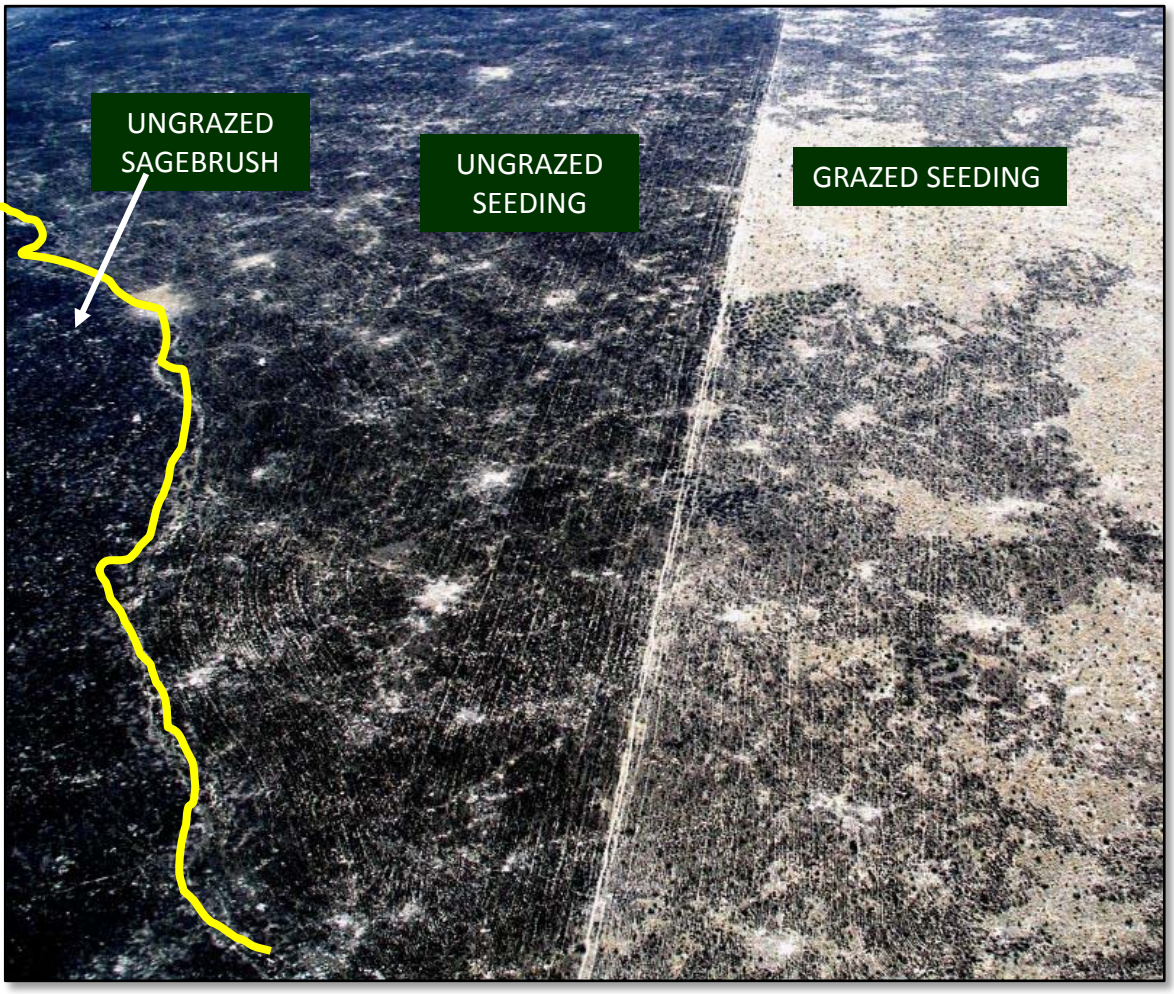
BLM

Idaho State Office

Considerations for Strategically Reducing

Fuels and Wildfires on Public Lands in the Great Basin with Targeted Grazing



Prepared by

Great Basin
Restoration Initiative Workgroup
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Executive Summary

Wildfires are predicted to become increasingly larger and more intense in the future, which will impact natural and fiscal resources, private property, and lives. Although great progress has been made in fire suppression and fuels management implementation over the last decade, it is clear that these two programs, along with the post-fire rehabilitation program, are not adequate. On public lands in the Great Basin, livestock grazing is an underutilized tool in assisting managers to achieve fuels and vegetation management objectives that could minimize wildfire impacts to high priority areas. The report, *Interactions Among Livestock Grazing, Vegetation Type, and Fire Behavior in the Murphy Wildland Fire Complex in Idaho and Nevada, July 2007,* documents that livestock use of forage (i.e., fuels) may affect fire behavior in certain vegetation types and that guidance on a carefully planned and targeted livestock grazing program should be developed. In concert with one of the recommendations in the July 2007 report, the Great Basin Restoration Initiative Workgroup has developed this guidance to assist managers in evaluating the need and potential implementation and monitoring of a targeted grazing program. It applies existing information, research, and experience in designing and implementing fuelbreaks using targeted livestock grazing on public lands at a landscape scale.

Targeted livestock grazing must be carefully implemented and monitored to meet fuels management objectives on an annual and long-term basis. Grazing to reduce fuels on a landscape must be both strategic and surgical. Surgical means that targeted livestock grazing will be done to the level and **limited to the minimum area needed** to meet fuel and landscape or project management objectives within BLM's regulatory framework. Therefore, sound project planning is essential. This planning includes the identification of priority areas for protection (derived from land use and fire management plans; ecoregional assessments; etc.), followed by the development of a strategic fuels/livestock management plan (similar to an allotment management plan) utilizing livestock grazing and other existing or planned fuels management projects. It involves Bureau of Land Management resource and fuels specialists and livestock permittees who select the preliminary treatment areas to be analyzed in the National Environmental Policy Act (NEPA) process. The key component of this planning effort is to focus livestock use in strategic strips or bands (width to be determined based on site or landscape characteristics) that either reduce or slow wildfires or assist in fire suppression activities (i.e., provide safe zones for burn outs). Implementation of these strategies will require new funding sources as well as innovative ways to work with livestock operators and other livestock providers to accomplish agreed upon fuel management objectives. Stewardship contracting and direct contracting are potential mechanisms to accomplish these objectives.

Monitoring and evaluation are critical to ensuring that the lessons learned are available to all interested parties. Since this approach to reducing wildfires at a **landscape scale** is relatively untested, an adaptive management approach starting with pilot projects is recommended. Knowledge, research, and experience gained in implementing this strategy must be continually used to improve the effectiveness of targeted grazing strategies to meet fuels and resource objectives.

Purpose of Guidance

The suggestions in this document begin to address one of the recommendations in a report developed by an independent team assembled by Bureau of Land Management (BLM) Idaho State Director Tom Dyer titled *Interactions Among Livestock Grazing, Vegetation Type, and Fire Behavior in the Murphy Wildland Fire Complex in Idaho and Nevada, July 2007* (http://pubs.usgs.gov/of/2008/1214/). Specifically, the recommendation supports the production of a general technical report that focuses on published research and existing field examples of how livestock grazing influences fire extent, severity, and intensity. The suggestions herein are not intended to fully meet the recommendation to produce a general technical report on this subject. Instead these suggestions focus on the strategies and administrative requirements to identify and implement this type of program on public lands in the Great Basin. It provides BLM managers suggestions and options to utilize targeted livestock grazing to influence fuels and future wildland fire behavior and extent on public lands at multiple scales. It does not address the question of timing to return livestock to burned and/or seeded areas.

Introduction and Background

Public lands in the Great Basin encompass nearly 80 million acres that are at high risk of degradation due to invasive species and wildfires. Cheatgrass is a concern on an estimated 25 million acres of public lands, and between 1991 and 2008 an estimated 17 million acres of rangeland burned in the five-state Great Basin. The Great Basin Restoration Initiative (GBRI) (http://www.blm.gov/id/st/en/prog/gbri.html) began in 1999 after 1.7 million acres burned in the Great Basin area. The GBRI promotes a proactive approach to the cheatgrass wildfire cycle that focuses on maintaining intact native plant communities and strategically restoring degraded plant communities.

Wildfire concerns came into the forefront again in 2007 with the occurrence of two mega-fires, the Murphy Complex Wildfire in Idaho and Nevada (650,000 acres) and the Milford Flat fire in Utah (363,000 acres). The Murphy Complex Fire was controversial in regards to the role that livestock grazing had on the spread and size of this fire. The report produced by the interagency team (described in the Purpose of the Guidance) section supported proceeding with an evaluation of a "targeted grazing" approach to reduce wildfires in the Great Basin.

Targeted grazing is defined as "the application of a specific kind of livestock at a determined season, duration, and intensity to accomplish defined vegetation or landscape goals" *(Targeted Grazing: A Natural Approach to Vegetation Management and Landscape Enhancement* (http://www.cnr.uidaho.edu/rx-grazing/Handbook.htm)). This is not a new concept; however, the expected outcome of targeted grazing described in this document is focused on meeting resource/fuels objectives at a landscape level, not just on livestock

production and rangeland sustainability at a management unit (ranch or BLM allotment) level. To accomplish targeted grazing objectives related to fuels management, the land manager and livestock permittee must agree on a "strategic" approach that uses livestock to reduce fuel loads in an effective and sustainable manner on selected strips or zones at a scale commensurate with the wildfire issues. The land manager contributes landscape ecology and fuels management expertise, while the livestock permittee has the knowledge and skill to mange livestock to meet a shared objective.

In addition to the *Targeted Grazing* publication mentioned above, the University of Idaho prepared a comprehensive review and reference document entitled *Literature Review and Synthesis of Interactions among Grazing, Fire, and Invasive Plants in the Sagebrush Steppe Ecosystem* (http://www.cnr.uidaho.edu/range/MurphyFireComplex/). This publication serves as the basis for the majority of the research used to support the concepts described in this guidance.

Desired Outcomes of Targeted Grazing Strategy

The overall goal of a targeted grazing strategy is to reduce fire size. A combination of grazing strategies can be implemented to alter the structure and continuity of the vegetation (fuel) to limit the rates of fire spread and ultimately the overall fire size. Reducing the height and quantity of the fuel, primarily invasive annual grasses, reduces average flame length and the intensity of the fire and facilitates direct attack by fire crews. Changing the fuel continuity or connectedness of the fuel helps to reduce the rates of spread and allows fire crews and/or firefighting aircraft more time to gain access and initiate suppression action.

Where these suggestions are implemented, risks to Great Basin native plant communities are expected to be lessened due to a reduction in the number, size, and intensity of wildfires. Fire has been an evolutionary component of most Great Basin plant communities therefore our goal is to manage and reduce, not eliminate wildfires. Targeted grazing can be an important component of the overall strategy of reducing wildfire impacts thereby maintaining or restoring land health per the appropriate Standards for Rangeland Health in the Great Basin. If effective, these treatments will help reduce the negative effects of wildfires on biotic, social, and economic resources including but not limited to:

- **Conservation of Important Wildlife Habitat and Land Health.** Intact shrubsteppe plant communities in the Great Basin provide habitat to numerous bird, mammal, amphibian, and reptile species. Wildfires are one of the primary threats to wildlife habitat, especially sage-grouse; consequently, practices that reduce fire size and spread are needed. It is important to keep in mind that intact shrubsteppe and other plant communities contain a mixture of species compositions and successional stages. Sage-grouse and many big game species require this mixture of successional stages

and plant communities to meet their habitat needs during different seasons and stages in their life histories.

While extensive areas of shrubsteppe habitat remain in portions of Idaho, Nevada, Utah, and Oregon, other areas have burned repeatedly. For example, in the Big Desert Sage-grouse Planning Area in southern Idaho, an area that has historically served as a stronghold for sage-grouse, approximately 63 percent of the area burned at least once between 1990 and 2003. Additional large fires have occurred since then, further expanding the influence of cheatgrass on ecological functions and repeat wildfires. Without proactive intervention and appropriate fuels management practices, including targeted grazing, the likelihood for conservation of shrubsteppe habitat and successful restoration and/or recovery after wildfires over the long-term is doubtful.

- **Minimized Threats to Life and Property and Disruption to Livestock Operations.** Wildfires often threaten areas of human habitation, including important energy and national defense facilities, putting people, including fire fighters, and their property at risk. Wildfires also disrupt livestock grazing operations by direct damage to range improvements and, in some cases, loss of livestock. The greater impact to the livestock operator is the temporary loss of livestock grazing during the recovery of burned vegetation or seeding establishment. Alternative forage sources are often limited and expensive, which can have a significant impact on livestock operators in the short-term.

- **Reduced Fire Suppression and Rehabilitation Costs.** Spending on fire suppression and post-fire rehabilitation continues to increase in the Great Basin. Data for the years 2006 and 2007 provide conservative costs of $81 million for fire suppression (does not include a number of non-BLM expenditures) and $100 million for post-fire rehabilitation. The savings realized by implementing targeted grazing programs in the Great Basin is tied directly to the number of programs implemented and the effectiveness of the programs, both of which are unknown at this time. Cost effectiveness of implementing targeted grazing programs must be considered relative to implementing other fuels management projects. As targeted grazing plans are developed and implemented, a good accounting of expenses is recommended to quantify fire suppression and rehabilitation savings.

Variables Affecting Vegetation and Wildfires

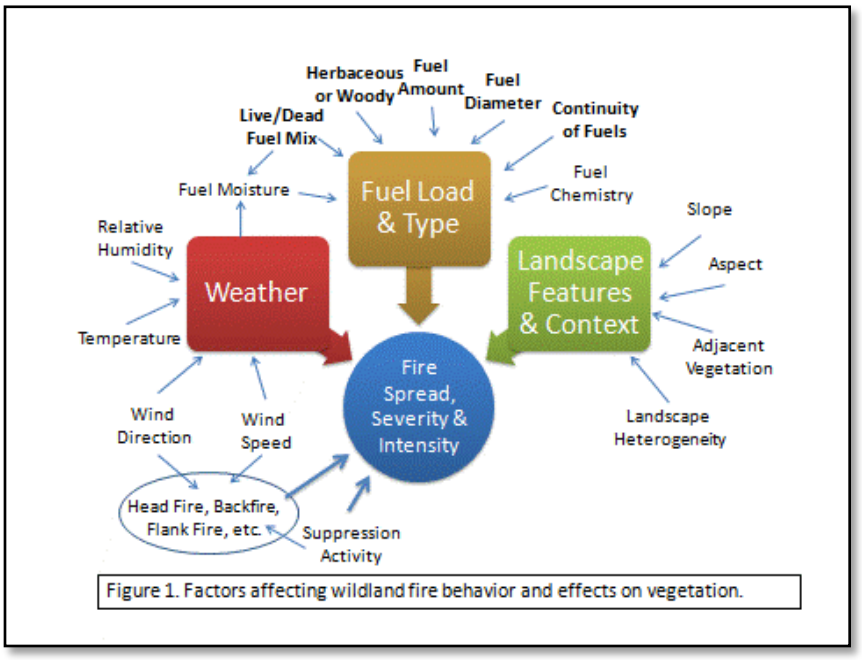


Figure 1. Factors affecting wildland fire behavior and effects on vegetation.

There is a complex relationship between the landscape, fuels, and fire behavior and severity (see Figure 1). To be effective, targeted livestock management must be strategically planned at a landscape level to modify fuel characteristics, primarily fuel amount and continuity, in a sustainable manner in strips or zones within allotments or pastures. Landscapes are heterogeneous with mix plant communites and landforms that must be considered in a fuels management plan. There is also a high degree of temporal variability in climatic factors affecting plant production that results in a highly variable, annual fuel load. While managing fuels is a primary objective, it is also crucial to recognize that targeted grazing in strips or zones in an allotment or pasture must maintain the sustainability of perennial native and seeded communities and not degrade annual plant communities to the degree to which soil erosion or other invasive species increase beyond acceptable levels.

Livestock Effects on Fuels

Livestock affect vegetation and fuels primarily through consumption of plants (i.e.., fuels) and trampling. Specifically, fuel loads and continuity may be reduced by livestock grazing. Livestock factors that affect the degree of success in meeting fuels management objectives include but are not necessarily limited to:

- **Kind and Class of Livestock**. The kind livestock commonly permitted or used to control fuels on public lands include cattle, sheep, and horses. Each of these herbivores has different preferences for plants at different seasons of use that must be considered when designing a fuels reduction strategy. Sheep and horses can generally utilize forage closer to the ground than cattle and thus have the potential to reduce fuels to a greater degree than cattle. Using goats and sheep in combination is generally more effective in reducing both herbaceous and shrub fuel loads. The class of livestock (age or sex group of a particular kind of livestock) may also be important

depending on type of forage, slopes, and distance from water. For example, a steer will generally forage further from water and use steeper terrain than a cow-calf pair. If present, wild horse, burro, and wildlife utilization of forage must be taken into account when planning fuels reduction projects as well.

- **Season of Use and Palatability.** The time of the year that livestock graze vegetation can significantly affect kinds and amounts of plants used. This is due in part to differences in plant palatability that is influenced by the season of livestock use and type of livestock (e.g., cattle, sheep, horses, goats, etc.) present. For example, sheep will utilize some sagebrush in the fall, whereas cattle generally will not. Plant growth stage differs greatly depending on vegetation class (i.e., grass, forb, succulent, shrub, or tree). Grasses also have a different growth pattern, and thus palatability is dependent upon whether they are a cool or warm season plant. Some plants (e.g., sagebrush) have a high volatile oil content that reduces palatability. Plant growth stages and palatability also varies spatially across the landscape due to different weather patterns and temporally due to differences in weather from year to year (i.e., precipitation and temperature differences) and inter-annually (i.e., timing and amount of precipitation). Changes in livestock season of use may be needed to effectively reduce fuels given the variability in palatability of herbaceous plants at different seasons.

  Recent research on livestock grazing demonstrates that some kinds of livestock may be "trained" to be differentially prefer certain plants over others (www.behave.net and www.livestockforlandscapes.com). Training cattle to eat noxious weeds or other target herbaceous species has been more successful than training them to eat more sagebrush. Training livestock to eat new foods takes a period of dedicated management, with the results tending to be most apparent after a couple of years. The rancher has to make the trained animals part of the base herd. The use of supplements can also be used to override grazing animal preferences and encourage use of plants that are not normally preferred (www.behave.net).

- **Livestock Numbers and Time Span of the Grazing Period (Duration of Use).** Increasing livestock numbers per unit area and/or increasing the time span of the grazing period will increase the utilization levels and trampling effect on plants. Increasing the time span of the grazing period can have similar fuels management results compared to higher stocking rates for a shorter period of time. However, plant growth stage and palatability must be considered in this scenario as well as the effects of different grazing systems on plant composition and vigor. Higher livestock numbers for a shorter period of time can be a better fuels management strategy in cheatgrass or medusahead wildrye dominated rangelands due to their shorter period of palatability compared to native or seeded herbaceous perennial plants.

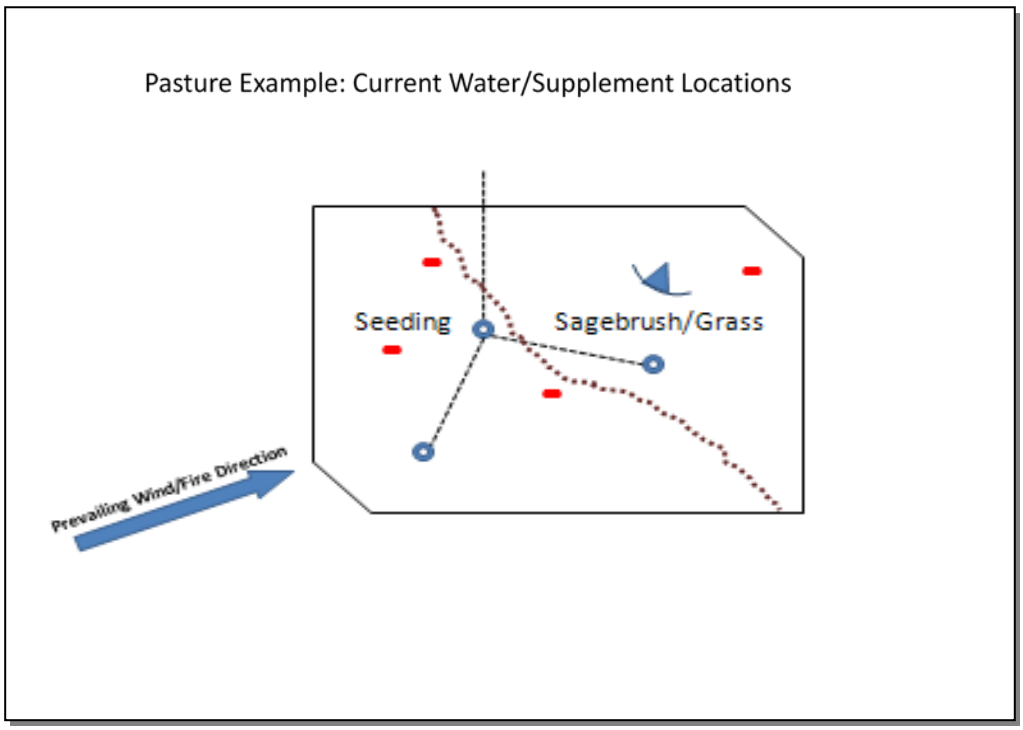
  Duration of grazing during the growing season is also affected by the potential for

regrowth on perennial plants or additional germination of annual plants due to precipitation after grazing has been removed. Repeat grazing during the same growing season may be required to meet fuels management objectives.

Continuous grazing throughout the growing season at utilization levels above 50 percent was one of the factors contributing to the current lack of diversity in shrub steppe plant communities. Livestock numbers, length of grazing season, season of use, physiological needs of desired vegetation, the livestock owner's management capacities, and the goal of the prescribed grazing management all need to be balanced to meet fuels management and resource objectives.

- **Livestock Distribution.** Landscapes are diverse with many plant communities, water locations, distribution of palatable plants, and topographical characteristics (e.g., slope, aspect, rockiness). Uniform livestock utilization within targeted grazing pastures or selected locations is essential in order to maintain the effectiveness of these areas as fuelbreaks. Water availability can be manipulated to direct grazing pressure onto fuel reduction strips or zones. To be an effective component of targeted grazing, water sources must be dependable to attract livestock and stoppable when it is time for the livestock to graze elsewhere. Water distribution can be manipulated by developing new trough locations on existing water pipelines, hauling water to temporary troughs in strategic locations, or constructing water catchments. It may be necessary to deny livestock access to water outside targeted grazing strips or zones to meet fuels management objectives. When fuels management goals have been met in targeted grazing strips or zones, livestock access to water supplies in these areas may need to be denied to prevent further forage removal.

  However, due to the disturbance associated with watering sites (e.g., livestock trails, trampling, heavier use on nearby vegetation), water developments need to be carefully planned and located so that indirect impacts to other resources such as important wildlife habitat are avoided or minimized. Using water distribution to target livestock grazing in strategic locations in a pasture or allotment is preferable to installing new fencing (temporary or permanent) to accomplish the same fuels management objectives. However, there are situations (e.g., along roads) where a combination of water, supplements, and fences may be required for public safety or to improve targeted grazing outcomes. See Figure 2 for an example of using water to direct livestock use to a targeted grazing zone in a pasture. Impacts of water developments and other treatments or structures on other resources must be evaluated in a National Environmental Policy Act (NEPA) document (see "Environmental Analysis and Clearances" section). Also, locations of long-term monitoring studies should be considered when planning and implementing new livestock watering projects, supplement placement and fence projects.



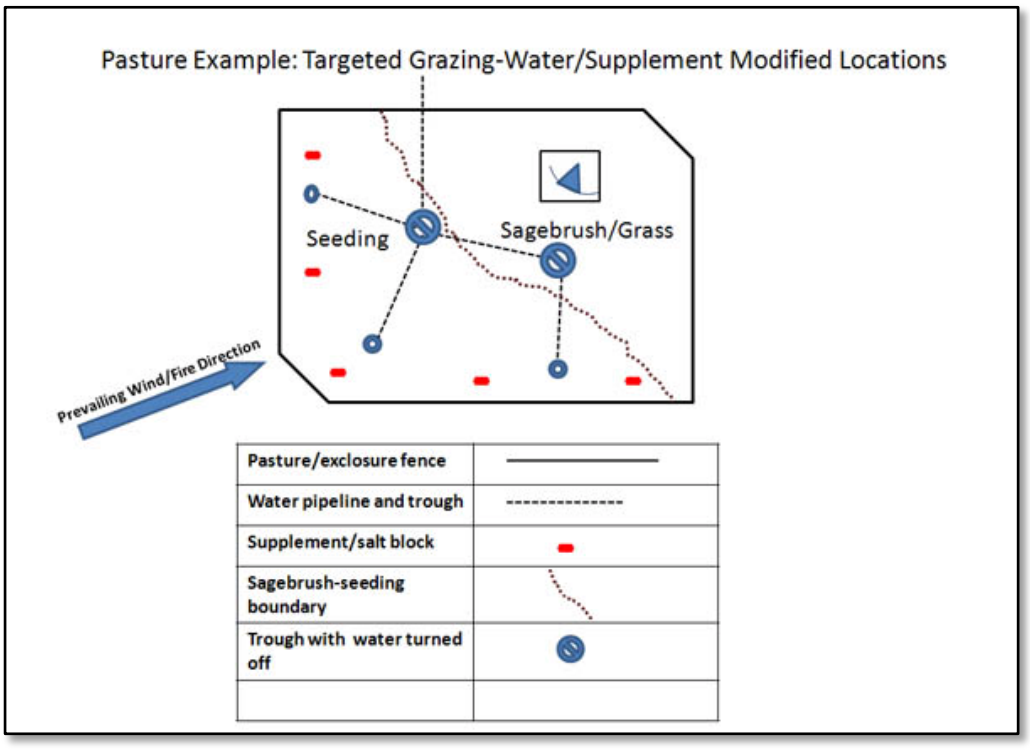


Figure 2. Hypothetical example of moving water locations and supplements and fencing a reservoir to promote targeted grazing in herbaceous vegetation in a zone on two sides of the pasture with the goal to reduce probability of wildfire burning into adjacent sagebrush/grass stand.

Changing salt or other supplement locations can attract livestock to use designated targeted grazing strips or zones (see Figure 2). In areas with limited water availability, the use of salt and/or other supplements can help meet livestock distribution while indirectly meeting utilization objectives. There is potential to spray high energy protein supplements on underutilized vegetation or less palatable species to increase livestock use of these areas.

Herding is another option to encourage livestock use within targeted grazing areas. Herding is generally more effective with sheep and goats but can be used with cattle if the livestock operator is dedicated to making it work. A combination of herding with appropriately located water and supplement sources offers one of the best opportunities to make a targeted grazing program work. Costs of herding need to be considered and may require compensation for the labor required to make it work.

- **Integrated Livestock Management.** Combinations of livestock type and use may be required to optimize the use of livestock to strategically manage fuels. This approach is not new as grazing plans and allotment management plans have utilized these same criteria to develop sound approaches to managing the vegetation and soil resource and meet livestock production objectives. What is different in the suggestions in this document is the emphasis on meeting or obtaining sustainable resource management and fuel reduction goals strategically at a landscape level. The challenge is to manage fuels in strategic strips or zones across a pasture, allotment, or landscape without unduly impacting other resource values in adjacent areas or causing unacceptable impacts such as an increase in invasive species, unacceptable soil compaction, degradation of wildlife habitat, unacceptable loss of perennial plants, or soil erosion in the targeted grazing strips or zones.

Implementation Area for Targeted Grazing

The emphasis of this document is to assist managers in selecting an appropriate landscape unit to design and implement grazing plans or allotment management plans to strategically reduce fuels in a connected series of strips or zones in pastures or allotments. A landscape unit may be a watershed; a basin and range unit; sage-grouse planning unit; a land use or fire management plan area; or an ecoregion. The selection of the landscape unit should not be arbitrarily limited by an administrative boundary; rather, it should be selected based on resources at risk; past and future fire potential; and the feasibility of using livestock to meet fuels management and resource objectives within the defined landscape. Existing seedings, fences, and water sources in allotments or pastures are also factors that should be considered in developing this program.

This does not preclude this guidance from being used at a more local management unit scale, such as within a grazing allotment/pasture in strategic strips or zones or even in conjunction

with a specific fuels management project. In fact, consideration of livestock impacts on and benefits of grazing should be considered in the design of most fuels management projects on rangelands.

Significant fuels reductions can be derived by focusing livestock grazing along roads, railroads, or other transportation corridors where human-caused wildfires are likely. At the project level, it is recommended that the benefits of livestock grazing to manage fuels over the long-term be considered in designing the project. For example, mowing sagebrush along roads is a common fuels management practice in intact sagebrush steppe communities. Livestock grazing may be a useful tool in removing fine fuels from these fuelbreaks, thereby increasing their effectiveness. Providing water and/or supplements/salt near mowed portions of a fuelbreak can further encourage livestock use within these treatments. Of course the effects of long-term heavier livestock use on herbaceous species and the accelerated reestablishment of sagebrush must be weighed with this strategy. Also, issues of traffic safety (e.g., risk of vehicle collisions with livestock) may be of concern along unfenced roads and railroad tracks when livestock are concentrated in these areas, depending on road type and degree of vehicle use and frequency of railroad use.

The next step in designing a plan to implement a targeted grazing program in a landscape context is to gather important information to determine if such a plan is feasible and, if it is, to identify strategic strips or zones where the targeted grazing program could be implemented:

- **Landscape Level Information and Data Needs Required to Develop Targeted Grazing Projects or Strategies:**

    - Wildfire history, including historic fire polygons, lightning strikes, and human starts (displayed spatially); prevailing winds and storm tracks; and fuel hazard models/maps.

    - Current vegetation map, including, at a minimum, intact sagebrush steppe or other native shrublands (salt desert shrub), seedings, cheatgrass, noxious weeds, and any human or natural fuelbreaks (agricultural fields, rocky areas, mechanical fuelbreaks, greenstrips, etc.)

    - Manmade features that may slow or stop fires such as roads, agricultural fields, powerlines, right of ways, greenstrips, other fuel management projects, etc.

    - Soil maps, if available, preferably at a third-order level (published soil survey) with specific information on rocky or shallow soils and soils with the potential for land treatments, especially seedings.

- Ecological site descriptions to identify potential plant communities and associated state and transitions models, to help set realistic vegetation management objectives and to plan seedings if native species are included in the seed mix.

- Grazing administration files, including allotment and pasture maps (fences), livestock permit (including numbers, class of livestock, and season of use by allotment and pasture), and maps of existing domestic sheep trailing routes (see Figure 3).

- Allotment monitoring files, including trend, actual use, utilization, rangeland health assessments, and climate data.

- Natural and human water developments depicted spatially.

- Topographic variables such as slope, aspect, and landform (see Figure 3).

- Land ownership.

- Other management units such as watershed boundaries, Sage-grouse Planning Areas, special management areas, wildland-urban interface boundaries, other special areas designated in the Community Wildfire Protection Plans, etc.

- Maps of important or key wildlife habitats, particularly sage-grouse nesting and winter habitat; lek locations; pygmy rabbit habitat; threatened and endangered animal and plant locations; big game crucial winter range; and others as locally appropriate.

- **Values, Issues, and Threats in Selected Landscape Unit:**

    - Review Land Use and Fire Management Plans and allotment management plans (if present) to identify opportunities, issues, and constraints to implementing a targeted grazing strategy at appropriate scale.

    - Coordinate with livestock permittees, other land owners, government agencies, tribal, and interested public on proposed targeted grazing strategy.

- **Is targeted grazing an appropriate tool?**

    - Will the desired plant communities, fuel loads, and other objectives result directly from targeted grazing, or will additional actions be required?

- How often will the targeted grazing treatments need to be repeated or maintained to achieve desired vegetation/fuels conditions on both a short- and long-term basis?

- Is the scale of planned targeted grazing implementation appropriate to the scale of the issues, goals, and objectives?

- What are the physical and infrastructure capacities of the area and limitations of the livestock operator(s)?

- What are the impacts of planned targeted grazing management on livestock health, performance, and economic values? Are these impacts acceptable to the livestock operators? Will livestock operators require compensation for reduced animal performance to meet fuels management objectives?

- Many factors affect this decision, and they will change from project to project. Thoroughly and collaboratively decide whether targeted grazing is an appropriate tool in whole, in part, or not at all before proceeding with developing a plan and implementation strategy. Consider whether other tools may be more effective, economical, and appropriate than targeted grazing. (See Figures 3 and 4, which illustrate a step-down process to plan a targeted grazing program in strategic zones or strips using some of the information in this section.)

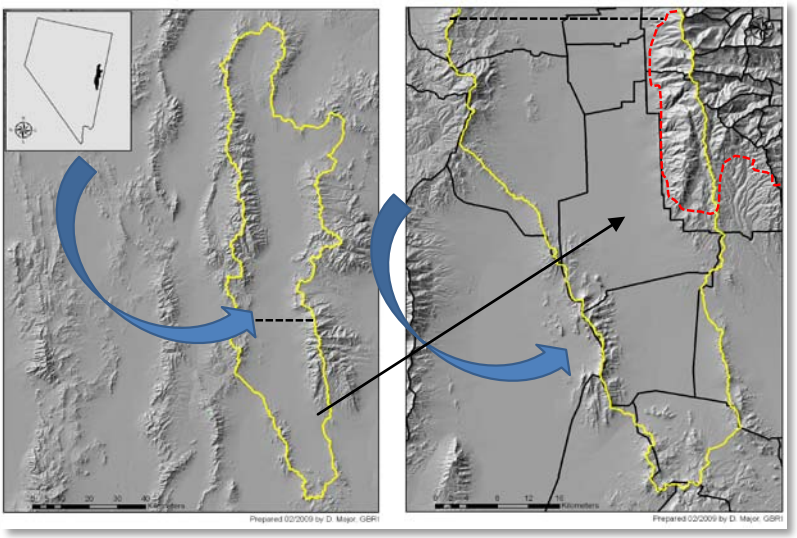


Figure 3. Priority Watershed in Eastern Nevada (yellow perimeter) to maintain sagebrush stands in upper elevations. High priority area is in upper right mountain range (red dotted line) in figure on right. Black outline polygons are pastures. Prevailing wind direction in fire season is shown by blue arrows.

(1 kilometer = .6 mile)

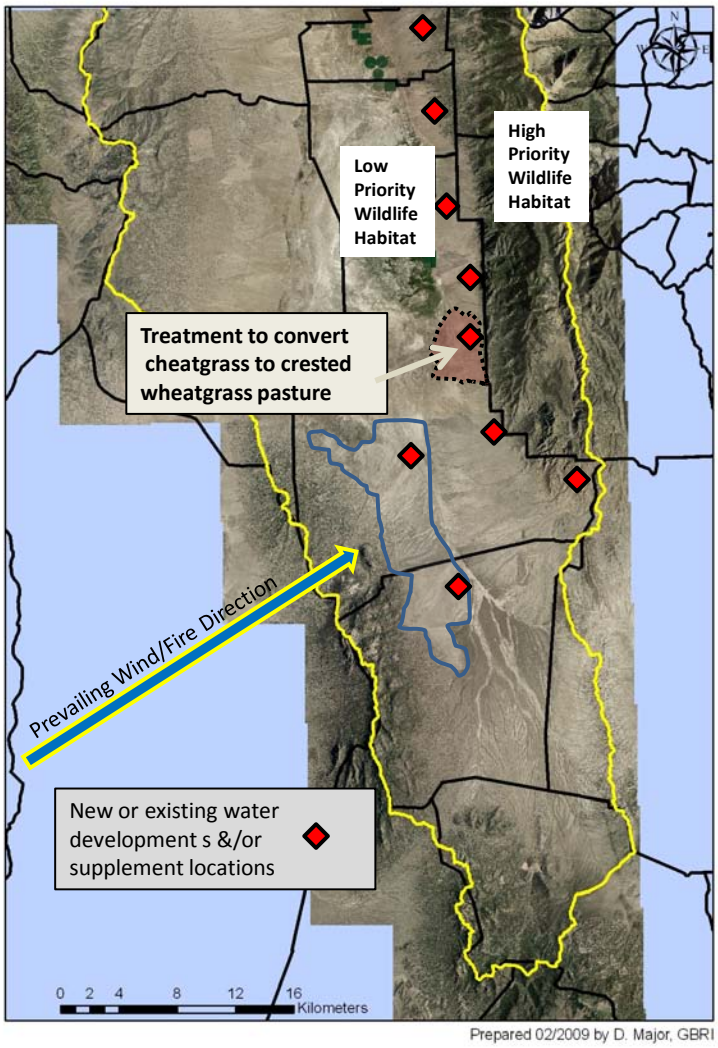


Figure 4. Modification of water and supplement locations to implement targeted grazing program in a strip at base of mountain range with high wildlife values. New water sources were also installed in the seeding in this diagram to further improve strategic fuel reduction given the proximity of the seeding to the high quality wildlife habitat.

- **Process to Design Targeted Management Projects at the Landscape Level:**

  - Assemble the data from the two preceding sections titled "Landscape Level Information and Data Needs Required to Develop Targeted Grazing Projects or Strategies and "Values, Issues, and Threats in Selected Landscape Unit" for use by the interdisciplinary team and collaborators to develop the targeted grazing objectives and program for the selected landscape unit.

  - Develop a set of potential targeted grazing alternatives based upon the information assembled in the preceding two sections. Evaluate the alternatives consistency with appropriate land use and fire management plans. Even though an action may not specifically be provided for in a Land Use Plan (LUP), if it is not specifically disallowed and is consistent with LUP goals and objectives, an Environmental Assessment (EA) or Environmental Impact Statement (EIS) may still be prepared to implement the project.

Modify or discard alternatives that do not clearly meet objectives in these plans. Develop an allotment management plan if appropriate.

- Evaluate the effectiveness of the viable alternatives with the use of fire behavior models (e.g., BEHAVE, FARSITE, and FSPro (Fire Spread Probability)) to determine which of the alternatives best meet fuels management objectives in terms of reducing wildfire behavior in the landscape project area. However, BEHAVE is not spatial, and current fuels models for sagebrush are fairly generic. This limits BEHAVE's use in predicting changes in fuels and corresponding effects on fire behavior on a spatial scale. FSPro is a special model that calculates the probability of fire spread from a current fire perimeter or ignition point for a specified time period.

- Increase coordination with livestock permittees, other government agencies, landowners, or managers, and with interest groups within the targeted grazing area. Obtain agreement on treatments and the proposed locations of strips (including approximate width) or zones where the targeted grazing program is proposed for implementation

- After coordination, begin preparation of appropriate NEPA documents (see "Environmental Analysis and Clearances" section). Through the decision record/rationale process, select the most effective and environmentally acceptable alternative.

- Secure funding, as appropriate, to begin implementation of the plan (e.g., identified treatments and structures needed to implement the targeted grazing program). (See Figure 4 for example of an implemented program.)

- Establish pre- and post-targeted grazing monitoring studies (see Monitoring and Evaluation section). (See Figure 5.)

- Modeling fire spread and behavior under different fuel and weather conditions is needed to evaluate success at the **landscape** scale. However, models are not a good measure of **project (strips or zones where targeted grazing has been implemented)** effectiveness. Therefore, once the piloted grazing program has been implemented, evaluate the potential effectiveness of the targeted grazing treatments using real data (reduction in fuel loads, decrease in fuel continuity, etc.). If a wildfire occurs after the implementation of a targeted grazing program, conduct an evaluation of the projects success in meeting objectives.

Figure 5. Spring grazing in seeding on left side of fence has reduced fuels to satisfactory level. Seeding to the right of fence receives slight livestock utilization due to distance from water. Note the increase in sagebrush density in the spring grazed pasture which will require strategic sagebrush thinning (inside the dashed lines) soon to maintain the integrity of the grazed fuelbreak strip.

- **Process to Design Livestock Fuels Management Projects at the Management Unit or Project Level.** Although the focus of this guidance is to implement landscape scale targeted grazing in an integrated system of strategic strips or zones, a more local application at either an allotment, preferably in an Allotment Management Plan, or at a project level still has merit. At these scales, parts of the process described above would be applicable in designing projects especially at the grazing allotment(s) level. At the project level, other program direction would take precedence over the guidance provided above. However, fuels, emergency stabilization and rehabilitation (ES&R), and other range improvement projects could benefit from consideration of targeted grazing by livestock as a tool to reduce the size and adverse impacts of future wildfires. Therefore, this guidance may be beneficial in planning treatments at the project/treatment level.

Targeted Grazing Strategies
by Major Great Basin Biomes and Plant Communities

- **Sagebrush Steppe.** Historic intact sagebrush plant communities in the Great Basin (includes both the northern sagebrush steppe and southern Great Basin sagebrush vegetation types) **generally** had longer fire return intervals and smaller, less intense fires because there was a diverse mixture of successional stages, species, functional/structural groups, phonological stages, and relative plant moisture content. As a fire moved through this kind of environment, the burning conditions would continuously change. At lower elevations and in the central and southern Great Basin, many plant communities had fairly widely spaced plants requiring more severe conditions to carry a fire. As cheatgrass or medusahead wildrye fills in the interspaces between native plants, fuel continuity and length of the fire season begins to increase leading to eventual dominance by cheatgrass after repeated wildfires without rehabilitation.

  As described in the Murphy Complex Report, livestock grazing is not as effective in reducing fire potential in intact sagebrush steppe communities compared to herbaceous plant communities under extreme weather condition. Grazing may make a difference under less extreme fire and weather conditions (see Figure 6). Thinning or removing sagebrush in selected, strategic areas (i.e., hand cutting, use of Tebuthiuron, mowing, mastication, Dixie harrow, or roller chopping) may increase the effectiveness of the grazed fuelbreak in reducing wildfire threat (see Figure 7).

  If absolutely necessary to meet fuels management objectives, small areas of sagebrush with a cheatgrass understory may be removed and seeded to increase forage use by livestock in strategic fuelbreaks. This approach would generally be limited to maintaining short lengths of a fuelbreak across a landscape where removing sagebrush prior to seeding is essential to reducing gaps in the fuelbreak. Targeted grazing in these seeded strips would reduce fuel loads and continuity, improving the value of these areas as a firebreak (see Figure 7).

  Sheep grazing in the fall can reduce sagebrush biomass and may be a viable option for reducing woody fuels (www.behave.net). Generally, fall sheep grazing needs to be continued for a period of years to effectively reduce sagebrush biomass.

- **Salt Desert Shrub.** Targeted grazing probably will not be as effective as in other vegetation types due to low fuel levels and greater distance between perennial plants. The exception is salt desert shrub communities in which the understory is dominated by cheatgrass, especially in wet years. Dominance of cheatgrass in this plant community may increase in the future due to rising CO_2 which increases cheatgrass production.

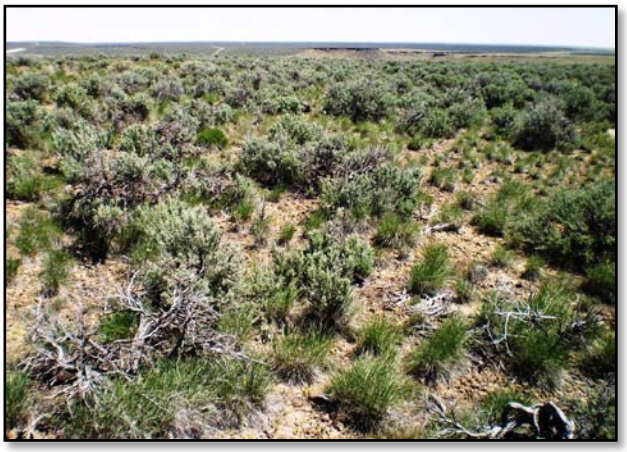


Figure 6. Intact sagebrush steppe plant community with a good understory of native species and biological soil crust would require intensive management and careful monitoring to achieve any fuels management objectives. Generally, targeted livestock grazing should not be considered in these plant communities as sagebrush and herbaceous plant composition is appropriate. Plant communities in this condition are desirable to maintain for wildlife and other uses.

Figure 7. Sagebrush removed by mowing to provide a fuelbreak in a large expanse of sagebrush. Sagebrush understory includes a mix of some native grasses and cheatgrass in the lower areas. Grazing should be applied when cheatgrass is green and at an appropriate utilization to maintain native perennial species. A grazing system that includes alternate year spring use on each side of the fence would assist in meeting both a fuels management and perennial plant sustainability target. Spot treatments of cheatgrass areas with approved herbicides could be incorporated in the management of this fuelbreak to reduce cheatgrass if livestock grazing does not meet fuels management objectives.

Extra caution must be exercised in this biome as lower precipitation and productivity requires more restrictive livestock grazing to reduce impacts on native vegetation and biological crusts.

Annual Grassland. Good potential exists to reduce fuels in rangelands dominated by annual grasses if:

- Grazing can be concentrated during the active growth period up to the production of seedstalks. Grazing cheatgrass during the summer is generally not advisable while grazing in the fall and winter on low elevation rangelands may reduce cheatgrass biomass through grazing when cheatgrass is wet or through trampling of standing dead plants (see Figures 8 – 9).

Figure 8. Cattle grazing can be concentrated on cheatgrass along fenced road as long as cheatgrass is green and water is nearby. Use in adjacent sagebrush would not be unacceptable under this grazing plan if livestock use is terminated (water removed or shut off) as cheatgrass begins to cure. Close use supervision would be required to ensure that the adjacent sagebrush area is not overused when livestock preference changes from the annuals to perennial herbaceous species.

Figure 9. Cheatgrass dominated rangeland where targeted grazing program would be difficult to implement without fencing and water development. Concentrating livestock near the road with water/supplements could cause a highway safety problem. Also, cheatgrass growth stage varies considerably (green to cured), which will reduce uniform livestock removal of forage/fuel.

- Grazing levels do not reduce ground cover to the point that soil erosion (wind or water) increases beyond acceptable limits. It is especially important to adjust livestock stocking rates proportionately in low and high precipitation years as cheatgrass production is closely tied to spring and winter precipitation.

- Targeted grazing does not significantly increase the amount of undesirable species (noxious weeds or other plants of concern) or significantly reduce the levels of native or seeded perennials. A noxious weed detection and control program may be necessary.

- If native species begin to recover due in part to the reduction in fire frequency, the targeted grazing plan should be reevaluated and modified if continued recovery of native species is desired.

- **Perennial Grasslands.** Seedings of perennial grasses or stands of native grasses have the greatest potential to sustainably and consistently reduce fuels and minimize the potential for soil erosion and increases in invasive species. Management of introduced versus native perennial grasslands requires different strategies due to the differential effects of

livestock on the persistence and vigor of native versus introduced species:

- **Introduced Grasslands.** There is a large body of research and experience showing that introduced grasses (e.g., crested wheatgrass, Russian wildrye, intermediate wheatgrass) are very resilient under moderate to heavy grazing regimes. Palatability of these perennial grasses is generally high in the spring and fall, if regrowth occurs. Forage kochia (*Kochia prostrata*) is an introduced half-shrub that is very competitive with cheatgrass and resists burning through most of the fire season. It is most palatable in the fall and winter and during the summer when it is green. A combination of species/cultivars of introduced wheatgrasses, forage kochia, and other fire resistant plants combined with appropriate grazing can create an effective fuelbreak.

  Greenstrips (strips of fire resistant vegetation strategically placed on the landscape) should be grazed and/or maintained by mechanical or chemical means to promote their effectiveness. Reduction of fine fuels in greenstrips by grazing can further improve the effectiveness of these fuels management projects by reducing fuel continuity and loads. Caution must be exercised in assuming that a grazed greenstrip is wide enough to meet fire management objectives as a larger grazed area may be required where the greenstrip is relatively narrow (e.g., 100-200 feet wide). Grazing on crested wheatgrass greenstrips or seedings is most effective when cheatgrass outside the greenstrip has cured and livestock preference shifts to the green seeded species (see Figure 10). The grazing and increased green period in greenstrips can reduce the probability of wildfire spread from cheatgrass or sagebrush into these treatments.

  An increase in wolf plants (grasses that have a high proportion of stems); soil compaction on clay and loam soils by livestock when the soils are moist; and the potential for increase in shrub species that increase wildfire hazard are all concerns with grazing at higher levels in introduced grasslands

Figure 10. Crested wheatgrass greenstrip that could be effectively grazed at this time to reduce fuels along road. Fencing would not be necessary if water was provided along the greenstrip given the difference in palatability between the crested wheatgrass and adjacent cheatgrass and sagebrush. However, concentrating livestock use on this greenstrip for even a short time may require warnings to the public of increased livestock near the road.

- **Native Grasslands.** Native grasslands in the Great Basin generally are a product of natural succession after a wildfire in intact shrub steppe plant communities or restoration of native species after a wildfire. Many native Great Basin plants are susceptible to damage from livestock grazing when it is not well thought out and carefully managed. Targeted grazing for fuels management in native grasslands in the Great Basin needs to be carefully planned and intensively managed. Timing of grazing and utilization levels must be more conservative compared to introduced grasses. Sustaining the native species while appropriately reducing fine fuels must be the primary goal. Where targeted grazing opportunities are limited in a landscape and use of native grasslands is required, a grazing plan needs to be carefully crafted to balance fuels reduction with sustainability of native grasses, regardless of the type of agreement that is made to accomplish the fuels management objectives.

- **Management Flexibility during Periods of Drought and above Average Rainfall.** Given the extremes in climate from year to year, livestock permittees and BLM rangeland and fuels management specialists must work together to ensure that fuels management objectives and vegetation sustainability goals are met regardless of levels of plant production in any one year. Livestock numbers, season of use, and duration of use should be commensurate with fuel loads and in consideration of perennial plant needs in drought or wet years in targeted grazing areas. Forage production models are available to help forecast annual production early in the growing season, which could be helpful in planning targeted grazing strategies. Of course, the appropriate modifications to the livestock permit and, if required, NEPA compliance must be followed for changes outside of existing requirements. Timely implementation of management changes required to appropriately graze cheatgrass during dry and wet years may be difficult due NEPA and administrative constraints. It may be possible to incorporate management flexibility for grazing cheatgrass to meet quantifiable fuels management objectives in the grazing permit.

Livestock Grazing Administration

- **Consultation with Livestock Operators and other Land Owners.** Livestock operators (existing permittees/leases, or other livestock operators) and other land owners (e.g., private, state, federal) must be consulted with early in the planning process during the scoping process to evaluate the feasibility of implementing targeted grazing approaches in their allotments or on their lands. This is especially important when a landscape level targeted grazing program is being considered.

  Targeted grazing will be a change from the typical management that the livestock premittee(s) are used to. When targeted grazing is conducted to manage fuelbreaks, livestock performance may decline due to frequent livestock moves and reduced

forage quality. The operators and agency personnel need to discuss and agree on trade-offs between livestock performance (if this is a potential issue) and benefits to the permittee of reduced wildfire threat in their allotment(s).

If contract grazing by an outside contractor is the best option to implement targeted grazing in an allotment, the permittee(s) in that allotment needs to agree and be fully involved in the development of the contractor's grazing plan, including the maintenance of the range improvements required to meet targeted grazing objectives.

- **Authorizing Livestock**

  - **Grazing Permits/Leases.** If the season of use or number of livestock required to meet fuels management objectives is not consistent with a permittee's current grazing permit, a grazing decision compliant with the grazing regulations would be required. In order to ensure appropriate livestock use in targeted grazing areas into the future, a long-term change to the permit/lease is recommended.

    Another option is to authorize a non-renewable permit in accordance with 43 CFR 4130.6-2. The analysis of impacts of the use made under the non-renewable permit must be NEPA compliant and may not be a good long-term approach to achieve targeted livestock use to reduce fuels. However, this approach might be appropriate to deal with wet springs with large amounts of plant production, especially in introduced grasses and cheatgrass areas in the targeted livestock grazing strips or zones. Cooperative permittees who have the flexibility in their operations to make required changes in livestock numbers should be utilized as long as their allotments and/or pastures are strategically located given fuels management objectives.

  - **Stewardship Contracting.** Stewardship contracting is another good option to accomplish fuels management goals with the grazing management program. The following guidance on using livestock for stewardship projects is taken **directly** from the "2005 Stewardship 'End Results' Contracting Guidance Version 2.0":

    - "Stewardship projects are used to accomplish one or more of the goals in P.L.108-7, Section 323, where the BLM enters into contracts or agreement for services to achieve land management goals and meet local and rural community needs. A source for performance under a contract must be selected on a best value basis. The legislation authorizes the value of vegetative material to be applied as an offset against the cost of services received and stipulates that multi-year contracts may exceed five years but may not exceed ten years." (Page 1 in Stewardship Contracting Guidance)

- "Stewardship contracting is not a replacement for the Bureau's established timber sale or grazing programs. Projects which include forage that is currently authorized under and can be removed using established grazing permit(s) or lease(s) are not suitable for stewardship contracting. Vegetative treatments which could be accomplished under the established grazing program should be addressed within the regulations of the Bureau's grazing program (43 CFR 4100) whenever possible. If it is determined that the vegetation treatment cannot be accomplished using a grazing permit or lease (or the forage has been advertised as available and no applications for a grazing permit/lease are received), the reasons must be documented in the project description prior to project approval." (Page 1)

- "Any stewardship contracting project which uses livestock for vegetation treatments should not interfere with existing grazing permit(s) or lease(s) on public lands. The authorized officer and project lead shall consult, cooperate, and coordinate with permittees or lessees, the State and all applicable interested public during the development of any stewardship project that could potentially affect the use and efficient administration of an existing grazing allotment." (Page 6 in Stewardship Contracting Guidance)

- "When it is determined that grazing permit(s)/lease(s) cannot be used to accomplish the desired vegetation management and this determination has been documented, livestock use may be authorized in a stewardship contract or agreement. The contract or agreement will establish any applicable limits and restrictions on the related livestock use. No authorizations or other provisions of the regulations in 43 CFR 4100 would be required or automatically apply to those situations. Using livestock as a vegetation treatment under the authority of stewardship contracting has no priority for renewal and cannot be transferred or assigned under any other authority." (Page 8 in Stewardship Contracting Guidance)

- "When using livestock as a vegetation treatment, the vegetation used could be considered a bid item. In this case, an open market situation exists and the contracting officer would have several options to establish a minimum product value including: 1) setting the minimum bid as zero, 2) use the private pasture rate for the applicable State, or 3) performing a market analysis to determine appropriate byproduct value if any." (Page 12 in Stewardship Contracting Guidance)

Funding Opportunities to Implement Targeted Grazing Program

Innovative approaches to implementing targeted grazing systems to reduce fuels should be explored. Specifically, opportunities to use stewardship authority and the development of agreements should be considered to assist other partners in implementing land treatments and projects to implement desired targeted grazing programs (http://www.forestsandrangelands.gov/stewardship/index.shtml).

The Range Improvement (8100) program is available to fund range improvements/projects on public lands. Contract grazing to meet fuels management objectives is another possibility to implement these kinds of programs. The BLM's Fuels Management Program is another potential source of funding for seeding fire resistant vegetation in a targeted grazing program.

Providing incentives to livestock permittees to cost-share installation of water sources, fences, and seedings should be pursued. For example, increasing use in a strips or zones in a targeted grazing area could result in rest for the remainder of the pasture. Livestock permittees could contribute to project implementation and maintenance of water developments, fences, and moving supplement locations. For this strategy to work, water, supplements, and fencing all must be managed to meet targeted grazing objectives.

Another approach to consider is to separate the targeted grazing from the normal permitted use and initiate a joint fuels management project. The agency and rancher would enter into a contract with the post-treatment fuels conditions described in the contract. The contract could be for specific periods of time when targeted grazing would be most effective. The contract does not change the grazing permit, and project-specific financial arrangements should be developed. This approach has been used for creating fuelbreaks and breaking up homogeneous fuels conditions in large cheatgrass dominated areas in Utah.

Collaborative partnerships are another source of funding and are being encouraged by BLM. For example, Utah BLM has been able to leverage additional funds and support for fuels and restoration projects working with the Utah Partnership for Conservation Development (UPCD), Utah Division of Wildlife Resources (UDWR), Rocky Mountain Elk Foundation, Joint Fire Science Program, Sportsmen for Fish and Wildlife, Mule Deer Foundation, School and Institutional Trust Lands Administration (SITLA) of the State of Utah, Questar Gas Corp., grazing allotment associations, Utah Grazing Improvement Program, and Utah Department of Agriculture and Food. Targeted grazing funding could be pursued through these types of cooperative organizations.

BLM's Healthy Landscapes program also provides funding for a wide variety of projects that improve or maintain land health at the landscape level. Leveraging Healthy Landscapes funding with other program funding such as fuels management, invasive species, 8100, etc., should be explored.

Environmental Analysis and Clearances

Changes in the grazing permit (terms and conditions) require an Environmental Assessment and decision, while implementing new pasture fences, water sources, grazing systems, or fuels management projects require NEPA compliance and a grazing decision. NEPA options include Categorical Exclusions (CX), Environmental Assessments (EA), Determination of NEPA Adequacy (DNA), and Environmental Impact Statements (EIS). At the allotment or management unit scale, an EA or CX may be appropriate. A DNA is used when an existing NEPA document has already analyzed the proposed action. DNAs may be applicable to situations where the specific project was anticipated by a broader scale NEPA analysis or where, coincidentally, a previous NEPA analysis was done for the same kind of project. At the landscape scale, depending on issues and size of area, an EA or EIS may be appropriate. Guidance on the preparation of CXs, EAs, and EISs is found in BLM NEPA Handbook (H 1790-1). This handbook can be accessed online at the following address: (http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_handbook.Par.24487.File.dat/h1790-1-2008-1.pdf). Contact your NEPA Coordinator for updates on NEPA actions and revised guidance.

- **Categorical Exclusions.** Categorical exclusions (CXs) are categories of actions that Federal agencies have determined do not have a significant effect on the quality of the human environment (individually or cumulatively) and for which, therefore, neither an EA nor an EIS is required (Chapter 4, H1790-1 Handbook). A CX is a form of NEPA compliance, without the analysis that occurs in an EA or an EIS. It is not an exemption from the NEPA. CXs, where appropriate, can save time and money when implementing certain targeted grazing activities. Any proposed treatment or authorization must be subjected to sufficient review to determine if any of the criteria apply in the NEPA Handbook listed in Appendix 5, *Categorical Exclusions: Extraordinary Circumstances.* If any of the extraordinary circumstances apply, an EA or an EIS must be prepared. CX's are occasionally updated or discarded; therefore, check with the appropriate environmental coordinator for current CX's in effect. CXs that may apply to authorizing or implementing targeted grazing include:

    - Placement and use of temporary (not to exceed one month) portable corrals and water troughs, providing no new road construction is needed (Appendix 4, D-2 in BLM NEPA Handbook).

    - Temporary placement of a pipeline above ground (Appendix 4, E-18 in BLM NEPA Handbook). This CX may apply to the temporary placement of livestock pipeline (black poly) to carry water to a strategically placed tank.

    - Construction of small protective enclosures, including those to protect reservoirs and springs and those to protect small study areas (Appendix 4, J-9 in BLM NEPA Handbook). This CX could be used to fence reservoirs or

springs to control livestock grazing for a targeted livestock grazing program as long as the exclusion also benefitted the integrity of these developments or natural water bodies.

- **Environmental Assessments and Environmental Impact Statements**. The decision on whether an EA or EIS is required for a targeted livestock program to reduce fuels and wildfires is dependent, in part, on significance of effects, size of project areas, and issues within the area proposed for project implementation. Guidance on making this decision can be found in Chapter 7 of the *BLM NEPA Handbook.*

- **Tiering to other NEPA Documents.** You may tier to a NEPA document for a broader action when the narrower action is clearly consistent with the decision associated with the broader action. Use of livestock as a biological control technique is addressed in the *2007 Vegetation Treatments on BLM Lands in the 17 Western States Programmatic EIS* (http://www.blm.gov/wo/st/en/prog/more/veg_eis.html). The emphasis on using livestock as a biological control agent in this document is on invasive species control. Using livestock to control invasive annual species (e.g., cheatgrass, medusahead wildrye) has been addressed in this document; therefore, tiering of site-specific EAs to this programmatic EIS is appropriate. This tiering can be particularly useful in the context of the cumulative impact analysis in the programmatic Vegetation Treatment EIS.

- **Litigation and NEPA.** Using the appropriate NEPA approach is essential as the use of targeted grazing to strategically manage fuels could be controversial and subject to litigation. Good communication with our partners and the public early in the NEPA process is important. The following list contains some actions to improve the defensibility of NEPA (from Brad Grenham, solicitor in Oregon in 1998):

    - Support findings with clear and detailed analysis of evidence. Cite studies, research, or monitoring data and other environmental documents.
    - Analyze a range of alternatives covering the full spectrum that will meet the purpose and need of the project.
    - Include an appropriate cumulative impact section starting with the proposed action that includes connected or similar past, present, and future actions as well as actions with similar impacts. To provide the big picture, summarize and incorporate by reference associated analysis in other documents. In order for the EA/FONSI to be adequately supported, the BLM must analyze mitigation measures in detail and explain how effective the measures would be.

Planning

- **Land Use Plans.** Targeted livestock grazing in strips or zones, whether at a project, allotment (including but not limited to Allotment Management Plans), or landscape level, must be consistent with the current land use plan (LUP). Few if any BLM LUPs specifically discuss targeted grazing or targeted grazing for fuels management. One possible approach using the LUP process is to include a targeted grazing component in an alternative when a LUP is updated or rewritten. Then, individual project NEPA analysis could be done with DNAs. This approach has been used to address cheatgrass by analyzing non-renewable grazing with specific criteria and triggers in new LUPs. An existing plan may be amended to make changes in the terms, conditions, and decision of an approved plan. The amendment process is tailored to the anticipated level of public interest and potential for significant impacts, and it requires preparation of a Federal Register Notice followed by an EA or EIS. LUP Guidance is found at: (http://web.blm.gov/internal/wo-500/directives/dir-hdbk/hdbk-dir.html).

- **Fire and Fuels Planning.** All units that have burnable vegetation are required to have Fire Management Plans (FMPs). Most plans were completed in 2004 and have subsequently been updated. These plans address fire suppression and fuels objectives. In several locations, including Utah, the FMPs have associated LUP Fire Management Amendments, including NEPA, and are now in effect.

  The purpose of the FMP is to identify and integrate all wildland fire management guidance, direction, and activities required to implement national fire policy and fire management direction from Resource Management Plans (RMPs). Overall direction from the RMPs and their associated implementation plans allows fire to be restored as an integral part of ecosystems to meet resource management objectives and to improve protection of human life and property through the reduction of hazardous fuels. The FMP allows management direction to be easily accessible by fire and resource personnel. It highlights management direction to facilitate development and implementation of fire management strategies.

  Where appropriate, the use of targeted grazing to strategically manage hazardous fuels should be included in these management strategies. The role of targeted or traditional grazing on proposed or existing fuels management projects needs to be considered to ensure that the effectiveness and longevity of fuels management projects can be maintained.

Integration into Fire Suppression Activities

Knowledge of location and condition of targeted livestock grazing fuel management areas is important when evaluating wildfire potential and in planning fire suppression strategies during a wildfire. Current status and locations (spatially mapped) of these projects should be available to resource specialists who may be resource advisors, fire managers, and fire dispatchers. Current status includes information as to whether the current year's fuels management objectives are met. The status of targeted grazing projects may require updating throughout the fire season depending on precipitation patterns, growing season conditions, and livestock grazing effects on fuels.

Monitoring and Evaluation

Since targeted grazing strategies to reduce fuels is a relatively new and potentially contentious approach, a sound monitoring and evaluation program is essential. An adaptive management approach based on good monitoring and evaluation data will promote adjustments in management and information sharing across the Great Basin:

- **Implementation Monitoring.** Implementation monitoring answers the question, "Did you do what you said you would do?" In other words, were the grazing modifications (e.g., season of use, class of livestock, numbers) required to implement the targeted grazing program accomplished? Were the treatments, range improvements (e.g., fences, new water developments, changed water locations), and supplement placement implemented according to the targeted grazing strategy approved for a project, allotment, or landscape? Implementation monitoring should be documented and maintained in the appropriate monitoring files and recorded in various reporting databases (e.g., NFPORS, RIPS).

- **Effectiveness Monitoring.** Effectiveness monitoring measures or rates the success of the treatments, grazing plans, and fuels reduction in the area where the targeted grazing is implemented. There are four effectiveness components that are recommended for monitoring in all targeted grazing programs: 1) Fuels reduction, 2) Maintenance of native or seeded specie, 3) Modeling to predict effectiveness, and 4) Effectiveness of targeted grazing pastures in modifying actual wildfire behavior.

  A key component to informative effectiveness monitoring is selecting conditions, indicators, or attributes that really measure the objective and are affected by the implemented management. While this sounds obvious, we often have partial or limited knowledge of the mechanisms between all of the moving parts of a treatment and the resources and values it will affect. So, we fall back to a familiar monitoring method. This may or may not adequately address effectiveness of a specific targeted

grazing treatment. The better we can explain the relationships between the objective, management action, and how the monitoring documents those relations, or a component of those interactions, the more likely that the selected effectiveness monitoring will be informative.

There is a Department of Interior CX that covers monitoring defined as "Nondestructive data collection, inventory (including field, aerial, and satellite surveying and mapping), study, research, and monitoring activities" in Appendix 3, 1.6 in following handbook: (http://www.blm.gov/style/medialib/blm/wo/Information_Resources_Management/policy/blm_handbook.Par.24487.File.dat/h1790-1-2008-1.pdf).

Required components of a targeted grazing monitoring program to reduce fuels includes:

- **Fuels Reduction.** Since the objective of the targeted grazing program is to strategically reduce fuels in strips or zones, fuel loads, or a surrogate for fuel loading (e.g., biomass) is an essential attribute to monitor. Three techniques are recommended to monitor fuel reduction:

  - **Biomass.** Biomass as defined in this guidance is the total amount of current or previously living plants (grass, forbs, shrubs, trees, and succulents) above ground. It includes current and previous years' production of all plants that are still standing (e.g., standing dead) and not detached plant materials contacting the soil surface (e.g., litter). A good reference for protocols to determine fuel loads (biomass) can be found in Brown, J. K., R. D. Oberheu, and C. M. Johnston (1982) titled "Handbook for inventorying surface fuels and biomass in the Interior West" (http://www.treesearch.fs.fed.us/pubs/29401).

    Biomass should not be confused with total annual production, which is a measure of the net quantity of above-ground vascular plant material produced within a year. Total annual production is measured by the Ecological Site Inventory protocol and is not synonymous with biomass, which represents all live and standing dead fuels, a variable that is required in most fuel models. Biomass data should be collected by fuel size classes used in fuel models (see previous reference).

    A good technique to visually assess the removal of biomass in a targeted grazing area is the establishment of a couple of utilization cages that would allow managers and livestock operators to see the difference in biomass (and stubble height) with and without grazing. If used, utilization cages should be moved after the current grazing period and before the next year's initiation of

grazing.

- **Stubble Height.** Stubble height, as used in this guidance, is the height of herbaceous (grasses and forbs) plants at a point in time (e.g., height of residual vegetation). Stubble height measurements are a relatively quick and easy method to measure the reduction of fuel heights as grazing is taking place or at the end of a grazing season. Stubble height measurements (what has been left at the beginning of the fire season) are a better measure relative to fuels than are utilization studies (what has been used). Utilization studies should not be substituted for stubble height measurements to monitor fuels objectives in targeted grazing treatments.

  Stubble height objectives should be developed for annual species and perennial grasses and forbs in targeted grazing areas. A lower stubble height for annual grasses compared to perennial plants is appropriate as the fuels management objective in areas with cheatgrass dominance should focus on maximum reduction of fine fuels. In mixed cheatgrass and native or seeded perennial plant pastures, appropriate stubble heights should be developed for all species or functional/structural plant groups. The stubble height protocol and field form can be found in *BLM Technical Reference 1734-3, Utilization Studies and Residual Measurements* (http://www.blm.gov/nstc/library/techref.htm). This protocol is a good method for livestock permittees to monitor progress towards fuels management objectives , especially throughout the growing season. Frequent rechecks of stubble height may be required during a long growing season to ensure that target stubble heights are obtained. It should be noted that stubble height is not a component of fuel models.

- **Remote Sensing-Landscape Performance Anomalies.** The Normalized Difference Vegetation Index (NDVI) can be used to estimate primary productivity and Leaf Area Index (ratio of total upper leaf surface of vegetation divided by the surface area of the land on which the vegetation grows). A model has been developed by scientists at the USGS's Earth's Resources Observation and Science system that takes the imagery from an Advanced Very High Resolution Radiometer (AVHRR) satellite and identifies area of "over-performance" (higher primary production) and "under-performance" (lower primary production). This model was applied as a part of the interagency effort described in the report *Interactions Among Livestock Grazing, Vegetation Type, and Fire Behavior in the Murphy Wildland Fire Complex in Idaho and Nevada, July 2007*. A comparison was made using pasture performance anomaly data and the actual use for corresponding pastures yielding a R^2 =0.74. The potential exists to monitor gross fuels removal objectives over a landscape using this technology.

- **Impacts of Grazing on Perennial Plants and Soil**

  - **Foliar Cover.** Foliar cover is a good attribute to measure to determine if native or seeded species are being maintained or if undesirable species (e.g., noxious weeds) are entering or increasing in a targeted grazing area. Cover also provides documentation of bare ground over time which is closely tied to erosion potential and openings for invasive species. The recommended sampling protocol is the line-point intercept as described in the *Monitoring Manual for Grassland, Shrubland, and Savannah Ecosystems* (http://usda-ars.nmsu.edu/monit_assess/monitoring.php).

  - **Actual Use.** The number of AUMs used in the **targeted grazing area** should be documented by documenting allotment/pasture, number of livestock, and period of use (start and end date). If possible, these figures should closely fit the actual use of the targeted grazing area as opposed to the entire allotment or pasture. Actual use data is essential in order to understand cause and effect relationships between livestock grazing and fuels modification. If fuels, plant community, or other resource objectives are not being met, actual use data may help explain why the grazing prescription isn't working as expected or if the treatment isn't being implemented as required. Actual use can assist in making changes in livestock management to meet objectives in subsequent years. It may be difficult to accurately determine actual use on unfenced targeted grazing strips or zones in larger pastures. In these situations, stubble height or biomass may be a better measure of livestock use than actual use.

  - **Soil Characteristics.** Effects of targeted grazing programs on several soil characteristics, compaction layer, and soil structure should also be monitored as some soils are subject to degradation due to livestock impacts, especially when soils are wet. A compaction layer is a near-surface layer of dense soil (increased bulk density) caused by repeated impact on or disturbance of the soil surface. Compaction can be assessed qualitatively using *Interpreting Indicators of Rangeland Health, Version 4* (http://www.blm.gov/nstc/library/techref.htm) or monitored quantitatively with impact penetrometers as described in the *Monitoring Manual for Grasslands, Shrublands and Savannahs.*

    Soil structure (size and shape soil peds) can be degraded by concentrated livestock trampling over a period of time. Loss of soil structure and the biological activity of the surface soil can impact erosion and the ability of soil to support plant life. A soil stability kit (http://usda-

ars.nmsu.edu/monit_assess/monitoring.php) can be used to objectively monitor the ability of the soil surface to resist erosion. Soil compaction and loss of soil structure can lead to reduced water infiltration rates and reduced plant rooting depth resulting in a loss of desirable plants, a change in plant composition, or an increase in undesirable plants.

- **Weather/Climate.** Precipitation and temperature data, especially during the growing season for herbaceous species, are closely correlated to total above-ground biomass production. Spring temperatures and precipitation impact the emergence and loading of cheatgrass with late spring and early summer temperatures, precipitation impacting emergence of native warm season grasses, and the curing of live fuels. Weather conditions during the fire are especially important, including temperature, relative humidity, and wind speed. Fire weather conditions are important in running models and understanding the effectiveness of the targeted grazing program when a wildfire contact occurs.

- **Observations, Photographs, and Plant Vigor.** During the data collection process, several photographs should be taken from a photo point with an established GPS coordinate. End of grazing period photographs are especially important to take for documenting plant and soil conditions just before the fire season begins.

  Observations should be recorded outside the immediate study area to document noxious weeds that may be outside this area. The more heavily disturbed areas should receive special attention given the susceptibility of these areas to weed entry.

  Observations of plant vigor of desirable herbaceous species should also be recorded. Biomass, seed stalk production, and plant basal diameter and/or height are several indicators of plant vigor that are easily described or measured. Techniques to measure vigor are described in BLM Technical Reference 1730-1 "Measuring and Monitoring Plant Populations (http://www.blm.gov/nstc/library/techref.htm). Vigor, along with the other studies described above, can provide a warning of loss of sustainability of the desirable perennial plants in a targeted grazing area. Vigor is also a visual indicator that livestock operators can use (along with stubble height) to fine-tune management of targeted grazing projects.

- **Modeling Fire Behavior.** The effectiveness of targeted grazing in reducing fuels and wildfires can be evaluated by utilizing biomass and stubble height data to model wildfire behavior (e.g., rate of spread, flame length) under different environmental and topographic scenarios. This same data collected from nearby pastures on the same ecological site that are not in the targeted

grazing plan can provide a direct comparison of the expected fire behavior in a traditional grazing plan versus the targeted grazing plan. Additionally evaluating actual vegetation, weather, and fire data in comparisons to model runs can help fine-tune a model to site-specific conditions.

These models include BehavePlus, FARSITE (http://www.firemodels.org/content/view/112/143/), and FlamMAP (http://www.firemodels.org/content/view/14/28/). The BehavePlus fire modeling system is a PC-based program that is a collection of models that describe fire behavior, fire effects, and the fire environment. It is a flexible system that produces tables, graphs, and simple diagrams and can be used for a multitude of fire management applications. BehavePlus calculations are for a set of uniform conditions. With BehavePlus, the user looks at the effect of a range of values on the results. There are no GIS layers.

Modeling of the impacts of grazing on fire behavior should be able to occur using the dynamic fuel models (RMRS-GTR-153) and the two above models along with adjustments within the model. The Short, Sparse Dry Climate Grass (Dynamic) GR1 fuel model accounts for sparse grass, generally short, caused either naturally or by grazing. The Low Load, Dry Climate Grass-Shrub (Dynamic) GS1 fuel model could also be used to look at grazing impacts in areas with a greater shrub component.

FARSITE (fire area simulator) adds a spatial component (GIS layers). FARSITE looks at an ignition point and spreads the fire from that point outward based on environmental and topographic input. Conditions vary in both space and time. The fire behavior in a pixel depends on the adjoining pixels and the time it burned.

FlamMap (fire mapping and analysis system) also adds a spatial component where point calculations are done for each pixel. Input data is similar to FARSITE. FlamMap projects fire behavior elements across the entire landscape vs. taking it from one point. Conditions are constant in time but vary in space.

Models can also be used to establish a fuel load objective for a targeted grazing area under selected weather conditions (e.g., wind speed, humidity, and temperature). FSPro may provide a better evaluation of targeted grazing projects than FARSITE as it is a little more dynamic. FlamMAP models with static weather and fuel moisture parameters. FARSITE uses variable weather and fuel moisture over time and is most useful for short-term projections. FSPro is based on a user selected number of FARSITE runs.

It is clear that fire modeling is an evolving tool and will require a careful evaluation and adaptation to evaluating targeted grazing projects. Also, expertise to run these models is a scarce skill in BLM that will also need to be addressed as targeted grazing projects increase.

- **Wildfire Contact with Targeted Grazing Area.** The true test of the effectiveness of a targeted grazing program can be evaluated when a wildfire comes in contact with one of these project areas. The following variables should be documented immediately after the wildfire by the fire management and local Field Office personnel:

  - Fire weather conditions at time of fire contact with targeted grazing area. The best information is from a NOAA weather station or a RAWS station if they are close to the targeted grazing area. Fuel moisture should be collected at this time (e.g., clip, weigh, dry, and weigh again).

  - Fuel loads inside and outside of targeted grazing area (if fire did not consume all fuels).

  - Other variables that should be documented include time of day, suppression activities (e.g., backfire, retardant drop) in the targeted grazing area, other fire activity in the area, fire size, ignition date, and adjacent fuels.

  - Fire behavior parameters, including flame length and rate of spread in both the targeted grazing area and adjacent areas.

  - Documentation of the success of the targeted grazing area in stopping or modifying wildfire behavior. Describe reasons that the targeted grazing area was or was not successful in reducing fire spread or modifying fire behavior.

- **Sharing Results.** It is important that the results from the various fuels management targeted grazing projects across the Great Basin be widely shared. A website will be set up where case studies, experiences, monitoring, and evaluations can be easily accessed and used. This website will be located where this technical guidance is based so that the guidance can be rapidly modified as new information is received.

Conclusion

The use of targeted livestock grazing to reduce fuels within strategic strips or zones can help reduce wildfire impacts. Accomplishing this goal is a formable challenge given the many climatic, biological, wildfire behavior, and livestock management variables that may affect the outcome. It will require clearly defined fuels management objectives that can be accomplished in whole or in part using livestock. The overall goals of targeted grazing strategies may vary. They could include breaking up large expanses of relatively homogeneous fuels or creating a buffer of reduced fuels strategically placed to maintain high resource values adjacent to or near areas of high wildfire potential.

A number of other societal, economic, management, biological, and legal issues and values may also affect how fuels can be managed. The process to design and implement an effective targeted grazing program to manage fuels should address:

- Clearly defined fuels management objectives utilizing targeted grazing in strategic strips or zones in multiple pastures or allotments.
- The issues surrounding implementation of targeted livestock grazing to manage fuels.
- What success will look like.
- Alternative management approaches weighing cost, effectiveness, partner cooperation, environmental concerns, etc.
- Appropriate indicators/conditions and associated metrics that will be monitored to determine success/effectiveness.
- Long-term treatments and management needed to maintain the effectiveness of targeted grazing strips or zones.

There are no cookbooks for implementing a successful targeted grazing program to reduce fuels and therefore wildfires. Design and implementation will require a combination of good science, local experts (agency, ranching, academia, extension, environmental, and others), and the results from monitoring and evaluation of previous projects. An adaptive management approach is essential given the high degree of variability in the environment, both spatially and temporally, and the management needed to reach targeted grazing objectives. Targeted grazing to manage fuels is not the solution to the wildfire problem in the Great Basin. It is one of many tools that can be used to reverse the downward spiral that invasive species and wildfires are causing in the Great Basin.

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