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Presented at 2nd Annual North Central Idaho Grazing Conference
January 26, 2006

Why monitor?

Monitoring is the very basis of management for any business. We set objectives, develop a management plan to meet those objectives, then monitor to determine whether the objectives are being met and if not, why. The Society for Range Management (SRM, 1998) defines range monitoring as, "The orderly collection, analysis and interpretation of resource data to evaluate progress toward meeting management objectives. This process must be conducted over time in order to determine whether or not management objectives are being met." Monitoring must also identify what areas of management need revision to produce the desired objective. We cannot make effective management decisions if we do not know the effect of past management actions.

Although this guide is designed for use by public land livestock permittees, it is just as important that ranchers monitor their private rangeland too. A primary goal of both public and private land managers/owners is to insure the sustainability of rangeland resources and the use of those resources, including their productive capacity. The monitoring plan is as important a part of the ranch/allotment plan as the grazing system or stocking rate. The objectives, sampling techniques, study locations, monitoring responsibilities and time tables for monitoring should be as detailed as possible.

Who should monitor?

As ranch or allotment management plans (AMPs) are developed, a detailed monitoring plan should also be developed. Just as AMPs on public land allotments should be a cooperative, coordinated plan developed by the agencies and permittees, so should the monitoring plan. Both the permittees and the agencies can benefit from a cooperative effort. In most cases, a permittee may be interested in acquiring some, but not all the monitoring information or data that the federal agencies desire. Collecting the same kind of information at the same time is an inefficient duplication of effort. By working together, more monitoring can be accomplished and better decisions made.

The two most important factors in effective rangeland monitoring are: (1) the commitment to diligent monitoring and (2) the interpretation of the monitoring information that is collected. Permittees are on the allotment much more often than agency personnel, thus they are key to meeting both factors. Monitoring methods that require frequent data collection, such as photographs, are best done by the permittees. Even more important, permittees are likely to observe events that may be critical to the proper interpretation of monitoring data, such as an unusual storm event or insect invasion.

The degree of commitment will vary by permittee; each permittee should only commit to those monitoring elements that they are realistically willing to accomplish. However, all permittees should at least become familiar with the location of the monitoring sites and types of information being collected. In some cases the permittees may be able and willing to monitor additional sites, using the established methodology, thus adding to the data base and increasing its accuracy. Monitoring is a long-term commitment but it should result in more effective management.

Adaptive management

In recent years the U.S. Forest Service (FS) and the Bureau of Land Management (BLM) have started using the term adaptive management in their monitoring and management documents. **Adaptive management** is defined as the process of adjusting management strategies based on monitoring results. While this is really what management has always been about, there appears to be a new-found willingness of public land agencies to use this process. Currently, there is a window of opportunity for permittees to be involved in providing monitoring information to the agencies, being involved in the interpretation of monitoring data and, most importantly, having input in grazing management adjustments to meet the goals and objectives of both the agencies and the permittees. It is up to the permittees to take advantage of this opportunity.

Historical use records

Past-use records on your ranch/allotment can be very beneficial when developing a grazing management plan or monitoring present and future

trends. Historical use records are important for determining long-term carrying capacity, range readiness, potential of various range sites and interpretation of monitoring data. When looking for this information, try to answer the following questions:

Are there previous grazing management plans for your ranch/allotment?

- When and by whom?
- Still in use? If so, is it still effective?
- What changes have been made? If any, why?
- Have stockwater facilities and fences been changed? When and why?
- Is there old monitoring data available?

Has the stocking rate been adjusted in the past?

- When? Before or after you became a permittee?
- Was the stocking rate higher or lower? Why was it adjusted?
- What class and kind of livestock have grazed in the past?

What problems have been encountered on the allotment?

- Livestock trespassing from adjoining allotments
- Damage to the resources from other users; e.g. recreational use
- Gates left open or fences knocked down by others, resulting in your livestock being in the wrong pasture
- Poisonous plant problems that may limit when a pasture can be used
- Insects, rodents or invasive species that may have affected allotment condition

What range improvements projects have been completed and when?

- Was the improvement successful and still functional?
- Are there maintenance problems beyond your control?
- What agreements were made on maintenance responsibility?

Are there more or less wildlife numbers than in the past?

- Have hunting seasons changed?
- Are there problems with the time and duration of the seasons?
- Has there been wildlife damage to resources and/or improvements?
- What is the wildlife utilization before and after your livestock have grazed a pasture?
- Other factors that may have affected populations?

Do you have old photographs of your allotment or ranch that can be compared with current conditions to show historical range trend?

- Family photos showing the landscape in the background
- Other photos with identifiable terrain or vegetation in the background

Climate and weather data

Climate and weather data are essential for the interpretation of other monitoring studies. Precipitation records in particular should be kept on an allotment or pasture basis because of local variation. Maintenance of weather records is one of the easiest and most useful contributions a permittee can make in monitoring an allotment. Precipitation records obtained from rain gauges located near gates can easily be recorded on a periodic basis. The agencies may supply rain gauges in return for such data. Other climatic data of importance:

- Temperature, unusual freezes
- Flash floods; especially those that damage streambanks
- Snow depth and persistence that might be a potential source of water
- Patterns of storms over the allotment

Actual use

The agencies require each permittee to submit actual use at the end of the grazing season. These records are not only for billing purposes but are also used in evaluating grazing management and trend on allotments. It is essential that the permittee maintain accurate records of numbers, kind, class and age of livestock by date of grazing in each pasture. The agencies may provide a form to record this information. Ranchers should also maintain their own long-term records of actual use

by date and pasture. These records may prove useful several years after the use occurred.

Rangeland health

Rangeland health is defined as, “The degree to which the integrity of the soil, the vegetation, the water and air as well as the ecological processes of the rangeland ecosystem is balanced and sustained. Integrity is defined as: Maintenance of the structure and functional attributes characteristic of a particular locale, including normal variability (SRM, 1998).” This term replaces the terms ‘range condition’ and ‘ecological status’ that have been used in the past by the federal agencies.

The agencies are required to periodically assess rangeland health for reporting purposes. In addition to reporting requirements, rangeland health assessments are used to set management goals. Permittees are encouraged to go with the agency personnel when they are assessing rangeland health and become familiar with the process. The Natural Resources Conservation Service (NRCS) can also make rangeland health assessments on private land at the owner’s request.

Rangeland/riparian area trend

By far the most important monitoring element is rangeland and riparian area trend. **Rangeland trend** is defined as, “The direction of change in an attribute as observed over time (SRM, 1998).” Trend is described as up, down or not apparent. This definition and concept applies equally well to riparian areas. Trend is used to monitor the long-term affects of management actions. A one-point-in-time rangeland health assessment does not provide adequate information to determine the direction of trend.

Soil, water and vegetation are the basic resources on rangelands; thus trend on both uplands and riparian areas is primarily assessed by measuring vegetation and soil attributes. The first priority is to protect the soil from erosion. Perennial vegetation (especially herbaceous species) provides the best protection from erosion; the denser the ground cover of perennial vegetation, the less likely soil erosion will occur. We need to know whether our management actions are resulting in increasing or decreasing soil protection by the desired plant species. There are a variety of methods available to detect changes in vegetation. The challenge is in determining whether the changes were natural or due to management. Rangelands are dynamic; they are always responding to climatic cycles, weather, fire, insects,

grazing/browsing/soil disturbance by all animals living on the land and other physical disturbances; not just to livestock grazing.

Other rangeland goals include sustained forage and browse production, fish and wildlife habitat, watershed enhancement, control of invasive species and other uses on public lands. Obtainment of these goals is also dependent on having an optimum ground cover of desirable perennial plant species.

For monitoring trend on uplands, both the BLM and the FS have used nested frequency and ground cover transects since the early 1980’s along with permanent photo points. In 2005, both agencies in Idaho jointly developed a method for monitoring trend on riparian areas (Cowley and Burton, 2005). Detailed descriptions of monitoring methods used by the agencies can be found in “Sampling Vegetation Attributes” (Interagency Technical Reference 1996) as well as agency range manuals. There is little to be gained from permittees using a different method than what the agencies use. Instead, the permittees would be better advised to cooperate with and assist the agencies with their monitoring activities; especially in providing their insight on interpretation of monitoring data. Such cooperation will insure more thorough and frequent monitoring of allotments, provide data useable by both parties, result in better interpretation of data and facilitate the adaptive management process. Private land owners may wish to consult with the local NRCS or Cooperative Extension Service office for suggestions on monitoring methods to use or contract with a professional rangeland consultant to do the monitoring.

Number and location of trend study sites

The minimum number of trend study sites is one per pasture; more is better. Typically, the agencies may have only one site per pasture, located in the key area. **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. It is assumed that key areas, if properly selected, will reflect the overall acceptability of current grazing management over the range (SRM 1996).” While the concept sounds good in theory, identifying such a location is difficult and subjective, especially on rangeland that has several major range types and may also have both low and high elevation sites in each pasture. In this case, one site will certainly not be indicative of what is happening on all parts of the pasture.

However, if key areas are going to be used the permittees should be involved in selecting them because of their familiarity with the allotment and livestock use patterns. Reading trend transects can be time consuming. An alternative to more than one trend transect site per pasture is to locate additional permanent photo points in the pasture.

The agencies may also locate trend study sites in **critical areas**, defined as areas of special concern. Riparian areas, noxious weed infestations and habitat for threatened and endangered species are examples. Permittees should especially be involved in monitoring livestock use in riparian areas, as use and trend in these areas may dictate management on the entire allotment.

Even if permittees are not going to assist with monitoring studies on their allotment, they should at least know where the study sites are. **Do not put your salt block on or near a study site!**

Photographs

It has often been said that “a picture is worth a thousand words,” and that holds true for monitoring rangelands, especially range trend. Permanent photographic plots and photo points taken periodically provide a visual record of changes in vegetation (or lack of change) over time; i.e. trend (Sharp and Sanders, 2005). Photographs provide excellent evidence for court cases. It requires little training, time or expense to establish permanent photo points and take the pictures. On public lands, the range managers and the permittees should jointly select the location of the photo points and coordinate when the photos are taken and by whom.

At the very least, permanent photo points should be established at each trend study site, usually in the key area of a pasture and key riparian area. However, the more photo points there are in a pasture, the better the trend information and management decisions. The limiting factor on number of photo points is the commitment to routinely take the photos. The sites should be photographed at least annually at a specific time, but before and after grazing in each pasture is preferable. Before and after grazing photos document range readiness as well as the degree of use in a pasture. If taken only once a year, it is generally recommended that photos be taken at the end of the grazing season. Documentation of other events, such as recreational and wildlife use and damage, vandalism and condition of range improvements are also recommended. It is especially important to document heavy use by wildlife before and after livestock grazing in a pasture or on a riparian area with photographs.

The FS and BLM generally mark the location of permanent photo points by driving a steel post into the ground then measuring a known distance and direction from the post to locate the photo plot/point. Both agencies use a 3 ft x 3 ft plot frame that is permanently marked with one or more short steel stakes and/or long spikes, painted with a bright red or orange color. In addition to taking a close-up photo of the plot, they take a general view photo by raising the camera straight up from the plot to include a small portion of the horizon. The plot stakes should be long enough to locate, but short enough that livestock cannot rub on them. Sharp-tipped stakes should be avoided as they can injure livestock and horses. It is best to lay out the site so that photos are taken facing the south in order to avoid shadows in the photos. A prominent landscape feature, such as a mountain top in the background, is not only useful in locating the photo point but also insures other viewers will accept photos taken over time as being in the same location. Geographic Positioning Systems (GPS) receivers are relatively cheap and are a useful way to mark and find trend study sites. If you have to purchase a camera, consider a combination camera/GPS unit. Hall (2001) provides considerable detail about photo monitoring.

A frequently asked question is, “What kind of camera should I use?” If you do not already have a suitable camera, select one you are comfortable using and that can be carried in a saddlebag or pickup without damage. Digital cameras (minimum 3 megapixel, preferably 5) are now relatively inexpensive, especially when the cost of processing regular film is considered. Digital cameras also allow you to make sure the photo is acceptable before leaving the site. Contrary to popular opinion, digital photos are also acceptable as evidence in legal proceedings.

Purchase a durable field notebook (pocket size) to record the photo point location, date and other information such as livestock/wildlife use in the area, high insect populations, or other signs of disturbance that will be useful in interpretation of trend. Identify each point with a number or name.

Even if you use a computer for storing digital photos, consider printing each photo to place in an album in chronological order by pasture and photo point. Interpretation of range trend data is best done out on the range with agency personnel and an album facilitates the field interpretation. It is also handy to have the album with you for reference in locating photo points and sighting the camera the next time you take the photos.

Agencies are tending toward use of remote sensing (aerial photography) in lieu of or as a supplement to ground monitoring. If so, it is even more important that permittees become involved in monitoring; remote sensing is of questionable value without ground level data to aid in interpretation of the aerial photos.

Apparent trend

Apparent trend is defined as, "An interpretation of trend based on observation and professional judgment at a single point in time (SRM, 1998)." Early in the range profession, a range trend scorecard was developed based on indicators such as plant vigor, presence of seedlings, signs of soil erosion, etc. to determine apparent trend. The technique has not been recommended for many years due to its subjectivity. Unfortunately, the BLM and NRCS recently modified the old apparent trend scorecard and are using it for a rapid assessment of rangeland health, despite the objections of most range scientists. Use of apparent trend and the rapid assessment technique for determining rangeland health are highly questionable and I do not recommend either as a basis for rangeland management decisions.

Annual indicators

In addition to actual use, other annual monitoring information may be useful in interpreting long-term trend data and making adaptive management decisions. These include utilization mapping on uplands and stubble height, browse utilization and streambank trampling on riparian areas. Annual indicators should not be used as a part of the terms and conditions of a permit nor in lieu of long-term trend data to make grazing management decisions (University of Idaho Stubble Height Review Team 2004).

Mapping livestock utilization patterns can be a useful tool in grazing management. It can be used to establish key areas, identify distribution problems and solutions and to make adjustments in annual operating plans. Periodically, near the end of the grazing season, a range inspection tour should be made to map distribution of grazing use in an allotment or pasture. The question that needs to be answered is what areas of a pasture received light, moderate and/or heavy use. It is especially important to map utilization patterns when there has been a change in the grazing system or range improvements, such as additional water developments or a change in fence location. The use map should be prepared by the range managers and the permittees while riding together (the best way

to see rangeland is from the back of a horse). Periodic rides also provide an excellent opportunity for the range managers and the permittees to discuss problems and solutions. There is little, if any, management utility in measuring degree of use precisely on a few transect locations. For a detailed discussion on the use of utilization see Sharp et al. (1994) and Smith et al. (2005).

Other records to keep

Range improvements:

- Dates when water is available in springs, reservoirs, etc.
- Potential sources of new water
- Wildlife use of improvements
- Salt location each year
- Expenses, such as water hauling, maintenance, construction and labor

Field observations

- Poisonous, noxious and invasive plant locations
- Maintenance required, such as fence repairs to be done before the next season
- Unusual insect, rodent and wildlife use/damage

Use by others

- Off-road vehicle use and/or damage
- Undeveloped campsites, especially on riparian areas
- Hunting and fishing activity
- Vandalism, including gates left open, fences cut
- Trespassing livestock – include dates, number, ownership, entry point

Interpretation of monitoring data

As previously stated, interpretation of monitoring data is one of the most important elements of monitoring. It is at this point that we determine if trend is up, down or not apparent. Permittee participation in interpretation of the data is not only in the best interest of the permittees, but also the agencies. The permittees are on allotments much more frequently than agency personnel and may see things that are vital to the interpretation of trend. Most important, permittee participation improves communication, builds trust and greatly facilitates the adaptive management process.

If the data shows upward trend, both parties will likely agree to continue with current grazing management. If trend is not apparent, it may indicate no change in the condition of the rangeland or that the monitoring system is not sufficiently sensitive to measure the change. If the conclusion is there has been no change in condition, the decision must be made whether that is acceptable or not. Perhaps the management goals were unrealistic and not obtainable (expecting grazing management alone to convert cheatgrass infested rangeland to perennial native vegetation is an excellent example). If it is not acceptable, then a minor adjustment in management may be all that is necessary. The monitoring data may show that long-term management goals and objectives have been obtained. If this is the case, do new goals and objectives need to be established?

If the data shows downward trend, the real challenge in interpretation arises; why trend is downward. It should not be automatically assumed that downward trend is due to livestock grazing. Other factors that can cause downward trend include: weather, especially a prolonged drought; fire; insects; rodents and other wildlife use; recreational use; and invasive species. Sharp et al.

(1990, 1992) and Sharp and Sanders (2005) provide excellent examples of the effects weather and insects can have on rangeland vegetation and thus trend.

If it is determined that livestock grazing is the cause of downward trend, then a change in grazing management is probably warranted. **Downward trend does not automatically justify a reduction in stocking rate!** There are very few public land allotments that are overstocked. However, there are many public land allotments that have poor livestock distribution. Utilization mapping will show if distribution is the problem. If distribution is the problem, then there are several alternatives to obtain more uniform distribution, such as additional water developments, changes in fence and/or salt locations, or a change in the grazing system. A reduction in number of animals is not likely to solve the problem of overuse in one or more areas of the pasture, such as on riparian areas. Other management alternatives to consider include developing/using alternative forages, changing the time or system of grazing, or changing the class/kind of livestock. Permittees should be proactive in suggesting management changes to stop downward trend, if it is due to livestock grazing.

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This publication is issued as Contribution Number 1010 of the Idaho Forest, Wildlife and Range Experiment Station, College of Natural Resources, University of Idaho, Moscow, ID 83844-1135.

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