A Practical Reference

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Why Should a Land Manager Monitor Rangelands?

Land managers face many challenges in managing rangelands. These include making a decent income, maintaining the health of the landscape, and interacting with other people who have interests concerning the landscape. One continuous challenge is to know what is actually happening on landscapes, pastures and other rangelands.

Hence, this drives the need to monitor rangelands.

Monitoring is the process of watching, measuring and documenting interactions, conditions, and changes on rangelands so that sound management decisions can be made to sustain that site. And by sustaining that site also sustain the enterprise of the manager.

Monitoring can help managers:
- Recognize positive improvement and utilize it efficiently capturing more production potential.
- Recognize negative trends allowing remedial actions to be taken.
- Recognize disturbances such as weed infestation, drought, competitive use, shifts in plant community and alternatives for updated management.
- Document good management techniques and educate people with interests in rangeland health.
- Implement management techniques that can enhance the production and vigor of pasture yielding more profits, diversity and resilience to disturbance.
Since all sites and operations are individual, no single format of monitoring fits all situations. But there are some crucial factors needed for successful monitoring. They include:

- To start a monitoring process requires doing an ASSESSMENT to establish a BASELINE. This tells you where your range condition is RIGHT NOW. This should be as extensive and scientific as possible.

- Once a baseline is conducted, you should conduct on-going monitoring. This should be in-depth enough that it provides scientific data which can justify your management approach. But, it should also be simple enough that it is easily REPEATABLE. Without being easily repeatable, managers are less likely to actually do the monitoring and everything has been wasted.

- Monitoring helps you make management decision best if:
  - Conducted before decisions are made.
  - Conducted before, during and after use.
  - Conducted in agreement with other interests involved.
  - Conducted consistently for time, manner, and technique.
  - Recorded so you can compare results from each period, year and season.
  - Conducted with conviction.

Rangeland monitoring benefits all land managers. If the land manager is not the land owner it provides a scientific platform of data to conduct discussions, make management decision and negotiate lease terms in a manner that benefits both the landscape and the manager's interests.
Monitoring must track changes on all significant sectors of your landscape to be comprehensive. Some landscapes are fairly homogenous and can be completed with simple monitoring as long as usage is evenly distributed. Some parcels have quite a bit of variation and require additional monitoring to track what happens in various sectors.

This diagram reflects a landscape that has one division fence, a riparian area, a wooded grassland, two types of grasslands, and a stony outcropping. It also contains a stock tank between the two fenced areas. Such a mixture is common on landscapes.

The challenge is develop monitoring guidelines that encompass the entire landscape.
Rangeland (Pasture) Evaluation Factors

- **Random Design** – Research-based investigations require a random element in the design development so that statistical significance can be shown and argued with academic peers. The target significance utilized by researcher varies from 90 to 95 percent. Landscape managers from non-academic backgrounds are pleased to find a design that works “the majority” of the time.

- **Condition** – Academic protocols have long differed as to whether the “condition” evaluation of a rangeland site should be based on an evolutionary “climax community” which is the presumed development of plant domination in an area without the interference of disturbances, or present condition as a comparison to “desired plant community”. Cultural landscape managers determine “condition” based on a historical perspective and the ability of the landscape to support people, livestock, and wildlife.

- **Trend** – Ecological trend is the analysis of estimating the direction of a range site’s ecological community shift or a significant shift in site condition. Academic investigation often determines this based on observations of similar ecosystems. This often is contrary to their general support of site specificity and random sampling protocols. Traditional landscape managers tend to assess trend changes based on action/reaction and historical observations. Trend is a facet of evaluation that will require exposure and training to compliment the observation skills.

- **Community Composition** – Plant community composition in reality is the percentage of what type of plants may exist in a specific range site. Academics often measure plant canopy composition, plant weight by species, basal area, growth status, age of each species and any other number of
biodiversity designations including subspecies. Traditional producers tend to focus on dominant plant presence, desirable plant percentage and undesirable plant existence.

- **Degree of Utilization** – Utilization is the measure of how much of the forage produced has been eaten or consumed. Academics often evaluate utilization frequency, intensity, and selection. Producers have become more alert to academic studies in the areas of utilization since plant selection, timing, and species characteristics often determine the sustainable vigor of a range forage community.

- **Canopy** – Vegetative canopy is the forage characteristic that covers or shades the ground or other lower vegetation. This vegetative structure often prevents soil evaporation from the soil, inhibits precipitation from easily reaching the soil, determines the composition of other levels of plant community and also determines major structure in shrub, forest and some forbs communities. Canopy is often investigated as a determining characteristic to determine the trend of an area, but its measurement for pasture evaluation is often limited on small acreage. Producers often utilize it as a measure of shelter for livestock and wildlife.

- **Production** – Vegetative biomass production is the measure of plant community vigor and a reflection of climatic conditions. Academic research is usually based on the value of biomass production to serve as forage or crops. Traditional producers base much of their pasture evaluation on the production level maintained by a site.

- **Vitality** – Range site or pasture vitality is vigor of a plant community and the dominance of strong growing vegetation in comparison to decadent plant materials. Vitality is a reflection of active organic, mineral, moisture, and use cycles. Vitality directly affects production rates, inhibiting the establishment of noxious plants, and maintenance of desirable species composition.

- **Fragility** – The term fragility refers to the capacity of a specific range site or pasture to resist and recover from all types of disturbances, but notably to recover from poor management practices or a lack of knowledge when managing landscapes. The concept of fragility was popularized by the growing acceptance of holistic resource management that compares site capacity to use goals. Producers have embraced this approach while many academics tend to still break it down into subcomponents of ecosystem stability. This concept of compatibility with goals is crucial to initial small acreage management.
- In digesting years of formal range management training, applied research, and a life-long relationship with traditional producers, I have come to realize that pasture evaluation hinges on:
  - A clear understanding of the character and capacity of a range site gained from conversations with both local producers and local technical expertise.
  - A practical comparison of other similar sites in the immediate area to determine “condition” that is consistent with the affects of local climate and traditional management.
  - A technical comfort with the site based on NRCS and Cooperative Extension technical guides.
  - Establishing initial evaluation sites by determining several “representative” sites in each pasture and selecting one at random to prevent bias.

Evaluation of pastures must be based on comparison to sites in the immediate region, not philosophical ideals or pasture condition in other regions or ecosystems.

**Monitoring Techniques**

- **Line Transects** – A transect is a linear measurement of plant community and characteristics that can easily be converted into a percentage or fraction for site evaluation. Line transects usually involve randomly selecting a representative site and placing a marker. The investigator then randomly selects a compass direction (this site and direction will be marked and recorded for repeatability) and strings a line, tape, or rope 50 or 100 meters along that direction. Measurements of species occurrences, canopy, groundcover, and other factors can be recorded at predetermined increments along said line.

Then measurement process can be repeated each time by restringing the line and re-measuring the desired factors and elements. This process can be very accurate but is tedious and meticulous for implementation by laymen resource managers.

- **Pace Transects** – This type of transect mirrors the principle of line transects but no line is necessary. A transect stake is established and a magnetic direction chosen just as with a line transect. This method differs in that the evaluator simply takes paces along the imaginary line direction and records the findings that occur at the point of his shoe or boot. To maintain replication accuracy this method should be evaluated by the same investigator each time, or at least by someone with a similar stride length and recording criteria. The blessing of this system is that it requires only a staked location and a good memory or a notepad. Checking an average 50 pace transect takes only about 15 minutes and provides valuable comparison to the other times you checked the site.
Transects of any type easily record the percentage of each species on a site, the percentage of bare ground, and can record the number of plants bitten or utilized.

- **Clippings** – Forage production has often been estimated by clipping a given area of forage. This sample could then be interpolated to equal acre production or hectare production value. Academic research often requires thorough repetitive clipping samples to reduce statistical error in a sampling design. Livestock producers whether traditional or new residents often find this process exhaustive, mundane and or little real world application. You may have to sort the results of your “clip” to determine usable or desirable species composition.

By clipping an area 0.89 meters in square area an individual can determine the estimated pounds per acre of available forage (GRAMS PER .89 Meter x 100 = POUNDS PER ACRE). This may require a rigid square or circular steel hoops that you can randomly or selectively throw into a pasture to outline the square area you need to clip.
• **Cages** – Cages or “enclosures” are temporary rigid structures that prevent normal utilization of forage in an area by livestock and wildlife. If placed over un-grazed forage and left untouched for a grazing season, the forage on the inside of the cage serves as an “undisturbed” comparison. However, if your management techniques are stimulating vegetative production outside the cage the inside will still grow at a “normal” rate. By clipping the cage area before placement you can actually determine the growth rate of the site if left undisturbed for that growth season. This accurately measures new growth production for the season. Comparing this type of cage to standing crop on the exterior of the cage will allow you to estimate actual utilization of the current year’s active growth. Cages should be moved after the growing season unless you are trying to measure the cumulative effects of long-term grazing in the area.

• **Grids and plot frames** – Rigid frames have historically been thrown at random or selected points to observe and/or clip range sites. A version of these utilizing small internal dividers allows rapid estimation of plant community composition by logarithm principle. This is referred to as a “nested” plot. Most rigid plots were originally a square or circle with one square meter of area. This allowed estimation of pounds or grams of forage per hectare. United States investigators converted this to 0.89 square meter area, so that the pounds of forage could be equated to one acre of landscape. The frames were awkward and heavy and younger researchers began using heavy rope or plastic covered 5/16 aircraft cable with a circumference of 93”. This development allowed the “grid to be coiled and carried easily in a backpack, saddlebag or large pocket.

• **Photo-points** – By taking repetitive photographs from a given point (such as a transect stake) in the same direction it is possible to correlate transect, clipping, and measurement results with a visual image. Familiarity with the appearance of an image can then be utilized as a
condition reference and estimate of condition without completely repeating all measurements. This practice is easy, fast, repeatable, and one of the strongest chronological comparison records available to on-the-ground landscape managers.

- **Point Frames** – A point frame is a horizontal frame with 10-20 needle-like points which can be gradually dropped to mark plant occurrence and frequency along a transect (usually line transects). This highly accurate system is slow and tedious but can determine frequency, bare ground ratio, canopy cover (low), and species composition within a plant community.

- **MY “PIGGIN STRING” Method:** My approach to utilization begins at a moderate level and gets simple rapidly unless unforeseen events develop.
  - **MONITORING SITE** – Initially, I randomly select a transect location in each pasture and then permanently mark the sight. This includes a GPS coordinate and specific distances and directions to obvious landmarks.
  - **TRANSECT** - I then pace off a 25 or 50 step transect (about 50 meters for me) and record the dominant species within 8 inches of each toe step. I record whether the area immediately in front of each step is bare ground or vegetation (1” in front of toe). I record both of these sets of data on a small notepad where I give each transect a name such as “South Well #1”. This data gives me an estimate of ground cover and the percentages of which species are present and/or dominant. I use a “Range Monitoring Card” with Sharpie or a “Write in the Rain” notebook and a pencil so that a little moisture doesn’t stop me.
  - **PIGGIN STRING** - I then step back to the transect marker and throw a Piggin string with 8’ of in the loop or a flexible cable grid hoop over my shoulder at random. I find the piggin string or hoop and take a picture of the plants in the hoop. I then inspect the plants in the loop/hoop and estimate how many are new, growing and/or dead. If I want to estimate the carrying capacity of the site I then clip all of the plants down to a height of 1” to 1.5”. I weigh the plants in a paper bag and then I weigh the bag empty. By using a gram scale I can then estimate how many pounds of forage is currently standing on each acre in the pasture. If there are obvious differences within the pasture, I repeat the grid approach in the other area.
  - **PHOTO POINT** - I step back to the transect marker and chose a direction at random and take a photograph. I record the dates, locations, directions, and plant findings in the book.
CAGES – When I do use cages, I place two cages in large pastures and one in smaller pastures. Working with two, I place one and leave the encircled plants alone so that I can compare overall differences between utilized and dormant. With a second cage I clip the contents out just prior to the pasture being utilized. This allows me to compare inside and outside growth and vigor under use and non-use conditions. Cages should be rigid and strongly set in locations of general graze. This should be away from other structures, roads, watering points and travel paths.

APPROACH – Walk to transect and cage sites so that your traffic does not influence the results.

FOLLOW UP MONITORING – After you set your sites up you may reduce your monitoring to the Pace Transect, Hoop Grid, and Photo-point process. After you have a chronological set of photos documented (say one year of photos taken monthly or quarterly) you may opt to just visually inspect the area and take a photo-point picture. If the photo-point picture looks strange or out of context, you might consider re-initiating your method back to the transect-clip-grid-photo approach until you understand what is happening.

CONSISTENCY – After conducting the entire process for a relatively short period of time you will be able to correlate photograph characteristics with certain production and vigor values. Remember to go back and spot check your system occasionally. The monitoring should be done by the same people or person, since pace length and height of camera makes a big difference. Some folks mark both ends of a transect and place a steel post at the photo-point on which to set a camera.

WHY THIS BECOMES EASIER!

- Year 1 – 1 hour for site, transect, grid, clip and photo.
- Year 2 – 20 minutes for transect and photo.
- Year 3 – 5 minutes for photo point and inspection.
- Occasionally an hour on sites with problems.

TO TEST MY APPROACH I FIRST LET MY DAUGHTERS WHEN THEY WERE 5, 7, 8, and 11 CONDUCT THE PHASES OF MONITORING FOR TWO SPRINGS. THEY FOUND THEY COULD DO ALL OF THE MONITORING ON TWO PASTURES IN ABOUT ONE HOUR THE FIRST YEAR AND 45 MINUTES THE SECOND YEAR.

IT REQUIRED THAT I MADE THE ANALYSIS OF THEIR RESULTS AND MADE DECISIONS BUT DEMONSTRATED THE EASE OF THE TECHNIQUES.
When all of our scientific studies were digested for about a decade it became obvious that a general matrix guideline was present to help land managers determine how and when to graze pasture. This matrix was devised by combining the natural growth patterns of grass, its ability to recover within certain periods of time and the difference in grass recovery caused by stocking intensity.

It is called the “GRAZING RESPONSE INDEX”.

This grid lets managers evaluate the frequency they have grazed pastures, the intensity with which they have grazed pastures and the opportunity the pasture has had to rest and recover. By assigning scores to these three considerations, a manager can determine which pasture to use next and have some indication of the intensity to use.

<table>
<thead>
<tr>
<th><strong>GRAZING RESPONSE INDEX</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency of Use</strong></td>
</tr>
<tr>
<td>Less than 2 Uses (+1 score)</td>
</tr>
<tr>
<td>2 Uses (0 score)</td>
</tr>
<tr>
<td>3 or more uses (-1 score)</td>
</tr>
</tbody>
</table>

Here is how it works. A manager must determine how he/she has used the pastures in recent and past periods. Then you score each pasture. Determining frequency, intensity and rest may require a little technical help at first but it’s usually fairly intuitive. Then you compare the score of all your grazing site alternatives.

THE HIGHEST SCORE SHOULD BE YOUR NEXT GRAZING LOCATION!!!

An example:

<table>
<thead>
<tr>
<th>PASTURE A</th>
<th>PASTURE B</th>
<th>PASTURE C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currently in this pasture so it is not scored until you move out.</td>
<td>Used once this season, moderately, with partial season of rest. Score +1</td>
<td>Used 3 times last year, heavily with a full season of rest. Score 0</td>
</tr>
<tr>
<td>PASTURE D</td>
<td>PASTURE E</td>
<td>PASTURE F</td>
</tr>
<tr>
<td>Used once early this season, heavily but had partial season rest. Score 0</td>
<td>Used twice this season, moderately, little rest. Score -2</td>
<td>Used none this year, last use moderate, season long rest. Score +2</td>
</tr>
</tbody>
</table>
These considerations will become automatic after awhile, the grid just help to form the evaluation. Obviously a manager would want to move to Pasture F next and then probably Pasture B.

Please notice that the amount of rest and recovery a pasture receives, gets weighted much more heavily than frequency of use, or intensity of use.

MONITORING RANGELAND NEEDS TO BE A SYSTEM OF MEASUREMENT AND DOCUMENTATION THAT MEETS YOUR DATA NEEDS.

IT SHOULD BE KEPT AS SIMPLE AS POSSIBLE!