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Grazing Twice

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The Taylor Grazing Act engaged stockmen in grazing advisory boards to allocate allotments and set stocking rate to get rangelands stocked for their carrying capacity. Land management agencies also have adjusted stocking rate to prevent overgrazing. The focus on animal unit months (AUMs) of forage has led to a focus by ranchers on grazing up their AUMs and wanting to get back to their preference for AUMs.

Overgrazing could be defined as repeated bites of the same plant without adequate time to regrow in between. Yet, adjusting stocking rate is only one way to prevent overgrazing or to manage the effect of grazing on plant growth and plant health. Our history of focusing grazing management on stocking rate to avoid overgrazing may have worsened problems with cheatgrass, fires, perennial plant health, rangeland health, riparian functions and ranch economics.

Traditions - It is interesting to note that few public rangeland areas have two grazing seasons per year. There has been considerable effort applying grazing systems that provided some years of rest with 3 or 4-pasture rest rotation or with rotation of rest. Deferred rotation grazing provides for plant recovery with use during only part of the growing season. High-intensity, low-frequency, and short-duration grazing approaches reduce repeatedly grazing on the same preferred plants by shortening the grazing period. Over the last 50 years, there has been an

increase in grazing schedules that use fencing and labor to improve rangelands. Yet, most public rangelands still have long periods of permitted use, especially in big pastures where cross fencing is expensive and it takes time to use the available forage in that pasture. Long periods of exposure to grazing in a large field runs the risk of overgrazing in some areas while leaving other areas underutilized.

Grazing can impact plant health - Long periods of uninterrupted use cause stress on the most preferred green plants. When a growing plant is grazed, the parts of the plant that remain help to regrow the plant. Remaining leaves continue photosynthesis and supply carbohydrates. After regrowth, the fresh leaves are often grazed off again if the grazing animals remain in that location. The grazed plants are often preferred because they are the preferred species or in a preferred location and that is why they were grazed first. Also, fresh growth is more nutritious and palatable than other plants with older leaves having more lignin or other anti-quality compounds.

Season-long light stocking is often hard on the best forage plants (graze the best and fertilize the rest). Ungrazed forage plants may become "wooly" with old leaves and thatch that deters grazing. Ungrazed weeds or plants can outcompete forage plants. Ungrazed forage plants can die back from too much thatch, year after year.

Before adequate regrowth takes place, the second bite on the same plant diverts growth away from roots, and the preferred

forage plants fall behind in the competition to occupy soil. The roots of the preferred plants stop growth and limit photosynthesis. The more often a single preferred plant is re-bitten before recovery, the more stress, and the less productive their effective growing season.

Preferred deep-rooted perennial grasses are needed for rangeland health, resilience and resistance. Perennial grasses often survive fire and may impede the rapid spread of fire. They occupy ecological space that would otherwise become taken over by invasive annuals. Keeping them robust is the principal focus of rangeland management in many areas of Nevada.

The period of greatest stress to perennial grasses is typically when they are in the "boot stage." This is when seed stalks are forming, and the plant is getting ready to flower, go to seed, store carbohydrates, and go dormant - all within a few weeks. Typically, at this time, they are running out of soil moisture and therefore running out of the opportunity to regrow leaves and recover from grazing.

Shallow-rooted annuals have already set seed and browned off when deeper-rooted perennial plants are in the boot. Earlier in spring the annuals such as cheatgrass are likely to be preferred by livestock. Preference shifts as cheatgrass turns purple or brown and the perennials become the only remaining green plants. In a pasture of mixed annuals and perennials, the perennials become more sought after by grazing animals at the time when they become more vulnerable to grazing impacts.

Grazing management impacts animal nutrition - Long periods of uninterrupted use also cause livestock to miss

opportunities to graze preferred forage plants and plant parts during the time of greatest nutritional value. Livestock do not harvest an average sample of the forage in the pasture. They are very selective. Animals seek out preferred plant communities, patches within plant communities, preferred species within the patch and preferred plant parts. All these change as the season changes. And, all these opportunities for selective grazing diminish as the pasture is grazed for a longer duration. When the best forage is gone, animals select the next best forage and so on. Studies of daily gain per animal show a boost when livestock are moved to a new pasture with a diversity of fresh feed, unless the stress of the move offsets the improved forage quality.

Grazing management can avoid plant stresses - While livestock have to be somewhere every day of the year, they do not have to be managed to graze in a manner that is stressful, or repeatedly stressful to plants. Factors that decrease stress on plants include:

- Grazing in less stressful times during the growing season;
- Grazing for shorter periods during the growing season, and thus avoiding repeated grazing on preferred plants;
- Providing recovery time for growth once leaves have grown or regrown and are ready to photosynthesize; and
- Lighter levels of utilization that allow more leaf area to continue photosynthesis during the growing season.

While all these can be accomplished in grazing management, a singular focus on

utilization to avoid overgrazing misses the mark. Monitoring utilization in the fall can be misleading if it does not differentiate defoliation on growing plants that has a physiological effect from grazing on dormant plants that does not.

A utilization focus has diminished AUMs - Most allotment evaluations for term permit renewals in the Bureau of Land Management (BLM) have been heavily focused on stocking rate based on

utilization monitoring data since before the first Nevada Rangeland Monitoring Handbook in 1984. The U.S. Forest Service in Nevada is also focused on utilization, but they monitor it more often during the growing season and in riparian areas. As a result of this utilization focus, both agencies have steadily reduced the amount of AUMs of forage allocated. Figure 1 shows this national trend for the BLM since its formation

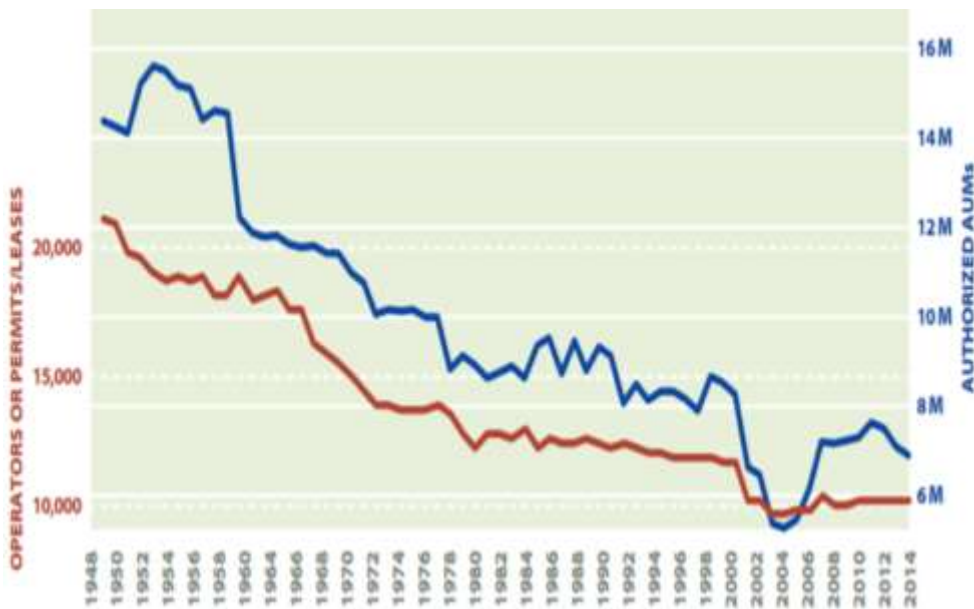


Figure 1. Represents the average number of authorized AUMs (blue line) and permittees (red line) in 10 western states including Nevada from 1948 to 2014 (Coalition for self-government in the West).

Fire - Nevada has two fire problems. One is the absence of fire that has allowed woody fuel such as sagebrush, other shrubs, and trees such as pinyon pine and juniper to continue growth with accumulation of woody fuels. Many of the areas in Nevada that were grass dominated at the time of European contact have become dominated

by these woody plants. This was probably caused by a combination of factors, including early overgrazing of fine fuels and ease of establishment of relatively unpalatable sagebrush and pinyon juniper due to lack of competition from stressed herbaceous forage plants.

The other fire problem is the abundance of fine fuels. Bunchgrasses provide abundant fine fuel in some areas. Annuals such as the very flammable cheatgrass provide an even carpet of fine fuels in areas where the perennials have been removed through less than optimum management or where annuals are simply more competitive. Litter can also enhance cheatgrass germination and establishment. Thatch above the root crown, accumulated from lack of grazing, also increases fire effects to perennials by increasing both the duration and the temperature of the fire at the root crown. A wildfire through a long-term enclosure killed more plants inside than outside where surviving plants were greater in density. Large areas of residual fine fuels affect the continuity of a fire's potential for destruction.

This combination and other factors have led to an impressive array of fires in Nevada (figure 2.) that became larger and more frequent in recent decades

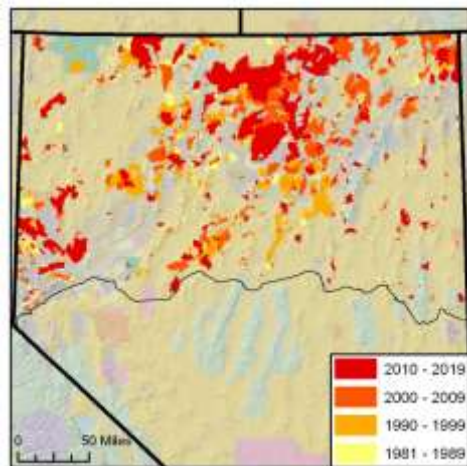


Figure 2. Fire size and age in Nevada has changed many sagebrush habitats across different land ownerships (shades of pastel in the background map).

Fire follows wet years with a lag time in northern Nevada

- Although fire is most risky in mid to late summer, there is often a lag time after wet springs before big fire years (figure 3). Precipitation much higher than normal, especially in the winter or spring, causes excess growth of fine fuels. These residual fine fuels remain flammable even after they pass through a winter as dormant perennial grasses or dead annual grass. While cheatgrass has become famous for spreading fire and helping to burn large swaths of sagebrush habitat, some of the large fires were spread with perennial bunch grasses. Bunch grass fires may occur if an area has not been grazed, either because of over-rest or because of light stocking and a mixture of overgrazed plants and undergrazed woody and thatch-laden plants. Often the big fires also burn with an excess of woody and sometimes decadent shrubs that have prospered at the expense of grasses because of suboptimal grazing. The combination of fine and woody fuel creates ease of spread and long flame lengths associated with intense heat.

The lag time between wet growing seasons and big fire years can be observed in figure 3. While the flow of the Humboldt River is an imprecise measure of rainfall, in wet years the watershed eventually becomes saturated enough to flow from more places, and this may reflect more soil moisture for grass growth. Notice that the years after high flow years commonly have high fire acreage in northern Nevada.

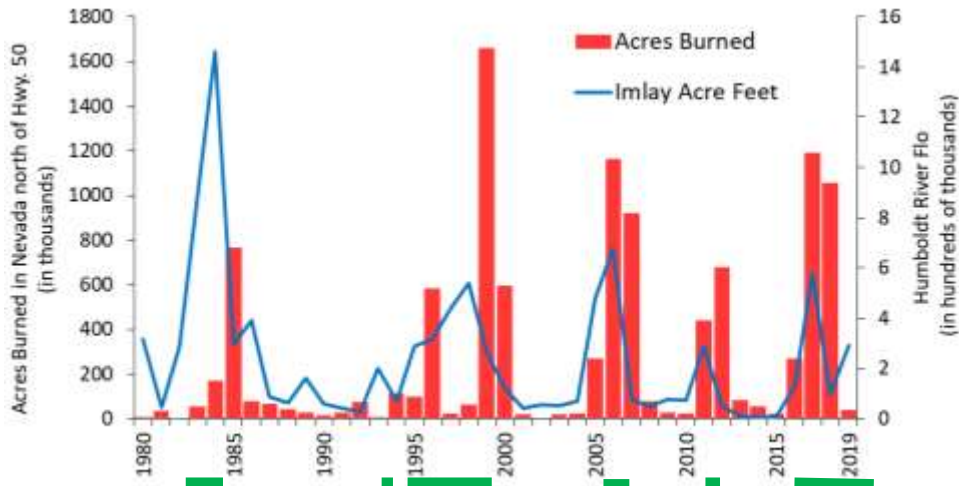


Figure 3. Depicts 1980 to 2019. Red bars reflect the number of acres burned in Nevada (north of Highway 50), and the blue line is based on U.S. Geological Survey annual flow data from the Imlay gage just above the Rye Patch Reservoir on the Humboldt River. Because of the lag time after wet years, and before big fire years, the green bars reflect periods when investments in strategically placed targeted grazing may have the greatest return on investment.

Dormant seasons are a good time to remove thatch and litter - This lag time provides a window of opportunity for use of grazing to create or maintain fuel breaks in strategic places, where grazed fuel breaks can be more effective in assisting fire control. This can prevent smaller fires from becoming megafires that may exceed tens or hundreds of thousands of acres.

Where there is a combination of bunch grasses and annuals is where grazing management means the most for rangeland resilience and resistance to invasive and often flammable or fire-cycle weeds such as cheatgrass. Grazing management should focus on maintaining perennial plant health and managing residual fine fuels, litter or thatch. Both can be accomplished in the dormant season.

Integrating concepts with livestock grazing management - So, a win-win alternative in many locations could be to keep livestock frequently moving during the growing season or during the calving and post-calving period. Moves when cattle are lactating should be slow and with low stress to avoid separating cows from calves and stressing animals. This is when cattle need the highest plane of nutrition. Constant or frequent movement enhances animal nutrition and plant health by allowing cattle to select their favorite patches, plants and plant parts; and preventing repeated grazing of regrowth.

Keeping livestock steadily moving to fresh forage during the growing season relieves plant stress by avoiding regrazing the preferred forage plants. This would be scored as a plus one for frequency in the grazing response index (GRI). It also

provides most of the growing season for plants to grow or regrow without grazing animals present to impact their regrowth. This would be scored a plus one for opportunity in GRI. By gently moving the animals through each and every pasture or most pastures on a ranch, the utilization level of grazing would almost always be light during the growing season. This would be scored as a plus one for intensity in GRI. The plus three GRI total score reflects the lack of stress on the important forage plants.

Their lack of stress is likely to be reflected in their growth and production and through time with better species composition. The preferred plants thrive and their lack of stress allows them to better compete with the competitor weeds or lower value species. Targeted grazing or dual species grazing could be used to stress the weeds.

Moving livestock also provides a strong approach for riparian areas and maintaining their function. This movement should be kept up through the mid to late summer and into the fall in order to be useful. Because riparian areas have a long period of soil moisture, they are able to grow or regrow over a longer growing season. Grazing a riparian pasture for only a portion of a growing season reduces grazing frequency and provides more opportunity for growth or re-growth.

Grazing twice - Having grazed through all of the pastures on a ranch would be a problem if one use period per year was all that was allowed. However, if the animals can return to a pasture or use area after the plants are dormant, their impact on plants is minimal or often positive. Grazing twice allows fast or steady movement with less plant stress and better animal nutrition in

spring. Then remaining AUMs can be harvested after the growing season, when grazing may save money because grazing rangeland could replace feeding hay.

In permits that allow use over a long season or year-round, this could be allowed without a change in the existing paperwork. In pastures with prescribed dates that do not allow late fall, winter and/or early spring grazing, that prescription may have been for a conservation purpose. Yet other strategies could accomplish the conservation purpose as described above and below. Also, see fact sheets on grazing response index (Swanson et al. 2019a; Swanson and Voth 2019b) and grazing strategies (Swanson and Voth 2019c).

Riparian considerations from grazing twice - Some rangeland managers hesitate to stop using rangeland pastures with riparian areas in them during spring, because spring is a time when livestock prefer to use uplands. Green growing plants on upland rangelands are at least as palatable as riparian plants, and cattle distribute themselves across the pasture. That changes later in the year when upland forage becomes dormant and dry. Cattle then shift toward more riparian use unless managers prevent this with fences or a combination of alternative stock water, stockmanship and protein supplements.

Stockmanship skills such as those described by Steve Cote (2018) can be used to place cattle with suitable forage. Protein supplement can complement high-energy dry grasses to provide complete nutrition and a positive post-ingestive feedback to the animal's subconscious brain. When placed animals feel good, they tend to stay put. When the forage has been grazed to desired results, it is time to use

Comment [S1]: Changes made in response to suggestions by reviewer 1

stockmanship again to locate them in a new place where they will find all the nutrients they need. Having sufficient stock water available within a reasonable distance to each use area also helps cattle stay where they are placed. Water available near upland grazing areas helps prevent concentrated prolonged impact in riparian areas.

Avoiding riparian concentration in the hot season can involve grazing a riparian area in well-managed riparian pastures, only available for prescribed use. Riparian pastures can be used as breeding pastures to maintain a high plane of nutrition while cows are maintaining body condition for conception. Cow herds in smaller pastures often need fewer bulls, a valuable economic savings to producers. Having riparian areas fenced separately also allows grazing during the hot season in upland pastures where perennials have gone dormant.

While grazing at times when upland forage is dormant and dry tends to shift use toward unfenced riparian areas, this shift fades in the late fall and winter. Also, even if the riparian area may be grazed twice in one growing season, early light use followed by a sufficient recovery period allows plants and riparian areas to become fully recovered. However, if the second use period is when cattle will concentrate in riparian areas, these small locations often control proper stocking rate for the whole pasture.

Long-term riparian resilience requires either short periods of use or light to moderate utilization, adequate periods for recovery, and mixing up the timing from year to year.

Distribution of livestock within a pasture can be managed with alternative stock water, stockmanship and protein supplements discussed above. Related

techniques for concentrating animals to create fuel breaks are described below.

Pastures with bitterbrush or other palatable shrubs - When herbaceous plants become dormant, cattle often look for high-protein shrubs such as bitterbrush, four-wing salt bush, shadscale, aspens, willows, etc. While riparian considerations have been discussed above, upland shrubs have not. In some locations, palatable upland shrubs may be a key species, especially during fall grazing. In other areas, perennial herbaceous plants are a key species, especially during spring and when grasses are in the boot. Consideration of the key species and their needs is an important aspect of selecting grazing management strategies.

The likelihood of having forage species with diverse needs in the same pasture is another reason to mix up the season of use from one year to the next. Animals go to different places within a pasture in different seasons. They graze different plants within the plant community or patch. Also, the physiological effects of grazing vary by the season of use because plants do different things at different times - root growth, leaf growth or stem elongation, bud initiation for regrowth, flowering, seed formation, carbohydrate storage, dormancy, etc. Grazing during different seasons or growth periods in different years allows plants to perform all their needed functions over a period of several years.

Dual-species grazing spreads the impact from grazing across more plant species. Even though most herbivore diets overlap and they consume a mixture of many different plants and plant types, different species (e.g. sheep or goats and cattle) prefer different plant species. Sheep, goats,

deer and antelope often prefer forbs (wild flowers) or shrubs and may each have their own favorites. Cattle, horses and elk often prefer grasses. Different herbivore species also both overlap in their spatial use and prefer different parts of rangeland pastures. Wildlife may seek hiding cover and use rugged terrain. Cattle tend to be central place foragers, often centered on water. All these factors should be considered in selecting objectives, key species, management strategies and monitoring approaches for adaptive management

Fall and winter grazing - Grazing is much cheaper than putting up hay. By not grazing public lands in the summer, those AUMs continue to be available for fall and winter use. Having hay in winter is also far less expensive if the emergency haystack can remain unused in the majority of winters when snow is not deep and it is not needed. After weaning, dry cows require less quality in their forage. The developing fetus requires little in the first trimester, and it is not until the last trimester and lactation that nutrient demands are greatest. Thus grazing on rangeland in fall and into the winter is a great opportunity to save money. Keeping cattle on a high plane of nutrition throughout the growing season (with movement, selective grazing and riparian pastures) adds to economic benefits in the form of higher conception and calving rates.

Grazing for fuel breaks - Using the remaining AUMs when the animals' impact on the plants is minimal or often positive also enables livestock to accomplish fuels management. Given the lag discussed above, this long dormant period when

residual fuels can be grazed strategically creates an opportunity for targeted grazing.

Ranchers and rangeland managers are acutely aware that after very wet springs, there is far more forage than the existing herd can consume. Stocking up when forage is abundant is likely to be expensive, and selling excess animals in dry years is likely to bring a low price, as well as deplete years of a well-managed genetics program. However, letting this awareness stop important conversations about adaptive management would be truly unfortunate.

What managers can discuss is how they could concentrate animals into a strategic location to create a fuel break. Even if only some pastures are grazed fully or some fuel breaks are created to protect important habitat, the probability that fires can be kept to a more reasonable size increases compared to allowing livestock to be widely dispersed and fuel to remain continuous.

Conversations among ranchers, rangeland management specialists, wildlife habitat managers and fire/fuels managers are tremendously valuable for sharing knowledge and ideas about:

- What is most in need of protection?
- How will fire likely travel in a given landscape?
- Where can fire-fighting equipment be made more effective with a fuel break?
- How wide does a fuel break need to be to provide some, or greater, benefit?
- How feasible is it to create such a fuel break?
- What guidelines are needed to avoid unwanted results?
- How could neighbors work together?

- How could agencies help with funds or materials?
- How could authority to place these fuel breaks be documented in a durable manner?
- Etc.

Conclusion - While there is no standard practice that will work everywhere, there are principles about how plants and animals grow, and about normal and variable weather that translates into biological cycles, risks, opportunities and sustainable economic enterprises. Grazing public or private land twice in a year may not be traditional and would take more movement of animals, and therefore more expense in the form of animal management. However, grazing twice per year in many places could provide better rangeland health and economic benefits, and lower risk.

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