An Overview of Interpreting Indicators of Rangeland Health:

For More Information Visit:
http://fresc.usgs.gov/products/rangehealth/

Download Assessment Manual from:

Rangeland Health
Focus Biological & Physical Processes

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

* “Integrity is the maintenance of the functional attributes characteristic of a local including normal variability”

Interpreting Indicators of Rangeland Health

Ecological Processes

• Energy flow – the conversion of sunlight to plant and then animal matter.
• Nutrient cycle – the movement of nutrients, such as carbon and nitrogen, through the physical and biotic components of the environment.
• Water cycle – the capture, storage, & safe release of precipitation.

Terminology Clarification

Inventory – A record of land and enterprise resources. This information is used in planning.

Monitoring - The orderly and quantitative collection, analysis and interpretation of resource data to evaluate progress toward meeting management or conservation objectives.

Assessment - The process of estimating or judging the value or functional status of ecological processes. It is generally a “moment-in-time” evaluation that is not repeated in the future. In other words, it not a monitoring tool.

Assessment

Determining Rangeland Health is an Assessment. The assessment of rangeland health may use inventory and monitoring data. However, range health is an assessment because it determines if something is “good” or “bad.”
Five Steps to Evaluating Rangeland Health

1. Verify soils
2. Obtain or develop Reference Sheet
3. Collect supplementary information
4. Rate the 17 indicators
5. Evaluate the 3 rangeland health attributes

Step 1 – Verify Soils to Identify Ecological Site at Evaluation Area

- Consider slope, aspect, elevation, & topographic position
- Verify soil with a shallow soil pit:
  - Surface Texture
  - Depth to restrictions
  - Diagnostic horizons
- Identify ecological site
- Document soil-ecological site information on Evaluation Sheet- Appendix 1 (page 66)

Step 2. Obtain or Develop Reference Sheet

A unique reference is needed for each Ecological Site

- An ecological site is a kind of land with specific physical characteristics (soil, topography, climate) which differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation in its' response to management.
- In other words, a kind of land with similar potential.
- Other stratification systems can also be used at a broader scale.
A unique reference is needed for each Ecological Site

Using soils to identify ecological sites

The defining of an ecological site on the landscape begins with the soil type. It can be a bit complicated to link a specific soil series or soil map unit to a specific ecological site.

But... the point remains – when identifying ecological sites, begin with the soil.

A clear definition of “ecological site” allows development of the “reference state”

Reference State...

The state where the functional capabilities represented by soil and site stability, hydrologic function, and biotic integrity are performing at a near-optimum level under the natural disturbance regime.

From a clear idea of the “Reference State” comes the development of a “Reference Worksheet”

Generating the Reference Worksheet

• What do you need to define potential for an ecological site?
  – Ecological Site Descriptions
  – Soil Survey Information

http://esis.sc.egov.usda.gov

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http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm
Generating the Reference Worksheet
• What do you need to define potential for an ecological site?
  – Ecological Site Descriptions
  – Soil Survey Information
  – Ecological Reference Areas = “A landscape unit in which ecological processes are functioning within a normal range of variability and the plant community has adequate resistance to and resiliency from most disturbances”

Special Management Areas
Exclosures

Generating the Reference Worksheet
• What do you need to define potential for an ecological site?
  – Ecological Site Descriptions
  – Soil Survey Information
  – Ecological Reference Site
  – Expert knowledge (old timers and brilliant ecologists)

Generating the Reference Worksheet
Capture temporal and disturbance variability!

No Reference Worksheet—don’t bother going to the field!

Generating the Reference Worksheet
Step 3 - Collect Supplementary Information
• Spatial and temporal variability
• Ecological reference areas (as developed in step 2)
• Functional and structural groups sheet
• Quantitative Data
Step 4 - Rate 17 Indicators

Indicators

Elements of an ecosystem used to assess processes that are to difficult or expensive to measure.

Due to the complexity of ecological processes a “suite” of indicators are recommended.

Quantitative & Qualitative Studies

- Quantitative
  - Objective
  - Measure attributes
    - "Cheatgrass cover is 85%"

- Qualitative
  - Observed
  - Describe or rate attributes
    - "Cheatgrass is rated as abundant"

The 17 Indicators

1. Rills
2. Water Flow Patterns
3. Pedestals/Terreccettes
4. Bare Ground
5. Gullies
6. Wind Scour Areas
7. Litter Movement
8. Resistance to Erosion
9. Loss of Soil Surface
10. Plant/Infiltration Effects
11. Compaction Layer
12. Functional/Structural Groups
13. Plant Mortality/Decadence
14. Litter Amount
15. Annual Production
16. Invasive Plants
17. Reproductive Capability

Optional Indicators

Flexibility to add additional ecological indicators is provided.

Biological crusts may be considered as an optional indicator:

- Colorado Plateau—important functional component
- Tall Grass Prairie—unimportant and rare component

Rills

Small erosional rivulets that are generally linear
Water Flow Patterns
Path that water takes as it moves across the soil surface.

Pedestals/Terrecettes

Bare Ground
Exposed mineral or organic soil not covered by vegetation, gravel/rock, litter, or biological crust.

Gullies
Channel that has been cut into the soil by moving water

Wind-Scoured, Blowout, and/or Depositional Areas
Finer soil particles have been redistributed from interspaces and deposited near obstructions

Litter Movement
Redistribution of litter by water or wind
**Soil Surface Loss or Degradation**

Loss or degradation of soil surface (organic matter) affects site potential

- Intact soil surface
- Loss of soil surface

**Plant Community Composition & Distribution Relative to Infiltration & Runoff**

Vegetation growth form and composition affects infiltration and interrill erosion

- Desert grassland has good infiltration
- Conversion to shrubs greatly increases runoff

**Compaction Layer**

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

- Soil surface
- Compaction layer

**Functional/Structural Groups**

A suite of species that because of similar morphology, photosynthesis pathways, nitrogen fixing ability, life cycle etc. are grouped together

- Nitrogen fixing forb – Astragalus
- Biological crust is evaluated

**Plant Mortality/Decadence**

The proportion of dead/decadent plants expected for the site

- Dead sagebrush in larger stand
- Decadent grass (yellow crown) in shrub

Cool vs. warm season, tall vs. short grass, sprouting vs. nonsprouting Shrub, fibrous vs. tap root, annual vs. perennial,....
Litter Amount
Litter is dead organic material in contact with the soil surface and it influences several ecological processes.

Annual Production
Total above ground biomass is a measure of the vegetation available to harvest the sun’s energy.

Litter Amount

- Adequate litter for site protection and nutrient cycling
- Inadequate litter for site protection and nutrient cycling

Annual Production

- Normal annual production ~ 600 lbs/ac
- Annual production less than 300 lbs/ac

Invasive Plants

- State-listed noxious weed - Knapweed
- Invasive exotic - Cheatgrass
- Invasive native - Juniper

Reproductive Capability of Perennial Plants

- Measure of potential for seed or tiller production, not presence of seedlings/new clonal plants
- Poor reproductive potential
- Good reproductive potential

Step 5 - Evaluate the 3 rangeland health attributes

Indicators are grouped into 3 Attributes that collectively describe the “health” of a site:

1. Soil/Site Stability
2. Hydrologic Function
3. Biotic Integrity

There is not a single rating of “health”
**Soil/Site Stability**

Capacity of the site to limit loss of resources by wind/water erosion.

1. Desert grassland - good stability
2. Desert grassland - loss of stability

**Indicators of Soil/Site Stability**

1. Rills
2. Water Flow Patterns
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7. Litter Movement
8. Resistance to Erosion
9. Loss of soil surface
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12. Functional/structural groups
13. Plant mortality/decadence
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**Hydrologic Function**

Capacity of the site to capture, store and safely release water and to resist a reduction and recover this capacity after disturbance.

1. Sagebrush “captures” snow
2. Grasses have reduced ability (structure) to “capture” snow

**Indicators of Hydrologic Function**

1. Rills
2. Water Flow Patterns
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**Integrity of the Biotic Community**

Capacity of the site to support characteristic functional and structural communities and to resist disturbance and recover from disturbance.

1. Joshua tree/blackbrush site
2. Intact community with native grasses and increased fire

**Indicators of Biotic Integrity**

1. Rills
2. Water Flow Patterns
3. Pedestals/Terrecettes
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Linking Quantitative and Qualitative Data

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Quantitative Indicator</th>
<th>Measurement (References)</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare Ground %</td>
<td>Line Point Intercept (Monitoring Plant Populations)</td>
<td>Bare ground is positively correlated with runoff and erosion</td>
<td></td>
</tr>
</tbody>
</table>

Interpreting Indicators of Rangeland Health

**Intended Uses**

- Used by experienced personnel
- Provide a preliminary evaluation of rangeland health
- Identify areas (early warning) that are potentially at risk of crossing a threshold
- Communication tool

**Not to be used to:**

- Identify the cause(s) of resource problems
- Make grazing or other management decisions
- Stand alone as a trend or monitoring tool
- Independently generate national/regional assessments of rangeland health