Range Health
Overview

Rangeland Health
Resource Concerns and Tools
Attributes

Soil/Site Stability
Hydrologic Function
Biotic Integrity

Indicators
Rangeland Health

“The degree to which the integrity of the ecological processes of rangeland ecosystems are maintained”
*Rangeland Health (NRC 1994)*

“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 of Range Management (1995)*
Determining Rangeland Health

• NRCS Resource Concerns
  • SWAPAE+H

• Interpreting Indicators of Rangeland Health (IIRH) Assessment
  • 17 indicators

• 3 Attributes
  • Soil/Site stability
  • Hydrologic function
  • Biotic integrity
<table>
<thead>
<tr>
<th>Resource</th>
<th>Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td>Erosion, Subsidence, compaction, organic matter depletion, concentration of salts/chemicals, soil organism habitat loss/degradation, aggregate instability</td>
</tr>
<tr>
<td>Water</td>
<td>Ponding, flooding, seeps, drifted snow, depletion, nutrient/pesticide transportation, pathogens, chemicals, salts, sediment, elevated temperature</td>
</tr>
<tr>
<td>Plants</td>
<td>Productivity, health, structure, composition, pest pressure and wildfire hazard from biomass accumulation</td>
</tr>
<tr>
<td>Animals</td>
<td>Wildlife, invertebrates, aquatic and other organism habitat. Feed and forage imbalance. Inadequate livestock shelter, water, and distribution.</td>
</tr>
<tr>
<td>Energy</td>
<td>Efficiency of equipment, facilities, farming/ranching and field operations.</td>
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<tr>
<td>Human</td>
<td>Potential social, economic, and cultural resource and historic property factors.</td>
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</tbody>
</table>
Attributes

3 attributes define rangeland health
• Soil/Site Stability
• Hydrologic Function
• Biotic Integrity

This is measured through observable components of the 17 indicators
Attributes – Soil/Site Stability

Wind and Water Erosion – Wind Erosion

Detachment and transport of soil particles caused by wind

Aim to reduce wind erosion

Rangeland Health Assessment
Soil Site Stability: slight to moderate or less
OR Wind-Scoured and/or Depositional Areas Indicator #6: Slight to moderate or less
Attributes – Soil/Site Stability

The capacity of an area to limit redistribution and loss of soil resources (including nutrients and organic matter) by wind and water and to recover this capacity when a reduction does occur

<table>
<thead>
<tr>
<th>Soil/Site Stability</th>
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<tbody>
<tr>
<td>1.  Rills</td>
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<td>2.  Water Flow Patterns</td>
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<td>3.  Pedestals and/or Terracettes</td>
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<td>11. Compaction Layer</td>
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</table>
Attributes – Hydrologic Function

Weather Resilience – Naturally Available Moisture Use

Natural precipitation is not optimally managed and does not support desired land use goals or ecological processes

Aim to manage natural precipitation efficiently
Attributes – Hydrologic Function

The capacity of an area to capture, store and safely release water from rainfall, run-off, and snowmelt (where relevant), to resist a reduction in this capacity, and to recover this capacity when reduction does occur.
Attributes – Soil Site Stability & Biotic Integrity

Organic Matter Depletion

Management-induced depletion of soil organic matter resulting in limited soil function and processes

Aim to maintain, increase, and/or improve soil organic matter

Soil Organism Habitat Loss

Quantity, quality, diversity, or connectivity of food, cover, space, shelter, and/or water is inadequate to meet the needs of beneficial soil organisms

Aim to improve habitat for beneficial soil organisms

Rangeland Health Assessment (for both)

Soil Site Stability: slight to moderate or less

Biotic Integrity: Slight to moderate or less
Attributes – Biotic Integrity

Degraded Plant Condition
Plant Structure and Composition

Plant communities have insufficient composition and structure to achieve ecological functions and management objectives

Aim to improve plant structure and composition

Livestock Production Limitation – Forage and Feed

Feed and forage quality or quantity is inadequate for nutritional needs and production goals

Aim to balance the quantity and quality of feed and forage to meet livestock needs and reduce negative impacts

Rangeland Health Assessment
Biotic Integrity Attribute: Slight to moderate departure or less
Attributes – Biotic Integrity

The capacity of the biotic community to support ecological processes within the natural range of variability expected for the site, to resist a loss in capacity to support these processes, and to recover capacity when losses do occur.

The biotic community includes plants, animals, insects, and microorganisms.

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<td>15. Annual Production</td>
</tr>
<tr>
<td>16. Invasive Plants</td>
</tr>
<tr>
<td>17. Vigor with an emphasis on Reproductive Capability of Perennial Plants</td>
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Attributes of Rangeland Health

Soil/Site Stability

- the capacity of an area to limit redistribution and loss of soil resources (including nutrients and organic matter) by wind and water and to recover this capacity when a reduction does occur.

Hydrologic Function

- the capacity of an area to capture, store, and safely release water from rainfall, run-on, and snowmelt (where relevant), to resist a reduction in this capacity, and to recover this capacity when a reduction does occur.

Biotic Integrity

- the capacity of the biotic community to support ecological processes within the natural range of variability expected for the site, to resist a loss in the capacity to support these processes, and to recover this capacity when losses do occur. The biotic community includes plants (vascular and nonvascular), animals, insects, and microorganisms occurring both above and below ground.
Interpreting Indicators of Rangeland Health (IIRH)

Protocol is used to understand the quality of the ecological processes through appropriate quantitative measures

17 indicators
17 Indicators

- Rills
- Water Flow Patterns
- Pedestals and/or Terracettes
- Bare Ground
- Gullies
- Wind-Scoured and/or Depositional Areas
- Litter Movement
- Soil Surface Resistance to Erosion
- Soil Surface Loss and Degradation

- Effects of Plant Community Composition and Distribution on Infiltration
- Compaction Layer
- Functional/Structural Groups
- Dead or Dying Plants or Plant Parts
- Litter Cover and Depth
- Annual Production
- Invasive Plants
- Vigor with an emphasis on Reproductive Capability of Perennial Plants
# 17 Indicators

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<td></td>
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</tbody>
</table>
Rills

Small, intermittent watercourses with steep sides

Typically several centimeters deep

Generally linear erosion features that run parallel to the slope
Water Flow Patterns

Paths water takes as it moves across the soil surface during periods when surface water from rain or snowmelt exceeds soil infiltration capacity

Commonly referred to as sheet flow or overland flow
Pedestals and/or Terracettes

Pedestals indicate the movement of soil by water or wind from the base of plants or from around rocks or persistent litter, giving them an elevated appearance.

Terracettes are “benches” of soil deposition that form behind or between obstacles when materials are redistributed by water movement.
Bare Ground

Exposed mineral soil not covered by vegetation, gravel/rock, visible biological soil crust, or litter

Ground surface cover materials intercept raindrops, reduce soil particle detachment, and reduce soil movement by water and wind
Gullies

Well-defined channels cut into the soil by ephemeral water flow

Gullies can develop from enlarged rills, but sometimes formation may be much more complex and involve: (1) volume, speed, and type of runoff, (2) susceptibility of soil to erosion, (3) changes in ground cover induced by land use and treatments
Wind-Scoured and/or Depositional Areas

Wind-scoured areas including blowouts are formed as finer particles of topsoil are blown away.

Depositional areas are locations where windblown soil accumulates (on- or offsite).
Litter Movement

Litter is the uppermost layer of organic debris on the soil surface – freshly fallen or slightly decomposed vegetal material.

Litter movement refers to the change in location of litter due to water or wind.
Soil Surface Resistance to Erosion

This indicator assesses the resistance of the soil surface to erosion by water.

Resistance depends on soil stability and on the spatial variability in soil stability relative to vegetation and microtopographic features.
Soil Surface Loss and Degradation

The reduction in soil surface depth, organic matter, porosity, and structure as a result of wind or water erosion

Indicative of long-term change in rangeland health

Loss or degradation of part or all of the soil surface layer or horizon is an indication of a loss in site potential
Effects of Plant Community Composition and Distribution on Infiltration

This indicator reflects effects of vegetation composition and spatial distribution on the infiltration capacity of the soil within the evaluation area and the amount of time water is retained on the soil surface.
Compaction Layer

Near-surface layer or dense soil caused by impact or disturbance of the soil surface

Compaction layer can be caused by application of weight or pressure at or below the soil surface

Compaction layers restrict water percolation, plant growth, and nutrient cycling
Functional and Structural Groups

Plant species that are grouped together on the basis of similar growth forms or ecophysiological roles

Function typically refers to the ecophysiological role that plants and biological soil crusts play on a site

Structure refers to plant growth forms within a community
Dead or Dying Plants or Plant Parts

Dead or dying plants or plant parts (stems, branches, leaves, etc.) are a natural phenomenon in all perennial plant communities.

Dormant plants are not considered dead or dying unless there are obvious signs that parts of the plant are dead.
Litter Cover and Depth

The potential cover and depth of litter is related to the productivity and decomposition rates of a given ecological site.

Productivity and decomposition are influenced by weather conditions.

The cover, depth, and kind of litter are affected by plant community composition.
Annual Production

Represents the energy captured by plants through the process of photosynthesis given recent weather conditions

This is the only indicator that is directly linked to the ecological process of energy flow
Invasive Plants

Invasive plants are those which are typically not found on the ecological site or should only be in trace or minor categories under the natural disturbance regime.

Have the potential to become a dominant or codominant species on the site.

*Figure 14.* Juniper-dominated area in a sagebrush ecological site.
Vigor with an Emphasis on Reproductive Capability of Perennial Plants

Plant vigor relates to the robustness of a plant in comparison to other individuals of the same species.

Reflected primarily by the size of the plant and its parts in relation to the plants age and the local environment in which is it growing.
Indicators

Each indicator is rated into categories:

• Extreme to Total (E-T)

• Moderate to Extreme (M-E)

• Moderate (M)

• Slight to Moderate (S-M)

• None to Slight (N-S)
## Example Evaluation Form

### Interpreting Indicators of Rangeland Health Version 5 Evaluation Form - Page 2

<table>
<thead>
<tr>
<th>Evaluation Area ID: BigSage_CM_14</th>
<th>Date: 8/14/2018</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Departure from Expected</strong></td>
<td><strong>Code</strong></td>
</tr>
<tr>
<td>None to Slight</td>
<td>N-S</td>
</tr>
<tr>
<td>Slight to Moderate</td>
<td>S-M</td>
</tr>
<tr>
<td>Moderate</td>
<td>M</td>
</tr>
<tr>
<td>Moderate to Extreme</td>
<td>M-E</td>
</tr>
<tr>
<td>Extreme to Total</td>
<td>E-T</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Rating</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rills</td>
<td>S</td>
<td>No rills observed in evaluation area</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td></td>
</tr>
<tr>
<td>2. Water-flow patterns</td>
<td>S</td>
<td>Short, disconnected water-flow patterns 3' long and up to 1' wide in plant interspaces on slopes &gt;5%</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td></td>
</tr>
<tr>
<td>3. Pedestals and/or terracettes</td>
<td>S</td>
<td>Occasional pedestaled bunchgrasses associated with water flow patterns on slopes &gt;5%</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td></td>
</tr>
<tr>
<td>4. Bare ground (observed): 32%</td>
<td>S</td>
<td>Bare ground is much higher than expected, with bare patches &gt;2' that are occasionally connected</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td></td>
</tr>
<tr>
<td>5. Gullies</td>
<td>S</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td></td>
</tr>
<tr>
<td>6. Wind-scoured and/or depositional areas</td>
<td>S</td>
<td>Minor soil deposits found around perennial plant bases; no wind scours noted - matches what is expected for the site</td>
</tr>
<tr>
<td></td>
<td>N-S</td>
<td></td>
</tr>
<tr>
<td>7. Litter movement (wind or water)</td>
<td>S</td>
<td>Displacement of fine material up to 2' associated with water flow Patterns on slopes &gt;5%. Coarse litter does not appear to be moving</td>
</tr>
<tr>
<td></td>
<td>SM</td>
<td></td>
</tr>
<tr>
<td>8. Soil surface resistance to erosion: 3.2%</td>
<td>S</td>
<td>Observed values are consistently 1-2 categories lower than expected.</td>
</tr>
<tr>
<td>Interspace: 3.2% Plant Canopy: 3.8%</td>
<td>H</td>
<td></td>
</tr>
<tr>
<td>9. Soil surface loss and degradation</td>
<td>S</td>
<td>A-horizon is thinner (50cm) and lighter (10 YR 4/2) in color than expected</td>
</tr>
<tr>
<td></td>
<td>S-M</td>
<td></td>
</tr>
<tr>
<td>10. Effects of plant community composition and distribution relative to infiltration</td>
<td>S</td>
<td>Deep-rooted perennial grasses are somewhat reduced, resulting in slightly less infiltration, especially on steeper slopes</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td></td>
</tr>
<tr>
<td>11. Compaction layer</td>
<td>S</td>
<td>Thin, weakly developed compaction layer in interspaces, ~2' thick</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td></td>
</tr>
<tr>
<td>12. Functional/structural groups</td>
<td>S</td>
<td>Annual grasses are not expected for this site, but now a minor component; relative dominance has shifted towards shrubs with a decrease in perennial grasses. Biological crust cover is substantially lower than expected.</td>
</tr>
<tr>
<td>a. Relative dominance: c-M</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>b. F/S groups not expected at the site: M</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>c. Number of F/S groups: N-S</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>d. Spp # in dom &amp; subdom F/S groups: N-S</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>13. Dead or dying plants or plant parts</td>
<td>S</td>
<td>Approx. 20% of deep rooted bunch grasses have slight crown die-out which is not expected given the normal precipitation over the past two years</td>
</tr>
<tr>
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<td>M</td>
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<td>S-M</td>
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</table>
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THANK YOU

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