Soil Condition in the Context of Rangeland Health

Jon Gustafson
USDA, NRCS California
State Rangeland Management Specialist

Rangeland Health

Defined:

*"The degree to which the integrity of the **soil**, vegetation, water, and air, as well as the ecological processes of the rangeland ecosystem are balanced and sustained."*

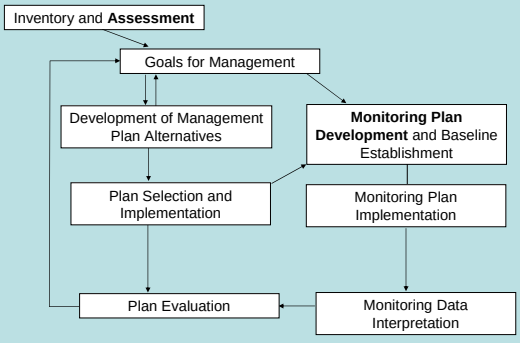
Society for Range Management Task Group on Unity in Concepts and Terminology (1995)

Presentation Preview

- Assessment vs. monitoring
- What is the rangeland health approach?
  - Attributes and interrelationships
  - Supporting materials
- Soil condition: The cornerstone of rangeland health
- Monitoring methods for soil condition
- Summary

Assessments vs. Monitoring

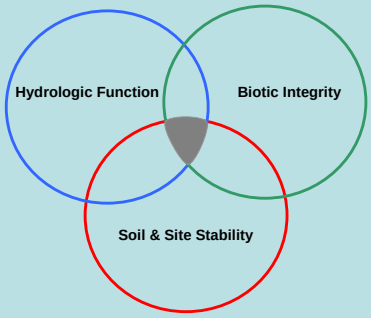
Assessments	Monitoring
• Used to document point-in-time site-specific conditions • *Qualify* key differences between what is expected vs. what is found • May be used to identify sites and key indicators to monitor	• Used to evaluate change over time • *Quantify* degree of change • Should be designed based on site-specific assessment implications



Rangeland Health

- Provides a scientific bridge between traditional range condition protocols and watershed assessment theory
- Provides common terminology
- Was designed for qualitative assessments
- Requires supporting data and some expertise

Rangeland Health Attributes



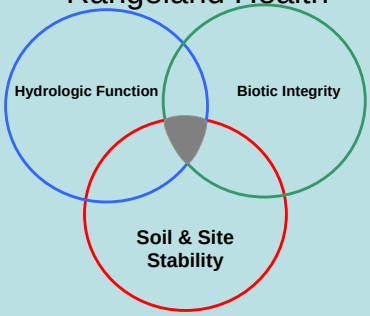
Rangeland Health Indicators

1. Rills
2. Water-flow patterns
3. Pedestals and/or terracettes
4. Bare Ground
5. Gullies
6. Wind-scoured, blowouts, and/or deposition areas
7. Litter movement
8. Soil surface resistance to erosion
9. Soil surface loss or degradation
10. Plant community composition and distribution relative to infiltration
11. Compaction layer
12. Functional/structural groups
13. Plant mortality/decadence
14. Litter amount
15. Annual production
16. Invasive plants
17. Reproductive capability of perennial plants

Support Materials for Rangeland Health Assessments

- Ecological site description
- Documentation of expected indicator conditions under normally functioning circumstances (reference sheet)
- *Interpreting Indicators of Rangeland Health* (now at version 4)

Soil Condition: The Cornerstone of Rangeland Health



Rangeland Health Indicators with Implications for Soil and Site Stability

1. Rills
2. Water-flow patterns
3. Pedestals and/or terracettes
4. Bare Ground
5. Gullies
6. Wind-scoured, blowouts, and/or deposition areas
7. Litter movement
8. Soil surface resistance to erosion
9. Soil surface loss or degradation
10. Plant community composition and distribution relative to infiltration
11. Compaction layer
12. Functional/structural groups
13. Plant mortality/decadence
14. Litter amount
15. Annual production
16. Invasive plants
17. Reproductive capability of perennial plants

Rangeland Health Indicators with Implications for all three Attributes

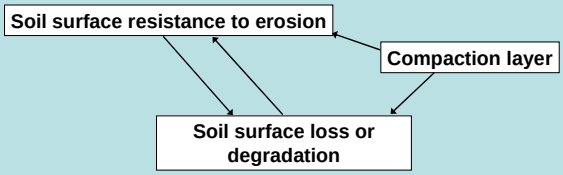
1. Rills
2. Water-flow patterns
3. Pedestals and/or terracettes
4. Bare Ground
5. Gullies
6. Wind-scoured, blowouts, and/or deposition areas
7. Litter movement
8. Soil surface resistance to erosion
9. Soil surface loss or degradation
10. Plant community composition and distribution relative to infiltration
11. Compaction layer
12. Functional/structural groups
13. Plant mortality/decadence
14. Litter amount
15. Annual production
16. Invasive plants
17. Reproductive capability of perennial plants

"But when should I suspect?"

- Reduced plant productivity *and*
- Loss of plant diversity

Potentially also:

- Reduced green period
- Increased runoff and/or compressed ("flashy") hydrologic response
- Reduced number of plants per unit area



Soil surface resistance to erosion

"Resistance depends on soil stability.

Soil surfaces may be stabilized by *soil organic matter* which has been *fully incorporated into aggregates* at the soil surface, adhesion of decomposing organic matter to the soil surface, and biological crusts."

Soil surface loss or degradation

"In most sites, the soil at and near the surface has the highest organic matter and nutrient content.

This generally controls the maximum rate of water infiltration into the soil and is essential for successful seedling establishment (Wood et al. 1997).

As erosion increases, the potential for loss of soil surface organic matter increases, resulting in further degradation of soil structure."

Compaction layer

"A near-surface layer of dense soil caused by repeated impacts on or disturbances of the soil surface.

Compaction becomes a problem when it begins to *limit plant growth, water infiltration, or nutrient cycling processes*."

Recommended Long-Term Monitoring Methods

Soil surface resistance to erosion – Soil stability test

Soil surface loss or degradation – Soil stability test and/or infiltration test

Compaction layer – Compaction test and/or infiltration test

Evaluating the Data

- Does management appear to create positive change?
- Timelines for realizing improvement may be highly dependent upon
  - Soil texture and structure
  - Soil chemistry
  - Effectiveness and aggressiveness of management approach
  - Degree of departure from optimal soil, biotic and hydrologic conditions

Summary

- Rangeland health is an assessment protocol that requires baseline information pertaining to the specific ecological site being evaluated
- Indicators of soil condition are critical to observe regardless of the ecological site
- Not all indicators are of equal value on all ecological sites & not all monitoring protocols are appropriate on all sites
- Response to changes in management will be dependent upon site conditions as well as the ability of the soil to recover