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Applying Adaptive Grazing Management

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Contents

Introduction

GRAZING MANAGEMENT REQUIRES FLEXIBILITY to adapt to ever-changing climatic conditions. On public lands, changes in grazing management may be brought about by the need to accommodate mitigation measures for endangered or threatened species. “Adaptive management is a formal, systematic, and rigorous approach to learning from the outcomes of management actions, accommodating change, and improving management” (Holling, 1978). Applying adaptive management is like applying the scientific method in that an “experiment” is conducted, results of the experiment are obtained through some type of data collection, and the efficacy of the experiment is analyzed against the original goal or hypothesis. Adjustments in management are made based upon the results obtained. In adaptive grazing management, actions are evaluated in a continuous loop by using rangeland monitoring to track results on the ground. This publication provides an introduction to some tools and methods used in adaptive grazing management in either a rangeland or an irrigated pasture setting. Ranchers employing adaptive management in their grazing plans are more nimble in meeting climatic and political challenges in a sometimes unpredictable landscape.

Stock and Monitor

In the ideal scenario, a rancher would have records of past stocking rates for the irrigated pasture or rangeland intended for grazing. This approach is called “stock and monitor” and relies on the validation of the stocking rate or carrying capacity of the pastures through repeated observations over time. Comparing yearly stocking rates with some measurements of the status of the land provides additional reliable information on which to base future grazing plans. For example, ground cover and vegetation attributes should be monitored over time to provide some indication of ecological trend of the ranch.

Ranchers may also have specific objectives they desire to track over time. For example, a rancher may desire to reduce the amount of an invasive species, such as cheatgrass, in a recently burned pasture. In this example, tracking the frequency (abundance) of this plant species over time would be an important thing to monitor.

Measurements of ground cover often include gap intervals between vegetation, bare ground, basal cover of perennial plants, litter (e.g., detached and dead plant stems, sticks), persistent litter (> ½ inch deep; e.g., pine duff, cow fecal patties, tree branches), gravel, and rocks. Vegetation measurements over time usually follow such things as individual plant species frequency (percentage of total), species composition (proportion of total weight; for comparison to ecological site guides), plant functional group (forbs, annual and perennial grasses, shrubs), canopy cover and density (for shrub dominated plant communities especially), plant structure (usually associated with wildlife), forage production, and forage utilization.

Monitoring information can be separated into short-term and long-term monitoring. Long-term monitoring usually follows changes in ground cover and plant species from year to year and provides information about the efficacy of grazing management and the climate in which a rancher operates. Short-term monitoring tracks management and/or the influence of climate within a single year and includes such things as forage utilization and forage production. These measurements are usually coupled with some measurement of yearly or twice-yearly precipitation. Inexpensive rain gauges can be made from 2-inch PVC to which oil and antifreeze are added (see instructions in Schalau, n.d.).

Although short-term changes won't necessarily drive long-term trend within a single year, they certainly can influence long-term trend over a period of years. For example, excessive forage utilization over a period of years can be expected to reduce the presence of desirable plant species and to increase the presence of bare ground. Adaptive management couples records of the timing, duration, intensity, and frequency of past grazing events for a particular pasture to longer-term measurements of ground cover and vegetation. This enables one to determine how effective the grazing management is for maintaining desired conditions on the ground.

Both long-term and short-term monitoring information allow a history of forage characteristics, ground cover, and grazing to be compiled which can then be compared to on the ground conditions as influenced by temperature and precipitation for the current year. Thus, this information can then provide guidance about grazing management to influence vegetation. For example, because fire burns up surface litter, a burn will often increase the amount of bare ground present for a couple of years. Applying grazing to the burned section of rangeland following seed set and forage dormancy after the first growing season can help restore surface litter to the ecosystem. With subsequent range monitoring, the effectiveness of this adaptive management action can be verified. See the Further Reading section for more information on monitoring methods.

Rangeland or Forage Inventories

Although stocking rate information is generally available for both public and private rangelands, the ecological results (monitoring) of the grazing employed may be lacking. For those who have recently purchased a ranch and desire to gain a better understanding of the results of their grazing management, it is important to implement some type of vegetation monitoring.

Because it will take time to gather the results from a monitoring plan, it may be helpful to have additional information upon which to base initial stocking rates. In these circumstances, it's best to use an inventory-based approach for grazing management for the first year or two of the new management. One approach is to use estimation tools available for different soils types by location that are available on the web. For most of Idaho, one such tool is the Natural Resources Conservation Service (NRCS) Web Soil Survey http://websoilsurvey.sc.egov.usda.gov from which one can zoom to a location of interest and generate estimates of the productivity of the soils in that area. The soil productivity of most private lands can be accessed with this resource.

Idaho Department of Lands and Bureau of Land Management (BLM) rangeland sites are generally available on Web Soil Survey and tables of favorable,

normal, and unfavorable forage production values (lbs/acre) are produced. Please realize that these data tables are rather coarse in their predicted numbers. However, some generalities can be established for different soils or ecological sites. Deep clayey or loamy soils will generally be more productive than shallow sandy or gravelly soils.

In all cases, using soil surveys or ecological site descriptions to identify vegetation potential should be verified on the ground for major soil types contained in the range pastures. This can be done by comparing an inventory of the vegetation, forage production, and the on-site soil classification to these guiding documents.

Rangeland sites on US Forest Service (USFS) lands are not available on the Web Soil Survey, though they do have internal soil survey information that can be requested. It is important to remember that public lands agency professionals will set stocking rates for the allotments being used in accordance with agency policy and goals. Permittees with a long and trusted relationship with the land management agencies, validated by rangeland monitoring, may have the capability for more flexible stocking rates up to the permitted numbers on the grazing allotment. Stocking rates exceeding the maximum number established by the grazing permit will usually need to be approved with a new National Environmental Policy Act (NEPA) document for the grazing allotment. This proposed action will be preceded by improved conditions on the ground resulting from good management practices and land treatments.

Estimating Forage Production and Utilization

For a recently purchased ranch, there may be a need to validate the initial stocking rate. Forward planning can enable one to estimate the anticipated number of livestock that can be run for the grazing period. Estimating forage production can assist in these decisions. On smaller acreages, this approach can help inform grazing decisions. On large rangeland pastures, considerable variation can be expected in the amount of forage produced. Depending on water sources, topography, slope, trails, and other contributing factors, there will also be variation in how livestock access and utilize that forage. However, even on large pastures, this information can be valuable when tied to existing known ecological sites or soil types that constitute a major portion of the pasture.

As available forage, forage utilization, and livestock grazing distribution are monitored over time, grazing management can be adjusted as needed.

Irrigated Pastures

Forage production can be estimated on your grazing lands by clipping and drying the forage. A simple method of doing this for small acreages involves clipping 10 to 20 randomized plots of forage, drying them in the oven for 24 hours at 150°F, and converting the grams of dry forage to lbs/acre (Figure 1). On irrigated pastures, forage production may need to be estimated at the conclusion of each 30 to 45-day period of regrowth following grazing.

Most often, forage harvest on irrigated small pastures is managed by maintaining an adequate stubble height. Graze bunchgrasses (e.g., orchardgrass, smooth brome, fescue, ryegrass) to no lower than 4 inches and then allow them to grow back 8 inches before regrazing. Graze sod grasses (such as bluegrass) to no lower than 2 inches and allow them to grow back up to 4 inches before regrazing. Allow 4 to 5 inches of stubble for bunchgrass at the conclusion of the growing season for overwintering.

Rangelands

On most private Northwest US rangelands, sustainable harvest of forage is defined as “take half, leave half.” At 50% use or below, plants should be able to maintain a healthy root system. Most of the weight of a plant is towards the bottom of the plant, so taking half of

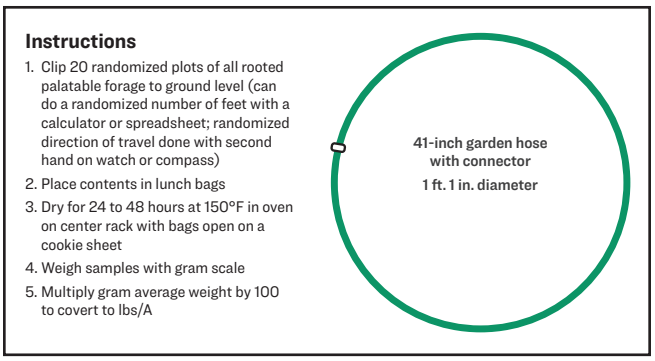

Figure 1. Determining average forage production on small acreages.

the available forage is not half of the total height, but half of the above ground biomass. You can estimate 50% utilization of forage using the "balance method" (Figure 2) or for native rangeland with a USFS Forage Utilization Gauge, which has correction values applied for the height of grazed plants (Figure 3). With the USFS Forage Utilization Gauge, a sample of ungrazed plants (10 to 20 plants) is obtained to determine the average ungrazed plant height and then all plants (usually 50 to 100) are sampled along a transect line and the average plant height (including both grazed and ungrazed) is calculated and compared to utilization percentages on the Utilization Gauge. Federal grazing permits may specify a lower utilization rate than 50% and the Utilization Gauge is effective in helping determine the level of use that occurs.

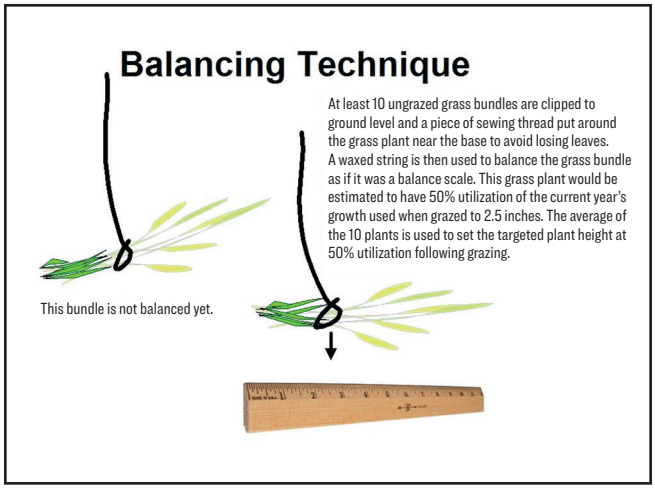

Figure 2. Determining forage utilization with the balancing technique.

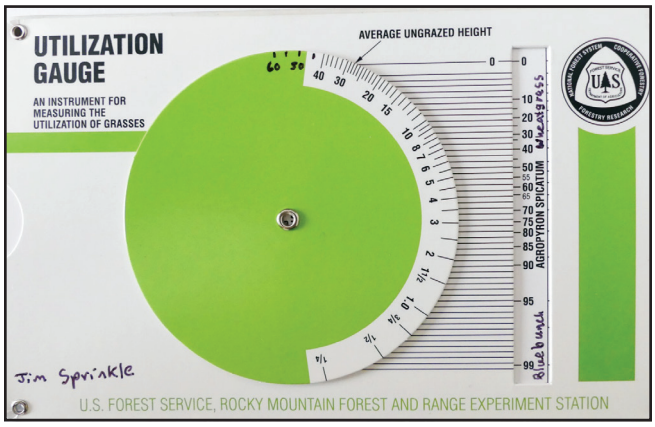

Figure 3. Determining forage utilization with the US Forest Service utilization gauge. Please note that not all plant species are on the gauge and that this gauge is designed to be used at the end of the growing season.

Forage production on rangeland is usually determined at peak standing crop at the end of the growing season. The estimated forage production can be determined in the same manner described for irrigated pasture. Combined with past stocking rate data, this data can provide additional information for forward planning of grazing. Available forage for consumption by livestock is estimated after adjusting for the amount of forage that should be left for plant sustainability (e.g., 40% allowable use leaves 60% residue for plant health purposes).

Animal Demand

The output for private lands from the NRCS Web Soil Survey, irrigated and non-irrigated, will be expressed as the number of Animal Unit Months (AUMs) which each acre can support. An AUM is a method of standardization used for grazing animals by range professionals. An AUM consists of the forage intake for a 1,000 lb cow plus her calf for 30 Animal Unit Days (AUDs), which is 26 lbs/day. A larger animal within species is adjusted by a simple body weight multiplier (Table 1). For example, the AUD for a 1,300 lb cow with a calf by her side would be 34 lbs. When considering stocking rate on private lands, the AUD is usually adjusted downward for non-lactating cattle. Across species, allowances are adjusted for the specific grazing habits of the species in question. For example, simple arithmetic would suggest that 6.67 sheep could take the place of a 1,000 lb cow and her calf. In reality, however, the forage intake of sheep (3%) is much higher than a cow when expressed as a percentage of body weight. Therefore, the Animal Unit Equivalent for a sheep is set at 0.17 instead of 0.15.

Table 1. Animal Unit Equivalents.

Animal	Animal Unit Equivalent	Forage Intake, lbs
1,000 lb dry cow	0.80	21
1,000 lb cow + calf	1.00	26
1,200 lb cow + calf	1.20	31
1,500 lb bull	1.50	39
150 lb mature sheep	0.17	4.5
1,200 lb horse	1.40	36
600 lb steer	0.60	16

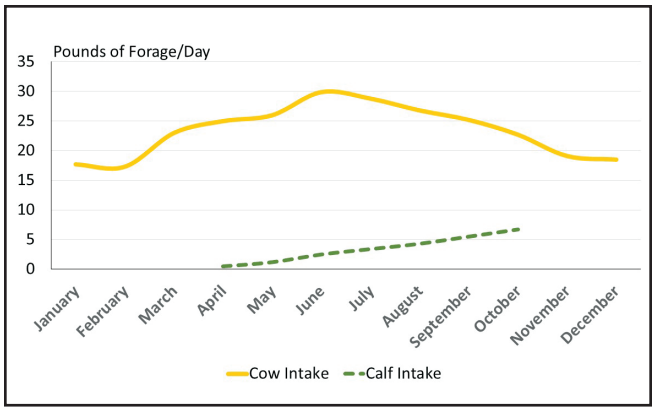

Figure 4. Yearly forage intake on rangeland for a 1,000 lb cow calving in March. Note: this is a standard animal unit day (AUD). Most cows in Idaho are much bigger. Average daily intake over the year for the 1,000 lb cow + calf = 25.3 lb.

Although horses will typically only eat about 2% of their body weight when idle and fed hay, their intake increases substantially when allowed free access to grazing due to their extended grazing patterns.

Cattle will change their level of forage intake by the season of year and stage of production (Figure 4). Over a year, the intake of a 1,000 lb cow plus her suckling calf will average around 26 lbs/day. If protein supplement is provided on rangeland during winter, forage intake can increase slightly. The AUM value used for cattle on federal grazing permits is averaged over the entire year. When applying grazing on private irrigated lands, more precise grazing management can be applied through the stages of gestation and lactation as forage intake changes.

Adjusting Animal Days for Forage Utilization

When forage utilization is under or over targeted levels, it is possible to use a formula to: a) calculate how many extra head of cattle can be grazed or how many extra days cattle can remain on pasture when forage utilization is below the target; or b) calculate how many fewer days or fewer cattle should have been allocated when there has been forage overutilization.

Equation 1: Adjusting for number of livestock

$$\frac{\text{Allowable utilization}}{\text{Actual utilization}} \times \text{Number of livestock} = \text{Targeted stocking rate}$$

Actual utilization

Example: There were 150 cows that grazed a 750-acre rangeland pasture last year for 45 days and achieved 35% forage utilization. Forage production for the current year is similar to the previous year and the operator desires to stock an adequate number of cows to achieve 50% utilization over 45 days.

$$\frac{50}{35} \times 150 \text{ cows} = 214 \text{ cows}$$

Equation 2: Adjusting for number of days grazing

$$\frac{\text{Allowable utilization}}{\text{Actual utilization}} \times \text{Number of days grazed} = \text{Targeted days of grazing}$$

Actual utilization

Example: The same 750-acre rangeland pasture is being grazed by 1,100 lb cows for 45 days. When utilization is estimated at several places in the pasture, utilization was around 35%. The goal is to find out how many additional days you could stay in the pasture and still meet the targeted utilization of 50%.

$$\frac{50}{35} \times 45 \text{ days}$$

= 64 days total grazing or 19 additional days of grazing

Keep in mind that forage utilization which occurs while forage is still growing is considered to be "relative" or "seasonal" utilization and, when measured again at the end of the growing season, will usually be lower than the forage utilization previously measured. Also, keep in mind that an adequate amount of forage should be left over the winter to provide plant cover against erosion and to allow for regrowth during the spring. Targeting no more than 50% utilization on native rangelands and leaving 4 to 5 inches of stubble height (bunchgrasses) for irrigated pastures will usually provide the plant protection needed.

Rotational Grazing

For effective grazing management, it is preferable to have acreages divided into several pastures to allow for regrowth of the forage and sustainability of preferred plant species. For native rangelands, deferred rotational grazing systems allow one to utilize different pastures at different times of the

year instead of grazing pastures at the same time every year. The impact on the health of the plant with respect to root growth is greatest when plants are grazed during the early boot stage of growth. Declines in root mass with Thurber needlegrass the year following grazing were minimal when plants were grazed after flowering in an Oregon study (Ganskopp, 1988) but root mass declined to about 61% of the previous year when grazed in the early boot stage. Spreading this early season grazing over different pastures during different years will allow plants to compensate.

Adaptive management considers the premise that divergent plant species may be influenced differently by grazing which occurs during alternate grazing schedules. Other than changing the number of animals being grazed or the days a pasture is grazed, changing the season of grazing (early spring, late spring to summer, late summer, fall to late fall) may be one of the main tools for influencing ecological effects on the land.

Putting it All Together

Now that some basic principles of grazing management have been described, let us consider how to apply these principles in two examples of adaptive management.

Scenario 1

Long term monitoring data indicates that the frequency of great basin wildrye is declining in one pasture. This pasture has been the first pasture used in a grazing rotation over a period of years. This particular species produces a lot of growth, provides a big "meal," and is still fairly tender and green until mid-summer. Utilization monitoring from the previous two or three years indicate that cattle have preferentially grazed this species following entry into the first spring pasture. At one location in the pasture, use on great basin wildrye has typically been around 65 to 70%, and at another location, 55 to 60%. Use on other perennial grasses at the end of the grazing period in this pasture has been around 20 to 35%. Monitoring indicates that as the season of year progresses, utilization of great basin wildrye declines in the other pastures grazed to about 50% use in mid-summer and 30% use in late summer. The adaptive management strategy chosen is to change the grazing rotation so that the first pasture grazed in previous years is used for late fall grazing the first year, then late summer grazing the second year, then mid-summer grazing the third year. Following this three-year deferment of spring grazing, the pasture of concern is used again in the spring. In this example, the grazing rotation change may allow the great basin wildrye to compensate with seedling recruitment in the pasture of concern.

Scenario 2

A set of 50 early weaned 460 lb replacement heifers are purchased in late August and placed on a 300-acre native range pasture in the Idaho foothills, 90% of which is accessible to livestock. Historically, this pasture has been used to pasture horses through the summer. Utilization of perennial grasses during this historic use has been at about 60%, slightly above what is desired. The ranch manager and owner decide to convert this pasture to fall use and want to keep utilization at 50% or less. They wish to do some forward planning in anticipation of how long they can keep replacement heifers on this pasture during the fall. It is anticipated the heifers will gain around 1.3 lbs/day while on this pasture, so the weight of the heifers in late September (one month later) is projected to be 500 lbs, which is 0.5 AUD, or around 13 lbs of forage intake per day. Forage production at two different areas of the pasture is estimated by clipping and is 350 lbs/acre. Wildlife use this time of year is usually around 5%. How long can the heifers be grazed and stay within the 50% utilization guideline?

- Forage supply = 300 acres x 90% accessible = 270 acres; 270 acres x 350 lb/acre = 94,500 lbs of forage
- Allowable use = 50% - 5% for wildlife = 45%
- Forage for harvesting = 94,500 lbs x 45% = 42,525 lbs
- Forage demand = 13 lbs AUD x 50 heifers = 650 lbs/day
- Days in pasture = 42,525 lbs ÷ 650 lbs/herd AUD = 65 days

Realistically, at this stage of plant growth the heifers will probably not be able to consume 2.6% of body weight due to a decrease in the passage rate of the forage caused by lower forage quality. However, this is a conservative projection for utilizing the pasture. At around 45 to 60 days, this operator should start looking closely at forage utilization to see if projections are correct. The rancher should also look for localized heavier grazing in some locations and attempt to redistribute livestock with salt and protein supplements.

Conclusion

Adaptive management considers the results of rangeland monitoring for defined stocking rates. Adjustments are made in stocking rates and season of use when climatic variation is encountered or when changes in ground cover or the plant community are desired. Having good monitoring data and using it to plan ahead allows managers to make more informed decisions about their grazing management. Managers are also able to assess the "on the ground" results of their decisions and to alter management accordingly in the future. With public land ranching operations, careful documentation that highlighs the results of management actions (monitoring) can also help ensure that good partnerships are maintained with land management agencies and that progress can be made towards shared goals.

Further Reading

Arizona Grazing Lands Conservation Association. 2012. *Guide to Rangeland Monitoring & Assessment*. https://globalrangelands.org/sites/globalrangelands.org/files/dlio/37404/guide-to-rangeland-monitoring-assessment.pdf

Herrick, J.E., J.W. Van Zee, K.M. Havstad, L.M. Burkett, and W.G. Whitford. 2009. *Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems*. Volume 1: Quick Start. http://jornada.nmsu.edu/monit-assess/manuals/monitoring

Kinnery, J.M. and W.P. Clary. *A photographic utilization guide for key riparian graminoids.* General Technical Report INT-GTR-308. US Forest Service, Intermountain Research Station. https://www.fs.fed.us/rm/pubs_int/int_gtr308.pdf

Perryman, B.L., L.B. Bruce, P.T. Tueller, and S.R. Swanson. 2006. *Ranchers' Monitoring Guide.* University of Nevada Cooperative Extension Educational Bulletin 06-04. http://www.unce.unr.edu/publications/files/ag/2006/eb0604.pdf

US Department of Interior. 2006. *Riparian area management: Grazing management processes and strategies for riparian-wetland areas.* Technical Reference 1737-20. BLM/ST/ST-06/002+1737. http://www.blm.gov/or/programs/nrst/files/final_tr_1737-20.pdf

US Department of Interior. 2011. *Multiple Indicator Monitoring (MIM) of Stream Channels and Streamside Vegetation.* Technical Reference 1737-23. BLM/OC/ST-10/003+1737+REV. https://www.blm.gov/nstc/library/pdf/MIM.pdf

US Department of Interior Bureau of Land Management. 1999. *Sampling Vegetation Attributes: Interagency Technical Reference.* Technical Reference 1734-4. http://www.blm.gov/nstc/library/techref.htm

US Department of Interior Bureau of Land Management. 1999. *Utilization Studies and Residual Measurements Interagency Technical Reference.* Technical Reference 1734-3. p. 97–99. http://www.blm.gov/nstc/library/techref.htm

Winward, A. 2000. *Monitoring the Vegetation Resources in Riparian Areas.* Technical Report RMRS-GTR-47. https://www.fs.fed.us/rm/pubs/rmrs_gtr047.pdf

References

Ganskopp, D. 1988. *Defoliation of Thurber needlegrass: herbage and root response.* Journal of Journal of Range Management 41:472–476.

Holling, C.S. 1978. *Adaptive Environmental Assessment and Management.* John Wiley & Sons, Chichester, NJ.

Schalau, J. n.d. *Simple Design for a Remote Rain Gauge.* Arizona Cooperative Extension. http://naturalenvironmentsociety-arizonasouthwest.com/references/PDFs/meteorol-water-research/UoA_Coop_RainGaugeInstruct.pdf.

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