Chapter 7: Rangeland Inventory and Monitoring

1. What is rangeland inventory?
2. What is rangeland monitoring?
3. What vegetational attributes are commonly used in range management?
4. What are the four primary types of grazing surveys used in range management?
5. How is rangeland condition determined?
6. How is rangeland trend determined?
7. What are decreasers, increasers and invaders?
8. What are three commonly used approaches in evaluating grazing intensity?
Chapter 7

- Rangeland inventory – a descriptive list of land, vegetation, infrastructure, and livestock resources for a particular pasture or ranch; provides accurate representation of existing conditions.

- Rangeland monitoring- a systematic approach to evaluate responses to management actions over time.
Characteristics commonly monitored on rangelands

1. Precipitation
2. Forage production
3. Changes in rangeland ecological condition
4. Livestock productivity
   a. calf/lamb crops
   b. calf/lamb weights
   c. death loss
Characteristics commonly monitored on rangelands cont.

5. Financial returns
   a. dollars per acre
   b. dollars per cow
   c. production costs
6. Riparian health
7. Soil/watershed health
8. Wildlife populations
9. Grazing use
10. Livestock numbers on pastures/ranch.
Components of Sound Western Ranching

1. Grazing Management
   a. Stocking
   b. Grazing system
   c. Drought plan

2. Ranch Capitalization
   a. Water
   b. Fence
   c. Corrals
   d. Roads
   e. Other

3. Livestock Management
   a. Livestock selection
   b. Breeding program
   c. Healthcare
   d. Supplemental feeding
   e. Poisonous plants

4. Brush Management
   a. Grazing
   b. Fire
   c. Herbicide
   d. Mechanical
   e. Biological
Components of sound western ranching

5. Government Assistance
   a. Drought relief
   b. Technical assistance
   c. Vegetation management
   d. Conservation

6. Government regulations
   a. Endangered species
   b. Clean air
   c. Clean water
   d. Land use
   e. Penalties
   f. Incentives
Components of Sound Western Ranching cont.

7. Product Demand
   a. Livestock
   b. Wildlife
   c. Recreation
   d. Plants
   e. Ecosystem services
   f. Other

8. Monitoring Programs
   a. Rain fall
   b. Forage production
   c. Trend in ecological condition
   d. Livestock productivity
   e. Financial returns
   f. Riparian health
   g. Soil health
   h. Wildlife populations
   i. Grazing use
Components of Sound Western Ranching cont.

9. Risk Management Programs
   a. Climate
   b. Biological
   c. Political
   d. Financial
   e. Other

10. Integration and Management.
# Primary components of a Ranch Inventory

1. Land area
2. Pasture sizes
3. Watering Points
4. Fences
5. Corrals
6. Buildings
7. Roads
8. Livestock
9. Wildlife
10. Farmland
11. Waterways
12. Equipment
13. Dams
14. Personnel
15. Other
Figure 7.1 Example of a vegetational map showing range sites, range condition, and physical features. (From Parker 1969.)
Figure 7.2 This aerial photograph shows range sites, range condition, present land use, and practices already applied. With this as a base, a complete inventory of the range can be made. Proposed changes are shown in black. Fencing is planned to take better advantage of the site, and additional water will be developed to improve livestock distribution. (From Gay 1965.)
Four Primary Vegetation Surveys Used by Range Managers

1. Grazing Intensity
2. Grazing Capacity
3. Range Condition
4. Range Trend
Methodology

1. Grazing capacity
   • Weight estimate- key species approach

2. Grazing Intensity (Forage Use)
   • % use
   • Stubble height measurement
   • % of grazed plants
   • References: Jasmer and Holechek (1984), Cook and Stubbendieck (1986)
Methodology cont.

3. Rangeland Ecological condition
   • Quantitative climax
   • Reference: Dyksterhuis (1949), Parker and Harris (1958), Cook and Stubbendieck (1986), Holechek et al. (1995)

4. Rangeland Trend
   • Quantitative climax approach
   • Reference: Dyksterhuis (1949), Parker and Harris (1958), Cook and Stubbendieck (1986), Holechek et al. (1995)
Vegetational Attributes Used in Range Management

1. Weight or biomass- Weight of plants on a given area at a given time on a dry matter basis.
2. Cover- percent of the area covered by different plants on a given area at a given time.
3. Density – number of plant per unit area at a given time.
4. Frequency –percent of quadrats of a given size in which a plant species occurs at a given time.
*5. Plant height.
Key species

Key species: Forage species whose use serves as an indicator to the degree of use of associated species:

1. abundant
2. productive
3. palatable
Key area

Key area: portion of the range; because of its:
1. location or
2. grazing or browsing value or
3. use
  ❖ can serve as an indicator of:
1. range condition
2. seasonal use
Grazing capacity and intensity

Grazing capacity - maximum animal numbers which can graze each year on a given area of range, for a specific number of days without inducing a downward trend in range condition.

- It is based on vegetation weight not cover.

Grazing intensity – Degree to which primary forage plants are grazed by livestock and wildlife.
Methods of measuring grazing intensity

a. Stubble heights of key forage plants
b. Residues of forage plants
c. % of plants grazed
d. % of herbage production of key forage plant removed by livestock and wildlife (% use).
Methodology Used in our Survey

3. Grazing Intensity-Stubble height/ocular appearance approach of Holechek and Galt 2000
Uses of grazing intensity information

1. Stocking rate adjustment
2. Maintenance of soil and watershed resources
3. Maintenance of wildlife habitat
4. Maintenance of livestock productivity
5. Maintenance of forage productivity

*Proper grazing intensity is the most critical component of successful range management.
**Grazing intensity is the primary factor driving trend in range condition.
***Grazing intensity is the primary factor driving returns from livestock production.
History of condition and trend

1. Dyksterhuis (1949) contribution
2. Reflects plant response to grazing
3. Validity of Clements and Dyksterhuis theories
4. Threshold concepts
   a. Is brush control needed?
   b. Should grazing be terminated?
Range condition and trend terminology

**Range site**- an area unlike surrounding area because of potential to support a different kind of climax vegetation (same as habitat).

**Range condition**- State of health of the range usually judged on the basis of the climax vegetation that remains for a particular site.

**Range trend**- Rate and direction of change in range condition.
Range condition and trend terminology

**Decreaser** - Decreases with grazing, very palatable.

**Ice cream** - Highly palatable and not abundant.

**Increaser I** - Moderately palatable, secondary forage.

**Increaser II** - Present in the climax but low palatability.

**Invader I** - Species not present in the climax with seasonal forage value.

**Invader II** – Species not present in the climax with no forage value.
Climax Sagebrush Grassland Range
Early Seral (Degraded) Sagebrush Grassland Range
Figure 7.3 Example of vegetation and soil characteristics associated with the Soil Conservation Service approach to range condition for prairie ranges in the central Great Plains. (From Parker 1969.)
**Figure 7.4** Changes in abundance of species groups for different range condition classes of the Soil Conservation Service.
Succession

Primary succession

Primary succession

Secondary succession

Weed stage

Pioneers

Seral stages

Climax

Climax plants

76-100% (wt)

51-75% Good (Late seral)

26-50% Fair (Mid seral)

0-25% Poor (Early seral)
Four assumptions

1. Climax is known
2. Climax has highest value plants
3. Climatic patterns are stable
4. Excellent range has better forage than poor ranges
Methodology Used in our Survey

2. Rangeland Ecological Condition- Dyksterhuis quantitative climax used by USDA-NRCS
Calculation of range condition

- Southwestern Montana
- 15-19 inch ppt. zone
- silty site

Cover (Actual)
- Idaho fescue 20
- Rough fescue 10
- Big sagebrush 5
- Cheatgrass 5
- Goatweed 10

50%
Calculation of range condition cont.

• Cover (Relative)

Calculation Procedures

• Idaho fescue  40= 20/50x100
• Rough fescue  20= 10/50x 100
• Big sagebrush 10= 5/50x 100
• Cheatgrass  10=5/50x 100
• Goatweed  20= 10/50x 100
• 100%


## Calculation of range condition cont.

<table>
<thead>
<tr>
<th></th>
<th>Allowed</th>
<th>Cover on site</th>
<th>Usable</th>
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<tbody>
<tr>
<td>Idaho fescue</td>
<td>25</td>
<td>40</td>
<td>25</td>
</tr>
<tr>
<td>Rough fescue</td>
<td>100</td>
<td>20</td>
<td>20</td>
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<tr>
<td>Big sage</td>
<td>5</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Cheatgrass</td>
<td>0</td>
<td>10</td>
<td>0</td>
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<tr>
<td>Goatweed</td>
<td>0</td>
<td>20</td>
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</table>

50%

Condition is fair (Mid seral)
Practical Application of Condition and Trend

1. Grazing capacity adjustments
2. Evaluation of management effectiveness
   - (Are you meeting your goals for a particular piece of rangeland?)
3. Separation of grazing from climatic effects
<table>
<thead>
<tr>
<th>SPECIES</th>
<th>COVER</th>
<th>RELATIVE COVER</th>
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<tr>
<td></td>
<td>FALL 1965</td>
<td>FALL 1995</td>
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<tr>
<td><strong>Grasses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black gram</td>
<td>20(^1)</td>
<td>10(^2)</td>
</tr>
<tr>
<td>Dropseed</td>
<td>1(^1)</td>
<td>8(^2)</td>
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<tr>
<td>Threawn</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Other grasses</td>
<td>14(^1)</td>
<td>1(^2)</td>
</tr>
<tr>
<td>Total grasses</td>
<td>36(^1)</td>
<td>23(^2)</td>
</tr>
<tr>
<td><strong>Forbs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Croton</td>
<td>t</td>
<td>t</td>
</tr>
<tr>
<td>Globemallow</td>
<td>t</td>
<td>t</td>
</tr>
<tr>
<td>Other forbs</td>
<td>2</td>
<td>t</td>
</tr>
<tr>
<td>Total forbs</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Shrubs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broom snakeweed</td>
<td>t(^1)</td>
<td>6(^2)</td>
</tr>
<tr>
<td>Honey mesquite</td>
<td>t(^1)</td>
<td>7(^2)</td>
</tr>
<tr>
<td>Yucca</td>
<td>t</td>
<td>2</td>
</tr>
<tr>
<td>Other shrubs</td>
<td>t</td>
<td>t</td>
</tr>
<tr>
<td>Total shrubs</td>
<td>1(^1)</td>
<td>15(^2)</td>
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</tbody>
</table>


*Note:* Overall plant community composition in fall 1965 is different from fall 1995 (probability < 0.05) using multivariate analysis variance (MANOVA).

\(^1,^2\)Row means with different letters differ (probability < 0.05).

t = trace.
Problems with using range trend to monitor rangeland health.

1. Vegetation composition on heavily grazed, degraded rangelands may be stable because desirable plants have been eliminated.

2. Vegetation composition may be stable but desirable plants have low vigor.

3. Vegetation trend provided little information on how vegetation residues meet soil, watershed, livestock, wildlife, and esthetic needs throughout the year.
Problems with using range trend to monitor rangeland health cont.

4. Fluctuation in annual and short lived perennial plants may cause large changes in vegetation composition not well related to health of the desirable forage plants.

5. By the time a downward trend is detected, long term damage to desirable perennial forage plants may have occurred.
Conclusions on Rangeland Condition and Trend

1. Clement’s - Dyksterhuis quantitative climax model works for most situations.

2. Four Elements are needed for grazing permit adjustment

3. Changes in condition and trend are the most important elements in grazing permit adjustment

4. Public rangeland managers have difficulty in interpreting and reporting condition and trend data
Conclusions on Rangeland Condition and Trend cont.

5. Range condition scores should depart 5% or more from intermediate and long term

6. Exclosures can play an important role in separating grazing from climatic influences.

7. Public rangeland managers need to learn how to better present condition and trend data to ranchers and public

8. Persuasion and education are better than coercion.
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<tbody>
<tr>
<td>Actual cattle animal unit years (AU/Y)</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>168</td>
<td>179</td>
<td>185</td>
<td>190</td>
<td>202</td>
<td>202</td>
<td>170</td>
<td>174</td>
<td>191</td>
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<tr>
<td>Stocking rate (acre/AU/Y)</td>
<td>173</td>
<td>173</td>
<td>173</td>
<td>156</td>
<td>153</td>
<td>144</td>
<td>138</td>
<td>128</td>
<td>128</td>
<td>153</td>
<td>152</td>
<td>136</td>
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<tr>
<td>Precipitation Afton Allotment (in./year)</td>
<td>11.9</td>
<td>NA</td>
<td>NA</td>
<td>13.8</td>
<td>8.3</td>
<td>12.4</td>
<td>8.5</td>
<td>7.1</td>
<td>6.5</td>
<td>8.0</td>
<td>9.6</td>
<td>7.2</td>
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<tr>
<td>Forage utilization (%)</td>
<td>20</td>
<td>38</td>
<td>31</td>
<td>29</td>
<td>26</td>
<td>30</td>
<td>23</td>
<td>32</td>
<td>23</td>
<td>NA</td>
<td>27</td>
<td>26</td>
</tr>
<tr>
<td>Fall vegetation standing crop (lb/acre)</td>
<td>551</td>
<td>349</td>
<td>566</td>
<td>446</td>
<td>495</td>
<td>650</td>
<td>568</td>
<td>306</td>
<td>159</td>
<td>276</td>
<td>437</td>
<td>247</td>
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<tr>
<td>Fall perennial forage standing crop (lb/acre)</td>
<td>292</td>
<td>160</td>
<td>337</td>
<td>325</td>
<td>338</td>
<td>486</td>
<td>481</td>
<td>288</td>
<td>130</td>
<td>224</td>
<td>306</td>
<td>214</td>
</tr>
<tr>
<td>Fall black grama standing crop (lb/acre)</td>
<td>88</td>
<td>57</td>
<td>38</td>
<td>91</td>
<td>72</td>
<td>107</td>
<td>134</td>
<td>113</td>
<td>19</td>
<td>16</td>
<td>74</td>
<td>49</td>
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<tr>
<td>Ecological range condition score</td>
<td>42</td>
<td>43</td>
<td>41</td>
<td>48</td>
<td>52</td>
<td>54</td>
<td>53</td>
<td>48</td>
<td>43</td>
<td>35</td>
<td>46</td>
<td>42</td>
</tr>
</tbody>
</table>


1 Long-term average precipitation is 8.47 inches.

2 Utilization data were collected in late spring and reflect use of forage produced in the previous year. Utilization data are ocular (nonquantitative) and therefore subjective.

3 Black grama is a perennial grass that is considered a key forage for cattle and a dominant component of the climax vegetation. NA = Not available.