

Guide for Using Goats to Manage Weeds in Urban Public Spaces

By Jennifer Cook
Masters of Agriculture Project
Colorado State University
June 2017



This guide is a tool for city planners, open space managers, Extension and USDA-NRCS personnel, and goat contractors to navigate planning a targeted weed grazing project, including the considerations, potential impacts, and monitoring methods of using goats for weed control in urban parks and open spaces. Land managers can use this information to develop and implement a targeted grazing project for weed control.

The guide includes an introduction to targeted grazing, a checklist of considerations for urban grazing projects, an example target grazing plan (see Appendix A) and examples of vegetation monitoring and data collection (see Appendix B).

Introduction to Target Grazing for Weed Control

Targeted grazing is a technique that employs livestock to manipulate vegetation to improve landscape function and enhance appearance. When the harvest of vegetation by livestock is managed with the right timing and frequency of grazing, it is a viable land management tool (Frost & Launchbaugh, 2003).

Grazing will either promote or reduce weeds at a site, depending on management. Weed management planning and vegetation monitoring is imperative in order to suppress targeted weeds while protecting desired vegetation from being overgrazed. The manager must keep in mind the life cycles of the targeted weeds, as well as the health of desired vegetation.

Although the goal with targeted grazing is to target weed infestations, goats will also eat desired grasses, forbs, trees, and shrubs. Be cautious that desirable plants are not being overgrazed. Desirable plants must remain healthy so they can eventually out-compete the weeds. After initiating a grazing plan, monitor vegetation before, during, and after grazing to evaluate grazing effects.

By itself, grazing may not completely eradicate weed infestations, but grazing is more effective when used with other control techniques such as biocontrols or herbicides. In most cases, several years, and in some cases multiple times per year of grazing is needed to control a weed infestation (Peischel & Henry, 2006). Grazing frequency and duration should be based on the palatability and morphology of the targeted weeds (Voth, 2010).

Monitoring the site regularly while the goats are grazing can alert the manager when to remove goats from a pasture due to overgrazing. Vegetation monitoring techniques such as taking photo points and using the ocular plant composition and weed density methods of monitoring will help track the short and long term changes in plant composition (Elzinga, Salzer, & Willoughby, 1998; Peischel & Henry, 2006; Willard, 2016).



Urban Grazing Considerations

Using livestock to graze in urban areas presents unique challenges. Use this checklist to help evaluate and consider the use of goats to graze weeds based on your specific circumstances.

- ◇ Are livestock allowed to be kept within the city? If livestock are not allowed in the city, grazing weeds is considered illegal.
- ◇ Community perceptions and safety should be considered from the start of such projects.
 - Consider how the grazing project is communicated to the community. Signage is very important for safety and liability.
 - Interpretive signs, social media, or workshops could be tools to further communicate about a grazing project. For example, plan a “Meet the Goats Days” at the site to give the community a sense of safety and understanding.
 - The size and presentation of the herd may also affect public perceptions. A large herd or larger animals (e.g., cattle) could be intimidating. A smaller herd of goats may be more acceptable for the general public.
- ◇ A written agreement or lease should be developed between the goat owner and the city. The agreement should include the following, but not limited to:
 - Liability—The goat owner should have their business insured and could have insurance on the goats, depending on how much they are worth to the owner. Secure fencing and signage are the first lines of defense to protect the goat owner from liability claims.
 - Land accessibility—how will the goats be transported to and from the site? What types of vehicles can access the site? How will water be delivered to the goats?
 - Grazing Infrastructure—what type of fencing does the city allow? Is electrified fence legal or appropriate considering public safety? Goats will need water tanks,

protection from predators, and shelter.

- Costs—who will pay for signage, fencing, water, tanks, and labor to monitor goats?
- Emergency Preparedness—consider how to respond in any emergency (such as fire, flood, livestock death, injury, or escaped goats). Know how livestock can be accessed and moved off-site if injured. Emergency preparedness can reduce liability or damage. Plan removable and temporary fencing in floodplains.

◇ There is no silver bullet to weed management, especially on urban public land. Although grazing is a more natural practice, there are economic, environmental, and social costs and implications.

- It is difficult to compare the economics of grazing to that of using herbicides or equipment because the resources used and the environmental, and social impacts are not the same. Long-term benefits might include human happiness, environmental health, plant biodiversity, and sustainability.
- Short-term costs—materials will be different in each situation, depending on access, infrastructure, and timing of grazing.

◇ Evaluate vegetation, land, accessibility, and ecosystems in the area before grazing.

- Be sure there are no poisonous plants available when grazing. While goats are not affected by many poisonous plants, some such as poison hemlock can be fatal to goats. Refer to the [CSU Guide to Poisonous Plants](#) website for species-specific information.
- Endangered plant and animal species or other wildlife could be impacted by grazing goats. Some sites may not be appropriate for grazing.
- Predators, such as dogs and coyotes, could harm the goats. If these are threats, plan accordingly.
- Natural resources such as air, water, and soil quality are potentially impacted by goat trampling, manure, fence installation, and accessing the site with vehicles.

◇ Develop a management plan.

- Define the area of targeted weeds.
- List the goals for the area and how each goal will be accomplished.
- List the targeted weed species and the best time for grazing those weeds.
 - Specify the number of times the area will be grazed each year.
 - Estimate the number of years the grazing treatment will be needed.
- Estimate correct stocking rate, based on carrying capacity of the site, so the area will not be overgrazed. Refer to [Dryland Pasture Condition Assessment and Guidelines](#)

for Colorado Small Acreages.

- Consider grazing impact not only on weeds, but also on desired species.
- Identify infrastructure needed (e.g., fencing, water tanks, shelter).
- Establish a monitoring system.
- Determine a revegetation plan if appropriate.

◇ Monitor the vegetation.

- Monitor the site before, during, and after grazing to identify if the goats are helping you meet the goals for the site.
- Monitoring the short and long term changes over time This data will help guide decision-making and may support funding of the project.
 - Photo points—take photos from the same spot, with the same horizon, before and after grazing each year. Photo points are a simple method to visually monitor vegetation over time.
 - Vegetation Inventory—Make a list or inventory of the percent of each species within an area. Inventory the species at the same time in the same area every year (see Appendix B).
- Involve the support of a local Extension agent or local Natural Resources Conservation Service (NRCS) to help inform the project with resources, knowledge, and monitoring ideas.





Glossary of Important Grazing Terms

Carrying capacity is the average number of livestock that can be sustained on a management unit compatible with management objectives for the unit. Carrying capacity is based on vegetation productivity, livestock forage needs, and safeguarding sustainable grass production.

Grazing duration is the period (days) of grazing and associated non-grazing period of a unit.

Frequency is how often a unit is grazed.

Stocking rate is simply the amount of grazing animals per unit.

References

- Cook, J., Nosal, D., Rizza, J., Bokan, S., & Lockard, E. (2017). Dryland Pasture Condition Assessment and Guidelines for Colorado Small Acreages. *CSU Extension*, bulletin # XCM 239. Retrieved from <https://sam.extension.colostate.edu/wp-content/uploads/sites/2/2017/05/GrazingGuide2017.pdf>
- Elzinga, C. L., Salzer, D. W., & Willoughby, J. W. (1998). *Measuring and monitoring plant populations*. Denver, CO: US Department of the Interior, Bureau of Land Management.
- Frost, R. A., & Launchbaugh, K. L. (2003). Prescribed grazing for rangeland weed management: A new look at an old tool. *Rangelands*, 25, 43-47. doi: 10.2307/4001839
- Knight, A. & Walter, R. (2001). *A guide to plant poisoning of animals in North America*. Jackson, WY: Teton NewMedia.
- Peischel, A. & Henry Jr., D. D. (2006). Targeted grazing: A natural approach to vegetation management and landscape enhancement. *American Sheep Industry Association (ASI)*. Retrieved from <http://www.webpages.uidaho.edu/rxgrazing/handbook/asitargetgrazingbook2006.pdf>
- Voth, K. (2010). What's edible? *Livestock for Landscapes*. Retrieved from <http://www.livestockforlandscapes.com/edible.htm>
- Willard, R. (2016). Animals in roadside vegetation management. *Washington State Department of Transportation Maintenance Operations*. Retrieved from <https://www.wsdot.wa.gov/NR/rdonlyres/C2EDF36B-63E7-434E-946E-E78F306501F5/0/goatreport.pdf>



Appendix A:

Example Target Grazing Plan for Weed Control

Area of Interest

Site #1 is a dryland upland field. It is divided into four—0.8 acre paddocks with non-electric welded wire fence panels.

Vegetation Goals

The vegetation goal for this site is to reduce target weeds and establish native grasses.

Targeted Weeds Onsite and Grazing Recommendations

The following perennial and biennial weeds will require repeated defoliation (three grazings) each growing season. Expect 5 years to suppress. Graze with a high stocking rate (8 goats per 0.8 acre) for a short duration, multiple times from May to November. Do not exceed site

carrying capacity each year. Monitoring vegetation before, during, and after grazing will help determine length and frequency of grazing.

Field bindweed
Canada thistle
Common mullein
Curley dock
Musk thistle
Scotch thistle
Salsify

The following annual weeds will not be targeted with the recommended grazing regime, but may still be impacted. Monitor these species to determine if they require alternate control methods such as herbicide treatment.

Lambsquarter
Kochia

Additional Weed Control Methods Needed

Cheatgrass is a winter annual and will not be suppressed by the recommended grazing regime. Till or spot spray patches of cheatgrass in the late winter (before March 15) and follow with grass seeding.

Target Grazing Plan

A herd of 8 goats will graze each paddock for 6 days each. One rotation through the four paddocks will occur in June, August, and October each year. Carrying capacity for the site should not be exceeded.

Goats should be brought into this area at the right time in order to impact the targeted weeds without significant impact on desired plants. Grazing should be monitored and animals promptly removed when the proper amount of control is achieved. The grazing schedule should allow for flexibility, based on vegetation rather than the calendar.

Scout each paddock prior to grazing and remove any poison hemlock.

| | |
|---|---|
| Paddock 1: June 1—7 August 1—7 October 1—7 | Paddock 2: June 7—13 August 7—13 October 7—13 |
| Paddock 3: June 13—19 August 13—19 October 13—19 | Paddock 4: June 19—25 August 19—25 October 19—25 |

The following preferred plants should be monitored during grazing. Goats should be removed if grasses are impacted.

Western wheatgrass – do not graze below 4 inches

Blue grama – do not graze below 2 inches

Slender wheatgrass – do not graze below 4 inches

Smooth brome grass - do not graze below 4 inches

Alfalfa - do not graze below 4 inches

Carrying Capacity

Below are the calculations to estimate how long the goat herd can sustainably graze preferred plant species based on estimated forage production. This will vary from year to year based on amount of rainfall.

| | |
|------------------|--------------------------------|
| Pasture Size: | Livestock: |
| P1 = 0.8 acres | 4- 250 lbs. goats = 1,000 lbs. |
| P2 = 0.8 acres | 4- 150 lbs. goats = 600 lbs. |
| P3 = 0.8 acres | TOTAL = 1,600 lbs. |
| P4 = 0.8 acres | |
| TOTAL= 3.2 acres | |

Forage Needs: (1.5% body weight)

1600 lbs. x .015 = 24 lbs. forage/day

Estimated Forage Production (Dry weight):

1500 lbs. per acre x 3.2 acres = 4,800 lbs. of forage per year

30% Utilization: (only use half of production, plus trampling, manure piles, wildlife eating)
 $4800 \text{ lbs.} \times .3 = 1,400 \text{ lbs.}$ of usable forage per year

Carrying Capacity:

$1,400 \text{ lbs. of forage} \div 24 \text{ lbs. forage/day} = \mathbf{60 \text{ days of grazing per year}}$

Infrastructure Needed

Water tanks and a shelter will be provided by the goat owner. Fresh water will be brought to site by city staff.

Monitoring Plan

Before, during, and after each grazing, evaluate preferred grass stand to determine if grazing is appropriate based on grass height.

At the same time every year, preferably mid growing season, photos will be taken at designated photo point sites. Photos can also be taken before and after grazing events.

Ocular plant composition plots and weed diversity plots will be used to track the short and long-term changes in plant composition. These methods should be completed at the same time every year.

Revegetation Plan

Grass seed should either be broadcast or drilled after weeds are suppressed. If broadcasting seed, goats grazing can be used to press the seeds into the soil. Once seedlings begin to grow, no grazing should be permitted in order to protect the new seedlings.



Appendix B:
Example Methods and Data Sheets for Vegetation Monitoring

Site Information Sheet

Unit Name _____ Site Name _____

Date _____ Observer _____

Monitoring Methods _____

Date Study Established _____

Study Location _____

Site Characteristics

Elevation _____ Percent Slope _____ Average Annual Precipitation _____

Range Site (Upland or Riparian) _____ Soil Type _____

Current Growing Condition (Above Average, Average, Below Average) _____

Pasture Use Information

Animal Type and Number _____ Dates of Use _____

Other Notes _____

Photo Points

Location _____

Direction _____

Ocular Plant Composition

This sampling method is used to record ocular estimates of plant species composition and bare ground. It can be completed quickly with few examiners.

1. Complete before grazing every year.
2. Plan one plot per acre and one control plot outside the grazing area.
3. Take photos from the same point every year, include the same horizon.

Equipment Checklist

100-foot tape

Flags

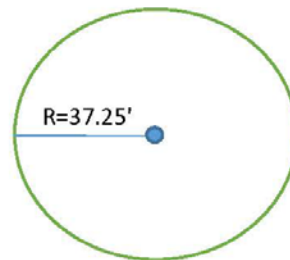
Site Information Sheets

Ocular Plant Composition Sheets

Photo Point Sheets

Site Maps

Camera



Sampling Procedure

1. Locate plot within a representative, uniform portion of the vegetation and site characteristics. It should be representative of the general treatment of the pasture.
2. The ocular plant composition is a circular plot with the radius of 37.25 feet, and an area of 4,356 square feet (1/10 of an acre).
Mark the center of the plot and then measure and flag the outside edge of the circular plot. Flagging the outside edge of the plot can be omitted once the examiner is familiar with the dimensions.
3. Once the plot is delineated, recon the plot to become familiar with the plant species and ground cover.
4. Return to the center of the plot and visually estimate percentages of canopy cover by species, and percent of bare ground. Record observations on the Ocular Plant Composition Form.

Resource

Colorado Resource Monitoring Initiative (2014). *Colorado Rangeland Monitoring Guide*. Retrieved from https://www.coloradocattle.org/CMDocs/ColoradoCattlemen/CRMI/RangelandMonitoringGuide%20-%20Web_2%20Version.pdf

Ocular Plant Composition Sheet

Site Name _____

Site Goal _____

Plot Size and Location _____

Flora ID Source _____

Flora ID Level _____

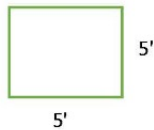
| | Plant Type | Species | % Canopy Cover |
|----|---------------|---------|-------------------|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |
| 14 | | | |
| 15 | | | |
| 16 | | | |
| 17 | | | |
| 18 | | | |
| 19 | | | |
| 20 | | | |
| 21 | | | |
| 22 | | | |
| 23 | | | |
| 24 | | | |
| 25 | | | |
| 26 | | | |
| 27 | | | |
| 28 | | | |
| 29 | | | |
| 30 | | | |

Density of Weed Species

Use this method to measure changes in the density of annual and biennial weed species (not perennials). Select 3-5 weed species to monitor.

Procedure

- Complete at the same time every year, at the correct time to monitor key specie rosettes.
- Randomly choose 10-12 plots per acre.
- Each plot is 25 square feet. Delineate plot and count the number of rosettes of each key species within the plot.



Notes:

Site Name _____

Date _____

Site Goal: _____

Key _____

Species: _____

| Plot 1 | |
|---------|--------|
| Species | Number |
| | |
| | |
| | |
| | |
| | |

| Plot 2 | |
|---------|--------|
| Species | Number |
| | |
| | |
| | |
| | |
| | |

| Plot 3 | |
|---------|--------|
| Species | Number |
| | |
| | |
| | |
| | |
| | |

| Plot 4 | |
|---------|--------|
| Species | Number |
| | |
| | |
| | |
| | |
| | |

| Plot 5 | |
|---------|--------|
| Species | Number |
| | |
| | |
| | |
| | |
| | |

| Plot 6 | |
|---------|--------|
| Species | Number |
| | |
| | |
| | |
| | |
| | |

Resource

Peischel, A., & Henry Jr., D. D. (2006). Targeted grazing: A natural approach to vegetation management and landscape enhancement. *American Sheep Industry Association (ASI)*. Retrieved from <http://www.webpages.uidaho.edu/rxgrazing/handbook/asitargetgrazingbook2006.pdf>

