

Announcements

- Lab reports:
 - Graded LIGHTLY, will be more STRINGENT
 - REQUIRED: Double space reports
 - REQUIRED: Citations are ESSENTIAL
 - REQUIRED: Describe method, calculations, and statistics in Methods section.
 - REQUIRED: Clean titles and labels for tables and figures.
 - REQUIRED: Set print area!
 - Careful about language: increase, decrease, significantly different, low vs. small

Ecology citation format

Adler, P. B., D. G. Milchunas, W. K. Lauenroth, O. E. Sala, and I. C. Burke. 2004. Functional traits of graminoids in semi-arid steppes: a test of grazing histories. *Journal of Applied Ecology* **41**:653-663.

Ecology citation format

Elzinga, C. L., D. W. Salzer, and J. W. Willoughby. 1998. Measuring and Monitoring Plant Populations. BLM Technical Reference 1730-1. USDI, BLM: Denver, Colorado.

Ecology citation format

Whisenant, S. G. 1990. Changing fire frequencies on Idaho's Snake River Plains: ecological and management implications. General Technical Report INT-276, USDA, Forest Service, Intermountain Research Station, Las Vegas, NV.

Methods

- Frequency Lab:
 - What we did in the field: "Frequency was recorded for three separate quadrat sizes....."
 - What we did to summarize and analyze data: ".....We summarized frequency data for the two prairie dog sites to obtain means and standard deviations. These summary statistics were then used to evaluate frequency data for each species and functional group of plants with the use of confidence intervals. Confidence intervals that did not overlap suggested a significant difference in vegetation on the two prairie dog sites."

Confidence Intervals

- If confidence level is 95%, you are 95% sure that the confidence interval range contains the true mean.
- If comparing two populations, if confidence intervals DO overlap, populations ARE NOT significantly different.
- If confidence intervals DON'T overlap, populations ARE significantly different.

Utilization

Rangeland Monitoring and Measurements RS332 & RS532

Sharp et al., 1994
Bartolome et al., 1980
Reed et al., 1999
Utilization Studies (pp. 1-5, 119-125, 89-102, 109-118)

Utilization, Production, and Carrying Capacity

- Utilization = measure of amount of production that is removed or destroyed
- Production = amount of vegetation produced in a given area; sometimes expressed as rate
- Carrying Capacity = given resources available (i.e., production), the number of animals that can be sustained on a landscape

Utilization

Percentage of current year's vegetative production REMOVED or DESTROYED by herbivores.

Utilization = Consumption + Destruction

From plant's perspective: What is lost?

Utilization

$$= \frac{(\text{Amount Consumed} + \text{Amount Destroyed})}{\text{Amount Produced}}$$

$$= \frac{(\text{Ungrazed Biomass} - \text{Grazed Biomass})}{\text{Ungrazed Biomass}}$$

What is this second one really measuring?

Consumption

Percentage of current year's vegetative production REMOVED or DESTROYED by herbivores.

Utilization = Consumption + Destruction

From ANIMAL's perspective: What is gained?

Why do we care? Energy budgets or animal nutrition

Uses of Utilization

- Document grazing intensity
- Determine spatial patterns of use
- Make SHORT-TERM management decisions
- Estimate efficiency of forage harvest
- Estimate energy acquired by grazers
- Estimate carrying capacity
- Assess one facet of plant community status (together with condition, trend & rangeland health)

Utilization does NOT inform us about ...

- Timing of grazing
- Distribution of grazing
- Duration and frequency of grazing
- Types of grazers (deer, elk, cattle, bunnies)
- What is left for the plants



Utilization ≠ Good Management Objective

Utilization is ONLY one part

- To really learn about impact of land use, to really meet an objective about grazing management:
 - Measure utilization
 - Measure other responses as well
- Responses:
 - Species composition
 - Ground cover
 - Total live plant cover
 - Canopy volume.....

How would we measure utilization?



Utilization Considerations

- Tough to measure what's REALLY gone, when:
- you don't know what was there, or
 - you don't know what could be produced

Measuring utilization is challenging!

Utilization Considerations

- WHEN to measure?
- WHO to measure?
- WHERE to measure?
- HOW to measure?

Utilization Considerations

- WHEN to measure?
 - Immediately after grazing?
 - At the end of the growing season?

Think about the definition.....

Utilization Considerations

- WHEN to measure?
 - Immediately after grazing?
 - At the end of the growing season?
- Answer:
 - For consumption, immediately after grazing
 - For UTILIZATION, at end of growing season

Utilization Considerations

- WHO to measure?
 - Plant communities are the norm, not monocultures
 - Palatability differs by:
 - Species
 - Phenology
 - Age
 - Soil chemistry
 - Preference differs by: species, age, recent history....

So WHO gets measured?

So WHO gets measured?

- All plants in community OR
- Key species
 - Good forage species
 - Preferred forage species
 - Species that confer watershed protection
 - Endangered or threatened species
 - Cool season species in cool season utilization studies, warm species in warm season
 - Poisonous species or weedy species

Key Species

- Commonly: A plant grazed by animal of interest.
 - Abundant, palatable, & managed to maintain or increase abundance
 - May use different species for different seasons
- Assumption: if key species is utilized properly, all species will be
- Problem? Like having your butt encased in ice, and your feet in the fire – on average, all is well!

Bottom line on WHO to measure?

- Species directly tied to management objectives!

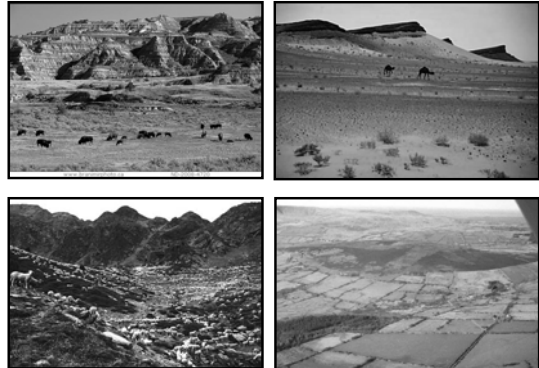
What is your objective?

- Carrying capacity?
- Energy intake of grazers?
- Conservation of wetlands?
- Conservation of a butterfly?

Utilization Considerations

- WHERE to measure?
 - Key areas
 - Representative of grazing activity
 - Responsive to management
 - Not too close or far from water
 - Not inaccessible to grazers or managers
 - Contains plants or responses of interest

Where are the KEY areas?



Caution!

- We ASSUME utilization level is correlated with the desired species composition and level of production
- Often untested
- Thus, when utilization is used without other condition/trend monitoring, it is not a sound basis for decisions

Utilization Methods

- Harvest methods
 - Before-after
 - Grazed-ungrazed
- Landscape appearance
- Height-weight
- Grazed class
- Residual biomass and stubble height
- Grazing Response Index

Harvest Methods

Before-After: Standing crop/biomass estimated before & after grazing period.

$$\text{Utilization} = \frac{(\text{Before} - \text{After})}{\text{Before}} \times 100$$

e.g.: $\frac{[(340 \text{ g/m}^2 - 175 \text{ g/m}^2)]}{340 \text{ g/m}^2} \times 100 = 49\% \text{ utilization}$

Harvest Methods

Before-After: A good choice when....

1. grazing is during dormant phase.
2. period of grazing is short.
3. need estimate of consumption during growing season.
4. clipping and removing vegetation is OK.

Harvest Methods

Grazed-Ungrazed: Caged (ungrazed) and uncaged (grazed) paired plots. Both plots clipped at end of grazing period.

$$\text{Utilization} = [(\text{Ungrazed}-\text{Grazed})/\text{Grazed}] \times 100$$

Harvest Methods

Grazed-Ungrazed: A good choice when....

1. monitoring is intensive.
2. many plots can be caged.
3. money/time is not a concern.
4. clipping and removing vegetation is OK.

Problem....removing the effects of the cage!

Landscape Appearance Method

(Key Forage Plant Method; Anderson & Currier Method)

- Qualitative, ocular estimate based on general appearance
- Compares observations in field with written descriptions of utilization classes
- Can be adapted for browse utilization

Landscape Appearance Method

(Key Forage Plant Method; Anderson & Currier Method)

Uses

- Utilization mapping
- Large areas
- Limited time
- Few researchers

Advantages

- Fast
- Minimal training

Disadvantages

- Subjective

Height-Weight Methods

- Based on assumption that height and weight are correlated.
- Therefore, height can predict weight.
- Gauges exist (e.g., Forest Service utilization gauge).

Uses

- For grass and grasslike species (not forbs or shrubs)

Height-Weight Methods

Advantages

- Largely objective
- Repeatable, fast, easy

Disadvantages

- Developing the height-weight relationship:
 - Requires ungrazed plants, which may not be available
 - Time consuming

Considerations

- Height-weight relationship is not linear
- May change depending on ecotypes, etc.

Height-Weight Methods

