

PRESCRIBED HERBIVORY FOR VEGETATION TREATMENT PROJECTS

An informational document prepared by the Range Management
Advisory Committee

Contributors

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DRAFT

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OVERVIEW

This document was produced by the Range Management Advisory Committee (RMAC) to provide assistance in implementing prescribed herbivory projects by foresters in the CAL FIRE Vegetation Management Program (VMP). It also serves as a resource for private landowners, local governments, and other stakeholders contemplating fuel reduction projects consistent with the Vegetation Treatment Program Environmental Impact Report (VTP Program EIR). The VTP Program EIR envisions using a combination of prescribed fire, mechanical treatments, manual treatments, prescribed herbivory, and herbicides to strategically reduce hazardous fuel loading within the State Responsibility Area (SRA). The information included in this document should aid the VMP Foresters in identifying environmental conditions where prescribed herbivory may be the best treatment alternative in terms of cost and environmental impact to achieve the fuel reduction objectives. While aimed at Cal Fire VMP implementation, the information contained herein also applies to anyone seeking to implement a prescribed grazing program for vegetation management.

Prescribed grazing, prescribed herbivory, contract grazing, service grazing, precision grazing, and targeted grazing are all approaches to managing vegetation using grazing or browsing animals, each with distinct applications and objectives. These practices rely on the distinct use of, and/or combination of management, infrastructure and technology strategies to achieve specific ecological, economic, safety, or land-use goals. Under the VTP PEIR, the intended outcome is to utilize domestic livestock to reduce fuel loads, mitigate wildfire risks, and enhance landscape conditions through strategic grazing practices that integrate advancements in animal management, fencing, monitoring tools, and operational planning.

[*Note:* The current mitigations included in the CAL VTP are not specific to grazing and create challenges for the practical implementation of grazing projects on the ground.]

The primary types of domestic livestock considered for vegetation management include sheep, goats, and cattle, though other herbivores may also be used strategically to achieve similar objectives.

In recent decades, sheep and goats have been used more frequently in VTP and Wildland Urban Interface (WUI) projects due to their grazing and browsing behaviors, wider dietary preferences, and agility in difficult terrain. Small ruminants have higher labor demands which allows for more precision in addressing specific vegetation and management goals. Additionally their shorter reproduction cycle provides greater flexibility for seasonal targeted grazing.

Cattle have been used more often in larger, open landscapes such as grasslands and woodlands due to their diet preferences and potential for extended treatment periods. Given the right conditions—including production goals, infrastructure, labor availability, and timing—cattle, like small ruminants, can be highly effective in targeted grazing applications.

Sheep, goats, and cattle can each be used independently or in combination, depending on project size, vegetation type, and management goals. Each species is capable of accomplishing work on its own, and in some cases, a mix of species may be beneficial. Livestock grazing can be an effective tool for establishing and maintaining fuel breaks in grass and shrub fuel types while also reducing ladder fuels and fine fuels across the landscape. Effective grazing requires careful consideration of animal species, stocking rates, and timing to achieve desired outcomes.

Determining the goals and objectives of the user is critical in evaluating the potential use of prescribed herbivory, also referred to as “prescribed grazing,” “targeted grazing” or “service grazing.” In general, CAL FIRE-initiated projects will include hazardous fuel reduction as the primary goal of the project. Resource protection and habitat enhancements, such as noxious weed treatment, may be secondary goals of projects. This paper provides guidance on the following:

- Benefits and limitations of using livestock
- Factors to consider in a site evaluation
- General animal characteristics
- Best management practices
- Contracting considerations
- CEQA considerations
- Resources for more information

BENEFITS

Prescribed herbivory can offer a variety of benefits in comparison to other proposed vegetation treatments included in the VTP Program EIR. Herbivory is a traditional method of biomass removal. In addition to the management of fine fuel loads to achieve desired conditions for wildfire, prescribed herbivory may also:

- Improve or maintain desired plant species
- Improve or maintain quantity & quality of forage

- Improve or maintain water quality & quantity
- Improve or maintain riparian & watershed function
- Reduce soil erosion
- Improve soil health
- Improve or maintain the quantity, quality, or connectivity of food and/or cover available for wildlife

Consider using prescribed herbivory in the project when the following concerns arise:

- Proximity to structures, compared to risks of using prescribed fire or mechanical treatments
- Steep slopes, compared to prescribed fire, manual, or mechanical treatments
- Soil compaction and surface disturbance, compared to mechanical treatments
- Noxious weed control, compared to manual or mechanical treatments
- Air quality and liability, compared to the use of prescribed fire
- Noise, compared to mechanical and some manual treatments

LIMITATIONS

There may be environmental, social, or project constraints that make prescribed herbivory an inappropriate treatment to consider, including, but not limited to, the following:

- Timing constraints on treatment implementation, especially in relation to the size and maturity of the vegetation
- Browsers prefer to eat the leaves and shoots, leaving larger woody material (one inch or larger) behind. Seasonal variations also affect the palatability and nutritional quality of vegetation.
- Goats may eat the bark of some tree species, which can kill the tree by girdling. This can be controlled through appropriate stocking rates, management practices on-site, and limiting their duration on-site.
- Herbivory may only remove live one- and ten-hour fuels (less than about one inch). Prescribed grazing may be used in conjunction with other vegetation

treatments if larger materials need to be treated or a high quantity of dead fuels is present on-site.

SITE EVALUATION

Several characteristics and parameters of the site must be evaluated prior to designing a grazing/browsing management plan, including but not limited to the following:

VEGETATION CHARACTERISTICS

Prescribed herbivory should be considered when the targeted vegetation to be reduced or modified is grass, forbs, or shrubs. Herbivores may also be appropriate in forested vegetation types when the targeted vegetation is shrubs and brush, such as in fuel break maintenance. Vegetation characteristics to evaluate include:

- **Species Composition:** Understanding the vegetation species on the ground will aid the grazing operator in identifying the appropriate animal for the job. Any noxious species on-site should be identified. Any potentially toxic species to livestock should also be identified. This information may dictate project timing by considering when the vegetation is most palatable, if the noxious weeds can be grazed before seed set to minimize seed production, or avoiding noxious weeds that have already set seed to minimize spread.
- **Height:** Goats can browse only as high as they can get their mouth when standing on their hind legs, or about 7 feet. Any vegetation higher than this is unlikely to be adequately grazed to meet fuel reduction goals.
- **Diameter:** Goats can browse shrub and tree stems up to approximately 1 inch in diameter. Material of greater diameter will likely be left on-site, denuded of any smaller stems, branches, and leaves.
- **Density:** The relative density or quantity of the vegetation to be removed or modified will aid in determining the number of animals and the length of time necessary to complete the job.

ENVIRONMENTAL CHARACTERISTICS

Herbivores can impact resources if not carefully managed. Key concerns include watercourses, wildlife habitats, cultural sites, and valuable vegetation. Special consideration should also be given to neighbors and residents when planning a project. Sensitive areas must be identified, marked on maps, and protected through clear mitigation measures. These measures should be included in the treatment plan and

communicated to the herder and project manager, ideally through a pre-operational field visit.

INFRASTRUCTURE

Moving herbivores to the site generally requires trucks and trailers. Once the animals are onsite, water and containment to the project site and potentially within the project to the desired vegetation must be addressed.

- **Roads:** Transportation of herbivores generally is by tractor trailer or pick-up truck with livestock trailer typically between 18'-30', depending on the number of animals. It is important to note if the site has an adequate turnaround and loading/unloading area to facilitate large truck traffic. This does not have to be directly at the project site as animals can be moved moderate distances on foot to the project area. Also note if there are access roads throughout the project area, and if the loading area will be different than the unloading area.
- **Water:** All herbivores require water onsite. Sheep and goats consume up to 2-gallons per animal per day, whereas cattle can require up to 25-gallons a day depending on climatic factors. Water can be from a water supply line to a portable water trough, an on-site stock pond, mobile water tank and trailer, or can be shipped in by a water tender. All available water sources in the general project vicinity should be identified during project development.
- **Containment:** Herbivores will need to be contained to the project boundaries or smaller subunits within the project area to control animal movement. This containment aids in managing the intensity of site impact and duration of grazing in the project area, protects on and off-site sensitive resources, and helps to protect the herbivores themselves from predators. Cattle, sheep, and goats require fencing and typically herding dogs are utilized; in addition, sheep and goats will generally utilize guard and herding dogs and an on-site herder. Portable electric fencing is a common tool for grazing operators, but any existing fences or barriers to animal movement should be identified.

SCALE

The size of the project and the amount of vegetation to be removed will have a strong influence on the economics of prescribed herbivory projects. As with mechanical treatments, the move-in and set-up costs are somewhat fixed regardless of project size. Herbivores also become more productive once they are familiar with the vegetative characteristics of the site. Larger projects will likely result in bids that are cheaper per acre or per animal day than smaller projects. However, small projects may still be competitive with other vegetation treatment methods, so the size of the project should not

discourage the use of herbivores. The contracting section below goes into further detail on this topic.

ANIMAL CHARACTERISTICS

Generally, animals can be divided into two categories, grazers and browsers; each category may overlap significantly depending on species, stage of life, availability of forage, animal genetics, or previous training of animals. Cattle and sheep fall into the category of “grazers,” and tend to prefer the bulk cellulose of grasses and forbs. Goats fall into the broad category of “browsers,” and tend to feed on more readily digestible leaves and shoots of shrubs and trees within their reach. All these animals have a limited ability to shift among these feeding strategies.

Utilizing multiple species together on the same site can be very effective for fuel reduction projects, particularly when the target vegetation is a combination of grass, forbs, and shrubs. Taking advantage of the dietary preferences of each herbivore can result in a more complete fuel reduction project. Grazing animals such as sheep or cattle will consume the grass and forbs, while browsing animals such as goats will consume the woodier material within their reach (up to 7 feet high).

Fuel reduction will also be dependent on the stocking rate, or the number of animals per unit area (density), over the specified lengths of time. Prescribed herbivory is generally performed at high stocking densities for short periods of time to encourage the animals to compete amongst each other for limited resources. This strategy encourages the animals to uniformly consume all the vegetation present and not preferentially browse and graze on only the most nutritious vegetation available. This strategy also aids in animal health as the livestock balance the amount of nutritious and less-nutritious vegetation in their diet over short time periods. It is not uncommon to see stocking rates equivalent to 450-900 of sheep or goats per acre for a 24-hour period.

Consumption per day of both grazers and browsers can be calculated by the following general rules:

- Goats will eat approximately 3% of their body weight per day of the dry matter weight of the forage being consumed.
- Sheep, horses, and cattle will eat approximately 2% of their body weight in dry matter per day.

A 100-pound goat would consume approximately 12 pounds of green brush per day. If the project objective is to reduce one ton (2,000 pounds) of brush per day from a specified area, it would take approximately one hundred seventy (170) 100-pound goats to accomplish that objective. By calculating the amount of biomass to be removed, the proper number of animals and length of the foraging period can be calculated. This guidance will help during the contracting phase of project development. There is not a typical mob size for multi-species systems; however, one herder can handle up to 1,500 head of goats and sheep and one semi-truck can transport approximately 400-450 goats and sheep, 35 cows, or 70-100 stockers (calves). The ratio of grazers to browsers can be tailored to the targeted vegetation to be removed.

Forage species being targeted for herbivory may not always provide a nutritionally adequate diet for the animals; therefore, mineral, or protein supplements may be required to maintain animal health and productivity. Toxic plants can be a challenge, particularly with sheep. Goats seem to be frequently resistant to most serious toxins but may limit their intake of scrub or forbs depending on the time of year or elevation. See University of California Agriculture and Natural Resources publication on livestock poisoning by plants in California (Forero et al. 2011). The experienced contract grazer will be able to identify any special constraints on the site and may be able to suggest seasonal project timing that will best meet the project's objectives.

BEST MANAGEMENT PRACTICES

There are important best management practices to integrate into the design of a prescribed herbivory project to minimize or mitigate potential environmental or social impacts.

- Identify and establish appropriate buffer zones around environmentally sensitive areas such as riparian zones, sensitive plants, threatened or endangered animal habitat and archaeological resources.
- To prevent introduction of seeds from undesirable plant species to the site, consideration should be given to where the animals are coming from, and whether viable seeds of undesirable species are present. If this is the case, the herd should be fed a weed free diet for three days prior to being introduced to the grazing site. Any supplemental feed brought on site should be free of noxious weeds.
- Use the highest appropriate stocking density to achieve uniform utilization of the targeted vegetation.

- Post signs informing public of danger of electric fences and unleashed guard dogs when the project area is open to the public. Discuss public interactions with the on-site herder and grazing project manager.
- Conduct appropriate public outreach so that the public will understand the project objectives. The general public will be very interested in what the animals are doing and why. Consider project signage or a one-page pamphlet or brochure available on-site describing the overall project, its objectives, and how herbivory is helping to achieve those objectives.
- Confirm that the grazing operator has well thought-out animal care procedures and protocols in place to ensure the animals are cared for in a responsible, humane fashion (ample stock watering, safety from predators, and careful animal observation and action for accidents, sickness or disease).
- Consultation with Certified Range Managers (CRM) when rangeland practices are being applied on forested landscapes or as appropriate.
- Develop a monitoring program that determines the effectiveness of the grazing/browsing program compared to the original planned results.

CONTRACTING

The following key points should be addressed in a contract with the grazing operator. A sample contract [A36] and Request for Proposals (RFP) are included in the appendices of this document for further guidance on this subject.

FINDING THE RIGHT CONTRACT GRAZING OPERATOR FOR THE PROJECT

There are a number of contract grazing outfits [A37] performing prescribed herbivory projects to meet specific objectives (ex. fuel reduction, invasive weed control, etc.), most often using some combination of goats, sheep and sometimes cattle. The size and scale of these operators vary, from smaller operations using only a few dozen head to commercial operations with upwards of 2,000 head performing year-round grazing services.

Determining the project's acreage and the targeted vegetation type and quantity will help determine the best contract grazer for the project. Often a Request for Proposal (RFP) or Request for Quote (RFQ) defining the project location and scope is announced to the general public and contract grazers are able to provide a bid or quote on the project (see Appendix A for an example RFP). Through this process the CAL FIRE project manager can determine which operator may be the best fit for the project.

A list of contract grazers can be found online through the links provided at the end of this document.[A38] Please take note that these are not the sole operators performing these services. Active contract grazers in the area can be found by contacting other organizations in the region that use prescribed grazing as a management tool. Some organizations to check with are local Resource Conservation Districts (RCD), Fire Safe Councils (FSC), or local city and county public works departments.

SITE ASSESSMENT

Before a contract grazer is able to develop a quote and scope of work for a project, it is common for the project proponent to schedule a tour of the site(s) that are being proposed for grazing. This allows the contract grazer to assess a variety of factors to determine the appropriate number of head, species and ratio of animals needed, water access points, fencing type required, truck and trailer access, and camp trailer sites (when an on-site herder is necessary). Inviting proposed contract grazing operators to become familiar with the site will allow for the most accurate cost quote and approach to achieving the project's goals using prescribed grazing. Consider designating a day during the RFP period for potential bidders to tour the project site.

Cost Structures for Grazing Projects

The highest demand months for contract grazers tend to be during the end of the spring growing season through the late summer months and sometimes early fall, depending on annual rainfall. This also varies from region to region. During those heightened demand months contract grazers often charge a premium for their services. Conversely, during the off-season months of fall and winter service fees may be less as the demand for contracts.

Factors Influencing Cost Structure

When requesting a cost structure from a grazer for a grazing project, several key factors influence the fee development:

- **Timing** of the project
- **Project Duration**
- **Project Size** (acres)
- **Number of Livestock** required
- **Number of Personnel** involved
- **Access** to and within the project site
- **Water Availability**
- **General Project Complexity**
- **Mobilization & Livestock Transportation Costs**

Prices fluctuate yearly, seasonally, and among different grazing contractors. To determine a competitive rate, it is recommended to request multiple quotes from various grazers.

Cost Structure Options

1. Rate per Acre

This structure is beneficial when the landowner or manager has a precise estimate of the acreage to be grazed. The grazer provides a per-acre rate, allowing for budget adjustments by increasing or decreasing the number of acres to be treated. Public RFPs/RFQs/RFBs often request bids in this format.

Example Bid: (rates are examples only)

Site	Acres	Rate per Acre	Total Cost
Site 1	14	\$995	\$13,930
Site 2	6	\$1,005	\$6,030
Site 3	16	\$995	\$15,920
Total Project Cost	36 acres		\$35,880

Additional costs such as transportation may apply.

2. Total Project Bid

In this scenario, the total number of acres is provided, and the grazer develops a comprehensive bid based on internal cost assessments. This method is beneficial for projects with multiple grazing units of varying complexity and accessibility. It is also common for larger-scale projects and public RFPs.

Example Bid:

- **Total Project Size:** 256 acres (spread across multiple sites)
- **Project Timeline:** June – September 2025
- **Total Project Bid:** \$217,600

This approach allows grazers to allocate resources efficiently based on site-specific conditions, leading to a more balanced and practical bid.

3. Rate per Time Period (Day, Week, Month)

A grazer provides a cost estimate based on a set timeframe. This method is useful when precise grazing acreage is unknown, such as projects involving difficult terrain, dense vegetation, or multiple property boundaries. Unlike the per-acre method, project outcomes may vary depending on herd size and vegetation palatability. Private properties often favor this approach, while public RFPs rarely request it.

Example Bid:

- **Project Description:** HOA property (45 acres, including residential areas)
- **Herd Size:** 600 goats
- **Labor:** 2 onsite personnel
- **Rate:** \$1500 per day
- **Duration:** 30-45 days
- **Transportation Fee:** \$3000
- **Total Estimated Cost (for 30 days):** \$48,000

Additional Considerations

- **Inflation Adjustments:** Ensure that cost estimates consider inflation trends.
- **Requesting Multiple Bids:** Comparing multiple bids helps assess competitive pricing and contractor reliability.

By understanding these cost structure options, landowners and managers can effectively plan grazing projects and budget accordingly.

Grazing Lease

A grazing lease is where the livestock operator pays to graze the property, generally on a per-acre basis or a per-animal-unit basis. **In this instance, landscape and vegetation objectives may be incidental to the lease.** This structure would be more common with cattle grazing on larger landscapes with a longer grazing period and existing infrastructure such as fencing and water. Livestock operators are willing to pay to graze a property if the input costs are low (i.e. existing fences and water), if the grazing season is long enough to offset the cost of shipping in and out, and if it coincides with the seasonality of their other grazing leases and production schedule. Leases would typically prioritize livestock production goals over vegetation management goals with the potential benefit of reduced fuel loads.

THE CONTRACT

Public agencies within the state of California have been using contract grazing for more than two decades and detailed contracts have been developed to address the needs and concerns of both the agency and the contractor. The contract generally stipulates insurance qualifications, labor details[A45], grazing schedules and terms of an annual or multiple year contract. Project proponents should inquire with local or regional public agencies known to use contract grazing as a vegetation management tool for sample contracts common in the project area. A sample contract is included in Appendix B of this document as an example of the general items that should be covered in a prescribed grazing contract.

CEQA CONSIDERATIONS

The project manager should investigate whether a prescribed herbivory project falls under one of the existing programmatic CEQA documents prepared by the Department. If it does, the program EIR will have a checklist that confirms whether the project is within the scope of that EIR, as well as any potentially significant impacts from the project and corresponding mitigation measures. Upon certification of the Vegetation Treatment Program (VTP) Program EIR, most prescribed herbivory projects will be covered by that EIR's checklist.

If the prescribed herbivory project does not fall under a program EIR checklist in whole or in part, it will require the completion of a separate CEQA Environmental analysis. The analysis may result in the filing of a Notice of Exemption or the completion and filing of a CEQA checklist and associated environmental documents (Negative Declaration,

Mitigated Negative Declaration, or Environmental Impact Report). The Sacramento Headquarters Environmental Protection staff can provide guidance on the appropriate analysis and documentation.

An example environmental analysis has been provided in Appendix C as a reference for projects that are outside of the scope of the VTP Program EIR, or that are proposed prior to the certification of the VTP Program EIR and do not fall under one of the existing CAL FIRE programmatic CEQA documents. The example environmental analysis provided was conducted by the Bureau of Land Management (BLM) under the National Environmental Policy Act (NEPA). While the NEPA process differs slightly from CEQA, this document provides a look at some of the environmental impacts to consider during the CEQA process.

RESOURCES

PRESCRIBED GRAZER CONTACTS

Please note that the RMAC has not verified the contact information provided on these lists nor does the RMAC endorse the contract grazers listed.

California Wool Growers Association

http://www.woolgrowers.org/targeted_grazing/producer.html

PUBLIC AGENCIES KNOWN TO USE PRESCRIBED HERBIVORY

Please note this list is not inclusive of all public agencies that use prescribed herbivory but is included as a guide for the types of local agencies that may have experience using contract grazing services.

Resource Conservation Districts

East Bay Regional Parks District

Cities of Lincoln, Oakland, Rocklin, and San Francisco

San Mateo County Parks and Recreation

Santa Clara County Parks and Recreation

Mid-Peninsula Open Space District (San Mateo and surrounding counties)

City of Petaluma

City of American Canyon

PRESCRIBED HERBIVORY RESOURCES

American Sheep Association. Targeted Grazing: A Natural Approach to Vegetation Management and Landscape Enhancement – A Handbook on Grazing as an Ecological Service. American Sheep Association, 2006.

http://www.woolgrowers.org/targeted_grazing/handbook.html Accessed 8/22/14.

Navaez, Nelmy. Prescribed Herbivory to Reduce Fuel Load in California Chaparral. University of California, Davis. ProQuest, 2007. PhD Dissertation.

Ingram, Roger S., Morgan P. Doran, and Glenn Nader (2013). Planned Herbivory in the Management of Wildfire Fuels, Herbivory, Dr. Breno Barros (Ed.), ISBN: 978-953-51-1052-1, InTech, DOI: 10.5772/48673. Available from:

[http://www.intechopen.com/books/herbivory/planned-herbivory-in-the-management of-wildfire-fuels](http://www.intechopen.com/books/herbivory/planned-herbivory-in-the-management-of-wildfire-fuels)

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