

# Restoring Dynamic Disturbance Processes to Promote Ecological Services



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Historically, rangelands were complex...



+

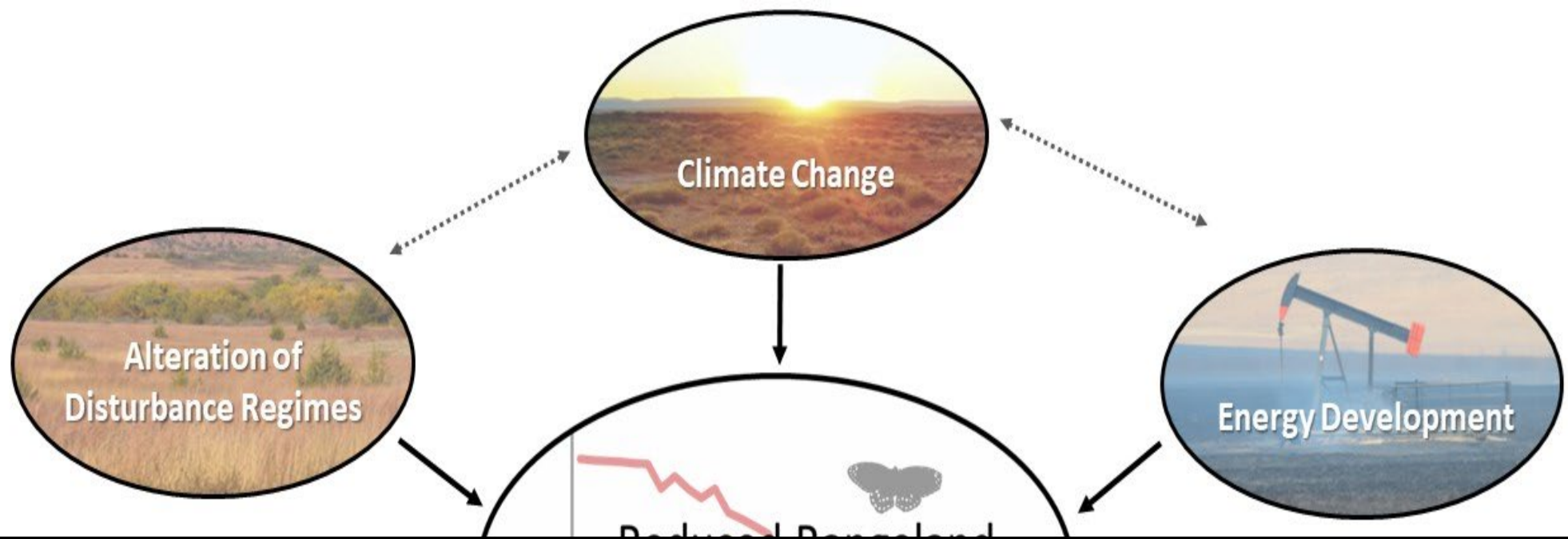




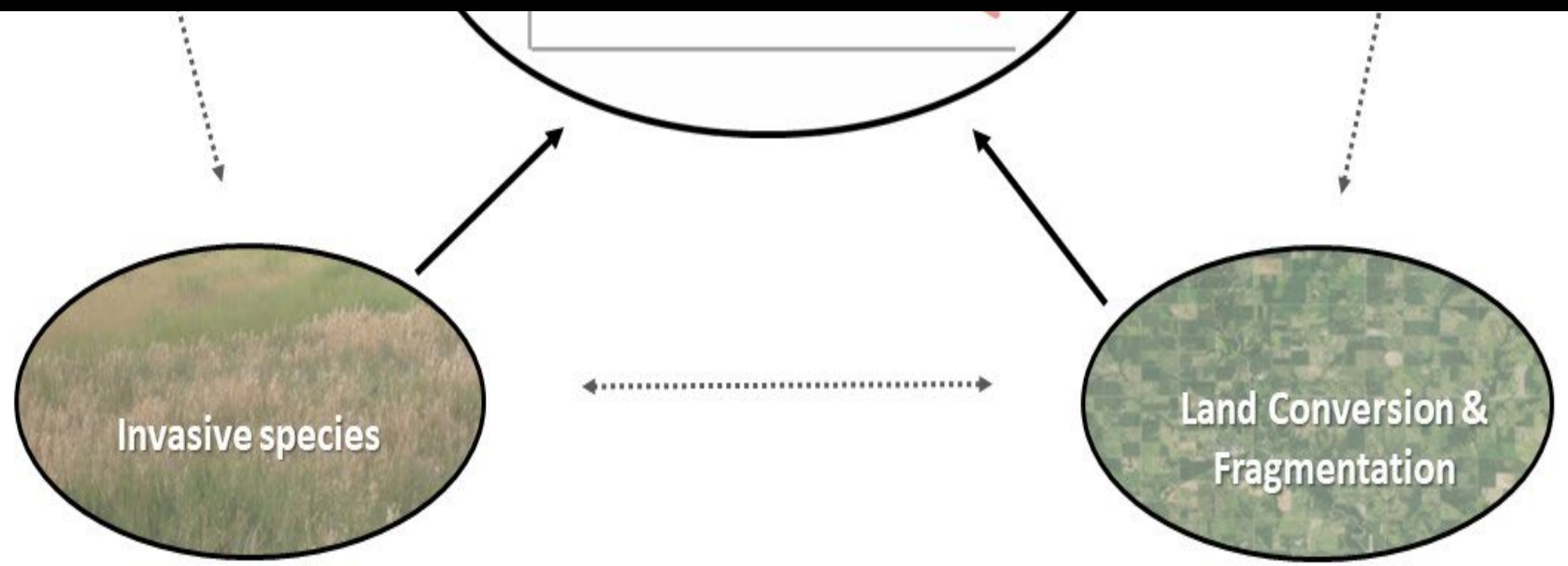




*Anthropogenic actions have changed the landscape*



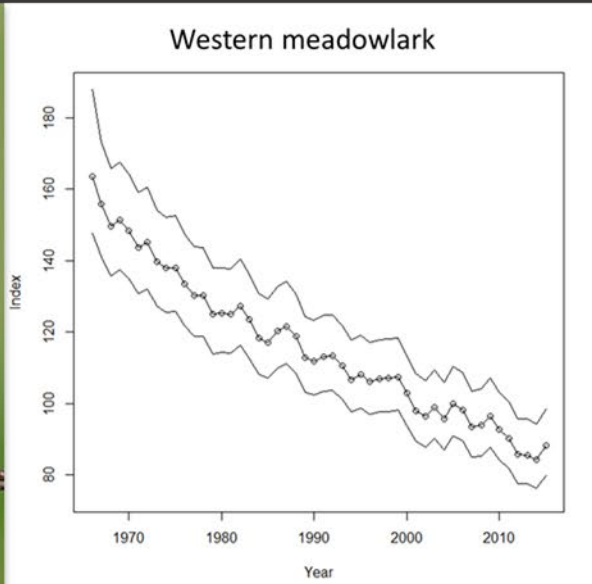
# **Simplified Rangeland Ecosystems**





# Simplified rangelands results in biodiversity loss

- Relatively few ESA listed species
- Species with large home ranges and complex life histories
- Common species becoming less common



\* In North Dakota Western Meadowlarks have declined > 60% over the last 50 yrs





# NORTH AMERICAN Bird Population Declines Since 1970

Net loss of **2.9 Billion Birds**  
**303 Species** in decline

## Bird Breeding Biomes

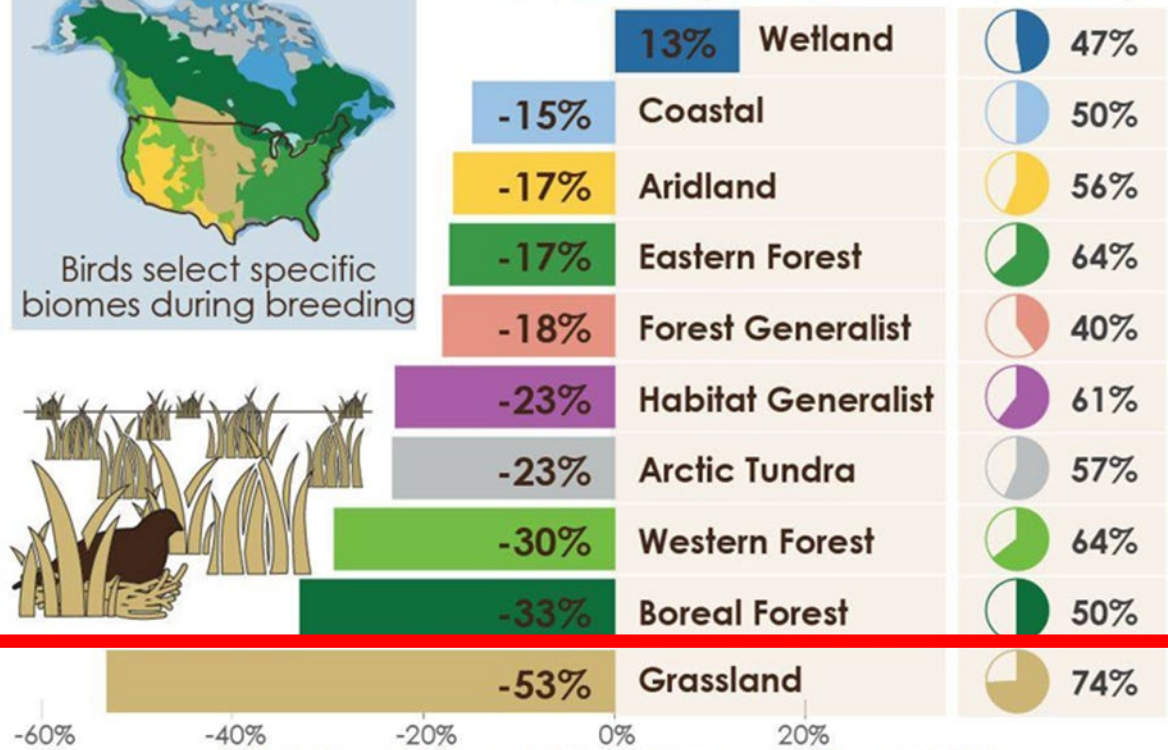


Birds select specific biomes during breeding



## Percent of Individual Birds Lost/Added in Each Bird Breeding Biome

## Percent of Bird Species Declining

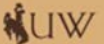


Bird Group Population Changes Since 1970

## GRASSLAND Bird Losses Since 1970

**717 Million** breeding individuals lost (**53%**)  
**23 Species** in decline (**74%**)

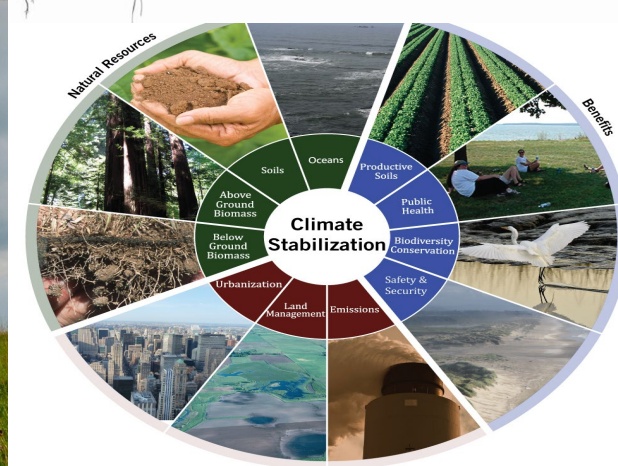
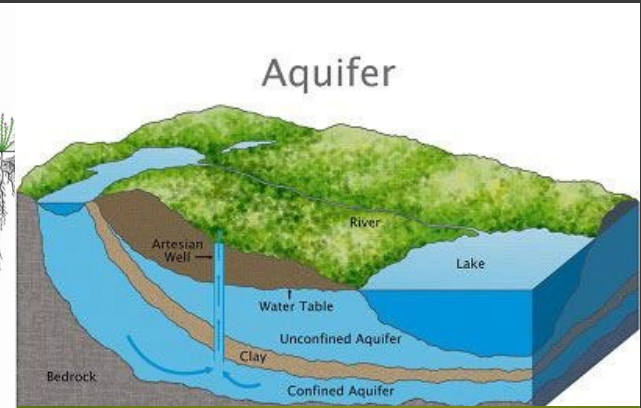
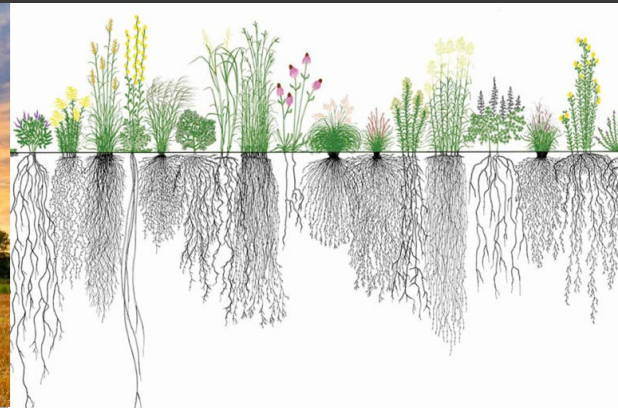
Grassland bird declines are particularly concerning



Data: Rosenberg et al 2019. Decline of the North American Avifauna, Science.



# Why we should care: Services and opportunities



Recreational opportunities and wildlife habitat

Food and income for over 1 billion people

Climate stability and storing over 30% of global carbon

Freshwater regulation, soil preservation, and pollination

Pollinators contribute an estimated \$235 billion to \$577 billion to global crop production annually.

— IPBES Pollination Assessment



# Rangelands also present opportunities...

## Global Extent of Rangelands

**Nearly 50% of terrestrial land cover**



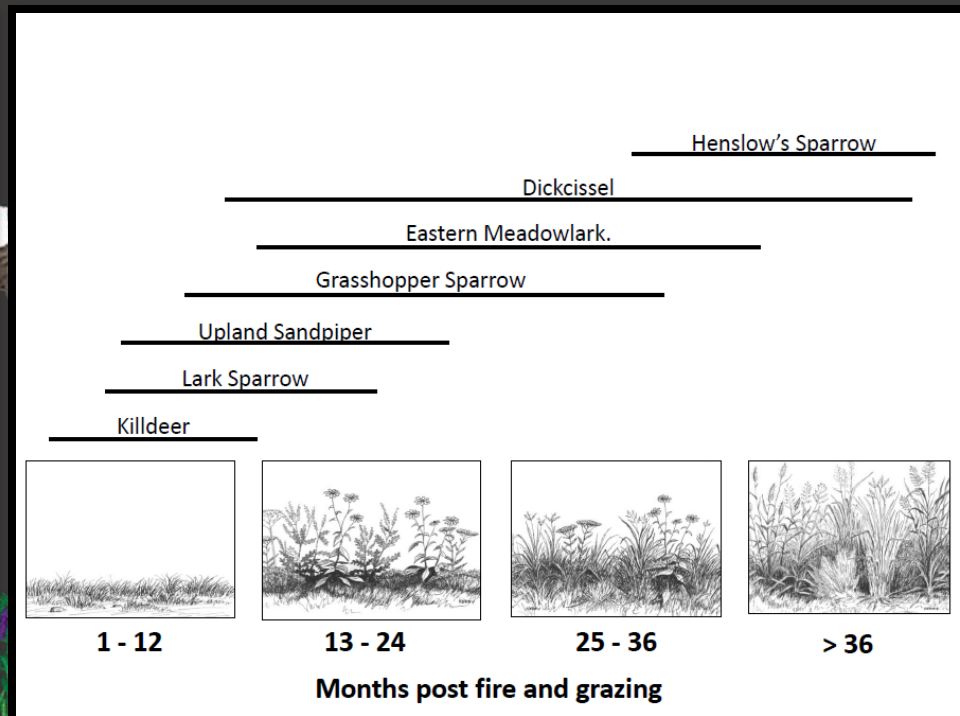
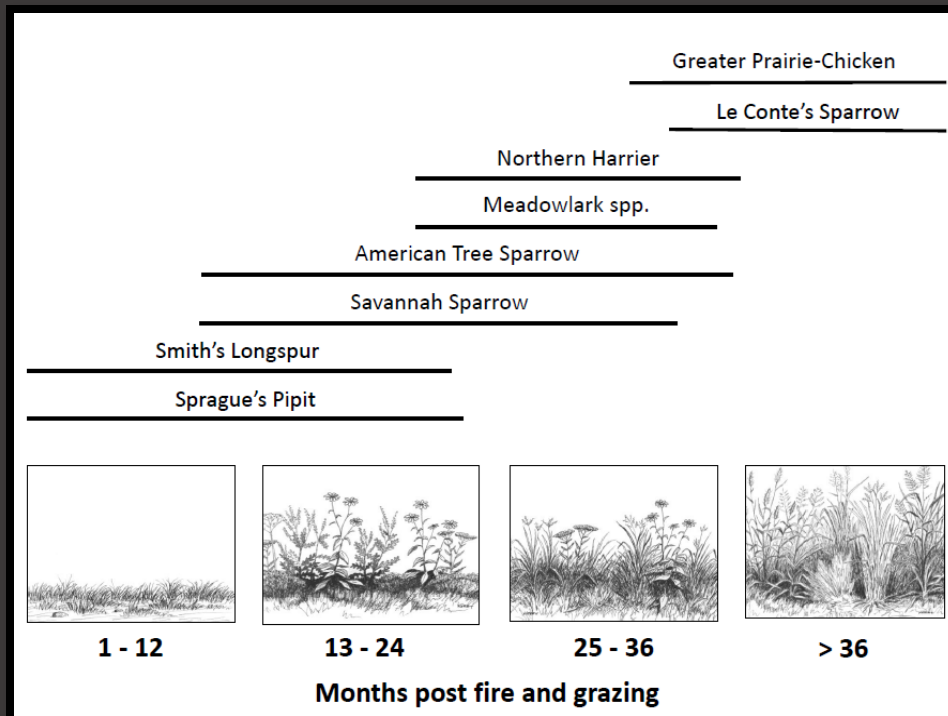
Notes :  
Data from Global Land Cover Characterization  
'International Geosphere-Biosphere Program' Dataset.  
See <http://edcdaac.usgs.gov/glcc/glcc.html>  
Projection = Geographic (Lat/Long)

### FAO Disclaimer

The designations employed and the presentation of the material in the maps do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal or constitutional status of any country, territory or sea area, or concerning the delimitation of frontiers.



# Promoting heterogeneity is part of the solution



0 Years Since Disturbance

1 Year Since Disturbance

2 Years Since Disturbance

3 Years Since Disturbance

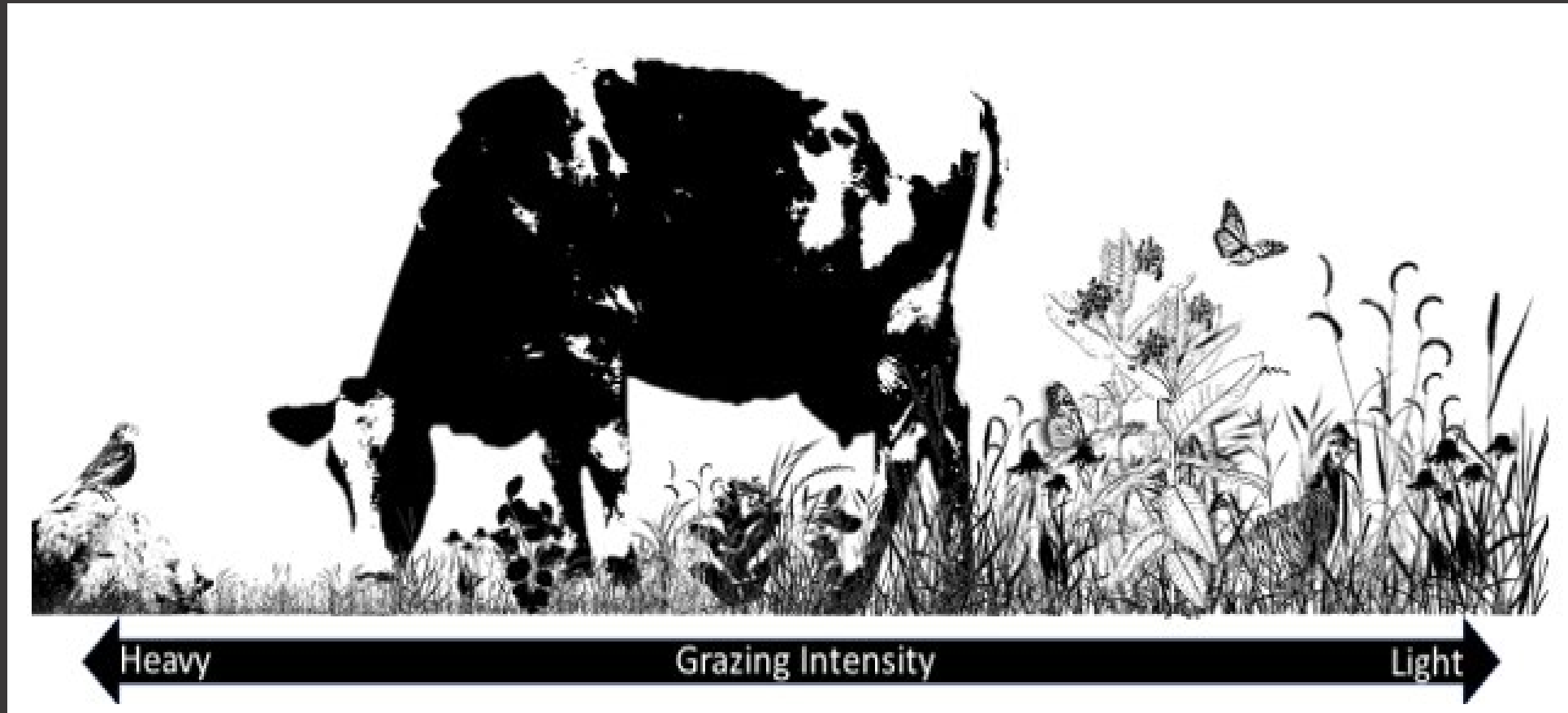
Winter bird community

Breeding bird community

Patch-burn grazing promotes diversity



But...promoting active fire regimes on private lands is not always easy or appropriate





# Restoring complexity to rangelands through heterogeneity management

- *Our **long-term goal** is to create sustainable rangelands that maintain livestock performance and promote floral and faunal biodiversity by promoting management actions that create heterogeneity*

1) Livestock performance



2) Plant-pollinator interactions



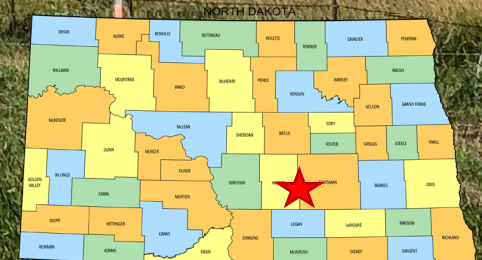
# Study Site

NDSU-Central  
Grasslands  
Research Extension  
Center

Mixed grass prairie

12, 65 ha pastures

Moderately stocked  
cow-calf pairs





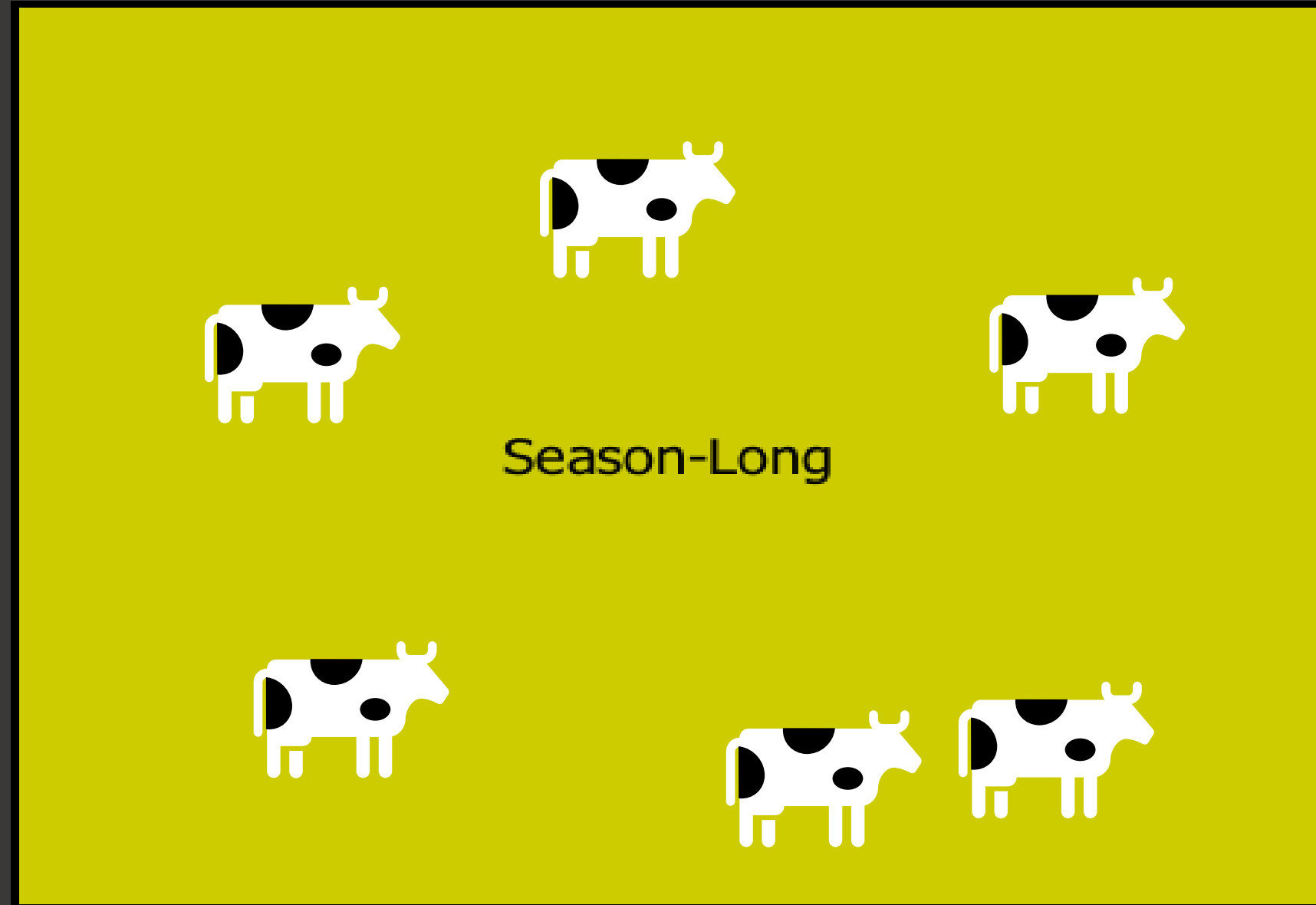
# Pasture Design

Status-quo  
treatment “control”

4 reps

Exterior fencing

## Season-Long Grazing (SLG)



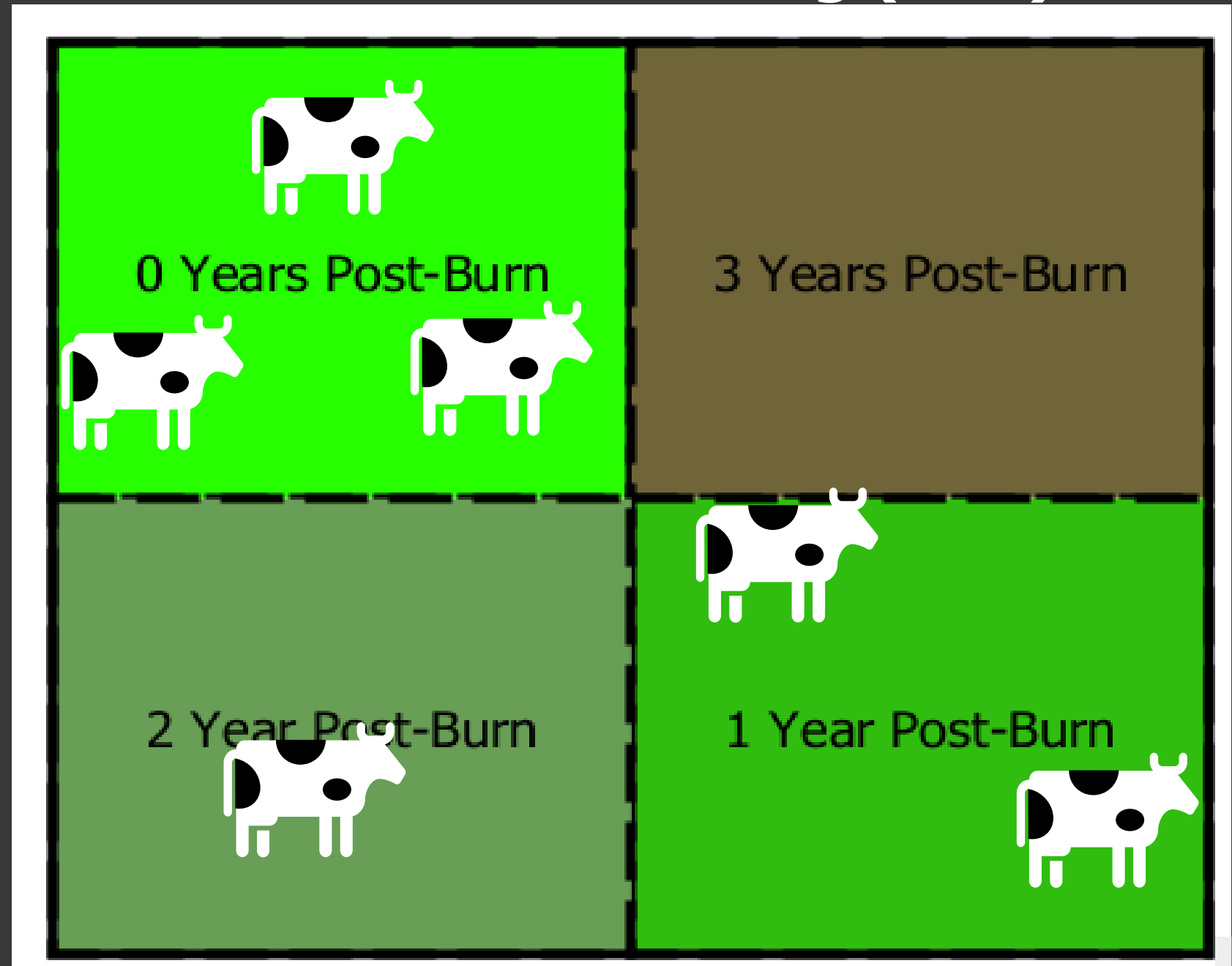
# Pasture Design

Heterogeneity focus—fire

4 reps

Exterior fencing

## Patch-burn Grazing (PBG)





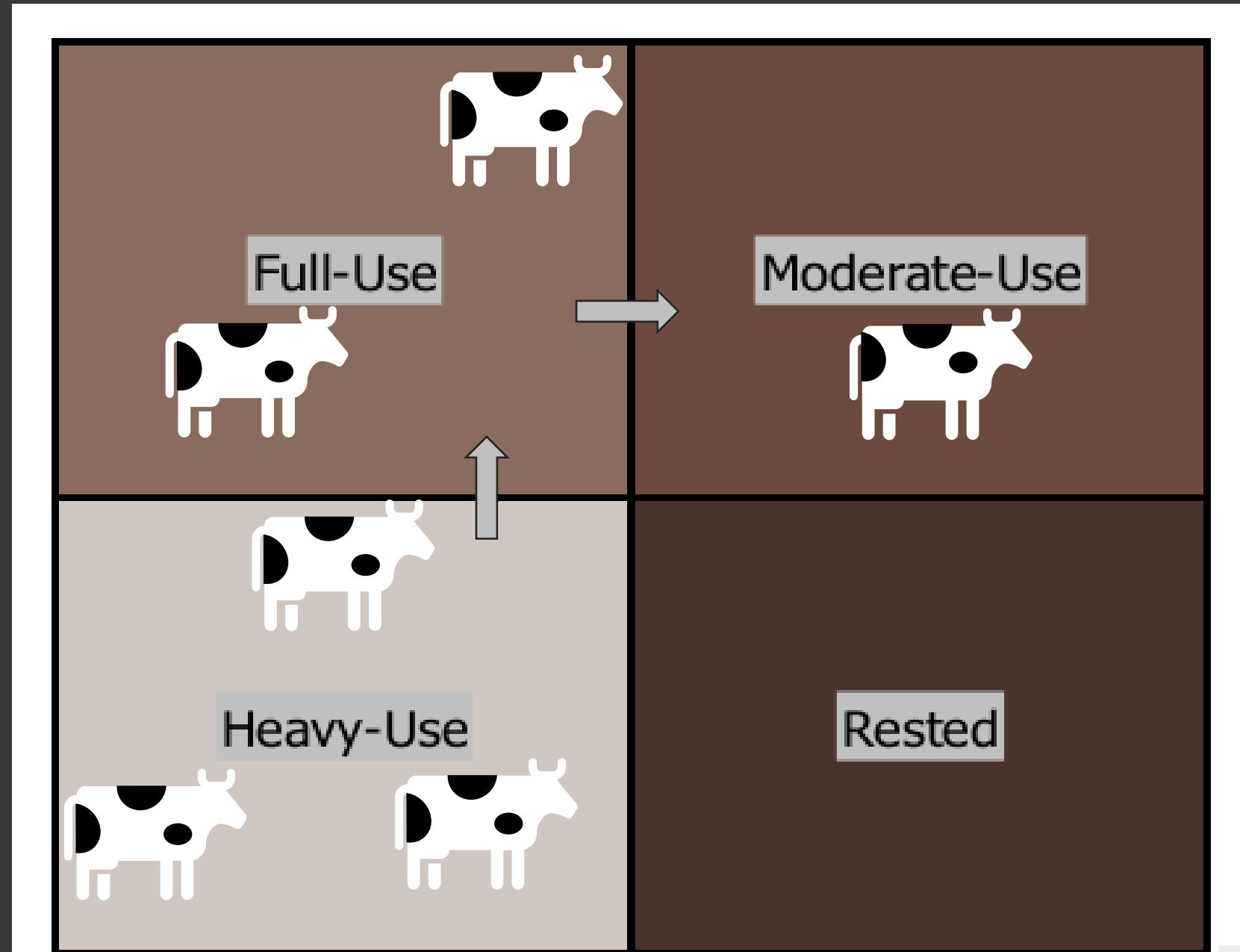
# Pasture Design

Heterogeneity focus—no fire

4 reps

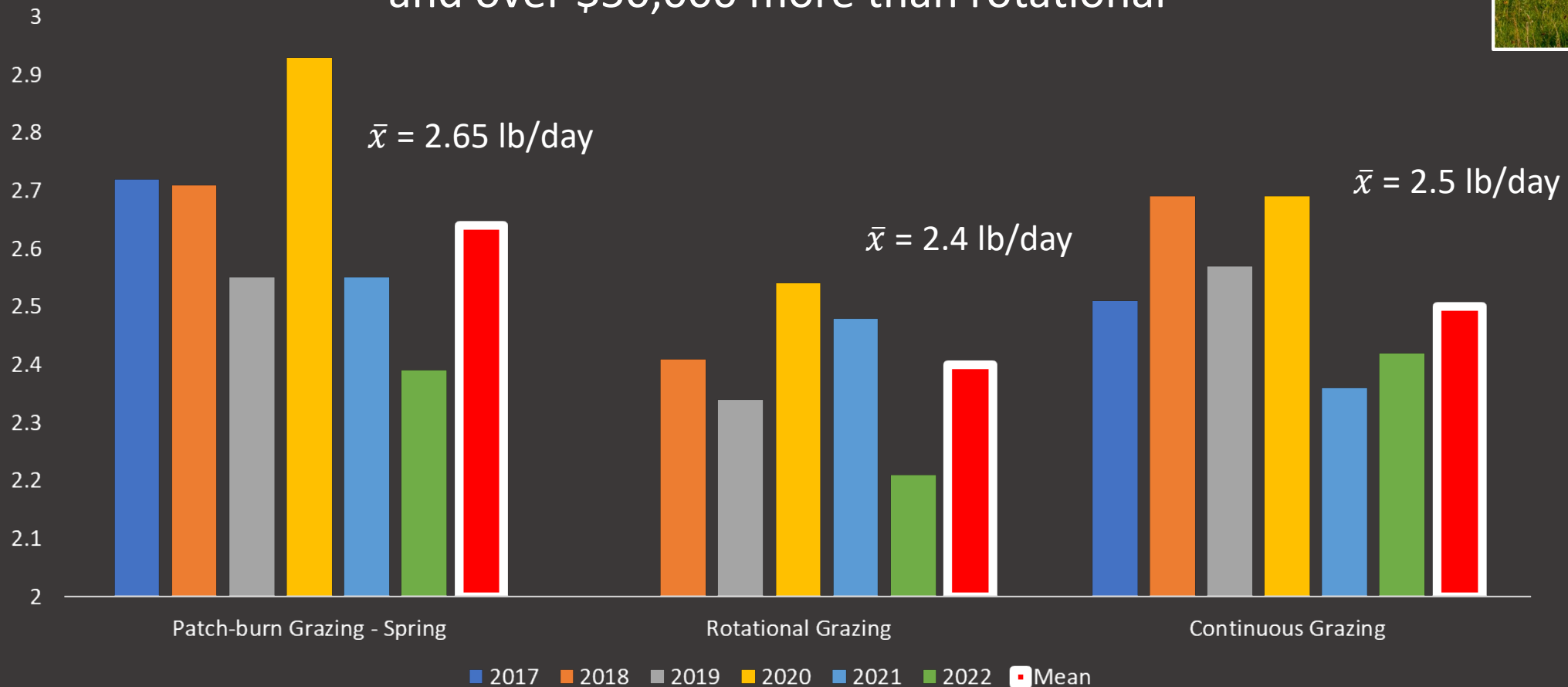
Interior fencing

## Modified Twice-over Rest-rotation Grazing (MTORG)



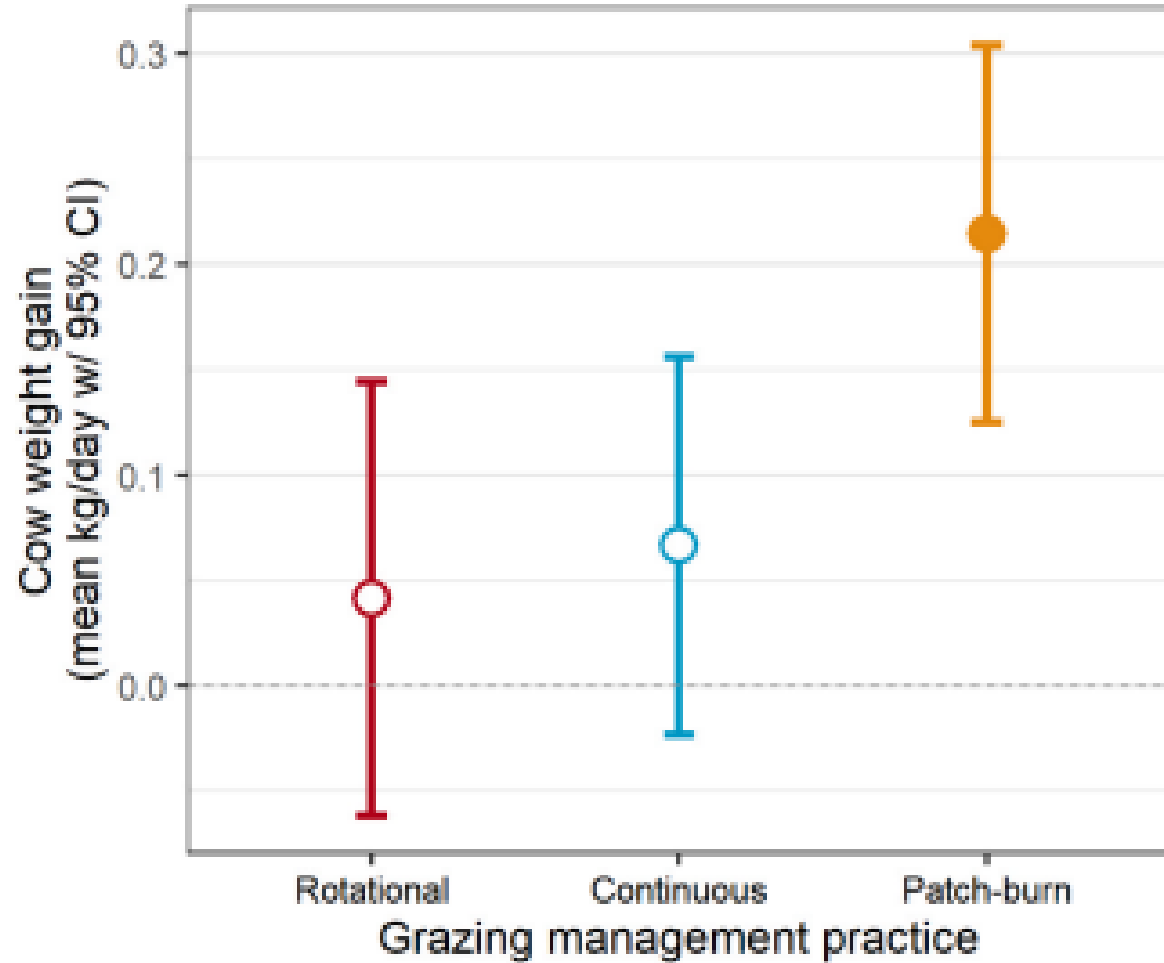
# Livestock outcomes: calf daily gains

\* A rancher grazing 500 calves for 150 days would net over \$30,000 more with PBG than continuous and over \$50,000 more than rotational





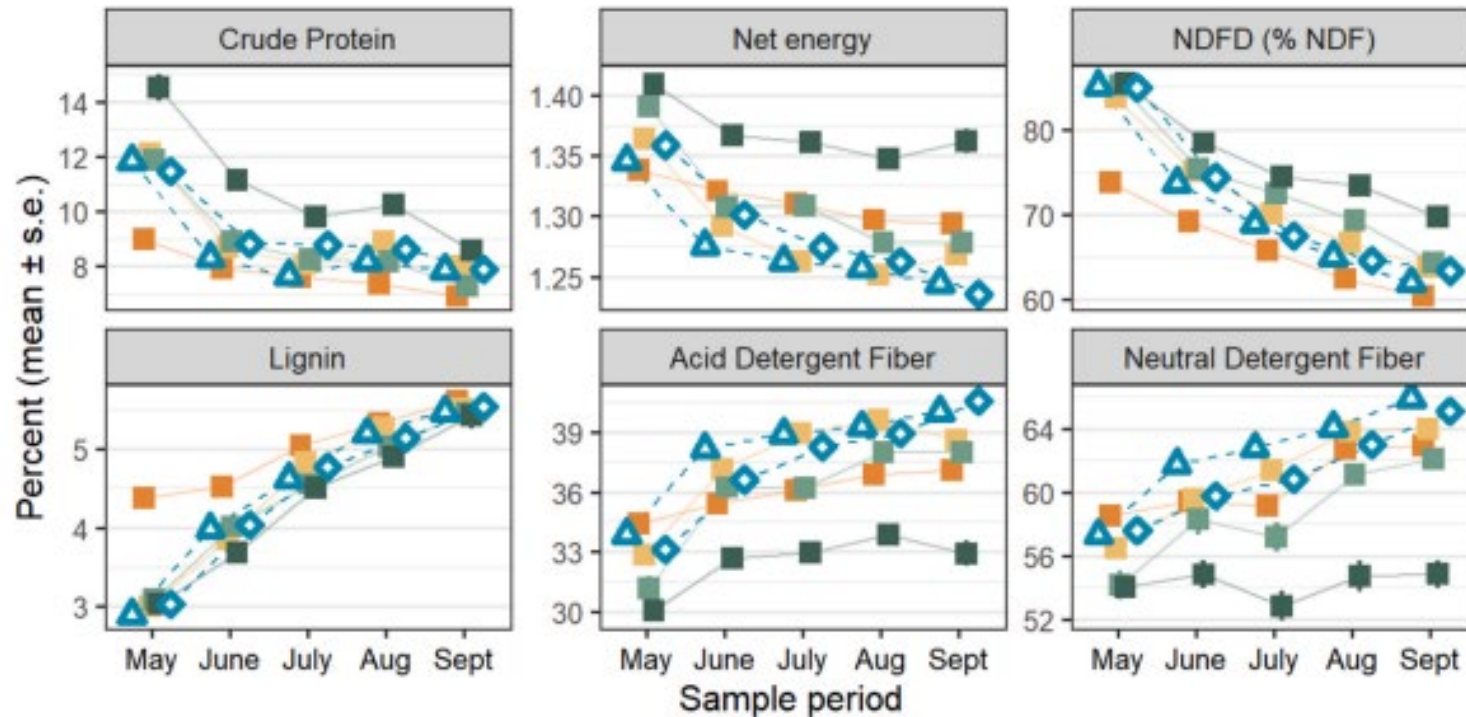
# Livestock outcomes: cow gains



Takeaway:

PBG consistently shows the greatest cow weight gains over 7 years

# Livestock outcomes: nutritional quality

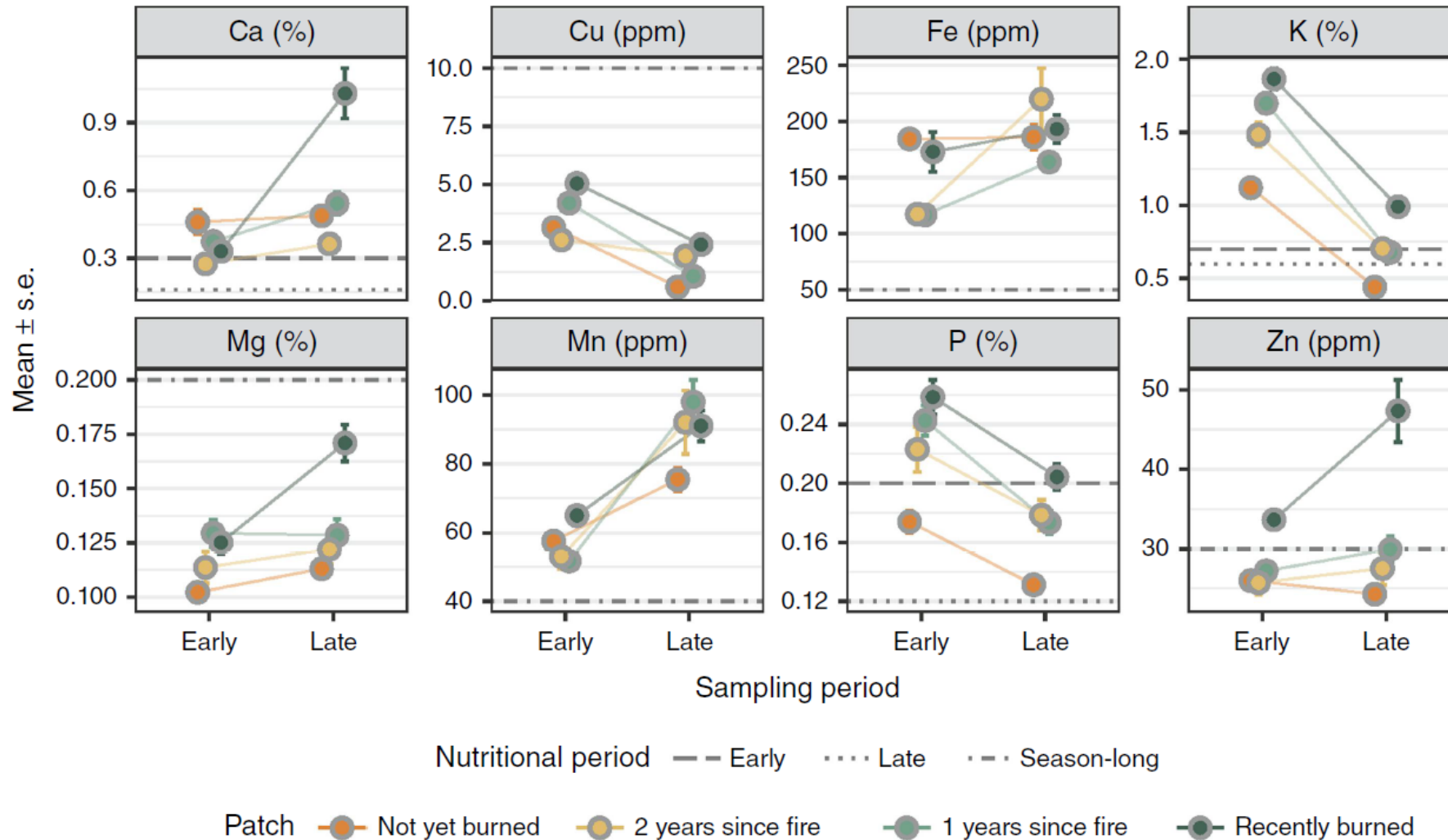


Takeaways:

- 1) Inclusion of fire results in higher quantities of positive forage attributes
- 2) Absence of fire results in higher quantities of negative forage attributes



# Livestock outcomes: nutritional composition



Takeaway:

Within PBG units, the recently burned patch has the greatest amount of key forage nutrients

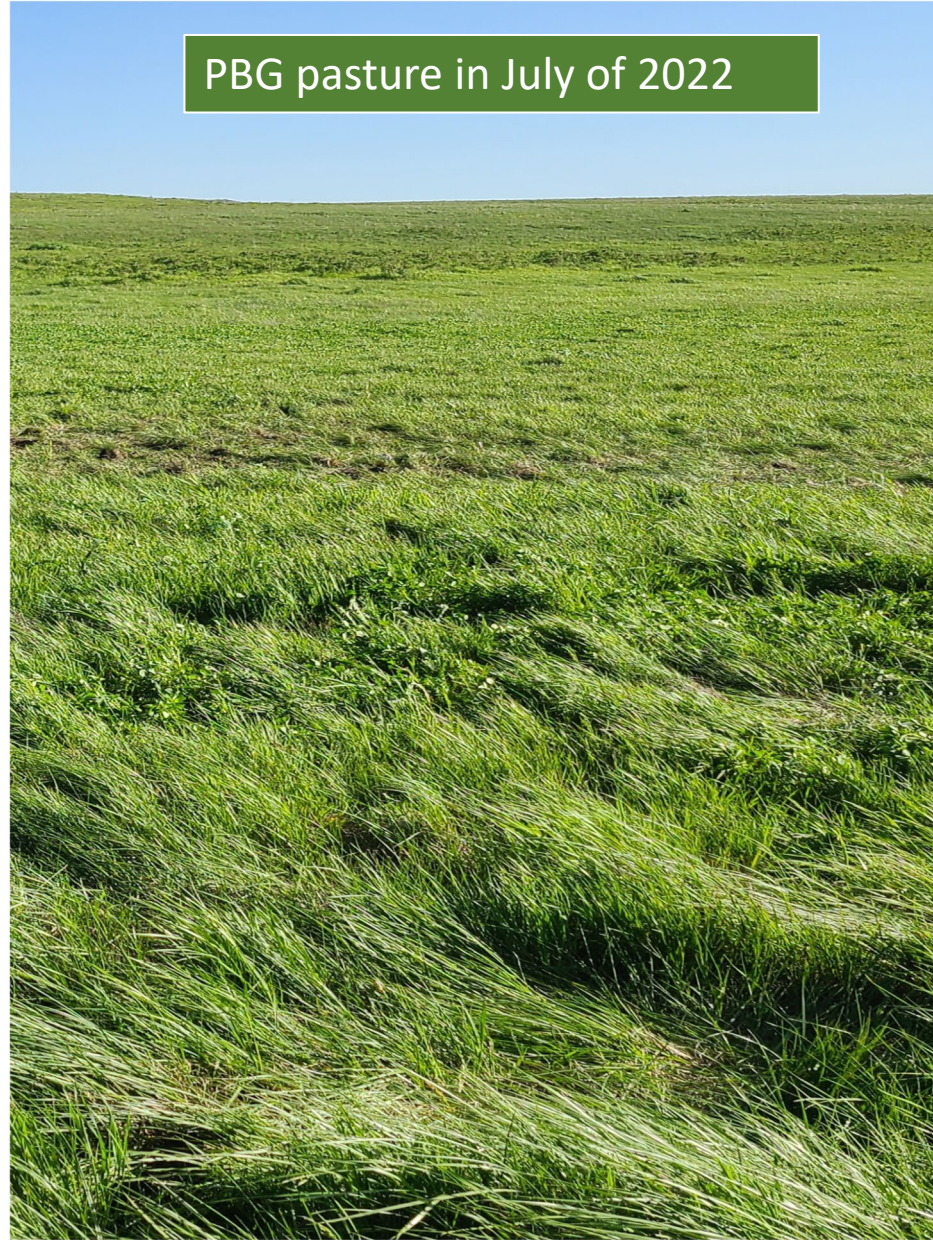


# Pollinator outcomes: summer 2021 drought

PBG pasture in July of 2021

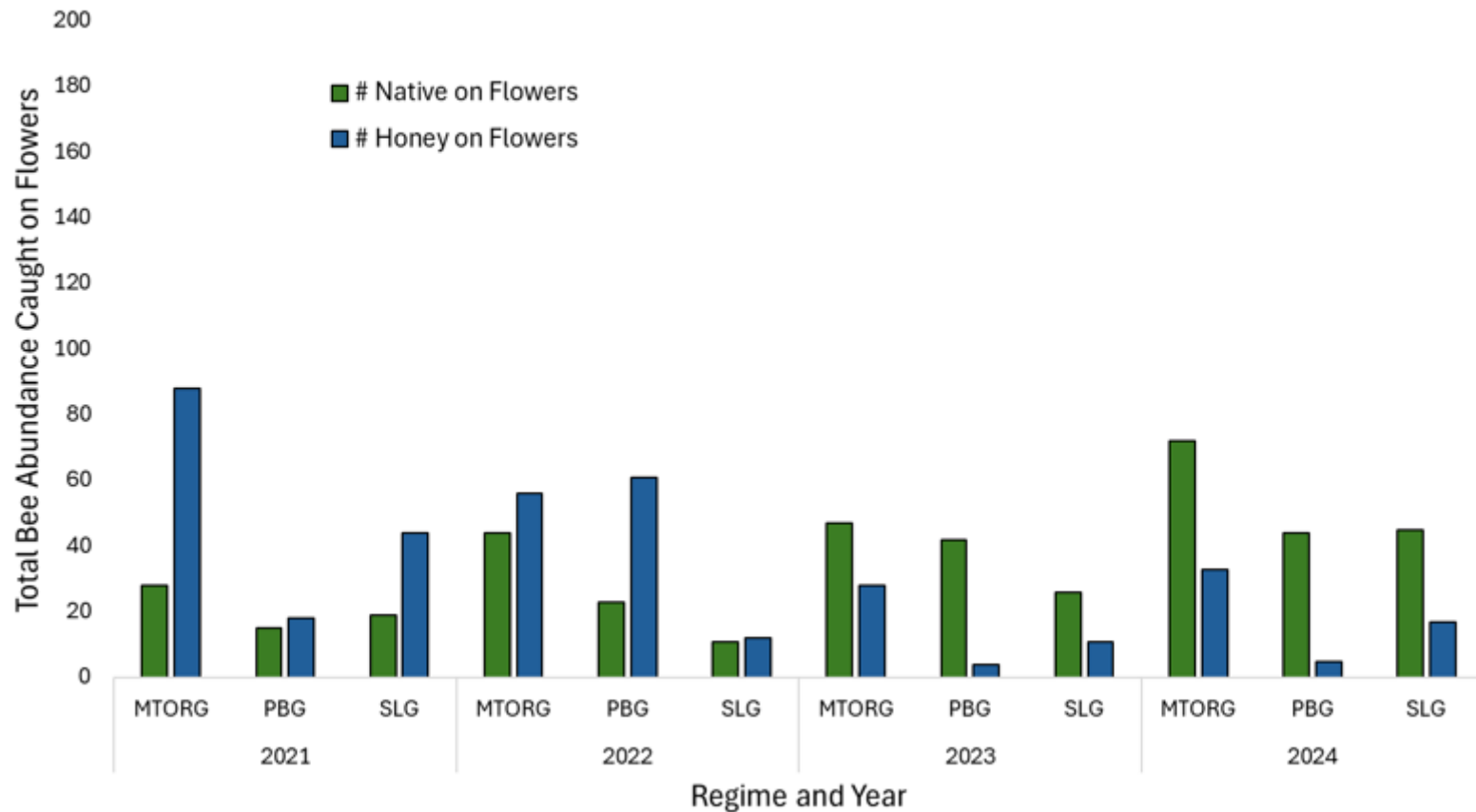


PBG pasture in July of 2022





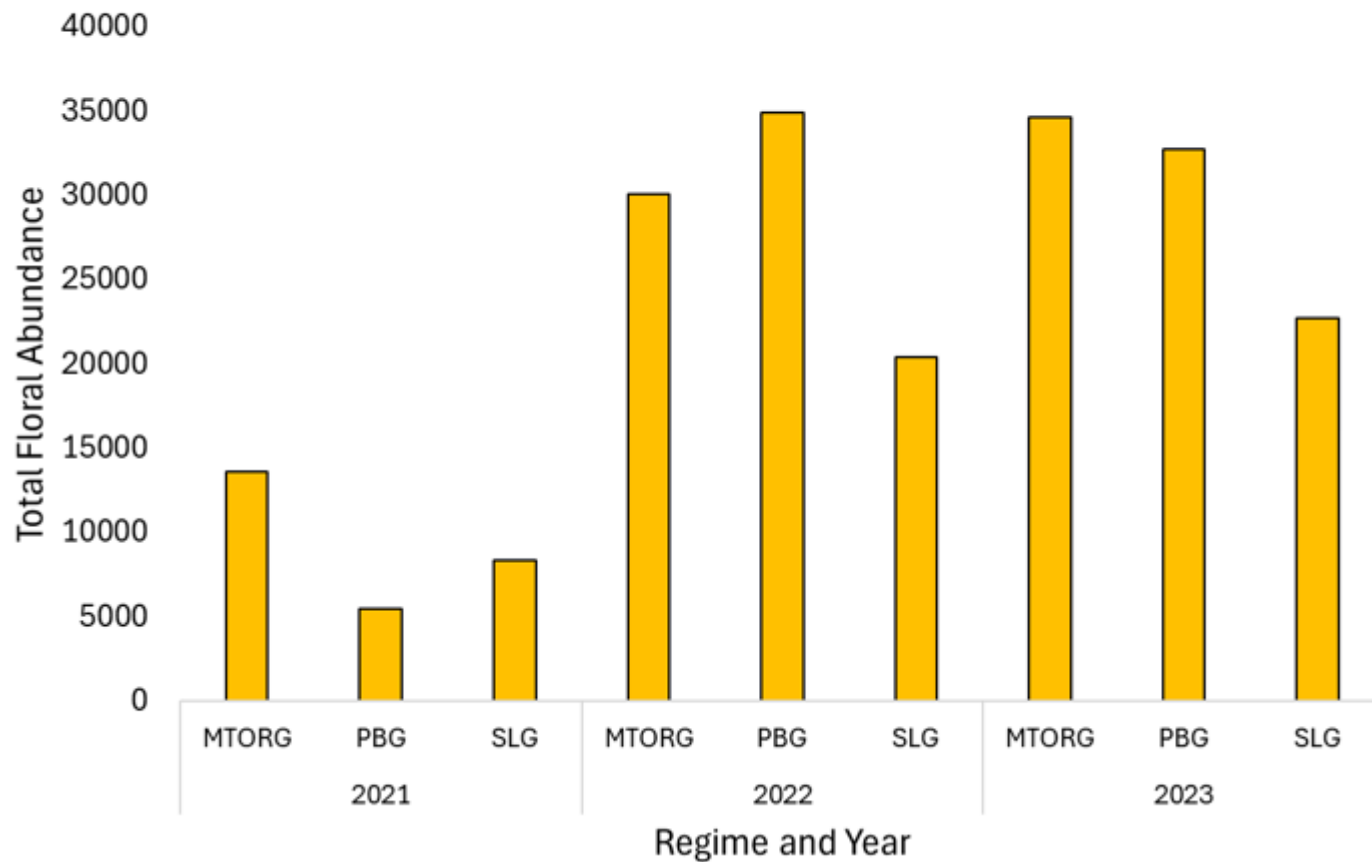
# Plant-pollinator outcomes: overview bees



## Takeaways:

- 1) All treatments are still recovering from the low abundances resulting from drought
- 2) MTOrg consistently had greater abundances followed by PBG and then SLG

# Plant-pollinator outcomes: overview flowers

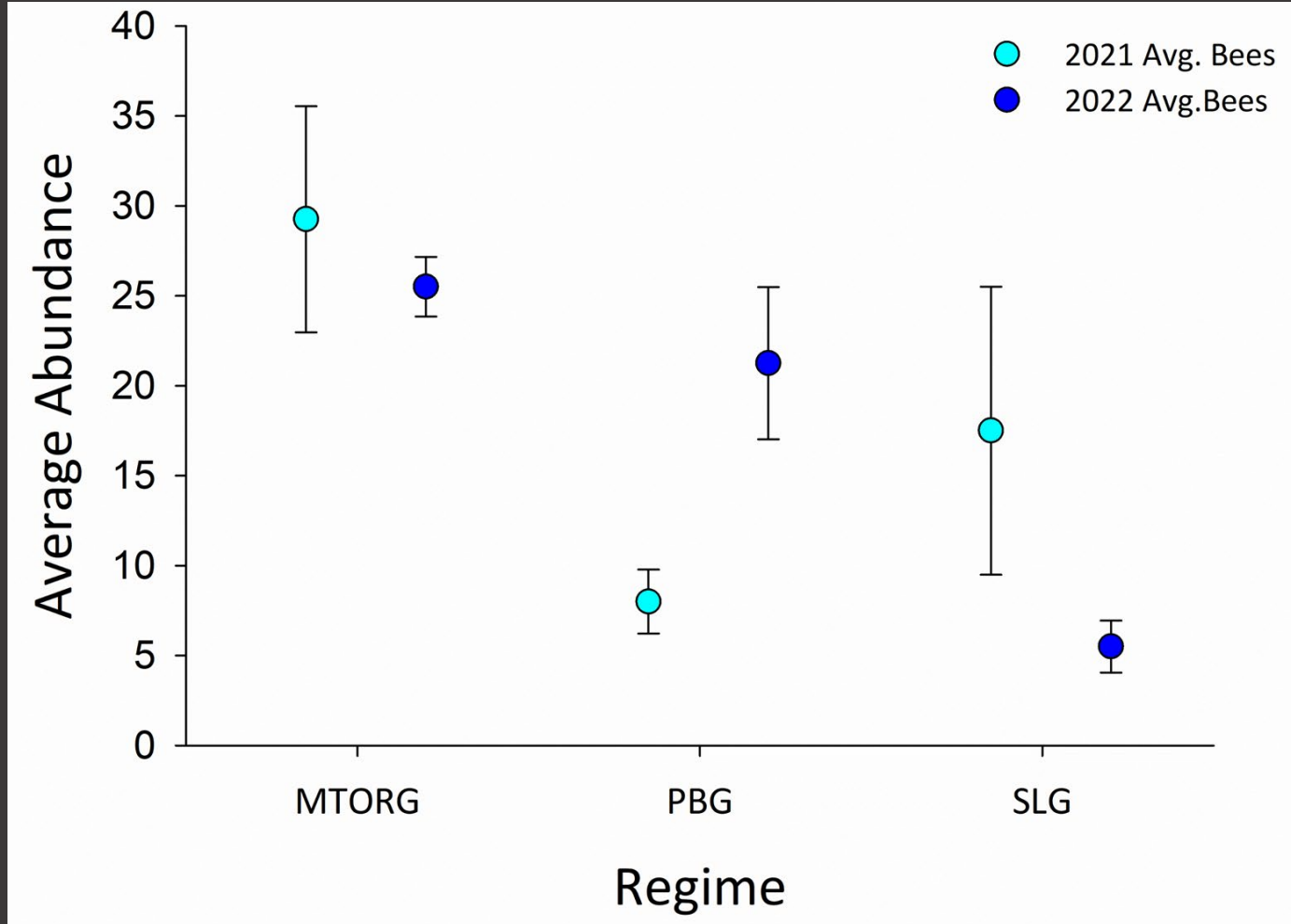


## Takeaways:

- 1) Flower numbers, like bees, showed a rebound post drought
- 2) PBG and MTORG have the greatest floral resources post drought while SLG consistently has the fewest



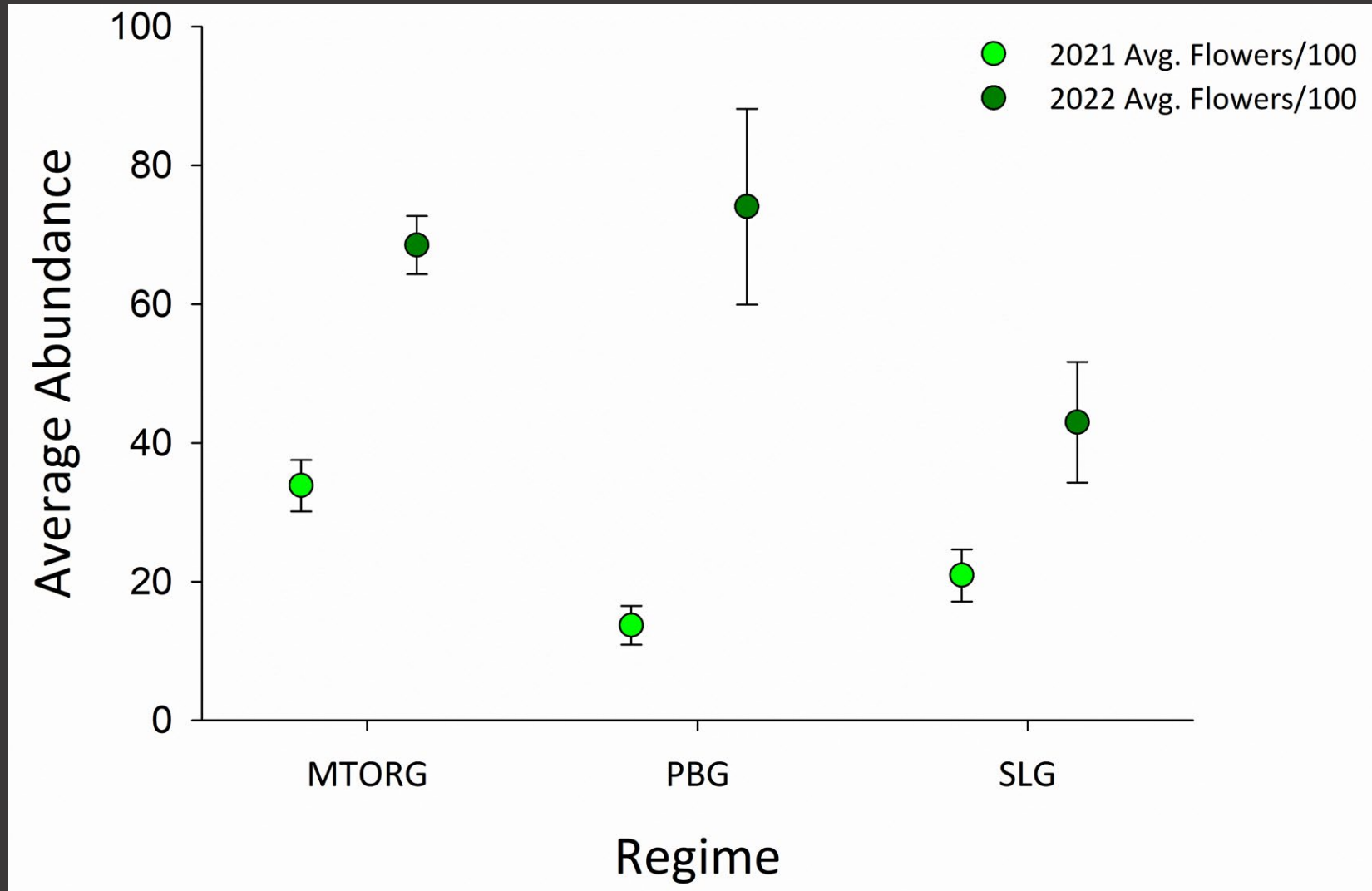
# Pollinator outcomes: bees early analysis



Takeaways:

- 1) Average bee numbers are greater in MTORG
- 2) PBG showed the greatest recovery post drought

# Pollinator outcomes: flowers early analysis

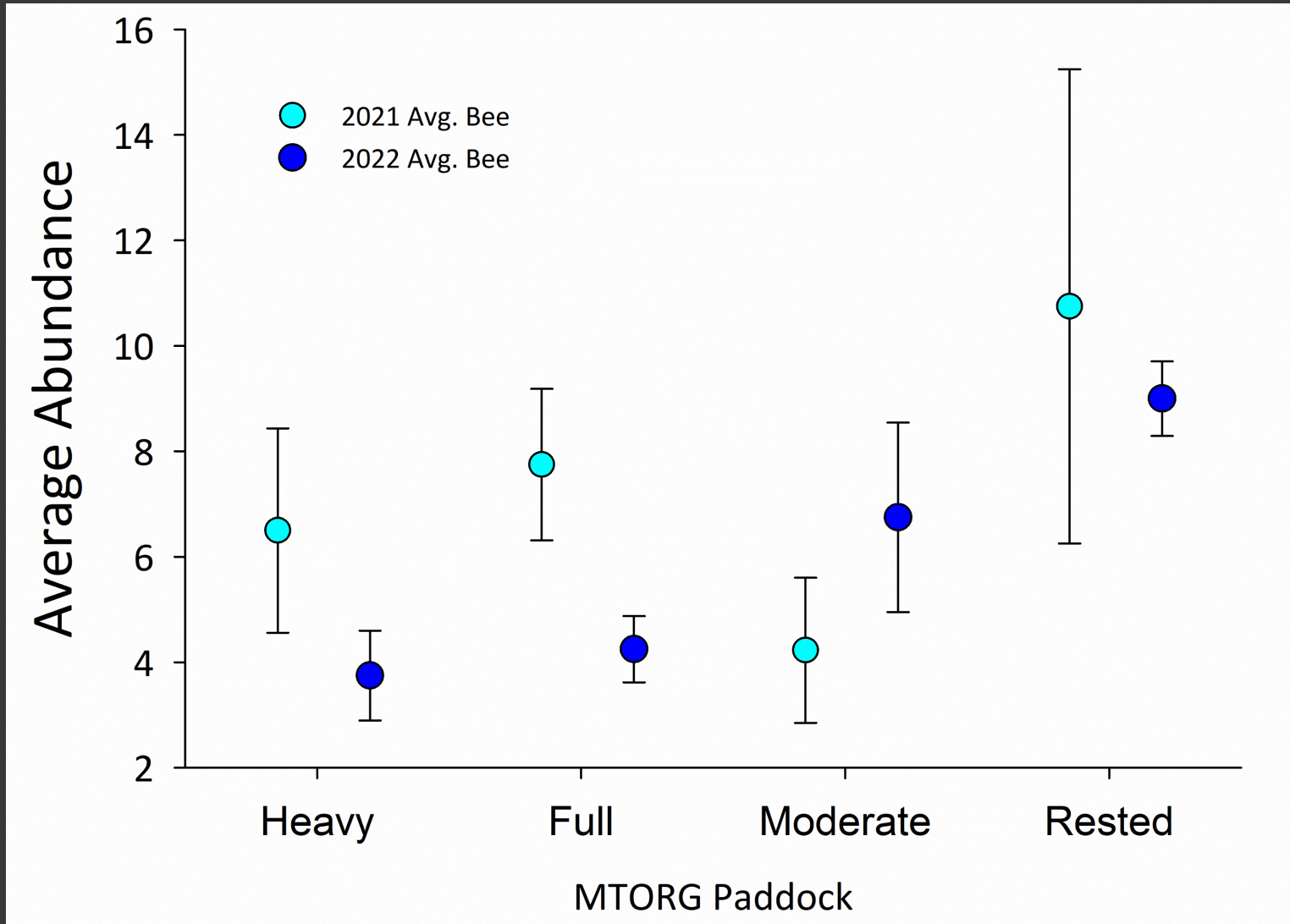


## Takeaways:

- 1) All treatments had greater flower numbers post drought
- 2) PBG showed the greatest floral resource recovery



# Pollinator outcomes: MTORG bees

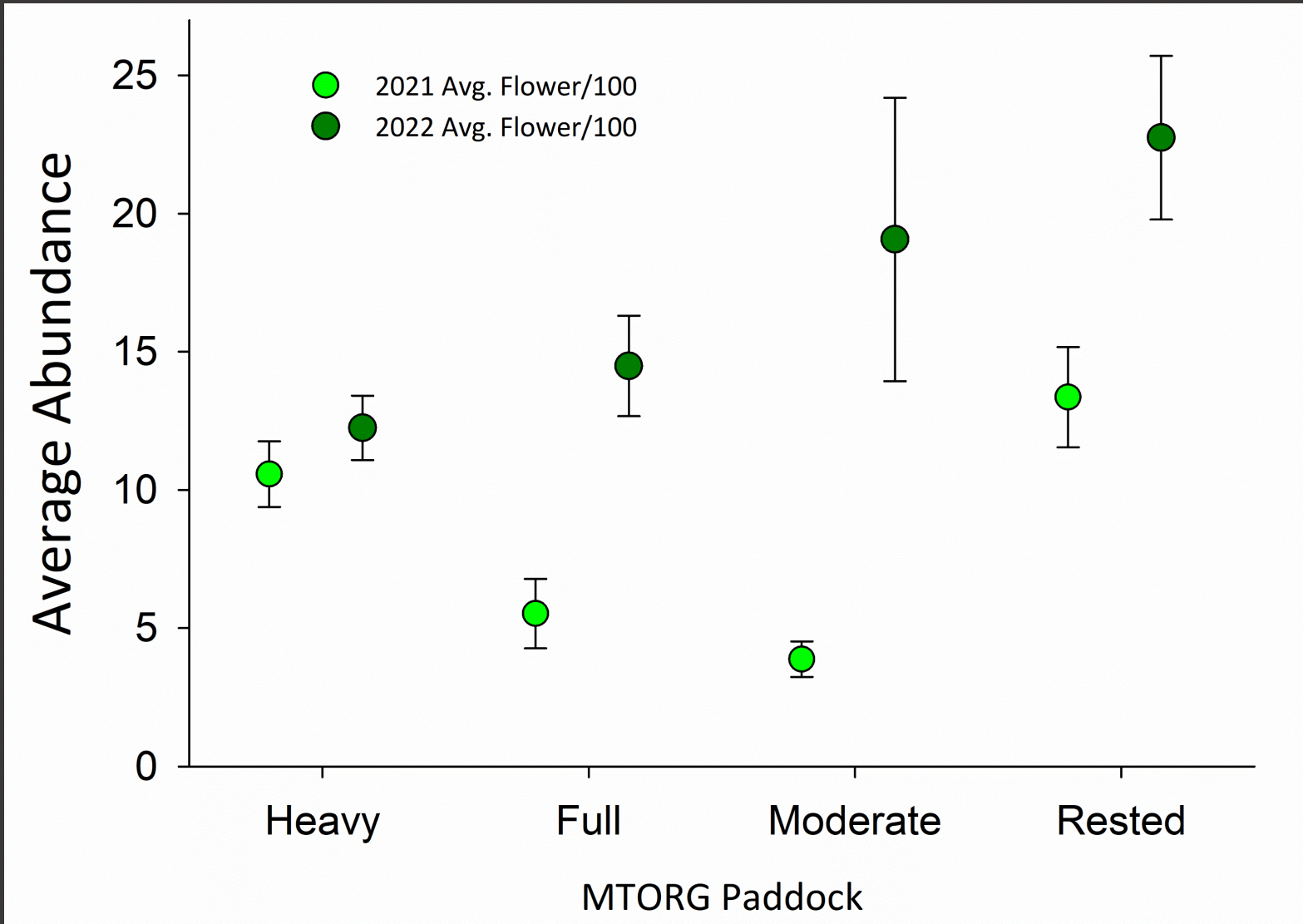
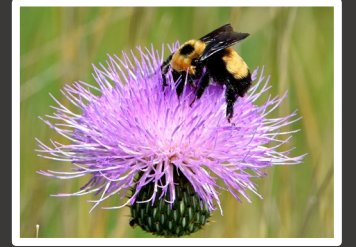


## Takeaways:

- 1) Increased grazing intensity results in relatively fewer bees
- 2) Rested areas promote bees, especially during drought



# Pollinator outcomes: MTORG flowers



Takeaways:

- 1) All intensities showed increased flowers post drought
- 2) Increased grazing intensity results in fewer flowers

# Conclusions



## Livestock

- FIRE!!!
- Greater calf gains, cattle gains, nutrient quality



## Pollinators

- Environmental factors may override management
- Fire may create more resilient landscapes for flowers
- Rested areas seem critical to bees and flowers



# Acknowledgements

- This work is supported by Renewable Energy, Natural Resources, and Environment: Agroecosystems Management grant no. 2020-67019-31154/project accession no. 1022241 from the USDA National Institute of Food and Agriculture.



National Institute of Food and Agriculture  
U.S. DEPARTMENT OF AGRICULTURE

- PhD students: Bethany Robertson, Esben Kjaer, and Justin Clarke
- CGREC staff and seasonal technicians

A photograph of a rural landscape featuring a dirt road that curves through a field. The field is divided into green and golden-brown sections, suggesting different crops or stages of growth. The sky is a clear, pale blue.

THANK YOU  
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