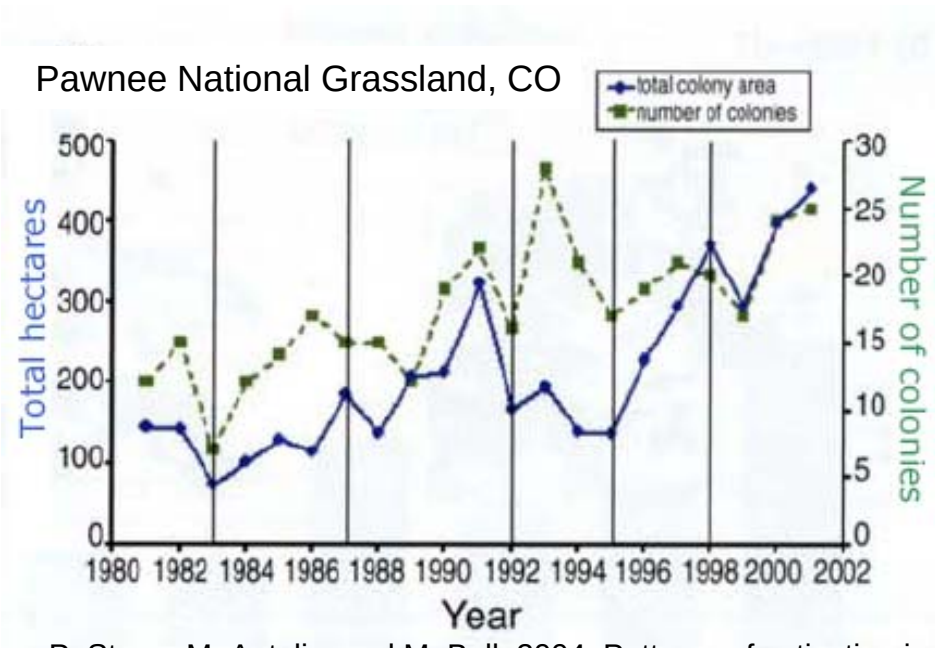

Can prescribed burning and prairie dogs be used in combination with livestock grazing to provide nesting habitat for mountain plovers? What are the costs?

Prairie Dogs



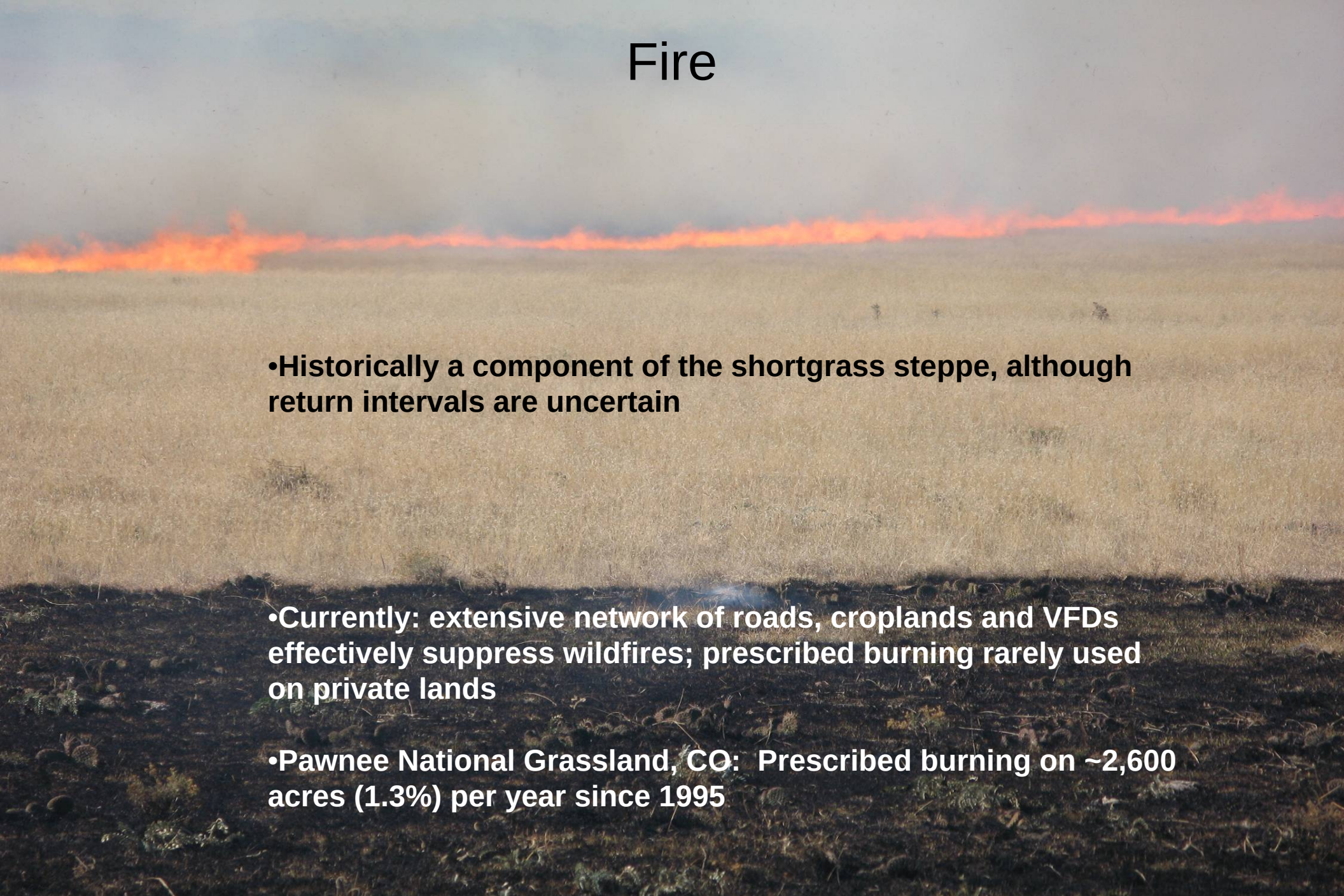
- Estimated to historically occupy 2 – 15% of shortgrass and mixed-grass landscapes
- Can impart more intense and chronic (year-round) herbivory regime than ungulates
- Non-ruminants, significant soil movement

Pawnee National Grassland, CO



P. Stapp, M. Antolin, and M. Ball. 2004. Patterns of extinction in prairie dog metapopulations. *Front Ecol Environ* 2:235-240

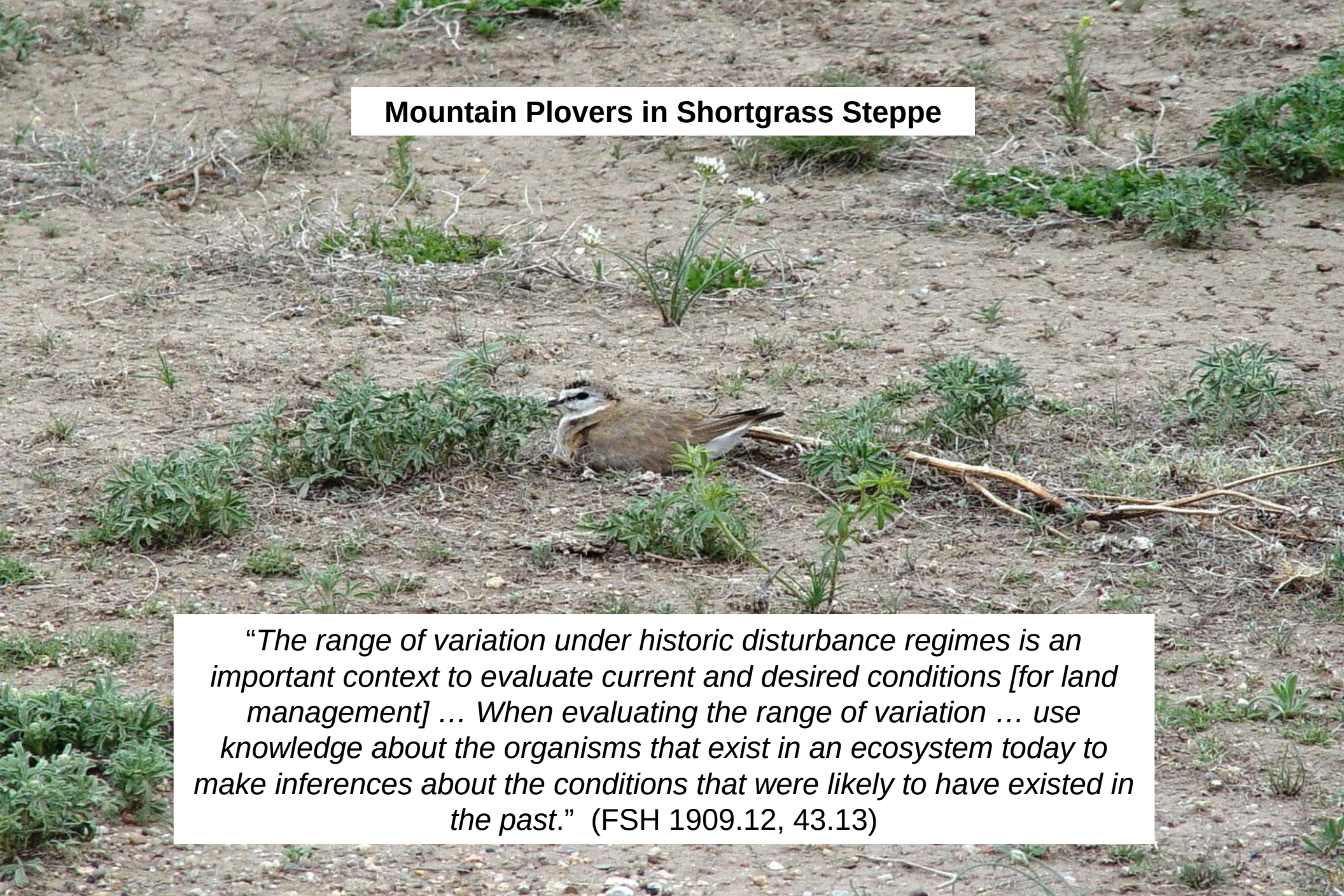
Fire



- **Historically a component of the shortgrass steppe, although return intervals are uncertain**

- **Currently: extensive network of roads, croplands and VFDs effectively suppress wildfires; prescribed burning rarely used on private lands**

- **Pawnee National Grassland, CO: Prescribed burning on ~2,600 acres (1.3%) per year since 1995**



Mountain Plovers in Shortgrass Steppe

"*The range of variation under historic disturbance regimes is an important context to evaluate current and desired conditions [for land management] … When evaluating the range of variation … use knowledge about the organisms that exist in an ecosystem today to make inferences about the conditions that were likely to have existed in the past*." (FSH 1909.12, 43.13)


Mountain Plovers in Shortgrass Steppe

Mountain Plovers in Shortgrass Steppe

Studies on Pawnee National Grassland, CO, 1970s – 1990s:

- Graul (1975): 92% of nests in "blue grama – buffalo grass patches", mean vegetation height < 8 cm, slopes < 2°

- Knopf and Miller (1994): Examined importance of bare soil in plover nesting habitat "on the relatively prairie-dog-free Pawnee National Grassland of Colorado":

  - Nest sites had more bare ground (mean = 32%), more cow manure piles, and less cactus than random shortgrass sites

  - Noted that "30% bare ground is likely closer to a minimum habitat requirement than an optimal one in Mountain Plover ecology"

- >20,000 Mountain Plovers estimated in the vicinity of Pawnee National Grassland in early 1970s (Graul 1976), but rare in this area by late 1990s

Management strategies for Mountain Plover nesting habitat

- **Livestock Grazing Intensity:**
  - Moderate summer grazing (0.5 AUM ha^{-1})
  - Heavy summer grazing (0.8 – 1.1 AUM ha^{-1})
  - Heavy spring grazing + supplemental feed
- **Prescribed burning:**
  - Spring patch burns (Pawnee NG)
  - Fall patch burns (CPER)
- **Black-tailed Prairie Dog Colonies:**
  - On-off colony comparisons
  - Effects of plague-induced colony extirpations

Management strategies for Mountain Plover nesting habitat

- **Livestock Grazing Intensity:**
  - **Moderate summer grazing (0.5 AUM ha^{-1})** **3**
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- **Prescribed burning:**
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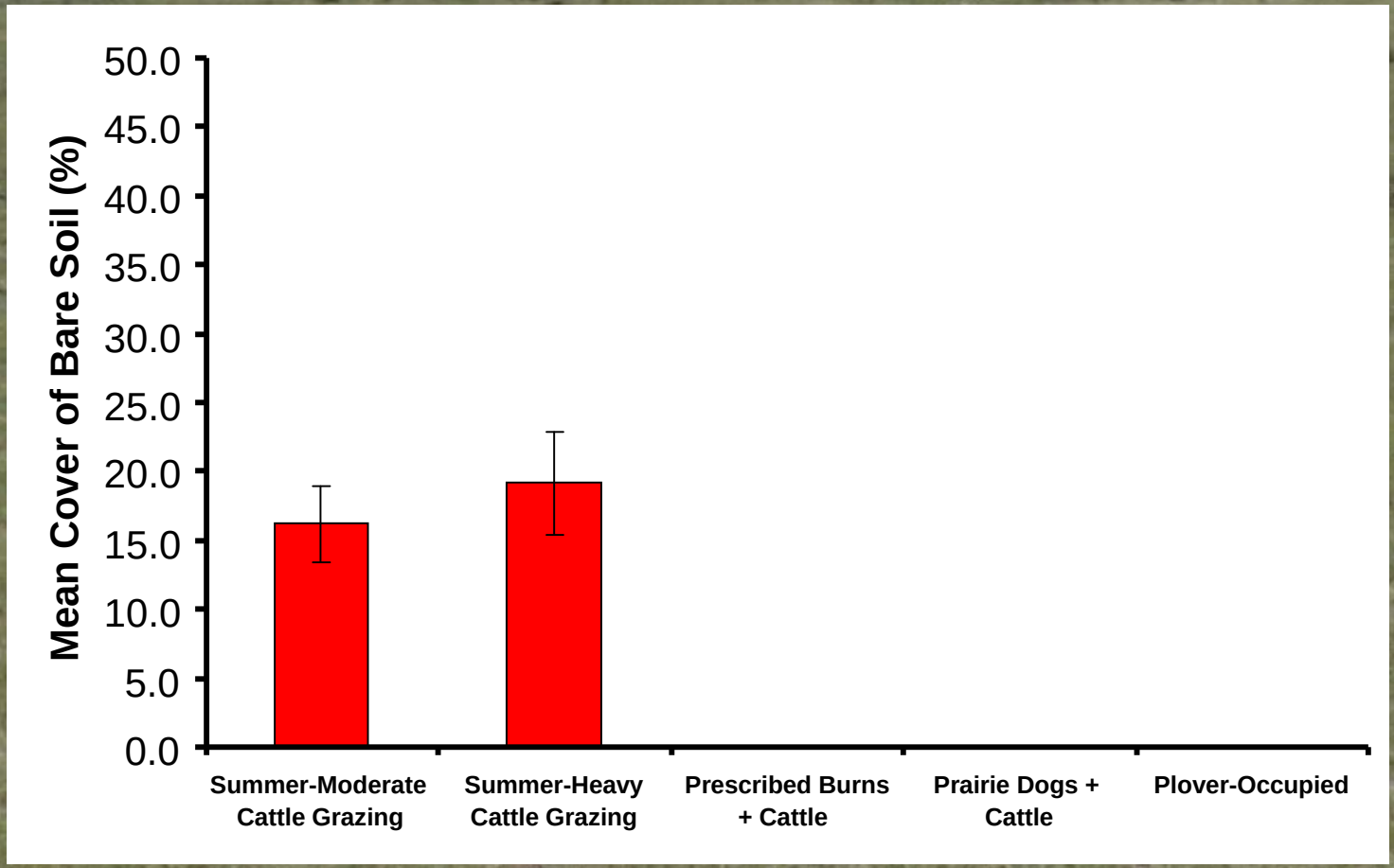
  - Fall patch burns (CPER)
- **Black-tailed Prairie Dog Colonies:**
  - **On-off colony comparisons** **3**
  - Effects of plague-induced colony extirpations

Management strategies for Mountain Plover nesting habitat

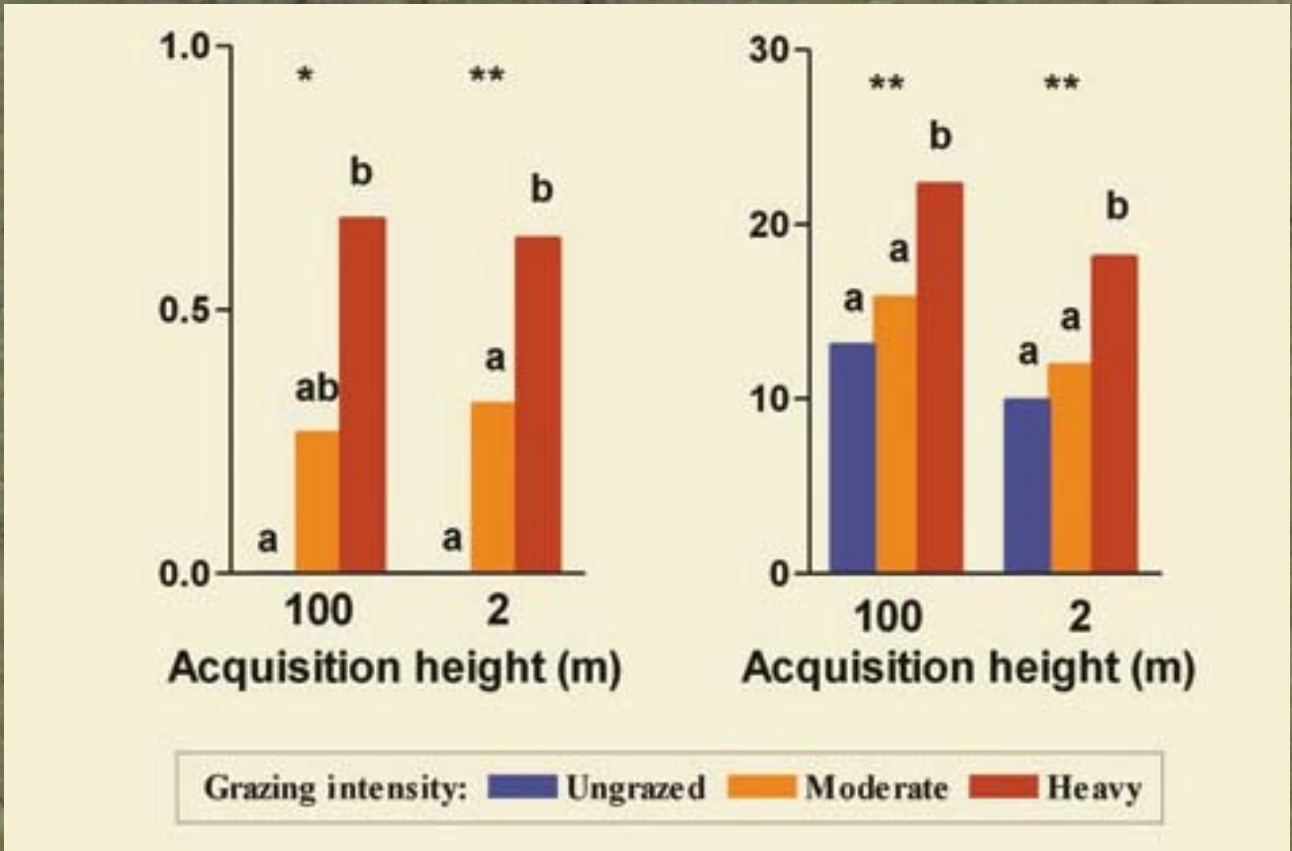
Measurements (2007 & 2008):

- Vegetation cover and height in a randomly-located grid of 45 1-m^2 plots in all pastures, colonies & burns
- Vegetation cover and height at plover nest and foraging sites (13 1-m^2 plots per site)
- All measurements during May 1 – 14 (early nesting phase)

Management strategies for Mountain Plover nesting habitat

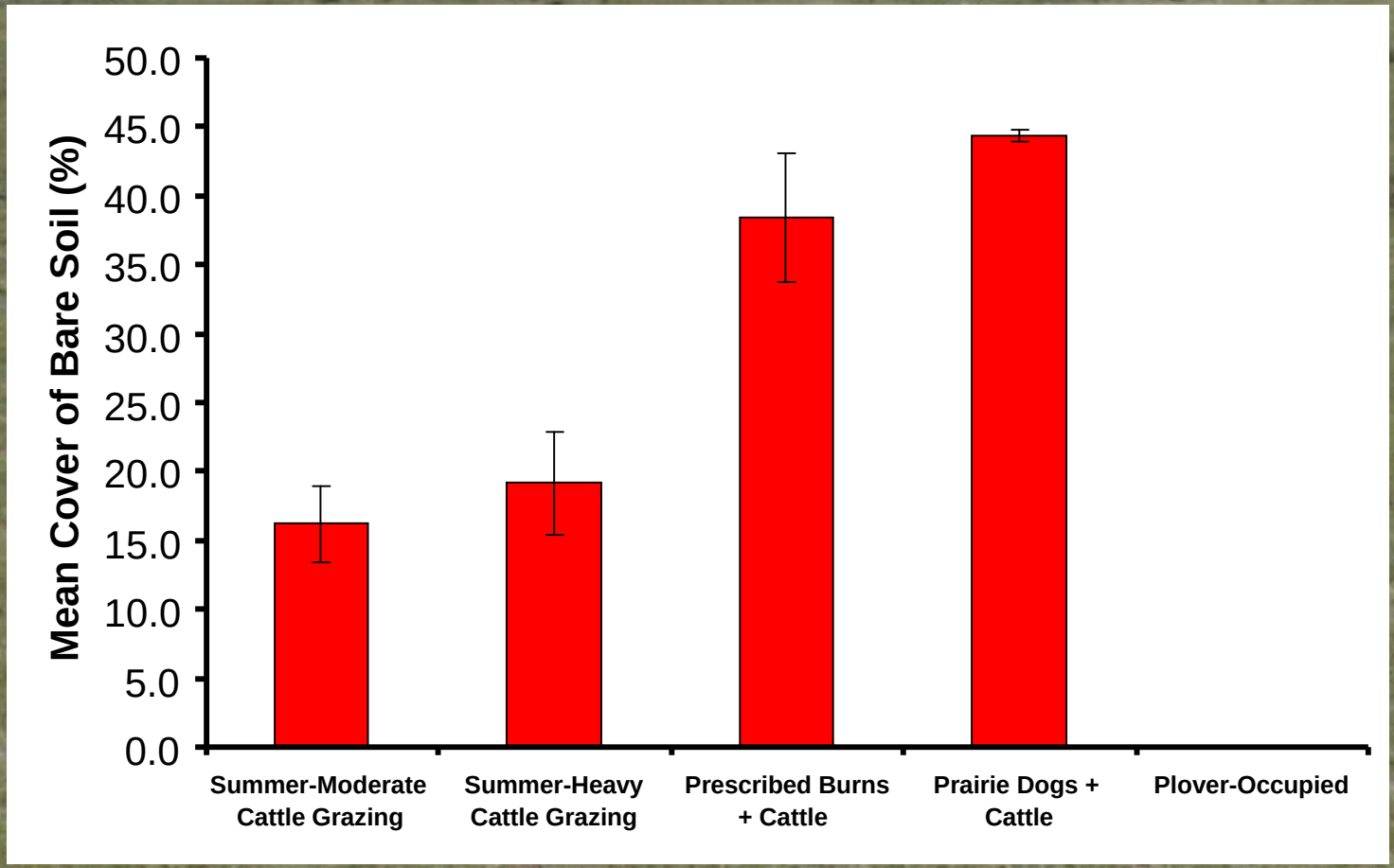


Management strategies for Mountain Plover nesting habitat

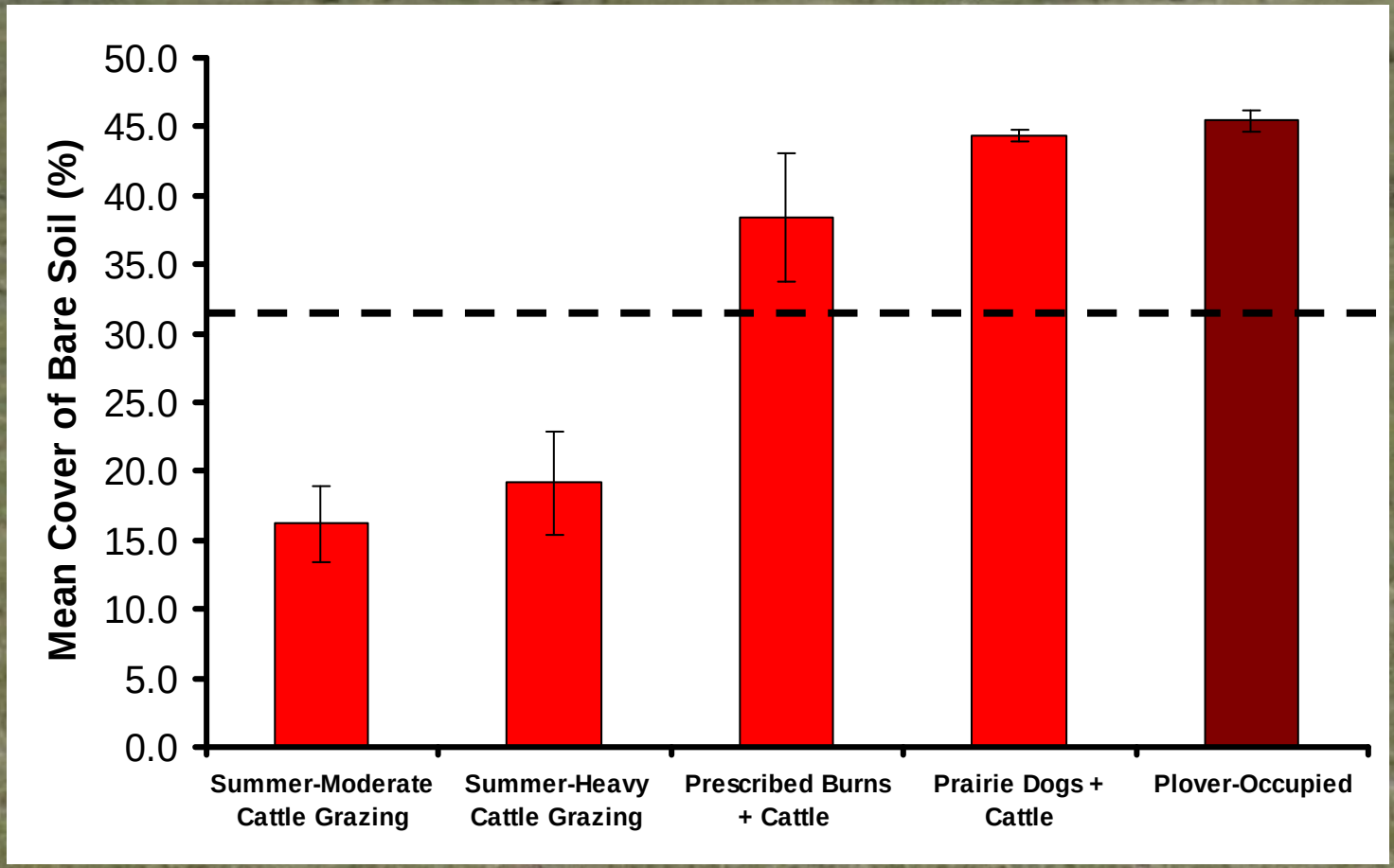


Booth *et al.* (2008) Image-based monitoring to measure ecological change in rangeland. *Frontiers in Ecology and the Environment* 6:185-190.

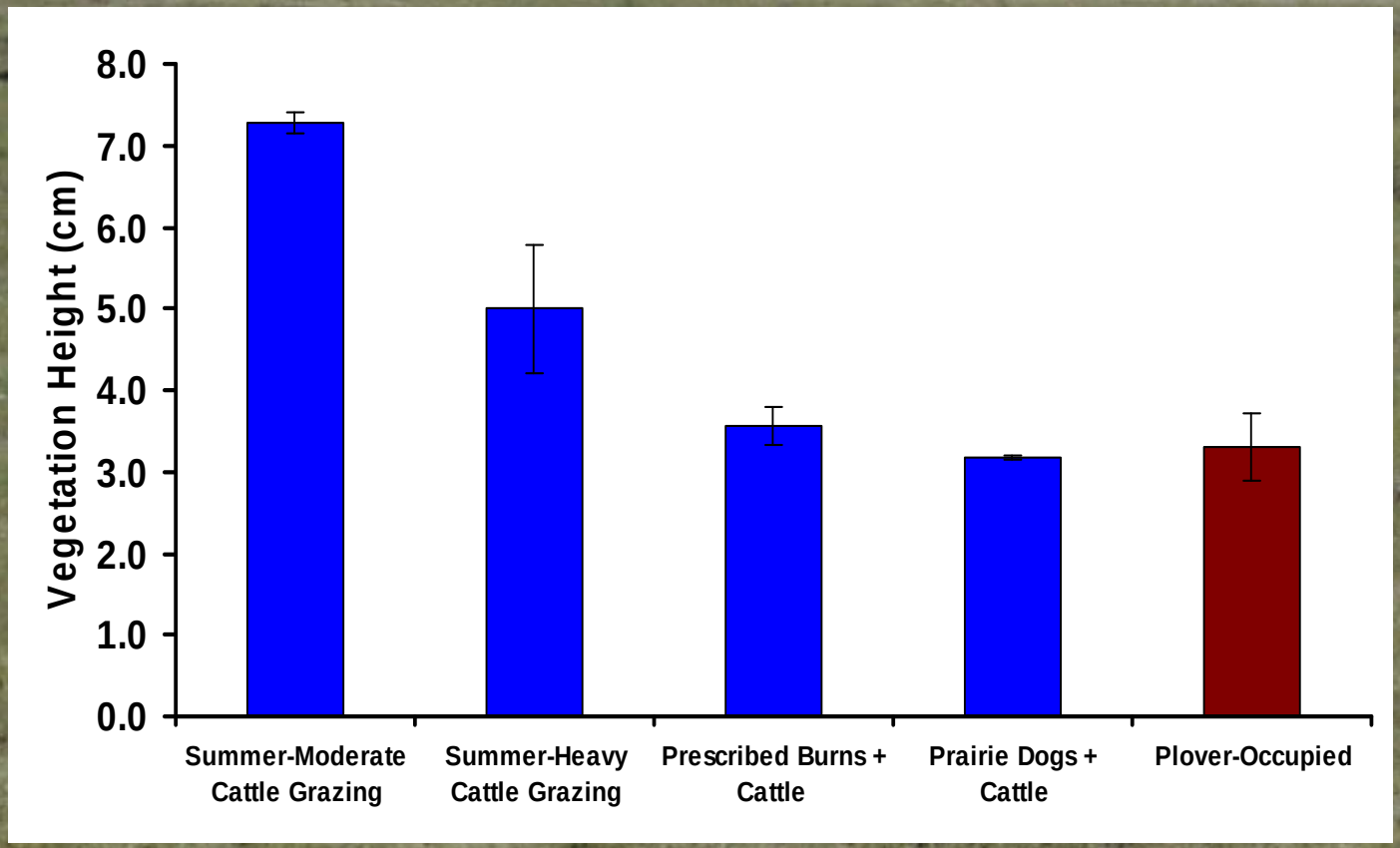
Management strategies for Mountain Plover nesting habitat



Management strategies for Mountain Plover nesting habitat



Management strategies for Mountain Plover nesting habitat



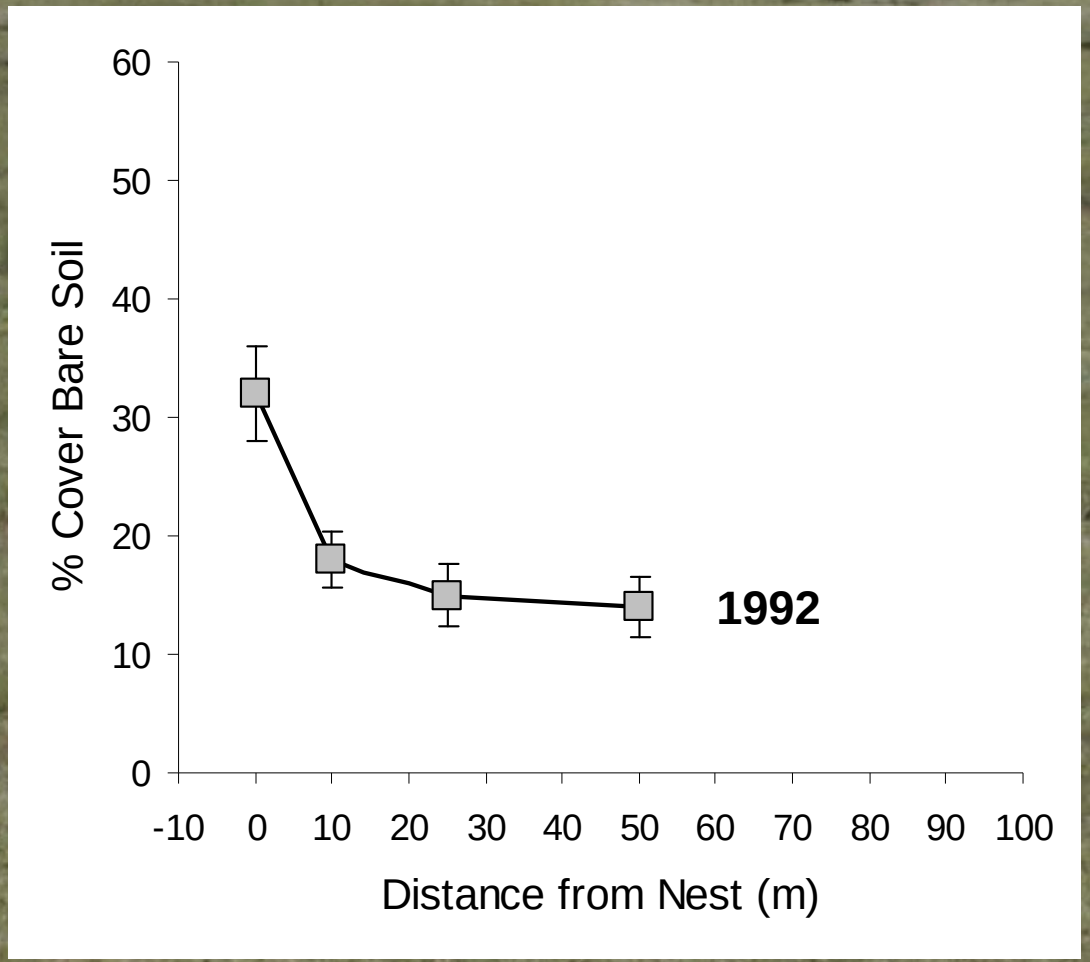
2008 Mountain Plover Survey: PNG & CPER

	Replicate Sites Surveyed	Points Surveyed	Density (Plovers per km^2) Mean	95% CI
Prescribed Burns	10	76		
Prairie Dog Colonies	8	54		
Rangeland (All sites)	20	160		
Rangeland (Random sites)	12	120		

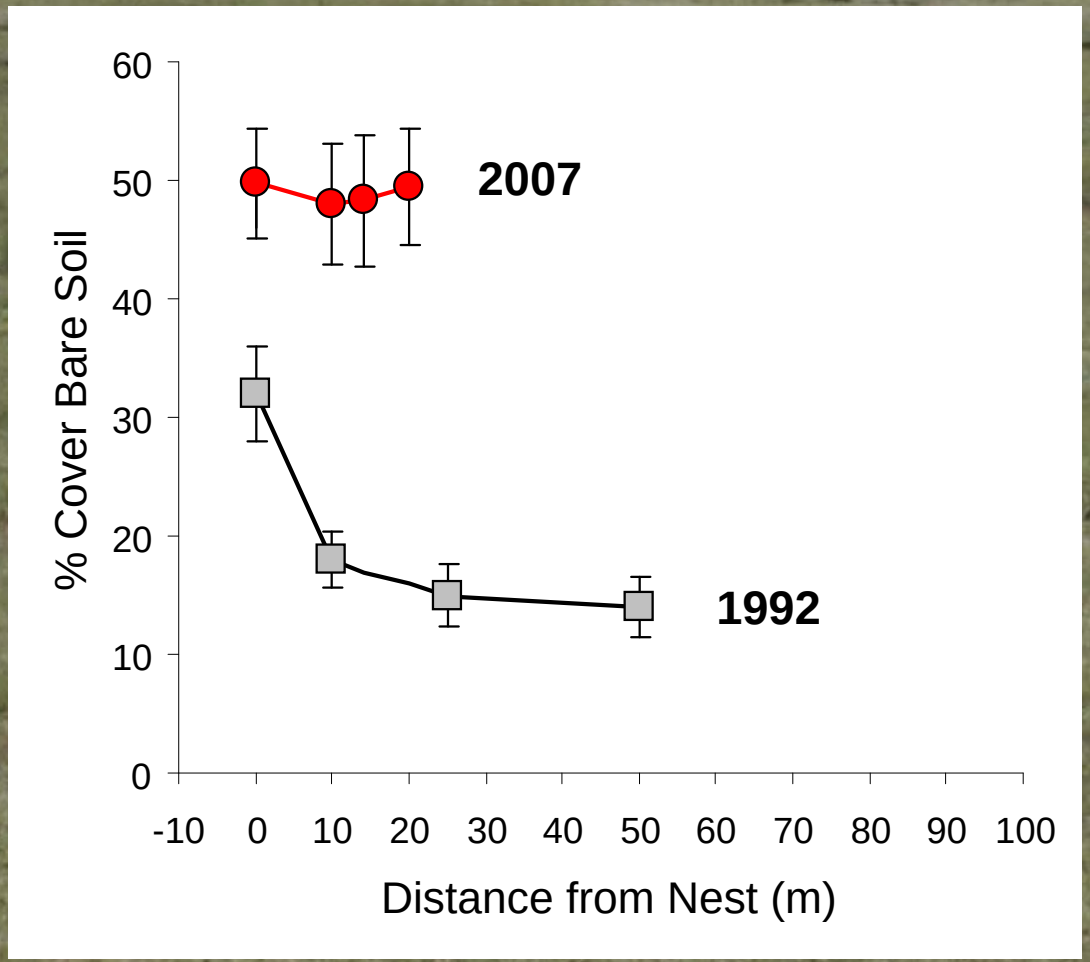
2008 Mountain Plover Survey: PNG & CPER

	Replicate Sites Surveyed	Points Surveyed	Density (Plovers per km^2) Mean	95% CI
Prescribed Burns	10	76	6.8	(3.3, 23.1)
Prairie Dog Colonies	8	54	6.2	(2.1, 18.3)
Rangeland (All sites)	20	160	0.6	(0.04, 2.4)
Rangeland (Random sites)	12	120	0	--

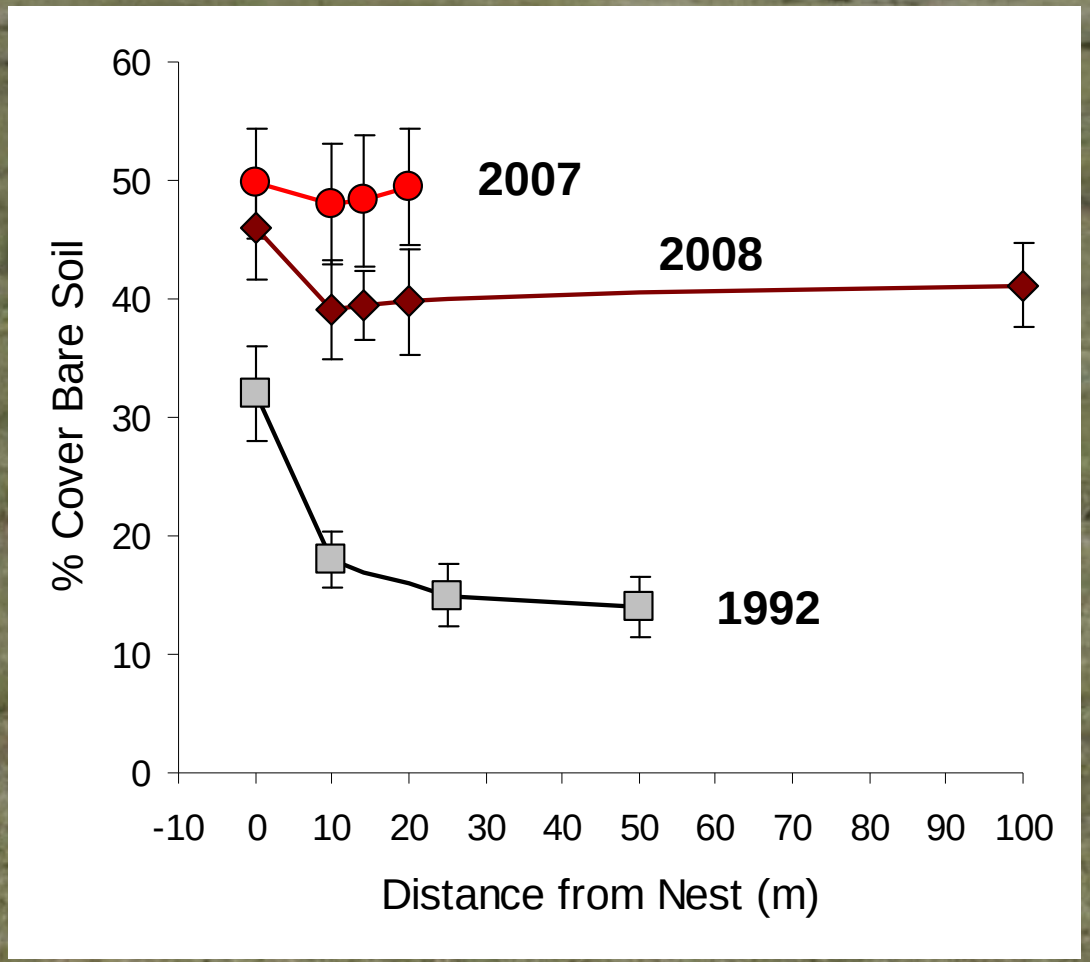
Vegetation Cover at Mountain Plover Nesting Sites

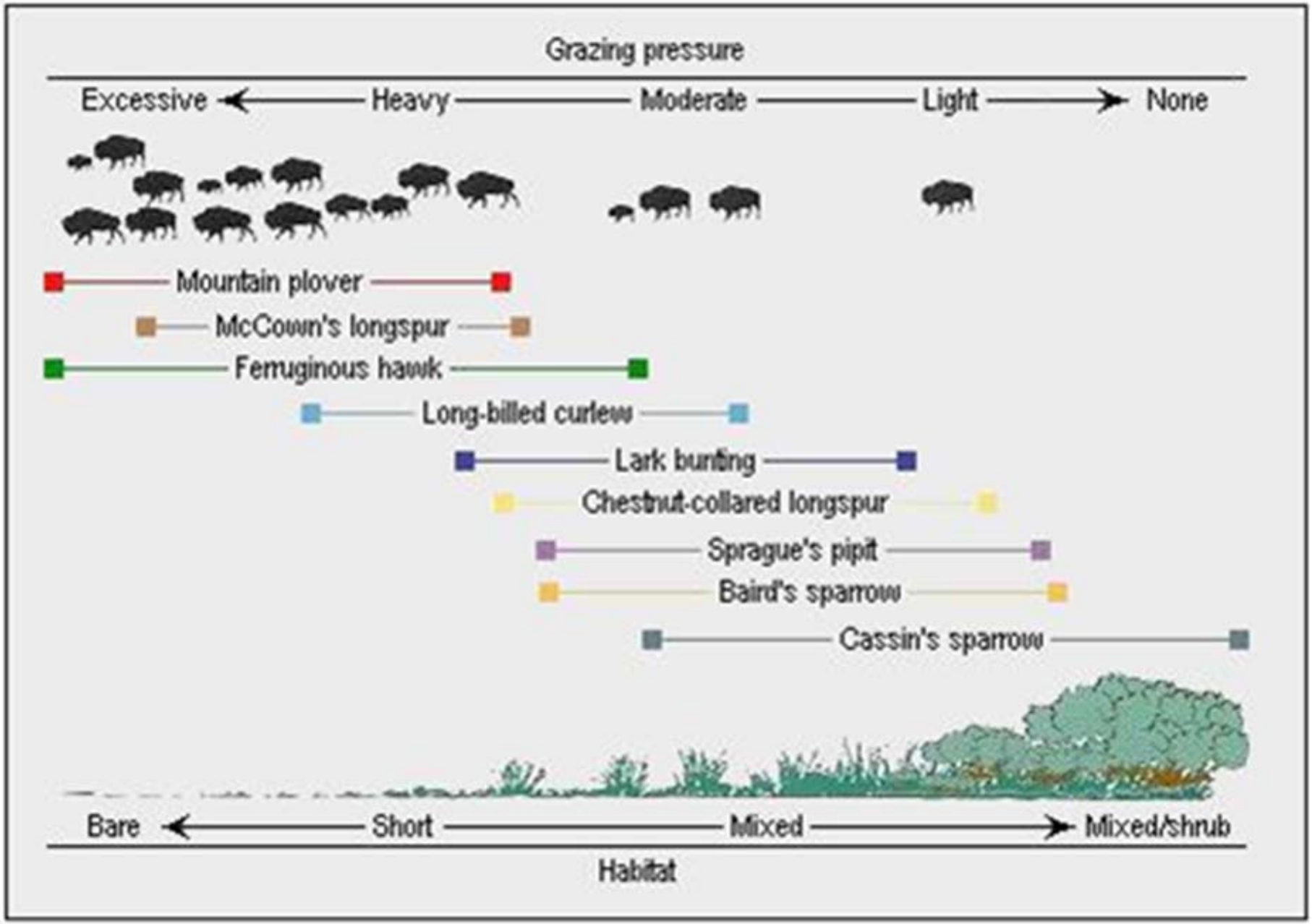


Vegetation Cover at Mountain Plover Nesting Sites

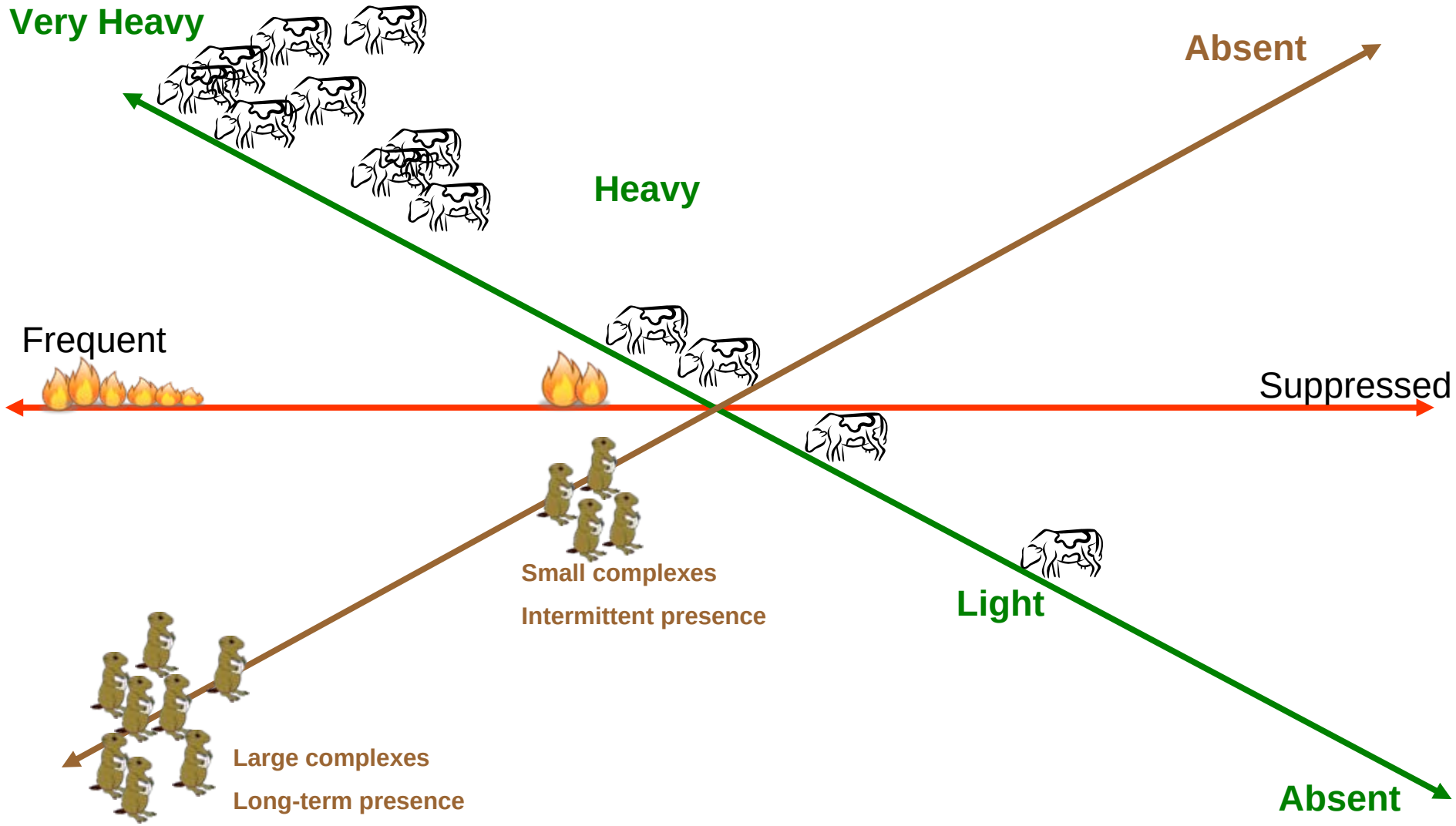


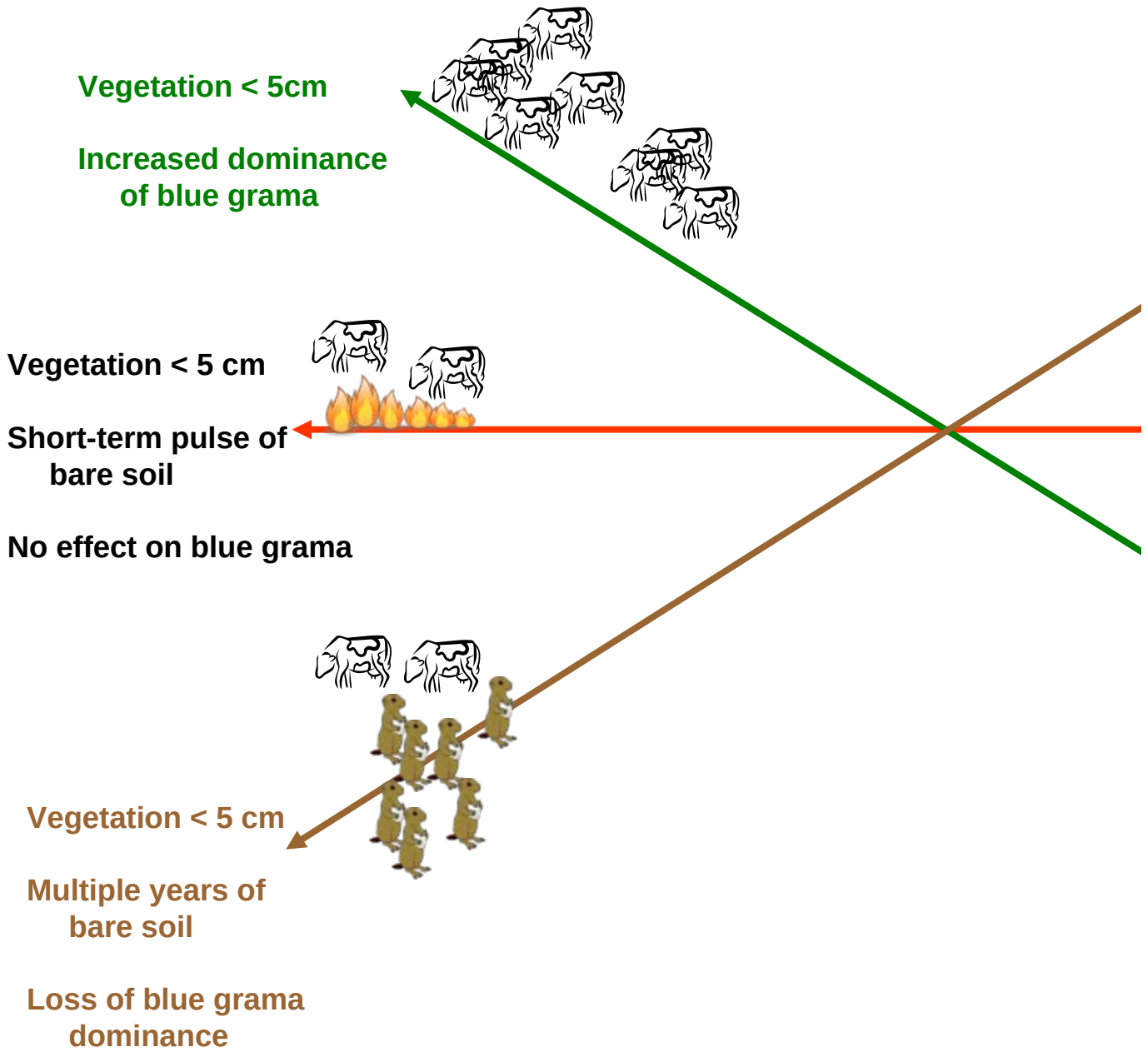
Vegetation Cover at Mountain Plover Nesting Sites

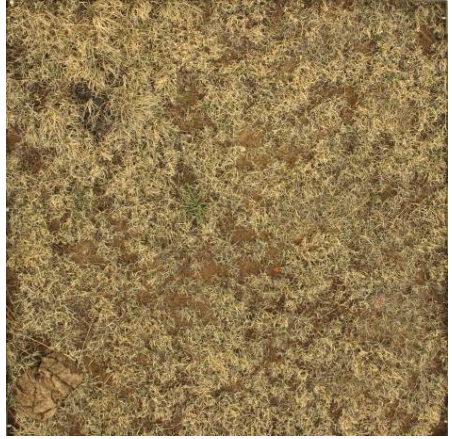




Adapted from: Knopf (1996)


Very Heavy
Absent
Heavy
Frequent
Suppressed
Small complexes
Intermittent presence
Light
Large complexes
Long-term presence
Absent


Vegetation < 5cm
Increased dominance of blue grama
Vegetation < 5 cm
Short-term pulse of bare soil
No effect on blue grama
Vegetation < 5 cm
Multiple years of bare soil
Loss of blue grama dominance



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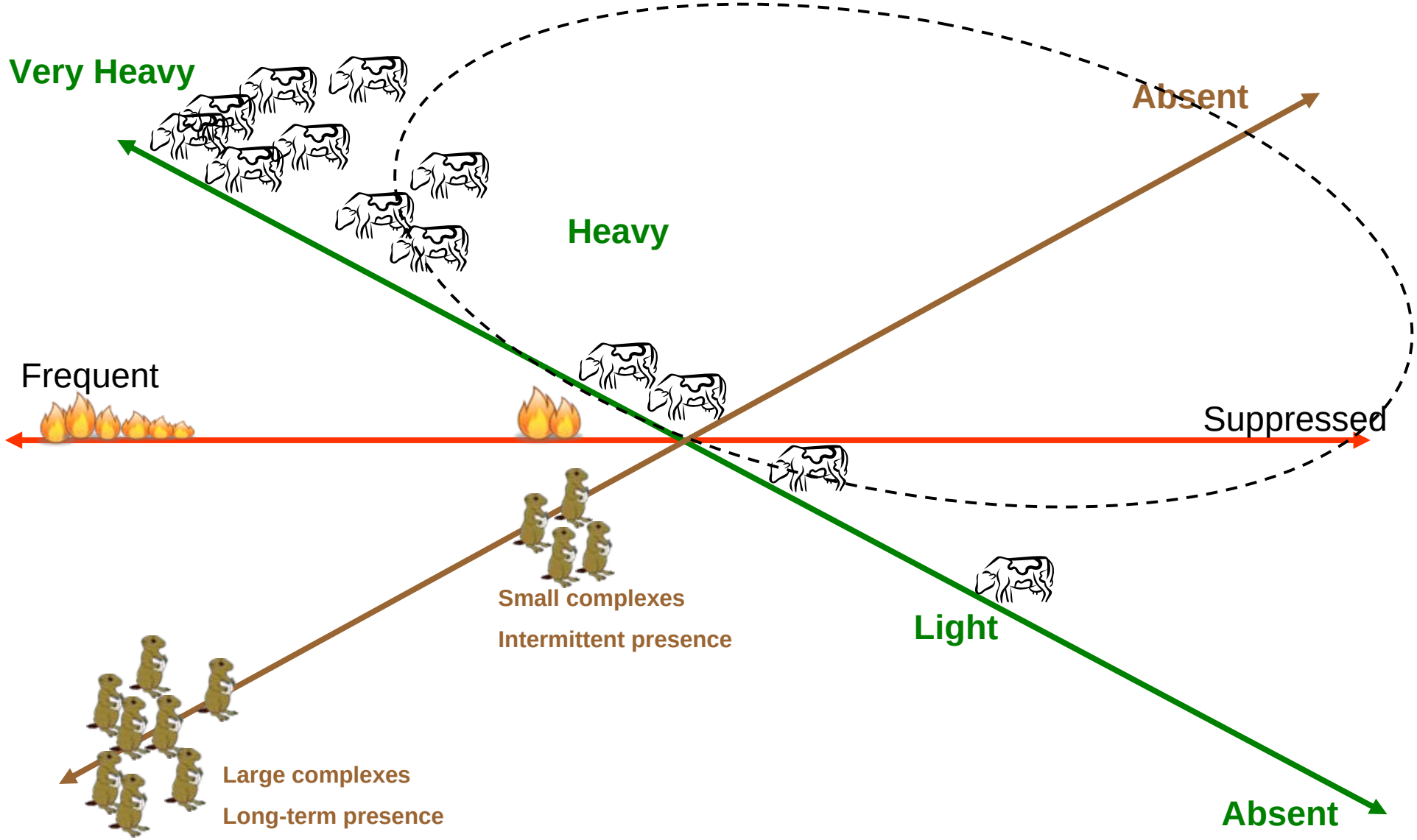
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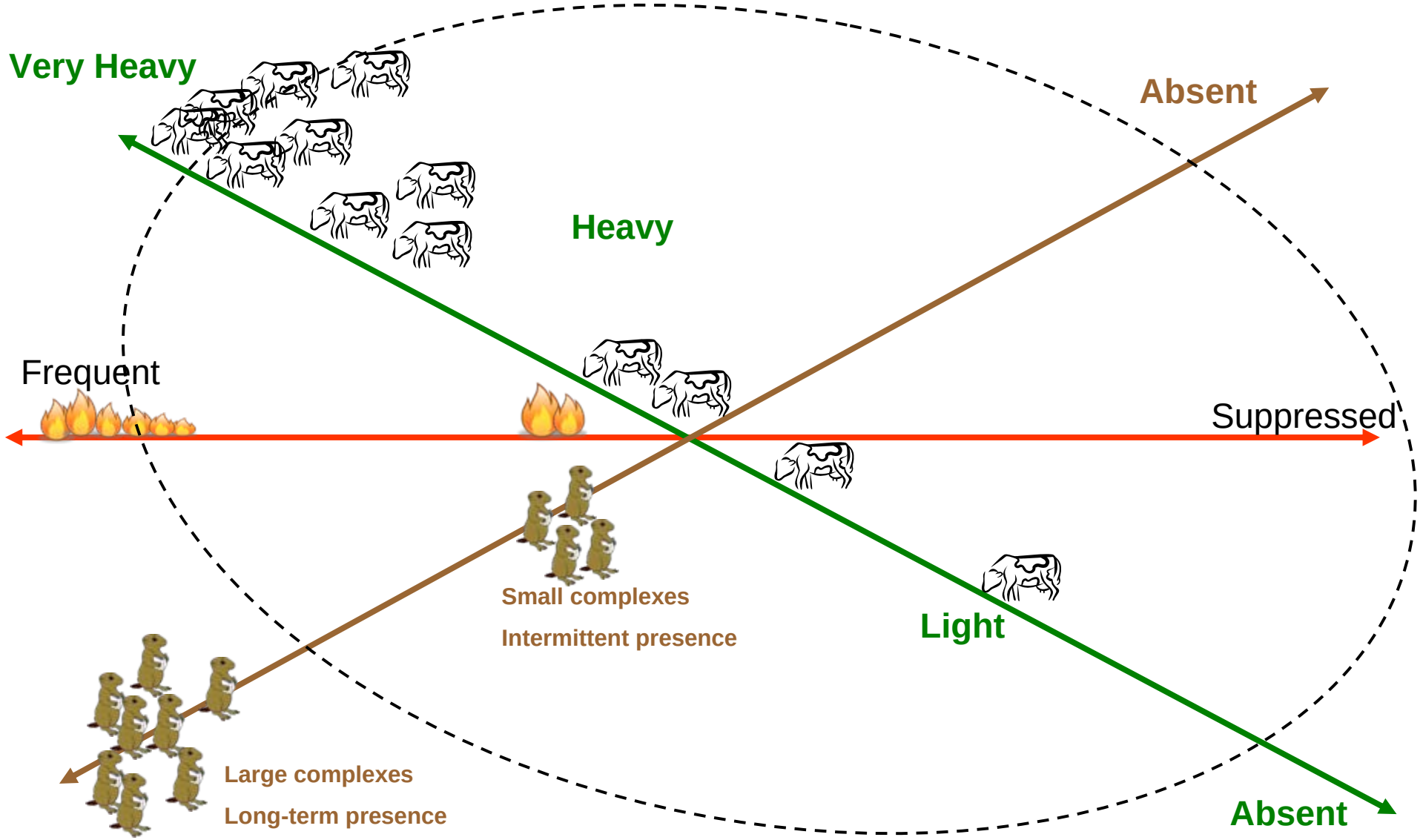
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Future Needs:

- Appropriate spatial scales for management practices
- Costs to livestock production

Acknowledgments:

- Fritz Knopf
- Patrick McCusker
- Beth Humphrey
- Mary Ashby
- Jeff Thomas
- Troy Smith
- Tammy Kanode
- Jessica Crowder
- Josh Baker
- Derek Flannery
- Tyler Odell

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