# Management of Growing Season Grazing In The Sagebrush Steppe

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The Owyhee Initiative Board of Directors requested a science review of management tools appropriate for spring growing season grazing on BLM grazing allotments in Owyhee County, Idaho. The following paper is a response to that request.

The specific questions submitted for a science review were:

1) Whether there is an effective, reliable and reasonably applicable method (e.g., utilization) for quantifying grazing use during the early growing season (generally up to seed emergence).

2) Whether currently available methods and information for quantifying grazing use that occurs during the early growing season (e.g., utilization) provide an appropriate and reliable indicator of grazing effects.

3) Whether a periodically evaluated grazing use standard for utilization applied during the early growing season, gives a reliable indication of grazing effects relative to Range Health Standards and Land Use Objectives.

The short answer to these questions, in the opinion of the authors, is that utilization is not an adequate or appropriate method of quantifying or managing growing season grazing. Both the existing research and our many years of grazing management experience is the basis of this conclusion. This review is primarily focused on management of early growing season grazing in lower elevation sagebrush steppe. These lower elevation sagebrush communities have long been used as early spring grazing areas, are susceptible to cheatgrass invasion and to frequent wildfires. Proper livestock grazing management and the maintenance of native shrub-bunchgrass vegetation are critical concerns, not just in Owyhee County but throughout the Intermountain West.

Environmental conditions common to the lower elevation sagebrush steppe are arid (8-12 inches precipitation), predominantly cold season precipitation, relatively mild winters, short spring growing season (approximately six weeks), hot, dry summers and rare fall green-ups. These conditions produce shrub/bunchgrass native vegetation. On undisturbed sites, the woody shrub overstory tends to dominate the herbaceous understory over time. Periodic disturbance from fires produces temporary grassy landscapes (Burkhardt and Tisdale 1976). The very short spring growing season is critically important to maintaining healthy perennial forage plants and should be the focus of grazing management when spring grazing occurs.

Native bunchgrasses, such as bluebunch wheatgrass, Thurber needle grass, squirrel tail and Sandberg bluegrass, are well-adapted to these environmental conditions. Unfortunately, a suite of exotic annual weeds also thrive under these conditions. Cheatgrass, an invasive annual grass, can establish dense monocultures on disturbed sites through which fires spread more easily than the more patchy fuels of native bunchgrasses (Whisenant 1990). This can radically increase the frequency and extent of wildfires well beyond the natural role of fire in the lower sagebrush steppe. Frequent cheat grass-fueled fires kill sagebrush and weaken native perennial grasses, which did not evolve with frequent fire. This creates self-sustaining annual grass monocultures where sagebrush/bunchgrass once existed.

## Grazing Research Issues

Land management agencies are expected to base their management plans on the best available science. Certainly, there are many research articles published in scientific journals regarding various aspects of rangeland ecosystems. Yet, well-designed and replicated grazing management research, especially in the intermountain sagebrush steppe, is remarkably lacking (Eckert and Spencer 1987, Miller et al. 1994). The vast expanse and variability of rangelands and the lack of control of grazing herds virtually precludes the strict application of the scientific method or critical experiment to rangeland grazing management. Because of this, even the conclusions in the Journal of Range Management or other 'scientific' natural resource publications on grazing studies are often debatable, less than conclusive and may not be representative of conditions beyond the particular study. When dealing with biological organisms, there are so many variables that research scientists cannot control and thus cannot statistically account for their effect on the results. For example, crop scientists generally deal with one plant species, have multiple replications on the same type of soil, slope and aspect, have the ability to control soil moisture on irrigated fields and generally deal only with the growing season. Animal scientists can apply some controls to research animals because they are tame and thus manage some of the variables. On the other hand, range scientists have no control on weather, little control on grazing animals, especially wildlife, over vast landscapes, and have limited opportunities for replications because of the physical variability of rangelands (Caldwell 1984). Heady (1974) calculated that if the number of all variables were multiplied together, the total number of pastures needed to study all permutations, with acceptable confidence, would be 13,000. However, scientific research on plant ecology, physiology and species response to experimental treatments coupled with many decades of grazing management experience has advanced the art of grazing management.

Rangeland management of necessity is an art as well as science. Science can provide managers with expected resource responses to certain treatments under specific conditions. The art becomes the manager and the rancher adapting, applying and tracking the response and based on that response, adjusting and reapplying management in order to meet stated goals. There is no “cookbook” prescription for good grazing management. It is a continual process of application, monitoring, adjustment and reapplication, otherwise known as adaptive management.

### Relevant Information

Research and practical experience have demonstrated that plant response to herbivory varies with plant species, degree and season of defoliation, weather conditions and plant vigor. Generally, defoliation has more negative impacts to the plant if it occurs during the active growth period than during dormancy (Miller et al. 1994). Perennial grasses use carbohydrates stored in their root systems for respiration during dormancy and to initiate spring growth. Restoration of root system and replenishment of carbohydrate reserves is not complete until after seed set (Stoddart et al. 1975). However, leaf regrowth after removal during the growing season comes from photosynthesis, rather than stored carbohydrates (Briske and Richards 1995). Richards and Caldwell (1985) found photosynthesis within 3 days of severe defoliation on crested wheatgrass and bluebunch wheatgrass exceeded the plants need for respiration and regrowth. Growing season grazing can interrupt or even preclude the forage plant from completing their annual phenologic cycle. Early clipping studies (Stoddart 1946) clearly demonstrated the adverse effects of severe late growing season defoliation on bluebunch wheatgrass.

Briske et al. (2008) has sparked intense discussion of the merits of different grazing systems. This review of grazing studies found that rotational grazing rarely produces greater plant production or animal production on either a per-head or a per-area basis compared with season-long grazing. They suggest that often, the rest periods in grazing systems occur while plants are not actively growing and that may be the reason for limited benefit to rotational grazing. Rather, the authors found that differences in stocking rate and variations in weather are the most important determinants of plant and animal production. However, this review did not consider the effects of rotational grazing on plant community composition and few of the reviewed studies were conducted on sagebrush/bunchgrass rangelands, such as those found in Owyhee County. Although Briske and colleagues evaluated the effect of grazing systems on total forage production, both experimental results and management experience recognize that grazing can affect plant community composition through selective grazing. The most palatable plants are at a competitive disadvantage especially during the growing season. Plant community composition is an important consideration when managing grazing on sagebrush/bunchgrass rangelands. Stands of vigorous perennial grasses with sagebrush and perennial forbs provide a stable forage supply and wildlife habitat while protecting soil resources.

As rangeland ecology research is highly site specific, the most appropriate and applicable research results are from studies conducted on the same or similar ecological sites as the area being managed. There have been relatively few grazing studies on sagebrush rangelands despite 120 years of grazing experience. Only two of the grazing studies reviewed by Briske et al. (2008) were conducted on sagebrush/bunchgrass rangelands although numerous clipping studies have been conducted.

Hyder and Sawyer (1951) conducted a 1938-1948 grazing study on sagebrush/bunchgrass rangeland at the Squaw Butte Experiment Station in Oregon and found differences in forage production with different seasons of use in rotational grazing. Two consecutive years of spring use reduced forage yields considerably. Overall, perennial grasses were larger and more vigorous, but not more dense, with rotational grazing. This study suggests that consecutive years of spring grazing can reduce plant growth and forage yields and that rotational grazing can result in more vigorous perennial grasses, compared with continuous grazing. Although rotational grazing cannot induce a site to produce more vegetation than it is ecologically capable of, this study suggests that altering the season of grazing can alter vegetation composition. As vigorous perennial grasses are preferred for most uses of sagebrush/bunchgrass rangelands, this study suggests that consecutive years of spring grazing are likely to be detrimental to these areas. Mueggler (1972) found competition from associated species influenced regrowth following defoliation more than intensity of defoliation.

Later research from the Squaw Butte Experiment Station by Ganskopp (1988) identified the early-boot stage of Thurber needle grass growth as the most susceptible to reduced vigor from grazing. Impacts from grazing were progressively less severe during early vegetative growth and late seed set. The author suggested that a single defoliation during the boot stage can significantly reduce subsequent growth, both above and below ground. This study suggests that Thurber needle grass, a common perennial grass in Owyhee County, should be grazed either before or after the boot stage and further suggests that other perennial grasses likely respond similarly.

Spring defoliation of bluebunch wheatgrass on sagebrush/bunchgrass rangelands in Utah (Stoddart 1946) and interior British Columbia (McLean and Wikeem 1985) that extend late enough to preclude regrowth before summer dormancy significantly reduced plant survival and vigor the following year. Neither severe defoliation in the fall nor season-long light defoliation significantly damaged bluebunch wheatgrass plants in British Columbia. These studies suggest that bluebunch wheatgrass, a common perennial grass in Owyhee County, is particularly sensitive to heavier levels of late growing season defoliation.

Working in south central Idaho, Sharp (1970) recommended a deferred rotation system consisting of at least two pastures for crested wheatgrass. With this approach, cattle are removed from the early spring grazed pasture while sufficient soil moisture remains for regrowth. Early spring use should be alternated between the pastures in a two year cycle.

## Management of Spring Grazing

The authors of this review have been asked to consider whether there is an effective method, such as utilization, to quantify early growing season grazing. Degree of forage utilization or ocular use assessments have long been used as one of the tools to determine appropriate stocking rates when managing grazing that occurs after the growing season (Smith et al. 2005). Many years of grazing experience as well as published studies have demonstrated the importance of conservative stocking rates regardless of the grazing system (i.e., Ellison 1960, Eckert and Spencer 1987). Some form of use assessment and past stocking rates are necessary tools to arrive at reasonable stocking rates for season-long grazing or grazing that occurs after the growing season. However, we believe (as did Western Coordinating Committees 40 and 55, 1998, Smith et al. 2005) utilization is just a tool and is not the management plan objective or an appropriate term and condition of permits.

Management variables for early spring grazing include: the date grazing starts and ends, duration of grazing, stocking rate and timing relative to plant phenology. With regard to early growing season grazing, we believe utilization is impractical to obtain and is of questionable biological significance. We think that perhaps the question for review is too narrowly focused on methods for quantifying early grazing. A more appropriate question is what methods are available to effectively manage early season grazing. Actual grazing use is sufficiently quantified by actual stocking rate, duration and season of use and impact to the plant community is assessed by long term trend.

Certainly in theory, degree of defoliation based on amount of plant growth *to that point in time* (relative utilization or seasonal utilization) could be quantified. Interpreting biologic significance to forage plants becomes questionable. The degree of defoliation during early season grazing is based on a continuously changing denominator. The amount of plant growth at the time of measurement is not a biologic constant as is total annual growth or peak production. Does 50% tissue removal two weeks into the growing season have the same impact on plant physiology as 50% removal near the end of the growing season? For example, Ganskopp (1988) demonstrated that clipping Thurber needle grass to 1 inch during different phenologic stages impacted the plant differently. Stoddart (1946) and McLean Wikeen (1985) and demonstrated similar results on bluebunch wheatgrass. The later into bunchgrass reproduction stages that defoliation occurs, the greater negative impact on the plant, especially if this is repeated year after year.

We believe that basing early season grazing on relative utilization is much too simplistic to assure proper grazing (Sharp et al. 1994). It imposes practical problems on the land manager if timely assessment of relative utilization is to be accomplished aside from the issue of what is of biological significance. Certainly, some amount of residual green tissue should remain on forage plants when spring grazing is removed but we believe there are other more effective tools for managing early grazing and assuring healthy plant communities.

The sagebrush/bunchgrass ranges of the Intermountain West evolved with some level of early growing season grazing (Burkhardt 1996). Some level of early season grazing is a necessity for range livestock operations as well as for big game. Research and practical experience have shown that healthy sagebrush/bunchgrass ranges can be maintained under early growing season use (Mclean and Wikeem 1985, Ganskopp 1988). This can be accomplished by providing the grazed plants the opportunity to complete their reproductive cycle at least every other year. Completion of seed maturity and carbohydrate storage in bunchgrass plants is more critical than in sod grasses. Generally, sod grasses benefit from much longer growing seasons and reproduce vegetatively as well as through seed production. Completion of the reproductive cycle in bunch grasses is important because the restoration of root systems and replenishment of carbohydrate reserves in the plant crown and roots is not complete until after seed set. Production of viable seed is certainly a prerequisite to long-term survival of bunch grasses but seed production is usually far in excess of what is needed for actual seedling establishment. However, restoration of annual root die-back and replenishment of carbohydrate reserves are more immediate requirements than seed production but are only completed after seed-set. Two management approaches have proven successful at providing bunchgrasses with seed production and carbohydrate storage opportunities. A system of "early on-early-off" or a two to three early-season pasture rotation allows grazed bunchgrasses to complete their reproductive cycle without grazing interruption at least on alternating years if not every year.

If growing season grazing is occurring every year on the same range unit, then the crucial management tool is controlling when that season's grazing use ends. Livestock must be removed early enough to insure sufficient remaining growing season (soil moisture) to allow forage plant regrowth and completion of the reproductive cycle. From a plant physiology standpoint it is more important when the grazing use stops than when livestock comes onto the range. Early spring turn-on dates are more of an animal consideration and the time of animal removal is plant/soil moisture driven. "Early on/early off" is essentially where the grazing animals "follow the green" elevationally up the mountain. This most likely approximates and natural system of wildlife herbivory that the sagebrush steppe evolved under (Burkhardt 1996) and today it works best with herded sheep. For range ewes to produce fat lambs by late August the summer bands need to be continuously moving to fresh green forage. Forage plants can then complete their reproductive cycle after the animals have moved on. This is especially critical on the arid and semi-arid salt-desert shrub and sagebrush ranges. If the grazing herds are slowly grazing their way up the mountain and not circling back to regraze areas already used, then the amount of residual stubble should not be a critical issue (once-over grazing). Three to four inches of residual leafage on primary perennial forage species behind the moving herd will allow plant growth to continue and phenologic development to be completed.

With fenced pastures or allotments and un-herded cattle the "early on-early off" management strategy becomes more difficult. The tendency is to leave cattle in place as long as there is adequate forage or until some moderate level of utilization has been reached. From a soil moisture and plant regrowth perspective this is nearly always too late to assure grazed plants the opportunity to complete their reproductive cycle. Where it would be difficult to "follow the green" with cattle, a system of two to three early spring pastures at similar elevations could be used. This would assure that forage plants could periodically complete their reproductive cycle without being grazed off prior to seed maturity. Under this rotation the timing of pasture moves is much less critical. The pasture that receives critical growing season use one year is not grazed during the next growing season thereby allowing forage plants to complete their reproductive cycle without grazing on alternate years. A system with 3 early use pastures could provide plants with two out of three years to complete seed production and restore root system carbohydrates. This might be necessary when range condition is less than healthy. The amount of residual stubble remaining after grazing use under a growing season rotation is less a plant concern than a watershed/habitat issue. This is because there may be little or no growing season soil moisture remaining to support regrowth after the end of the early pasture grazing period. In the other pasture, grazing is deferred until after seed set.

Under either early season grazing strategy, the measure of management success or failure is the changes in the plant community over time (trend) rather than tracking relative utilization. The range profession has long advocated the use of long-term trend monitoring to determine the impacts of grazing systems (Stoddart and Smith 1955). Other monitoring such as utilization and weather data is useful in interpreting trend but utilization is not an appropriate measure of management success or as terms and conditions in grazing permits (U of I Stubble Height Review Team 2004, Smith et al. 2005).

We believe that an extensive, rather than intensive, trend monitoring system is an important part of any grazing management program. Rangeland grazing is an extensive land use over vast and variable landscape expanses. We recommend a relatively simple permanent photo point trend monitoring system that includes both landscape and close-up photos. Re-photographing yearly, if possible, should adequately document any significant positive or negative change in plant composition without creating an excessive work load. The usefulness of photo monitoring for evaluating changes in plant communities has been well documented (Sharp et al. 1990, Bennett et al. 2000). In situations where annual photo monitoring may not provide sufficient trend information, quantitative methods may also be used. In addition to trend monitoring, the authors believe it is important on "follow the green" grazing to annually monitor behind the early use to assure that primary forage plants do, in fact, re-grow and set seed. Under early growing season rotations it is important that plants in at least one of the pastures complete the reproductive cycle each year. Any field monitoring should be conducted jointly by the range specialist and the livestock manager. This is a prerequisite to joint problem solving and good grazing management. Joint monitoring is the basis for building effective local knowledge of the effects of grazing. Monitoring and knowledge of local growing conditions will provide the livestock manager and the range specialist with the necessary information to make decisions for moving livestock. Sharp (1970) found late May was generally the time to move off a pasture of crested wheatgrass in southern Idaho in order to get regrowth.

The early season grazing strategies previously discussed are compatible with sage grouse nesting concerns. Grazing schedules that provide bunchgrasses the opportunity to fully develop to maturity provide sage grouse nesting cover in the interspaces around sagebrush nest sites. "Following the green" grazing strategies allow bunchgrass development each year following early grazing. Early grazed pasture rotation provides at least one ungrazed pasture each year for sage grouse nesting. Fischer et al. (1993) found sage grouse hens displayed nesting fidelity to general areas but not specific nest locations. This may allow hens to choose to nest in ungrazed pastures within the general area.

These strategies for managing early growing season grazing are also compatible with riparian resources (Mosley et al. 1997). Grazing during the cooler spring time when upland forage is still green and lush tends to minimize livestock use of creek bottoms. When livestock move out of spring pastures, riparian plants have the entire summer hot season to recover from any grazing impacts that may have occurred during the early spring use.

Fulcher (1973) challenged economists and range scientists to test his hypothesis that "properly designed grazing systems developed in conjunction with the agency's overall action plans for an area, are the least cost alternatives of meeting the major objectives and responsibilities of government agencies in managing public rangeland resources." It is advantageous to both the resource and livestock operator to employ a rotational grazing system as described above, rather than relying on utilization as the limiting factor in spring grazing. Sharp (1970) found that yearling cattle grazing spring regrowth in the fall nearly doubled the weight gain of yearlings grazing on pastures left un-grazed until fall. The regrowth tends to have a higher ratio of leaves to stems and higher crude protein than un-grazed plants. Spring grazing at a higher intensity also reduces the fine fuel and thus the chance and intensity of wildfire during the dry season (Pieper 1994).

Rimbey et al. (2003) assessed the economic impact of AUM reductions on the net return of model ranches in Owyhee County. On a model ranch considered typical of the Marsing, ID area, a 25% reduction in BLM grazing reduced net returns by $7.42/BLM AUM, for a total of $5,563. Increasing economic loss occurred as reductions increased, varying from $7.67 for a 50% reduction to $11.73 for a 100% cut. Annual net cash income decreased from $21,234/year under full permit use to $13,958/year with a 100% grazing reduction.

**Summary**

We believe that growing season grazing on sagebrush/bunch grass rangelands warrants special management attention. Research and practical experience both have shown that bunchgrasses common to the sagebrush plant communities are much more sensitive to growing season grazing than they are to dormant season use. Furthermore, that sensitivity relates to the timing of growing season use relative to the plant reproductive cycle. Defoliation early in the growing season has less negative impact to bunch grasses than during the flowering period. Consequently, we believe that the focus of management for growing season grazing should be on assuring that primary perennial forage grasses are allowed to complete seed set at least every second year.

In our opinion, the concept of measuring forage utilization or basing management on achieving some conservative utilization standard is inappropriate for growing season grazing. When utilization is measured during the growing season, the amount of plant growth is a constantly changing variable with no common biologic basis. Clipping studies, for example, have shown that 50% defoliation two weeks into the growing season has a very different impact on bunch grasses than 50% defoliation in the late growing season. In addition, there are very real, practical restraints in obtaining timely growing season utilization measurements on which to base management decisions.

We believe that the measure of grazing management success or failure is tracking changes in the plant community over time.

Monitoring trend is fundamental to the management of rangeland grazing. This can be easily accomplished using permanent photo locations and should be conducted jointly by the agency range staff and the permittee or livestock manager.

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