(Sheep) Grazing for Soil Health

Dirk Philipp, Department of Animal Science, University of Arkansas - Division of Agriculture

Objectives for today:

- Learn about ongoing research related to the Soil for Water Project
- What do I work on currently (and the most recent past)
- What's all about "Regenerative Grazing?" (…and what it means for climate change)
- Indicators of soil health; what should producers be looking for?


Field Rd
Field Rd
Field Rd
Field Rd
Field Rd
Field Rd
W Heck St
W Heck St
N Dvorachek Ave
N Dvorachek Ave
W Deane St
W Deane St
W Deane St
W Deane St
W Deane St
N Shamb

DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

Setup:

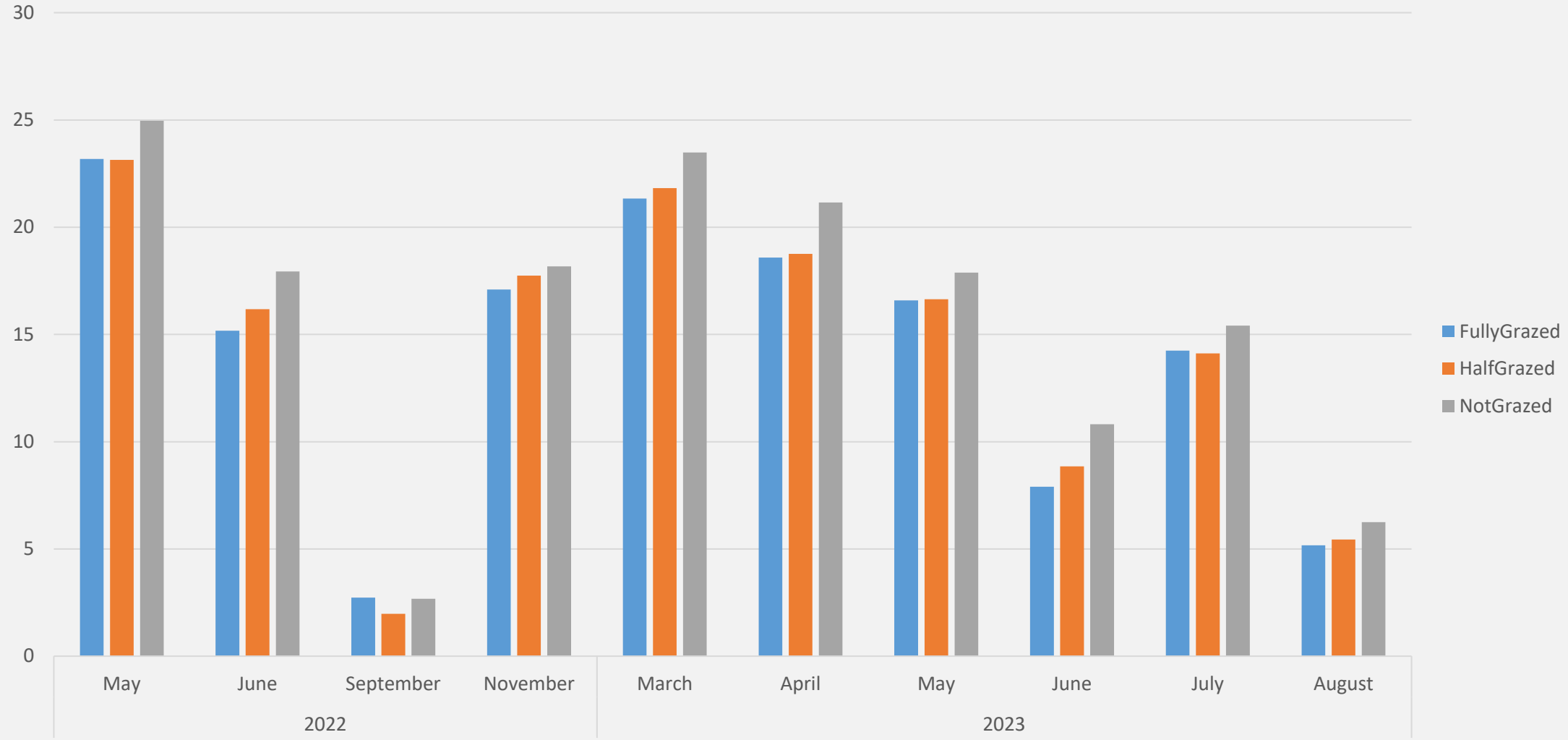
- 50% grazed of canopy
- 25% grazed of canopy
- Not grazed

- Plots grazed 1-3 days
- 3-4 grazing cycles per growing season

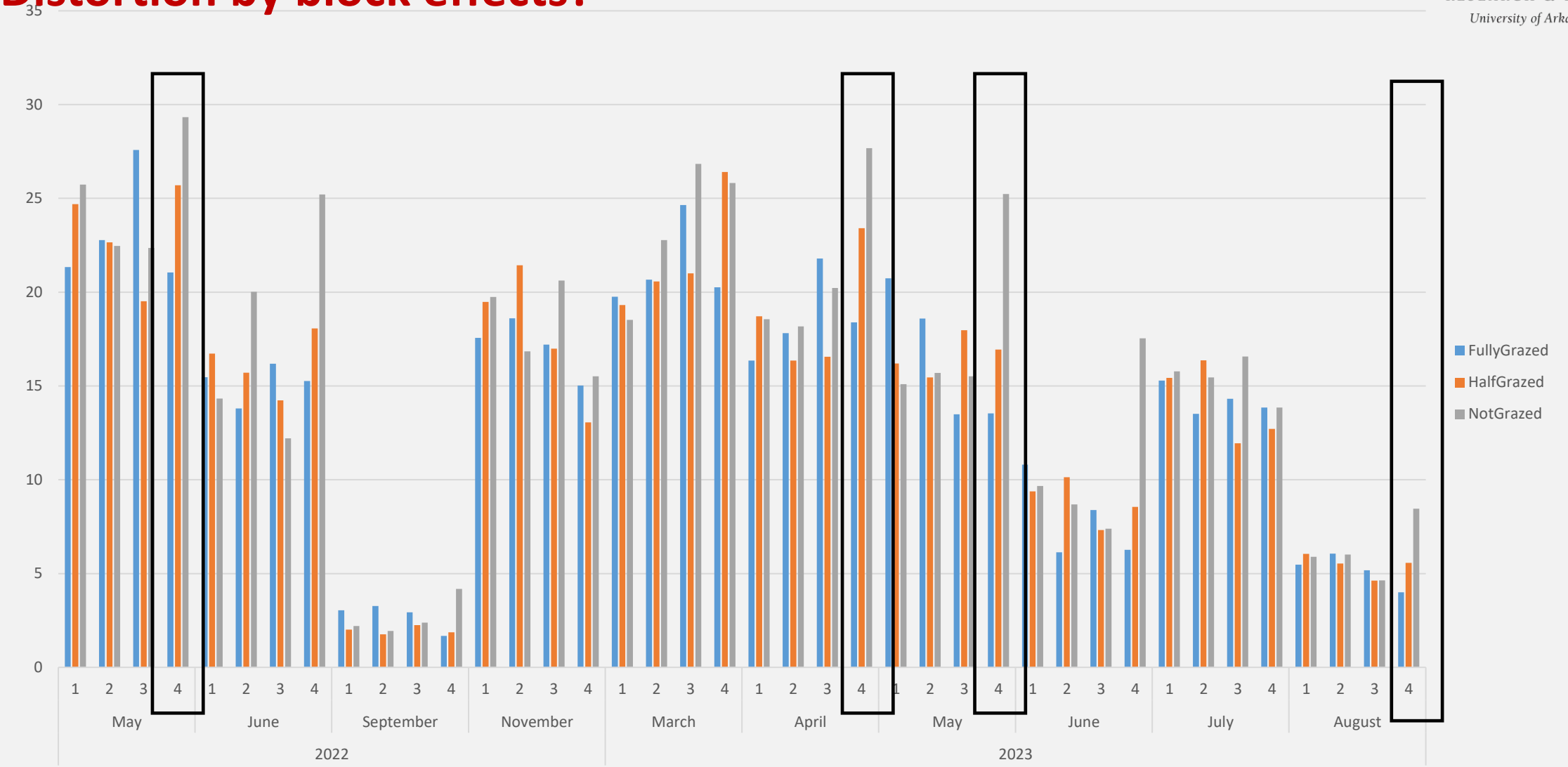
Data collected:

- Soil water content
- Soil chemical properties
- Forage mass

Soil water content (%) in grazed paddocks



Distortion by block effects?

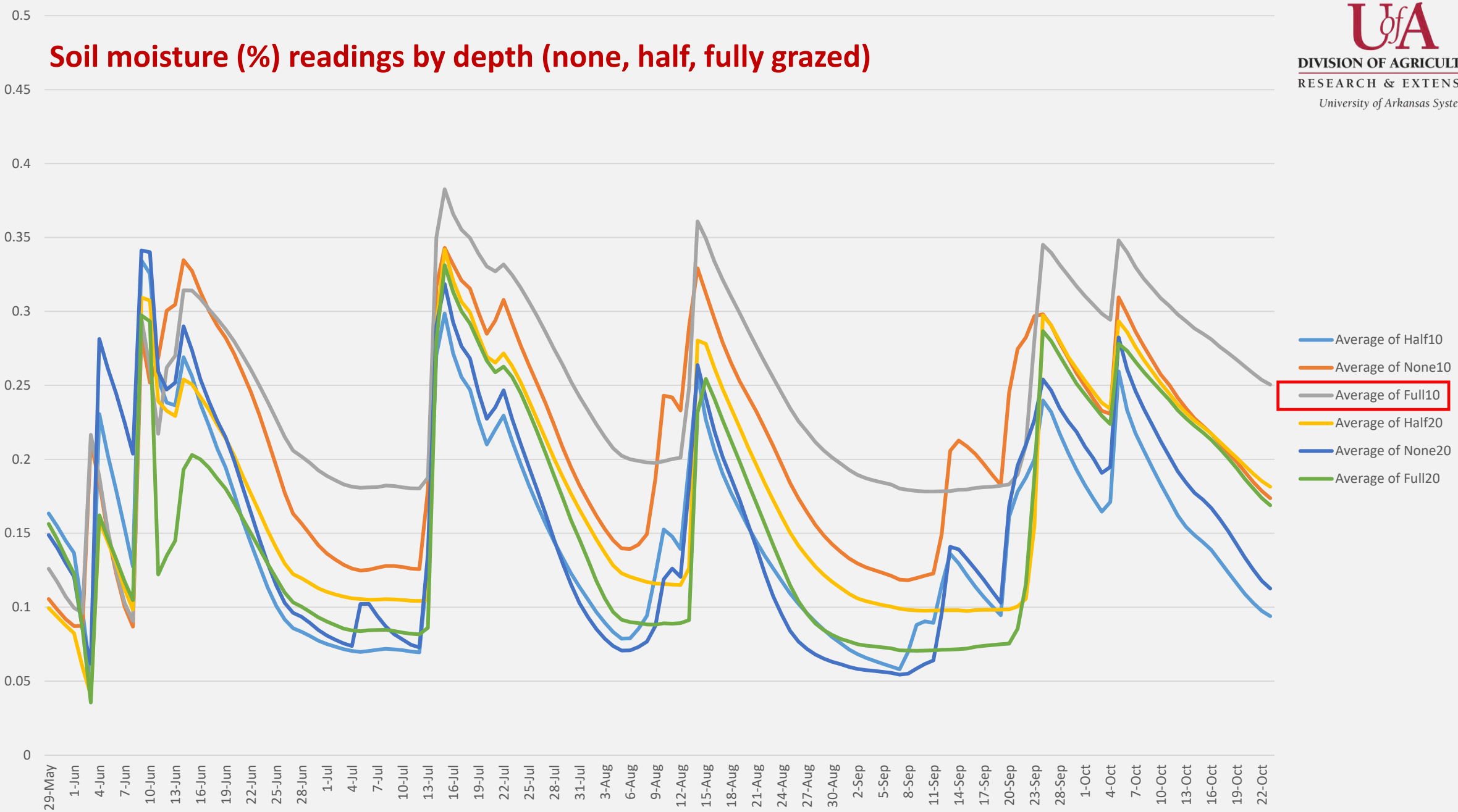


UofA
DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

Fully grazed plot

Soil moisture (%) readings by depth (none, half, fully grazed)



DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

What is driving Evapotranspiration (ET)?

DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

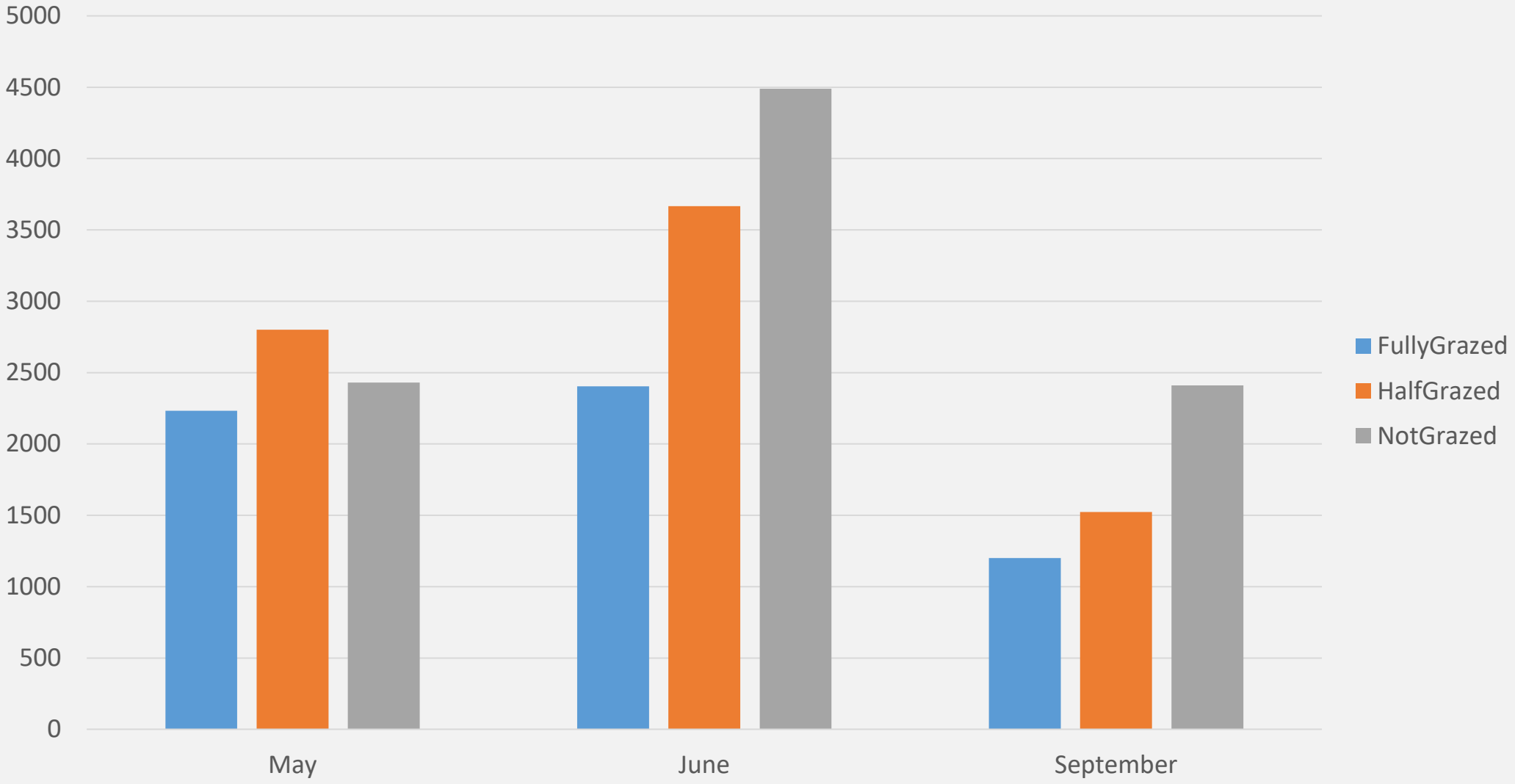
Four main factors:

- Solar radiation
- Air temperature
- Relative humidity
- Wind speed
- **Plant growth slots *in between* high water potential (soil) and low water potential (air)**
- **Difference in *evaporative demand of the atmosphere* drives ET**

A few take-aways:

- In a humid, subtropical environments, larger canopies likely means less soil water on average over time
- Soil moisture stays within a range that supports plant growth
- If soil moisture drops below critical threshold, plants stop growing and as a result less transpiration is occurring
- In Arkansas, soils rarely “dry out” completely due to relatively frequent rains

Forage mass (kg/ha) at the beginning of grazing cycles (2022)



DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

Left, non-grazed
Right, 50% grazed

DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

Left, non-grazed
Right, 25% grazed

A few words on soil sampling…

- Nothing unusual in terms of carbon and nitrogen on research paddocks
- pH ~6.0, total C = 1.36 average (x 1.72 = 2.3% SOM); total N = 0.13 % on average

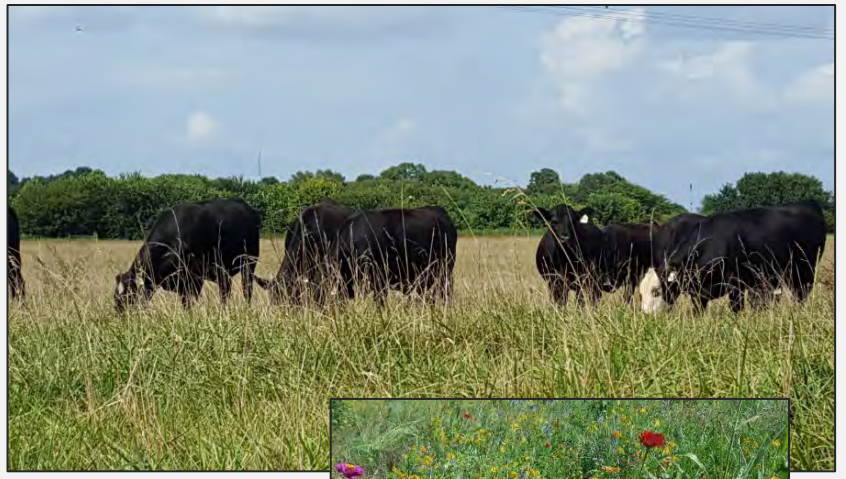
On-farm sampling:

- 3 farms (diverse sheep and cattle)
- Twice a year
- Standard analyses (plus Haney in some cases)

Why Mehlich-3?

- Widely used in research and extension
- Comparable across most soil conditions
- Variety of elements can be assessed at reasonable costs

Other Research and Extension Activities



1) Forage establishment and growth in pine woods and thinned hardwoods
   - SARE, completed in Fall of 2022 (Silvopasture)

2) Enhancing sustainability of forage-based ruminant production systems by improving N-use efficiency and decreasing N-emissions
   - USDA-NIFA, completed in Summer of 2023

3) Native Warm Season Perennials Grasses: An Enduring Solution to Summer Drought and Slump for Fescue Belt Organic Forage Production
   - USDA-OREI, started in Fall of 2023

4) Soil for Water Influence of grazing intensity on soil water content
   - SARE, ongoing

5) Developing a sustainable approach to roadside vegetation management in
   - The State of Arkansas, AR DOT, ongoing (Prairie Restoration)

6) Climate-Smart Grasslands – the Root of Agricultural Carbon Markets
   - USDA-NRCS, Multi-state, multi-institutional initiative, ongoing

7) Native grass/woodland establishment (multiple locations), UA Experiment Station, USDA-ARS Booneville

Agroforestry/Silvopastures

<u>Forage establishment in pine plantations:</u>
- 4 annual and 4 perennial forages

<u>Forage Establishment in thinned hardwoods</u>
- 2 perennial cool season forages

<u>Soil science component:</u>
- Root mass below forage plots
- Soil quality parameters upland vs. lowland
- Soil moisture and temperature in selected areas

<u>Outreach component:</u>
- Demonstration plots on private land
- Newsletter articles
- Site visits, field days

Forage Establishment in Pine Plantations

<u>Annual forages:</u>
- Annual ryegrass
- Italian ryegrass
- Crimson clover
- Arrowleaf clover

<u>Perennial forages:</u>
- Tall fescue (novel-endophyte)
- Orchardgrass
- Alflalfa
- White clover

Pine alleys:
- Loblolly pine
- 36-feet width
- ~30 years old (thinned)

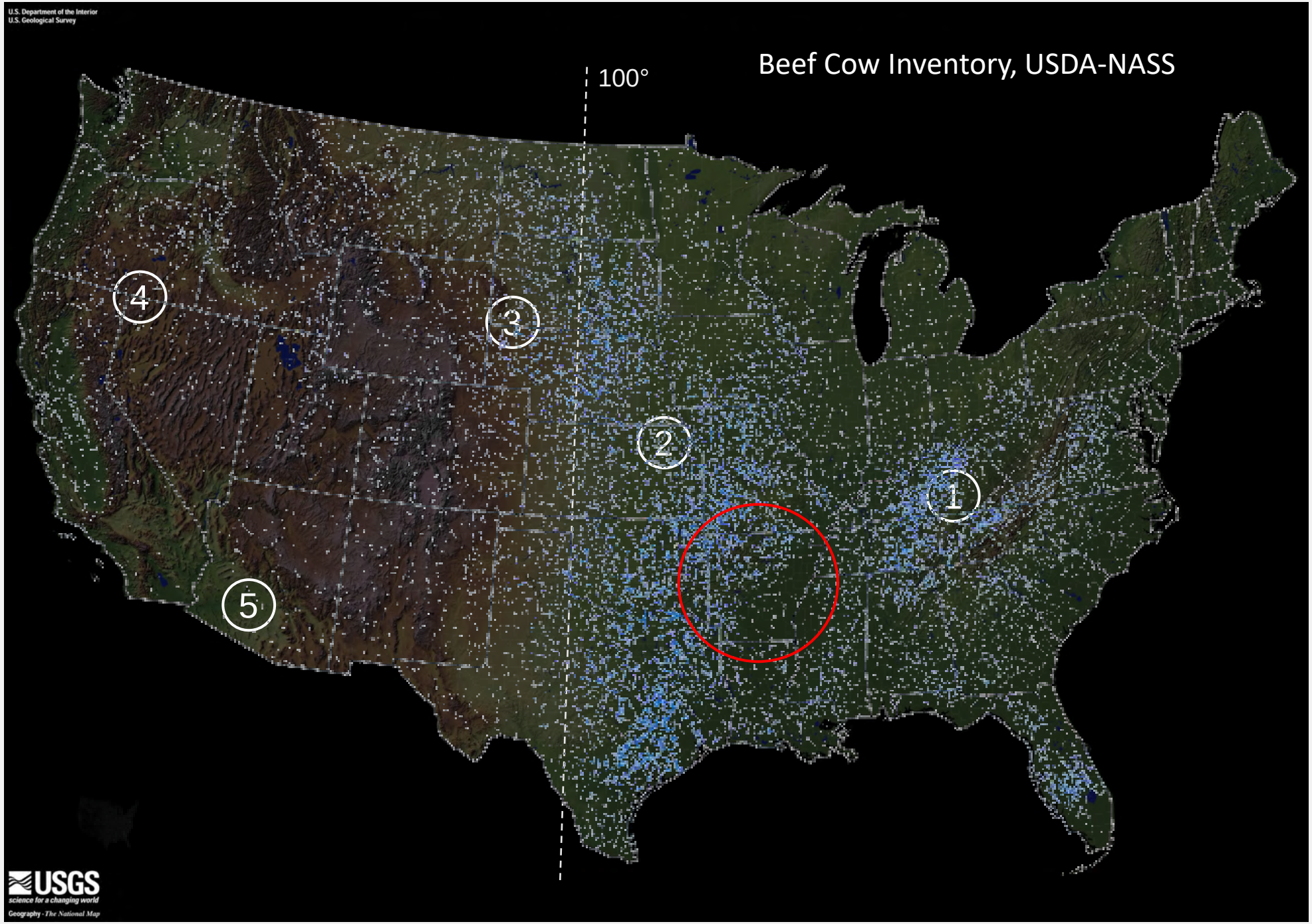
UofA
DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

So what do I think about regenerative grazing….
…and can grazing animals mitigate climate change?

UofA DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

It depends on a variety of factors, including:

- Prevailing climate and weather patterns
- Soil type
- Hydrology
- Biota (plant and animal life, above- and below-ground)
- Site characteristics, topography
- … and grazing management



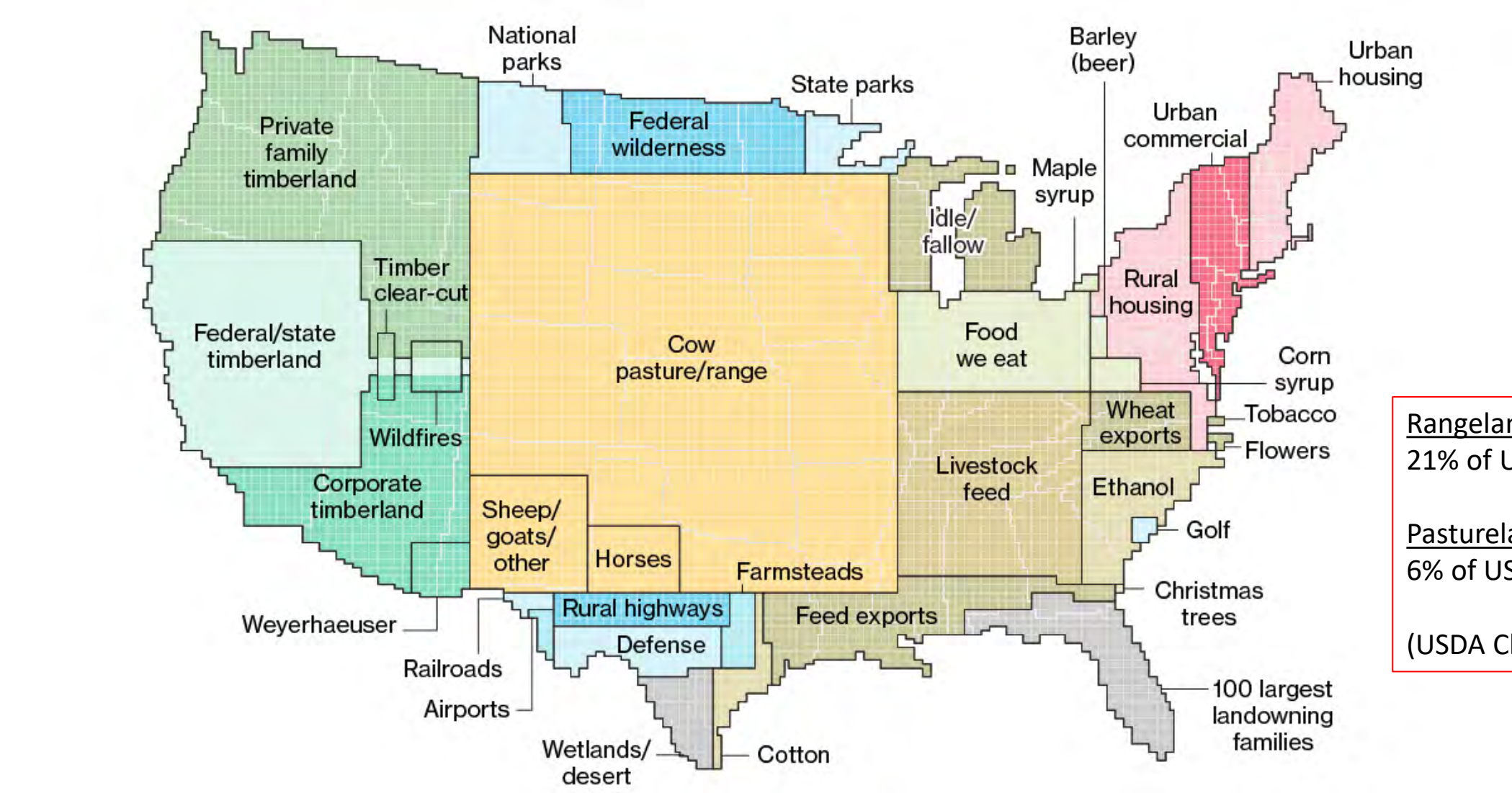
Grasslands in the US

1. Forested Region, some Savannas
2. Tallgrass Region
3. Shortgrass Region
4. Shortgrass and Shrub Region
5. Desert Grassland and Shrub Region

Based on 'Forages, Barnes et al., 2003

Certain rules and regulations apply…

- From a grassland ecology standpoint, grazing animals are disturbance factors, not necessarily drivers of carbon sequestration
- Disturbance (such as fire) leads to species diversity, shifts in grasses vs. forbs
- E.g., research from K-State at Konza prairie showed that maintaining species-rich plant communities requires grazers (bison) AND fire at a minimum (one factor alone is not enough)
- Large-scale carbon sequestration likely not possible with prevailing introduced forages
- Will total amount of land required change?



Rangeland: 405 m. acres, 21% of US surface area

Pastureland: 121 m. acres, 6% of US surface area

(USDA Climate Hub)

Source: Bloomberg News

What would be necessary to sequester more carbon on pastureland?

DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

- Diversification of forage base (carbon sequestration is transitional, not absolute)
- Shift to multi-story vegetative systems that sequester carbon at different levels (silvopasture, agroforestry)
- Likely very different approach necessary to doing livestock agriculture, including:
  - Product price structure
  - Type of land used
  - High- vs. low-intensity stocking
  - Carbon markets need to be established
- Food consumption is a cultural/economic/social decision, and not based on the latest life cycle assessment (LCA)

Practical Tips on Pasture Production – Animal Management – Natural Resources

- **All these are related and subject to long-term dynamics!**
- **Planning for the summer grazing/feeding periods starts in Spring (of years prior…)**
  - Whatever you do throughout the seasons affects everything else even years later
- Understand the natural resource base on your farm:
  - Hilltops, valleys, ravines, creeks, bottomlands, woodlands, pasturelands
  - What is the soil type? What is your soil's texture and fertility? History of use?

Soil Indicators to look for:

- We don’t have to reinvent the wheel
- pH, macro-nutrients, micro-nutrients (levels of N, P, K)
- Total C and N
- Sample soils on a regular basis
- Soil test reports are issued by the Extension Service

DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

Tallgrass Prairie National Preserve, Strong City Kansas