

Information and tools to conserve and restore Great Basin ecosystems

Post-fire Grazing Management in the Great Basin

Purpose: To provide guidelines for maintaining productive sagebrush steppe communities in grazed areas after fire. The focus is on plant communities that, prior to fire, were largely intact and had an understory of native perennial herbaceous species or introduced bunchgrass, rather than invasive annual grass.

Recovery of sagebrush steppe communities after fire

Increasing wildfire size and frequency in the Great Basin call for post-fire grazing management practices that ensure sagebrush steppe communities are productive and resilient to other disturbances, such as drought and plant invasion. Successful post-fire recovery hinges on the growth, reproduction, and recruitment of perennial understory plants, especially bunchgrasses. Perennial grasses provide livestock forage and wildlife habitat, increase resistance to exotic annual grass and broadleaf weed invasion, and assist with soil stability and hydrologic function. Although sites may

In Brief:

- Following fire, grazing should not resume until site objectives have been met; at a minimum, surviving perennial grasses must have regained productivity and be producing viable seed at levels equal to grasses on unburned sites.
- During the first years after grazing resumes, grazing should be deferred until later in the season after seed maturity or shatter to promote bunchgrass recovery.
- Once grazing resumes, a rotation system (rest, deferred, or decisional) is recommended for maintaining plant production, cover, and appropriate species composition.
- Careful monitoring and assessment is required to determine when grazing may be resumed, whether post-fire grazing management has been effective, and if changes in grazing management are needed.



Figure 1. Wyoming big sagebrush sites in eastern Oregon (about 11 inches of annual precipitation) with an intact understory of perennial bunchgrasses. Left: A site where management objectives had not yet been met and resting from grazing continued. Right: A site where bunchgrass recovery and soil stability objectives had been met and grazing was resumed.

be managed for a suite of different site-specific objectives, achieving adequate grass production sets the stage for long-term recovery for the rest of the plant community.

Indicators of post-fire recovery:

- Surviving perennial grasses have regained productivity and reproduction
- There is successful recruitment of new perennial plants
- The land has sufficient cover of perennial plants, surface litter accumulation, or cover of biological soil crusts to stabilize soil surfaces

How long should burned areas be rested or deferred from grazing?

Both grazing and clipping studies indicate that it takes bunchgrasses at minimum one to three years to recover to pre-fire conditions and two to three years to produce high quantities of seed in the sagebrush steppe (Bates et al. 2009; Bunting et al. 1998; Jirik and Bunting 1994; Roselle et al. 2010). Grazing rest and deferment schedules should be used to manage the recovery of bunchgrasses and other herbaceous species after fire. Failure to implement a program of grazing rest or deferment may slow recovery (Kerns et al. 2011) and promote undesirable plant species. The rate of perennial grass recovery at a given site will depend on site conditions. In particular, recovery may be slower in lower elevation areas and under low precipitation (Knutson et al. 2014) and may therefore require an extended rest period. Sites with inadequate seedbed conditions, exposed soil, or erosive soils may require an increased post-fire recovery period before resumption of grazing to prevent soil loss.

Rest and deferral recommendations:

- Site conditions, post-burn weather, and the abundance of perennial grasses should always be considered when determining the length of grazing deferment or rest.

- Resting after fire until plants are producing seeds and then resuming grazing only after seed shatter is highly recommended to increase plant production and litter cover. This may require two or more growing seasons following fire.
- Rest or deferment into the third year (or beyond) should be considered if surviving or seeded bunchgrasses have yet to vigorously produce viable seed and biomass. This may be particularly important on relatively warm and dry sites and during drought.

A note about high severity fires:

High severity fires result in excessive mortality of bunchgrasses and increased risk of soil erosion. The goal of a grazing program remains the same – to promote perennial grass recovery, particularly bunchgrasses. High severity fires may require an extension of rest or deferment periods to allow perennial grasses to recover, soils to stabilize, and new seedlings (natural recruits or planted) to establish. Because fire severity will vary within a landscape, grazing deferment should continue until the most severely impacted areas have recovered.



How should burned areas be grazed?

Because site-specific conditions must always be considered, there are no universal rules for managing post-fire plant communities. However, once the decision is made to return livestock to the range, managers must consider how grazing season, intensity, frequency, and duration may affect ecosystem recovery of a burned site.

Season:

Season of use can have long-term effects on relative abundance of perennial grasses, shrubs, and invasive plants and, thus, resilience to fire and resistance to invasive annual plants. Season of use, therefore, should be carefully considered when developing grazing plans for sagebrush steppe communities (Burkhardt and Sanders 1992). Grazing and

Table 1. Useful indicators of post-fire site conditions, which should be compared to reference conditions.

 Soils	 Plants
<ul style="list-style-type: none"> • Amount of bare ground • Number of rills and gullies • Presence of pedestals or terraces • Presence of wind-scoured, blowout, and/or depositional areas • Resistance to erosion 	<ul style="list-style-type: none"> • Community composition • Presence of functional/structural groups • Degree of plant mortality/decadence • Annual production • Presence and density of invasive plants • Reproduction by perennial plants • Litter amount

Adapted from: Pellant, M., P. Shaver, D. A. Pyke, and J. E. Herrick. 2005. Interpreting Indicators of Rangeland Health - Version 4: Bureau of Land Management, National Science and Technology Center Technical Reference 1734-6.

defoliation during the active growing season (approximately April through June or July) in the first two or three years post-fire can increase bunchgrass mortality and reduce plant recovery (Bunting et al. 1998; Jirik and Bunting 1994). Once post-fire grazing resumes on a site, use should be **deferred until after seed maturity or shatter** to promote bunchgrass recovery (Bates et al. 2009; Bruce et al. 2007). This is especially important in the first years after grazing resumes.

Intensity:

Once grazing resumes, general grazing recommendations in unburned areas are for no more than 50 percent utilization during active growth, and no more than 60 percent during dormancy (Guinn and Rouse 2009). Under certain conditions (e.g., in warm or dry areas, after high severity fires, or during low precipitation years), even **lower utilization may be required** to allow perennial grasses and soils to recover. In cooler, moister areas, deferred rotation combined with **low to moderate stocking rates** (less than 50 percent utilization) may be as effective as short- and long-term rest (Bates and Davies 2014). Long-term (30 year) studies of post-fire recovery indicate that, even under moderate growing season grazing, sagebrush dominance will increase over time, (Harniss and Murray 1973, Hanna and Fulgham 2015), which ultimately can decrease the resilience of these communities.

Frequency and duration:

Although local conditions will determine the specific deferment schedule required for rangeland recovery, **a rotation system (rest, deferred or decisional)** is recommended for maintaining plant production, cover, and appropriate species composition on sagebrush steppe rangeland (Table 2). General grazing guidelines developed by Guinn and Rouse (2009) for unburned areas recommend that pastures be grazed a) no more than half of the growing season, and b) no more than in one of three years during the growing season for native bunchgrasses and in two of three years for introduced bunchgrasses. **Post-fire grazing after rest or during deferment periods may need to be lighter** than the aforementioned recommendations because **newly seeded and surviving plants are at risk of repeated defoliation** due to animal preference for foraging in burned areas. Options for mitigating livestock distribution problems in large grazing units include fencing, herding, and strategic placement of water, salt, and supplements.




Monitoring

Careful monitoring and assessment will assist managers in determining when grazing can be resumed, evaluating the effectiveness of post-fire grazing management practices, and deciding if adjustments in grazing management are required.

Sites should be monitored for utilization levels of perennial grasses and other plants, relative composition of perennial grasses and forbs, invasive annual grasses and forbs, shrubs, as well as species of interest such as those that are threatened and endangered. Sites also should be monitored for indicators of the three main attributes of ecosystem health: soil and site stability, hydrologic function, and biotic integrity.

Regular monitoring and assessment will allow managers and ranchers to adaptively manage grazing as conditions change in the post-fire environment. The effects of post-fire grazing management may not be detectable in the first few years after a fire (Bates and Davies 2014), so it is important that monitoring and adaptive management be carried out over time. Any downward trends in perennial grasses

Table 2. Typical grazing systems used in sagebrush-bunchgrass range of the Great Basin, along with their implementation requirements and suitability. For more information on grazing systems see: Holechek, J. L., R. D. Pieper, and C. H. Herbel. 2007. [Range Management: Principles and Practices](#). Upper Saddle River, NJ: Prentice Hall.

 Grazing System	 Implementation Requirements	 Suitability
Rest Rotation Grazing	<i>Minimum of three pastures</i> <ul style="list-style-type: none"> • One full year of rest on at least one pasture • Plants set seed two out every three years in each pasture 	<ul style="list-style-type: none"> • Sagebrush-bunchgrass range • Rough topography
Deferred Rotation Grazing	<i>Minimum of two pastures</i> <ul style="list-style-type: none"> • Deferment provided during period when plants are most grazing-sensitive on one or more pastures and on a rotating basis 	<ul style="list-style-type: none"> • Sagebrush-bunchgrass range • Rough topography • Riparian
Decisional (Rotation) Grazing (e.g., seasonal suitability)	<i>Multiple pastures</i> <ul style="list-style-type: none"> • Rest or deferment of pastures on a rotating basis <ul style="list-style-type: none"> - Designed mainly to graze prior to plants' sensitive period - May be incorporated into rest or deferred rotation systems - Stock moved based on seasonal forage production 	<ul style="list-style-type: none"> • Sagebrush-bunchgrass range • Rough topography, especially with strong elevation or precipitation gradients, variable ecological sites or conditions

and forbs, or failure to maintain other recovery objectives, such as limiting invasive plant cover, would indicate that grazing management practices should be modified to promote resilient plant communities.

Authors

Kari E. Veblen
USU Dept. of Wildland Resources and Ecology Center
kari.veblen@usu.edu

Beth A. Newingham
USDA Agricultural Research Service
Great Basin Rangelands Research Unit
beth.newingham@ars.usda.gov

Jon Bates
USDA Agricultural Research Service
Range and Meadow Forage Management Research Unit
jon.bates@oregonstate.edu

Eric LaMalfa
USU Dept. of Wildland Resources and Ecology Center
eric.lamalfa@aggiemail.usu.edu

Jeff Gicklhorn
University of Nevada-Reno
Natural Resources and Environmental Science
jgicklhorn@nevada.unr.edu

References

Bates, J. D., and K. W. Davies. 2014. Cattle grazing and vegetation succession in burned sagebrush steppe. *Rangeland Ecology and Management* 67:412-422.

Bates, J. D., E. C. Rhodes, K. W. Davies, and R. Sharp. 2009. Postfire succession in big sagebrush steppe with livestock grazing. *Rangeland Ecology & Management* 62:98-110.

BLM. 1996. Utilization studies and residual measurements, Interagency Technical Reference 1734-3. Bureau of Land Management National Applied Resource Sciences Center.

Bruce, L. B., B. Perryman, K. Conley, and K. McAdoo. 2007. Grazing management on seeded and unseeded post-fire public rangelands. *Professional Animal Scientist* 23:285-290.

Bunting, S. C., R. Robberecht, and G. E. Defosse. 1998. Length and timing of grazing on postburn productivity of two bunchgrasses in an Idaho experimental range. *International Journal of Wildland Fire* 8:15-20.

Burkhardt, J.W., and K. Sanders. 1992. Management of growing-season grazing in the sagebrush steppe: a science review of management tools appropriate for managing early-growing-season grazing. *Rangelands* 34: 30-35.

Guinn, K., and G. Rouse. 2009. Grazing management guidelines. USDA-NRCS, Range Technical Note-34, revised. Spokane, Washington. 10 p.

Hanna, S.K., and K. Fulgham. 2015. Post-fire vegetation dynamics of a sagebrush steppe community change significantly over time. *California Agriculture* 69: 36-42.

Harniss, R.O. and R.B. Murray. 1973. 30 years of vegetal change following burning of sagebrush-grass range. *Journal of Range Management* 26: 322-325.

Jirik, S. J., and S. C. Bunting. 1994. Post-fire defoliation response of *Agropyron spicatum* and *Sitanion hystrix*. *International Journal of Wildland Fire* 4:77-82.

Kerns, B. K., M. Buonopane, W. G. Thies, and C. Niwa. 2011. Reintroducing fire into a ponderosa pine forest with and without cattle grazing: understory vegetation response. *Ecosphere* 2.

Knutson, K. C., D. A. Pyke, T. A. Wirth, R. S. Arkle, D. S. Pilliod, M. L. Brooks, J. C. Chambers, and J. B. Grace. 2014. Long-term effects of seeding after wildfire on vegetation in Great Basin shrubland ecosystems. *Journal of Applied Ecology* 51:1414-1424.

Roselle, L., S. S. Seefeldt, and K. Launchbaugh. 2010. Delaying sheep grazing after wildfire in sagebrush steppe may not affect vegetation recovery. *International Journal of Wildland Fire* 19:115-122.

Great Basin Factsheets are developed and produced collaboratively by the groups below. Jeanne Chambers edited the factsheets, Lael Gilbert created the design and was responsible for layout, and Nolan Preece shot the photo for the masthead, which is of Monitor Valley in central Nevada.

