Grazing Management Tools, Rules and Guidelines.
As to methods there may be a million and then some, but principles are few. The man who grasps principles can successfully select his own methods. The man who tries methods, ignoring principles, is sure to have trouble.

~ Ralph Waldo Emerson
Objectives:

► Understand the difference between overgrazing and overstocking.
► Understand 5 factors that are manipulated in planned grazing management.
► Understand the factors that affect optimum stocking rate.
► Understand the difference between stock density and stocking rate.
Objectives cont’d.

► Understand what determines the proper recovery period and graze period and how these two are related.
► Understand the differences and linkages between animal impact, stock density, and herd effect.
► Learn 4 rules of proper grazing management.
► Learn 5 guidelines of proper grazing management.
Questions:

► Why are you in the livestock business?

► You own or control forage resources that in themselves have little economic value, and you are using the livestock to convert it to something of monetary value.
Questions:

- Are Overgrazing and Overstocking the same?
- NO!
Questions:

► What is the difference between overgrazing and overstocking?
Three Things That Affect a Plant’s Response to Grazing

► Frequency and Timing of Defoliation

► Intensity of Defoliation

► Opportunity for Growth/Regrowth
Five Things Manipulated to Achieve Grazing Management Goal:

- Stocking Rate
- Recovery Period
- Animal Distribution, Timing and Number of Grazing Areas
- Stock Density
- Animal Impact & Herd Effect
Stocking Rate

- A measure of forage demand, for a given area, FOR A GIVEN PERIOD OF TIME

- Measured with units of each such as Acres/AUM, AUD/acre, Acres/AUY
Economically viable stocking zone

Lbs

Lbs/ac

Lbs/HD

AUD/ac
Stocking Rate

- Normally changes over the course of time as a result of changes in animal size, physiological status, forage quality or palatability, etc.
- This change in demand should reflect the availability of quality forage for optimal biological efficiency.
Stocking Rate

1. Affects intensity of defoliation.
2. Coarse Adjustment
3. Optimum does not exceed sustainable carrying capacity.
4. Optimum SR is $f$ (amount, quality of forage, desired performance, direct costs, livestock price)
5. NOT A FUNCTION OF OVERHEADS!!!
6. Degree of flexibility should reflect environmental risk of the forage resource.
Recovery Period

Objectives

- Understand why recovery from defoliations is important for plant community health and the difference between “rest” and “recovery.”
- Understand what determines the proper recovery period and graze period and how these two are related.
Recovery Period

1. Affects frequency of defoliation and opportunity for growth/ regrowth.
2. Determined by operator and depends on growing conditions and plant vigor.
3. Too short hurts plant and sometimes the animal, too long hurts animal.
4. How do you know what the proper amount of recovery is?
## Effects of Residual Cover and Opportunity for Regrowth

<table>
<thead>
<tr>
<th>Grazing Mgmnt.</th>
<th>Residual /product</th>
<th>Roots (gm)</th>
<th>% utilization</th>
<th>ac/cow/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Residue</td>
<td>1150/1900</td>
<td>26.4</td>
<td>39.5</td>
<td>12.8</td>
</tr>
<tr>
<td>High Residue</td>
<td>3375/4550</td>
<td>118.4</td>
<td>25.8</td>
<td>8.5</td>
</tr>
</tbody>
</table>

Low Residue – GP up to several months, occasional growing season recovery, moderately stocked

High Residue – GP usu. <10 days and variable, growing season recovery every year, moderately stocked
- Can you be overgrazing without overstocking?
- What are some indicators?
• Can you be overstocked without overgrazing?

• How would you know?
“One Minute Essay” on Recovery Period
Animal Distribution, Timing, and Number of Grazing Areas (DTN)

1. Affects where and when defoliation occurs.
2. Commonly accomplished by varying number of paddocks through fencing.
3. Other methods include:
   - Attractants
   - Access to water
   - Burning
   - Herding
   - Timing access so key management areas are more or less desirable to animals.
Using paddock numbers to manipulate DTN:

- MAY affect livestock distribution, ability to select diet, stock density.
- Along with recovery period, paddock numbers determine GRAZE period.
- Increasing paddock number with a given recovery period decreases graze period and likelihood of second bite.
“One Minute Essay” on Animal Distribution, Timing, and Number of Grazing Areas
Objective

• Demonstrate and discuss how animal preferences, selectivity, forage diversity and time interact with stocking density, and how management can increase OR decrease forage demand per unit area and average daily nutrient intake of animals for a grazing period with increasing stocking density (paddock numbers).
Definitions

• Stocking rate (SR) – forage demand per unit area for a *period of time*,
  – Units such as acres/animal unit month (AUM) or animal unit days (AUD)/acre.
  – When calculated for a grazing period, referred to as *stocking intensity (SI)*.

• Grazing capacity (GC) – maximum sustainable stocking rate *for a given desired level of animal performance*.
  – Measured in same units as stocking rate.
Definitions

- Herbage Allowance (HA) – Ratio of forage available (GC) to animal demand (SR or SI) for the same period.
  - Inversely proportional to stocking intensity;
  - Indicates potential for dietary selection by the grazer;
  - May be most meaningful when considered as an average daily availability for a graze period.
Definitions

• Stocking Density (SD) – animals/unit available area at a given moment, *without any measure of time*.
  – AU/acre

• Area Allowance (AA) – units of available area/animal at a given moment; the inverse of SD: mathematically and graphically different from stock density.
  – Acres/AU

• *Higher SD ≠ higher SR or SI!*
Figure 1. Animal density expressed in different ways as affected by number of paddocks.
From Briske et al (2008)
Fig. 2. Predicted number of defoliation events in a grazing season at (a) light stocking rate, 0.3 AU ha$^{-1}$, (b) moderate stocking rate, 0.4 AU ha$^{-1}$, and (c) heavy stocking rate, 0.5 AU ha$^{-1}$.
32 ewes w/ ~48 lambs on .2 ac.
How do we reconcile the conundrum?!

- Nutrient requirements are expressed on a **DAILY basis**

- Daily intake $f(\text{stocking intensity:grazing capacity})$
  - Stocking intensity $f(\text{animal number, area, time})$
  - Grazing capacity $f(\text{forage availability and quality over time, desired performance})$
~60 hd on .5 acre
• Time and mobility interact to limit the amount of a large paddock that can be examined in a given period of time (Kothmann 1984), so not all forage in a paddock is actually available instantaneously.
Implicit assumption that all forage is available, even over time, fails to account for spatial variability in diverse landscapes (Norton, 2003).
An Alternative Paradigm

• Animal’s challenge: mix plants of relatively high quality with those of lesser quality to meet requirements.
An Alternative Paradigm

• Animal’s challenge: mix plants of relatively high quality with those of lesser quality to meet requirements.

• Grazing manager’s challenge: optimize animals’ opportunity to select adequate quality over time in a way that provides for the long-term sustainability of the resource.
Forage quality (e.g., CP or DDM)

Animal requirement

Maximum amount that could be consumed to meet requirement during a single grazing bout
Forage quality (e.g., CP or DDM)

Amount of forage

Maximum amount that could be consumed to meet requirement during a single grazing bout

Animal requirement

Amount depleted
Amount that could have been consumed to meet requirement during a single grazing bout that can no longer be mixed to meet requirements

Animal requirement

Residual that will still meet requirements

Amount depleted

Forage quality (e.g., CP or DDM)
THUS at higher SDs with constant animal numbers and the same availability of quality in a paddock, animals *may*:  
- select a wider variety of plants while (possibly) maintaining adequate nutrient intake *throughout* the graze period with *higher* stocking intensity, **OR**  
- select a diet with less variation but the same average quality for a graze period at *the same* stocking intensity **OR**  
- consume a higher average diet quality with a *lower* stocking intensity.
• Rate of forage disappearance in a paddock increases with SD but-
• If graze period decreases faster, proportionally, than SD increases, *stocking intensity decreases.*
Assumed:

• Complex, multi-species, temporally variable grassland (not tame pastures).
• Forage quantity and quality same among strategies (plant communities same).
• Different management implemented using the same pastures (similar animal distribution).
• Adequate management skill for each strategy.
• No livestock/grazing system interactions (animal behavior/selectivity remains constant).
Given:
- Cell size: 1600 ac
- Number hd: 50
- Required recovery period: 315 days
- Average annual SR: 11.4 AUD/ac

Assume:
- Complex, multi-species, temporally variable rangeland but similar sizes and distribution of plant communities throughout pasture.
- Distribution is similar when grazed continuously or with multiple paddocks.
- Adequate management skill for each strategy
- Animal behavior/selectivity remains constant.
- Area Allowance: 32 ac/hd.
- Stocking intensity: 11.4 AUD/ac
Given:
- Cell size: 1600 ac
- Number hd: 50
- Required recovery period: 315 days
- Average annual SR: 11.4 AUD/ac

Then:
Number of paddocks: 4
Paddock size: 400 ac
Area Allowance: 8 ac/AU
Graze period: 105 days
Stocking intensity: 13.1 AUD/ac
Cycle length: 420 days
% Grazed days/cycle:
  \[ \frac{105}{420} = 25\% \]

What happens to diet quality with this type of management?
Given:
- Cell size: 1600 ac
- Number hd: 50
- Required recovery period: 315 days
- Average annual SR: 11.4 AUD/ac

Then:
Number of paddocks: 16
Paddock size: 100 ac
Area Allowance: 2 ac/AU
Graze period: 21 days
Stocking intensity: 10.5 AUD/ac
Cycle length: 336 days
% Grazed days/cycle:
\[
\frac{21}{336} = 6.25\%
\]

What happens if we just decrease graze period by a factor of 4?
Given:
- Cell size: 1600 ac
- Number hd: 50
- Required recovery period: 315 days
- Average annual SR: 11.4 AUD/ac

Then:
Number of paddocks: 64
Paddock size: 25ac
Area Allowance: .5 ac/AU
Graze period: 5 days
Stocking intensity: 10 AUD/ac
Cycle length: 320 days
% Grazed days/cycle: 5/320 = 1.6%

What happens to plant community structure on different spatial and temporal scales?
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<thead>
<tr>
<th></th>
<th>4</th>
<th>16</th>
<th>64</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of paddocks</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Paddock size (acres)</strong></td>
<td>400</td>
<td>100</td>
<td>25</td>
</tr>
<tr>
<td><strong>Graze period length (days)</strong></td>
<td>105</td>
<td>21</td>
<td>5</td>
</tr>
<tr>
<td><strong>Area Allowance (acres/AU)</strong></td>
<td>8</td>
<td>2</td>
<td>.5</td>
</tr>
<tr>
<td><strong>Stocking intensity (AU·days/acre)</strong></td>
<td>13.1</td>
<td>10.5</td>
<td>10</td>
</tr>
<tr>
<td><strong>Cell stocking rate (AU·days/acre)</strong></td>
<td>11.4</td>
<td>11.4</td>
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</tbody>
</table>

Could we change these relationships?
What happens to nutrient intake as a result of this type of management?
Landscape impact of selective grazing

Edwards Plateau Ranch 3-D View w/ GPS Locations

1. 39% area used
2. 41% GPS points on 9% area
3. SR: 21 ac/cow
4. Effective SR: 8.2 ac/cow
From Howell, 2007
Conclusions

1. Nutrient intake and average forage utilization change quicker at higher stock density, but absolute intake and utilization can be increased OR decreased by varying the length of the grazing period.

2. With recovery period, number of animals, herds and grazing unit (cell) size held constant, increasing paddock numbers (and, therefore, SD) decreases Stocking Intensity and increases potential minimum dietary intake and uniformity of intake over the grazing period.
Conclusions

3. Management should try to provide adequate variety and quality of forage within and among paddocks to increase the likelihood of adequate nutrient intake within a grazing period.

4. *Management of time and animal distribution* in response to animal and plant community cues determine the outcome of a grazing management strategy. But increasing paddock numbers and SD *can* provide more management flexibility and control of dietary intake that can decrease the risk of nutrient deficiency and maintain acceptable performance.
Conclusions

5. Careful consideration should be given to infrastructure development with regard to plant community and animal production goals in relation to landscape diversity.

6. By exploiting animal selectivity, changing the depletion rate and variety of plants available during a graze period, more effective and sustainable use of vegetation that also provides adequate animal performance, and possibly increases carrying capacity of the landscape may be possible.
Animal Impact

► Objectives:
► Understand the differences and linkages between animal impact, stock density, and herd effect.
► Learn 4 rules of proper grazing management.
► Learn 5 guidelines of proper grazing management.
Animal Impacts
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1. Animal concentration achieved using attractants or other means to cause a special type of animal impact.
2. Usually used only on small areas to break crusts, increase soil/seed contact, break down standing dead vegetation, slope banks, etc.
3. Effect of time.
One Minute Essay” on Herd Effect
Four Voison Grazing Management Rules

1. Before a grass is regrazed, it must reach its maximum growth rate.
2. Period of occupation must be short enough to avoid regrazing.
3. Plant must be grazed in its optimum stage of growth.
4. Period of occupation must be short enough to allow animals to select a diet of sufficient quality.
Controlled Grazing Guidelines

1. Adjust recovery periods to pasture growth rate changes.
2. Use as short of grazing periods as optimum recovery and economics will allow.
3. Fluctuate animal numbers to match carrying capacity annually and seasonally.
4. Use large herds when possible.
5. Use the highest stock density (lowest area allowance) that is economically feasible.
Good students have your markers ready!