CORE CONCEPTS:
Attributes and Indicators

Managing Landscapes

Objectives
By the end of this lesson each student should be able to:
• Explain the importance of assessment, inventory, and monitoring.
• Identify the key features of assessment, inventory, and monitoring.
• Explain the importance of attributes, indicators, and methods for determining rangeland health.
• Identify attributes, indicators, and methods of/for determining rangeland health.
• Give examples of attributes, indicators, and methods of/for determining rangeland health.
• Describe the characteristics/give examples of a core indicator(s).
• Describe how qualitative and quantitative data collection work together
Outline

- Monitoring, assessment, and inventory
- Attributes, indicators, and methods
- Qualitative and quantitative data collection
- Additional Learning and Resources

Monitoring, Assessment, and Inventory

- How is the resource changing over time?
- What is the condition of the resource compared to a threshold or reference condition?
- Where is the resource and how much of it do I have?

Monitoring

How is the resource changing over time?
- Consistent data collection, analysis, and interpretation
- Indicator change over time
Assessment
What is the condition of the resource compared to a threshold?

- One point in time
- Compare an indicator or attribute to a threshold or reference condition

<table>
<thead>
<tr>
<th>Departure from Reference</th>
<th>None to Slight</th>
<th>Moderate</th>
<th>Extreme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stream Canopy Cover</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of Stream km</td>
<td>0</td>
<td>20</td>
<td>40</td>
</tr>
</tbody>
</table>

Inventory
How much of the resource do I have? Where is the resource located?

- Systematic
- Can include monitoring and assessment data
- Describe the amount, location, and condition of a resource

Attributes, Indicators, and Methods
Attributes

Component that provides information about the functional status of the ecological processes

Attribute: 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. (NRC 1994 Rangeland Health Report)

Desert grassland - good stability

Desert grassland - loss of stability

Attribute: 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. (NRC 1994 Rangeland Health Report)

Sagebrush "captures" snow

Grasses have reduced ability (structure) to "capture" snow
Attribute: Biotic Integrity

The capacity of a site to support characteristic functional communities (above and below ground) in the context of normal variability, to resist loss of this function and structure, due to disturbance, and to recover following such disturbances.

(NRC 1994 Rangeland Health Report)

Joshua tree/blackbrush site

Integrity diminished by exotic grasses and increased fire

How can we easily and economically describe how ecological processes are functioning?

Indicators

- Index of an ecosystem attribute or process that is too difficult or expensive to measure directly.
- What you are measuring
- May be more than one indicator for an attribute

Bare ground

Flow Pattern

Compaction Layer
1. Need something here to qualify "functioning". Most ecological processes are always functioning. Just not always in a healthy (or helpful) manner.

Jason Karl, 2/13/2015
Core Indicators...

are classes of indicators that are informative of many aspects of range health and are useful for answering many other resource management questions.

Core Indicators...

...are based on land health concepts

Core Indicators...

...are based on land health concepts
...can be measured consistently in all rangeland ecosystems

Arctic Tundra  Mojave Desert
Um... I'm not sure about this one. There's a lot they don't say about the range health attributes. They are a set of indicators (actually, classes of indicators) that are informative of many aspects of range health and are useful for answering many other resource management questions. (Not a very elegant def...)

Jason Karl, 2/13/2015
Core Indicators...

- are based on land health concepts
- can be measured consistently in all many ecosystems
- are scalable
- apply to many different objectives

Supplemental Indicators

- Additional indicators to evaluate when needed

**EXAMPLE:**
In the Colorado Plateau, biological crusts may be a useful supplemental indicator to help evaluate soil and site stability and biotic integrity.

Choosing Supplemental Indicators

- Bare Ground
- Vegetation Composition
- Plants of Mgmt. Concern
- Nonnative Invasive Sp.
- Vegetation Height
- Canopy Gaps
Choosing Supplemental Indicators

- Bare Ground
- Vegetation Composition: Plants of Mgmt. Concern
- Vegetation Height
- Canopy Gaps
- Plant Density

Methods

- Technique for measuring an indicator
- How to measure an indicator
- May be more than one method for an indicator
- Qualitative or quantitative

Quantitative & Qualitative Methods

- Quantitative
  - Objective
  - Measure features
    - "Cheatgrass cover is 85%"
- Qualitative
  - Observations
  - Describe, rate, or rank features
    - "Cheatgrass is rated as abundant"
Title of this slide doesn't seem to match the content.

Jason Karl, 2/13/2015
Quantitative and Qualitative Data Collection

- Quantitative methods are more precise
- Either qualitative OR quantitative methods can be more accurate

Soil surface

Compaction layer

NOT a compaction layer*

*Even though it has a high (quantitative) bulk density
How much bare ground?

- 10% 20% 50%

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Core qualitative indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil and site stability</td>
<td>• Rills</td>
</tr>
<tr>
<td></td>
<td>• Water flow patterns</td>
</tr>
<tr>
<td></td>
<td>• Pedestals/terrasettes</td>
</tr>
<tr>
<td></td>
<td>• Bare ground</td>
</tr>
<tr>
<td></td>
<td>• Gullies</td>
</tr>
<tr>
<td></td>
<td>• Litter movement</td>
</tr>
<tr>
<td></td>
<td>• Wind-scoured, blowouts and/or deposition areas</td>
</tr>
<tr>
<td></td>
<td>• Soil surface resistance to erosion</td>
</tr>
<tr>
<td></td>
<td>• Soil surface loss or degradation</td>
</tr>
<tr>
<td></td>
<td>• Compaction layer</td>
</tr>
<tr>
<td></td>
<td>• Litter amount</td>
</tr>
<tr>
<td>Soil macroaggregate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>stability in water</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Core quantitative indicators</th>
<th>Selected measurements and references</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare ground</td>
<td>Line point intercept (1, 2)</td>
</tr>
<tr>
<td>Litter amount</td>
<td></td>
</tr>
<tr>
<td>Proportion of soil surface</td>
<td>Canopy gap intercept (2)</td>
</tr>
<tr>
<td>covered by canopy gaps</td>
<td></td>
</tr>
<tr>
<td>longer than a defined minimum</td>
<td></td>
</tr>
<tr>
<td>Proportion of soil surface</td>
<td>Basal gap intercept (2)</td>
</tr>
<tr>
<td>covered by basal gaps</td>
<td></td>
</tr>
<tr>
<td>longer than a defined minimum</td>
<td></td>
</tr>
<tr>
<td>Soil macroaggregate stability</td>
<td>Soil stability kit (2)</td>
</tr>
<tr>
<td>in water</td>
<td></td>
</tr>
</tbody>
</table>

1. Elzinga et al. 1998 (Measuring & Monitoring Plant Populations)

Next Learning Steps

- Watch the IIRH Indicators and Attributes videos:
- Watch the core quantitative methods videos on the Landscape Toolbox:
  [http://www.landscapetoolbox.org/training/resources/](http://www.landscapetoolbox.org/training/resources/)
Typo on second bullet

Jason Karl, 2/13/2015
Indicators and Attributes Resources

• Monitoring Manual for Grassland, Shrubland, and Savannah Ecosystems, 2nd Edition
  http://www.landscapetoolbox.org/manuals/monitoring-manual/
• Interpreting Indicators of Rangeland Health, version 4
• BLM Core Terrestrial Indicators and Methods, Technical Note 440

Conclusion

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