Introduction

One of the most important components of a comprehensive ranch management plan is a well-defined long-term monitoring program designed to track changes in the condition of rangeland and riparian resources over time. The quality and quantity of rangeland and riparian resources can increase, decrease, or remain relatively stable in response to a multitude of driving forces, including management-induced and natural pressures (e.g. natural disturbances, changing environmental conditions, vegetation succession). Changes in rangeland resources commonly take place subtly over time and often go undetected and unaddressed with appropriate management actions (e.g. juniper encroachment). The ability to detect trends in rangeland and riparian vegetation attributes allows the manager to evaluate the effectiveness of management actions, assess current management’s ability to achieve resource objectives, provide evidence for maintaining or changing the current management strategy and identify changes in resource conditions that are the result of pressures beyond the control of management. Long-term monitoring of rangeland and riparian vegetation attributes is designed to detect trend and will be the focus of this article.

Riparian/Rangeland Trend

An important benefit of maintaining a long-term monitoring program is the ability to detect trend in rangeland and riparian conditions. Trend is the direction of change in rangeland and riparian soil and vegetation attributes and is usually described in terms of being upward, downward or stable. Soil, water and vegetation are the basic resources on rangelands; therefore, trend on both upland and riparian areas is usually determined by measuring change in vegetation and soil attributes over time. Measurement of vegetation attributes over multiple points in time (i.e. years) allows the manager to determine whether or not vegetation is trending toward or away from management objectives. Once the direction of change in vegetation attributes is identified, the challenge becomes determining whether the changes were “natural,” due to management or due to an interaction between “natural” drivers and management. Rangelands and riparian areas are dynamic systems that constantly change in response to fire, wildlife (and feral horses), climatic cycles, insect infestations, and natural vegetation succession; not just to livestock grazing. Therefore, any records that could be used to describe any of these potential causal factors become invaluable for interpreting the cause of rangeland or riparian trend. Therefore, it is also important to keep long-term records on climate, actual use, field observations, wildlife numbers, insect outbreaks, trespass livestock, range improvements and annual indicators of resource conditions (i.e. short-term monitoring data) for the purpose of interpreting the cause of observed trends in rangeland and riparian attributes. Photo monitoring can also be an invaluable tool for documenting trend and identifying its potential causal factors.

The sustainability of all environmental services of rangelands and riparian areas, including livestock forage production, depends on limiting accelerated soil erosion and degradation, effectively capturing, storing and releasing water, and maintaining productive, resilient biological communities. Desirable vegetation consists of native or nonnative plants that collectively function to meet management objectives (e.g. forage production for livestock, wildlife and aquatic habitat) and fulfill vegetation’s functional role in protecting soils from accelerated erosion and maintaining ecosystem processes (i.e. water, nutrient and energy cycling). Therefore, the fundamental objective of any management strategy should be to maintain or increase desirable vegetation and the primary question that a long-term monitoring program needs to answer is how management actions are affecting the cover and composition of desirable vegetation.

Methods for Monitoring Rangeland/Riparian Trend

There are several monitoring methods available for detecting trend in vegetation attributes.
Deciding among them really boils down to your technical expertise, management and monitoring objective(s) and the amount of time and resources available to you. Obviously, methods that generate quantitative data offer a more concrete interpretation of trend and are more desirable. However, these methods are more time and resource intensive than methods that provide only qualitative information, such as photo monitoring. Table 1 provides a short description of recommended monitoring methods of varying intensity levels for observing/detecting rangeland and riparian trend. For a complete description of how to establish and use these and other monitoring methods see the Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems (http://usda-ars.nmsu.edu/Monit_Assess/PDF_files/Quick_Start.pdf) or you can always contact me at 541-573-2506 for assistance.

Table 1. Recommended long-term monitoring methods of varying intensity levels, indicators generated and their interpretation. Intensity level refers to relative differences between the methods presented here. Methods have been developed that are much more time and resource intensive than those presented in this article.

<table>
<thead>
<tr>
<th>Method</th>
<th>Measured Attribute</th>
<th>Data</th>
<th>Intensity Level</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photo Monitoring</td>
<td>None</td>
<td>Qualitative</td>
<td>Low</td>
<td>Permanent photographs of a landscape are useful for observing changes in vegetation composition and structure and for visually documenting and interpreting trend measured with other methods.</td>
</tr>
<tr>
<td>Pace Transect*</td>
<td>Plant canopy cover</td>
<td>Semi-quantitative</td>
<td>Moderate</td>
<td>Increases in canopy cover indicate improved resistance to runoff and accelerated erosion. Basal cover is a more reliable long-term indicator because it is less sensitive to seasonal and annual differences in precipitation and use. Increases in bare ground indicate a higher risk of runoff and erosion.</td>
</tr>
<tr>
<td></td>
<td>Plant basal cover</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bareground</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plant canopy cover</td>
<td>Quantitative</td>
<td>High</td>
<td>Same as Pace Transect. A modified point intercept method is used to monitor riparian “greenline” vegetation attributes along the channel’s edge.</td>
</tr>
<tr>
<td>Line-Point Intercept Transect</td>
<td>Plant canopy cover</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plant basal cover</td>
<td></td>
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<tr>
<td></td>
<td>Bareground</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Belt Transect</td>
<td>Invasive or woody plant density</td>
<td>Quantitative</td>
<td>Moderate</td>
<td>Interpreting belt transect data is site-specific. In a riparian area, an increase in woody species may indicate upward trend. In sagebrush steppe, the presence of juniper could be an early warning indicator of degradation.</td>
</tr>
</tbody>
</table>

*The Pace Transect method is less accurate than the Line-Point Intercept method because it is difficult to pace in a straight line, especially through shrubs.
Location and Number of Trend Sites

Monitoring a rangeland in its entirety is impractical and illogical. Instead, key areas should be selected from the rangeland based on their potential to show change in vegetation attributes that are characteristic of much larger areas. A key area is defined as, “A relative small portion of a range selected because of its location, use, or grazing value as a monitoring point for grazing use. Key areas are assumed, if properly selected, to reflect the overall acceptability of current grazing management over the range (SRM 1996).” While the concept is good in theory, identifying such locations is difficult and subjective, especially on rangeland that has several major vegetation types and variable topography and elevation. In this case, one site will certainly not be indicative of vegetation trend on all parts of the pasture. A good strategy may be to locate a trend site in each of the major vegetation types within a pasture on areas that are likely to show a response to grazing management. For example, if a given rangeland is comprised of big sagebrush/perennial bunchgrass, low sagebrush/perennial bunchgrass, and a crested wheatgrass seeding, it may be a good idea to establish at least one trend site in each of the three major vegetation types. An alternative to more than one trend transect site per pasture is to locate additional permanent photo points in the management unit. Permanent photo points are much less time consuming and provide a qualitative means to documenting trend.

Selecting the number and location of trend sites should also be largely driven by management objectives. For instance, if a management objective is to reduce the population of a noxious weed in a particular portion of the pasture, it would be appropriate to locate a trend site in this area to monitor the long-term effectiveness of a weed control and restoration program. Trend sites should be selected based on known soil and vegetation attributes that are linked to management objectives and proximity to fence lines, supplement feeding areas, watering locations, and/or other potential livestock congregation areas. Once a trend site location is selected, it should be permanently marked with t-posts or re-bar and documented on aerial photos or maps. The trend site’s coordinates may also be collected by a Global Positioning System (GPS) unit to help with relocation.

Monitoring for Success

Monitoring can improve the management of most businesses. As a manager, you set management objectives, develop a strategy to meet those objectives, then monitor to determine whether the objectives are being met and if not, why. Successful management decisions can only be made with knowledge of the effect of past management actions and what areas of the management strategy need changed to produce the desired objective. With a growing nonfarm/ranch population that is interested in natural resource issues, monitoring becomes increasingly important. A long-term monitoring program provides a valuable source of information about management’s influence on range and riparian resources. With respect to public grazing allotments, monitoring provides the measured/observed results of a grazing management program, which may become imperative in the face of litigation related to the perceived impacts of livestock grazing. If you have an interest in developing a monitoring program for your rangeland and riparian areas please contact me at 541-573-2506.