

# Using Goats to Control Invasive Plants

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Brush and invasive species management is challenging. Chemical, Mechanical, Fire and Biological control tools are used, with goats serving as a biological control tool. Timing, intensity, frequency, duration and targeting of goat application to brush/invasives are key to controlling them, just as with other control tools. Goats are a feasible alternative to chemical or physical control of invasive vegetation (Distel and Provenza, 1991). Livestock for prescriptive grazing was first published in the USA in the 1930s (Mosley, 1996).

Time of year, stage of plant maturity, and region affects consumption of browse by goats (Mitchell, 1996). According to Perryman et al. (1995) plant damage by livestock occurs primarily through duration and intensity, rather than timing of grazing applications. Repeated brush defoliation depletes stored energy reserves, weakening/killing brush (Gipson, 2005). Stripping of bark by goats will kill the tops of woody vegetation >7 feet tall (Mitchell, 1996), but repeated defoliations within each season and over 3-5 years is required to kill some brush (Hart, 2006).

## Dietary Preferences in WI

Previous research (Lyons et al., 1996): Goat diets = 43% browse, 45% grass, 12% forbs in Western rangelands. In Wisconsin research, goats significantly prefer brush/woody vegetation (82-88% of diet) over forbs (9-15%), and consume very little grass (3%) (Nolden et al., unpublished data from M.Sc. research). Scottish highland cattle prefer 36% woody, 35% forbs, 29% grass in their diet, and they are a breed of cattle that consumes high amounts of brush (Harrington and Kathol, 2009). Goats eat nearly all woody vegetation and most herbaceous species. They avoid fuzzy leaves (common mullein) but relish plants with thorns and secondary plant compounds.

Time to clear brush with goats: 1 goat/ac per % brush cover season-long in OK for control (Mitchell, 1996). 1.5 goats/ac with 43% brush on 32 acres cleared all browse in under 2 seasons. 1.5 goats/ac with 62% brush on 24 acres took >2 seasons to clear all browse. 0.5 goats/ac for maintenance. Rotating goats is more effective than set-stocking for brush control (Mitchell, 1996). Mob mentality vs. searching favored foods: more uniform brush removal: 1) Browse is diverse in each paddock: healthier goats, 2) Goats can be moved when desired impact is obtained, 3) % of brush that recovers is reduced with each browsing event.

Multiflora rose was a problem in 1986 in West Virginia (Bryan, 1994)

- Goats reduced brush from 45% to 15% in one season
- Sheep required 3 seasons to do the same
  - Mowing/herbicide improved sheep effectiveness
- Actual goat kill of brush occurred in:
  - Early season defoliations
  - 5 years, killed 98%
- Management recommendations
  - Use goats for brush control
  - Use sheep for invasive forb control
  - Use cattle for toppling dead brush

## Goat Behavior

Goats are herd-oriented, smart, curious. They have a strong social hierarchy and show jealousy for what other goats are eating. This can result in injuries, but also learning. Goats need to be trained to Electric fences, Bucket, Come to call, Trailing, Medical treatments, and need to be handled with respect. Goats can be very impatient when setting up new paddocks and when insufficient forage is available. They like to eat high off the ground.

## Fencing: Keeping Goats In

Fence training involves setting up electric inside a permanent fence at >4 kV for 1 week. Preventing escapes is accomplished by:

- Keep fence HOT, all the time
- Lead goat must respect fence Remove escape artists immediately, retrain/sell/eat
- Socialize goats to humans Introduce new goats in permanent fence
- Keep goats on one side of the fence only
- Keep bucks and does well separated
- Don't lay/lift fence for goat passage, open the gates to let them through

#### Portable e-Net Fencing

Hot Fence: 1.5 kV min; 3 kV good; 7 kV great

Grounding

Battery

Energizer

Uneven Terrain

Lush Vegetation

Rock/Ice

Sand

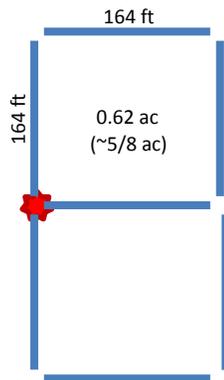
#### Fence Set-Up

7 Fence System

40-50 goats/paddock

2-5 days to defoliate

1-2 hours set-up

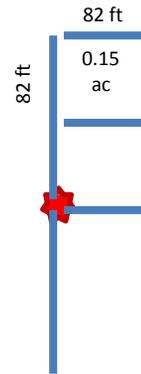


5 Fence System

10-12 goats/paddock

2-5 days to defoliate

0.5-1 hour set-up



## Rotational Browsing

Intended for management of vegetation, not just feeding of goats. Involves more labor in terms of moving goats faster and keeping them in higher-density groups. Goats are moved once they consume the desired amount of brush, not just when the best forage has been consumed for putting weight on the kids. The paddocks are re-browsed at least 2x/season; 3-5x is better. This extra labor/management/intentionality provides justification for contractor fees for goat browsing.

## Water

In dense brush during July of 2013, 110 of my goats consumed 18 gal/d total (6.4 AUEs). The vegetation provided most of their water needs. Goats drink more when it is hotter and drier or the vegetation is low in moisture content. The nursing does drink more water than other classes, and supplements containing a lot of salt (>20%) will cause your goats to consume more water. Goats will not drink brackish water. I've successfully used apple cider vinegar, wood ashes and barley straw to control slime in the water tank.

## Supplements

I provide salt mixed with the mineral (min 1200-1800 ppm copper in the mix). I don't provide an energy supplement (no grain) to my goats. Following the ideas of Pat Coleby, I give free-choice copper sulfate (blue powder from feed coop) year-round and have a free-choice hopper of dolomitic limestone paired with it (calcium counteracts any copper overdose). I provide epsom salts (Mg) free choice during the high potassium spring grass growth. Research at Utah State indicates that livestock can learn to consume a supplement or food for self-medication purposes (Provenza group, many publications).

## Shelter

Goats need shelter from wet, windy conditions below 40 degrees F. Brush can provide the needed shelter from mid-April through November in most years. I'm conducting research on shelter density preferences of goats, testing the Animal Welfare Approved guideline for 16 ft<sup>2</sup> per adult doe. The research results will be available in fall of 2015.

## Guardians

The primary predators in southern Wisconsin are domestic dogs and coyotes. I like using dogs and donkeys for guarding my goats, sheep and chickens. I breed, raise and train guardian dogs for Wisconsin farms. Appropriate early-life bonding conditions and the right temperament are critical for producing a functional guardian. Proper training is key. This topic is a whole lecture itself. Llamas and cows can serve as guardians also. Dogs are the only guardians that protect against aerial predators in addition to ground predators, and when kids are born on pasture/brush, or you raise pastured poultry, aerial predators are a problem. Two good books on the topic are included in the Reference section. If you move your fences more frequently than once every 2 weeks, coyotes will mostly avoid your goats due to their adjustment period to the new fence location. This does not work for wolves or domestic dogs.

## Health

All of the typical goat health problems occur in browsing situations. Additional health problems are rare, but occur and need to be watched for among the herd: deer worm and liver fluke, getting caught in electric fences, torn udders on does with poor udder structure, getting hung up in trees, trees falling on goats and fences in storms.

## Pasture Parasite Levels

Rotational browsing and grazing is not sufficient to protect goats from parasites. Browse and graze as high as possible (not closer than 2-4" from ground), select/breed for parasite resistant and resilient goats, only deworm those goats that need it (anemic, losing body condition, not growing, diarrhea) to prevent further anthelmintic resistance among parasites

Pastures will retain parasite contamination from the previous year, but those parasites will die off by early-summer if goats/sheep are not re-contaminating the pasture. Does will add parasites to the pasture, as will kids when they start grazing/browsing, which continues the cycle. Normal moisture years see a spike of parasites in June, whereas dry summers will keep parasite numbers low. Wet falls promote an increase in parasite larvae in pastures/browsing land.

## Supplies

<u>Necessary</u> \$1,700.00	Hand saw	Water tank & jugs	Trailer	equipment
Energizer, 3 Joule	Wiring	Mineral feeder	Water hauling tank	Portable vet supply kit
Ground rods	harnesses	Anemia chart	Water pump & hoses	Cordless drill
Marine batteries	Fence tester	Treats & bucket	Solar panel	Chainsaw
Battery recharger	Battery tester	<u>Nice to Have</u>	Catch pen panels	Weed whip
Fences	Extra posts	Guard animal	Handling	

## Stocking Rate/Density, AUE

Stocking Rate is the # goats/area/whole season

<u>Location</u>	<u>#Goats/Acre</u>	<u>Acres Cleared</u>
YLWA, 2011, 2012	6.8	12.34 (normal size meat goats)
YLWA, 2013	8.9	12.34 (smaller meat goats)
BAAP, 2012	4.6	29
WV 1986 (Bryan, 1994)	8-10	unreported
OK 1996 (Mitchell et al., 1996)	1 goat/ac/% brush cover	unreported

Stocking Density is the Instantaneous # goats/area/time

<u>Location</u>	<u># Goats/Acre</u>	<u>Time spent in 1 location</u>
YLWA, 2011, 2012	70	3.3 days (normal size meat goats)
YLWA, 2013	91.7	3.3 days (smaller meat goats)
BAAP, 2012a	24.2	10 days
BAAP, 2012b	48	5 days

### Animal Unit Equivalents (AUE)

Standardizes grazing pressure across goat sizes and classes

AUE = # goats metabolically equivalent to 1 Animal Unit (AU)

1 AU = a 1000 lb cow @ 2.6% daily DMI

DMI by goat class: (adapted from Nut. Req. Sm. Ruminants, 2007)

Open Does = 1.95%

Lactating Does = 3.19%

Bucks = 1.6%

Kids = 3.63%

Fast AUE Calculation:

Sum the lbs of goat

Divide by 1000

NOTE: 70 goats = 5.18 AUE = 5.18 cows, but 91.7goats also = 5.18 AUE (smaller goats; not all goats are created equally)

Most breeds of goats work for browsing. Short goats can't reach as high into brush and tend to escape under fences more than bigger goats. High-strung goats are more likely to jump fences. Electric netting is needed for non-myotonic goats. Myotonic goats can be run with cattle with 2 strands of electric fencing since this "breed" cannot climb, jump or crawl under/over/through fences. The "pet-type" Myotonics that are prevalent in Wisconsin are too small, but those that are bred to be a standard goat size work well. Myotonia is a recessive trait that can easily be bred into any goat, so it is not specific to a breed. Goats cost from \$.06-\$4.00/lb live weight at auction, to \$90-350/head from commercial breeders, to \$150-\$7,000/goat from purebred breeders.

### WI Contract Browsing Fees

Some goat producers provide contractor services to private landowners with brush control problems. They work their herd through brush-invaded landscapes from April-November each year, charging hourly rates of \$25-60 for personnel, \$100-200/trip to deliver the goats to the site, and \$2-3.00/head/day for the goats. Rates vary by company. They typically provide the goats, fences, energizer, batteries, water tank, mineral feeder and mineral, and labor. With a herd of 200 goats, a contract browser can fully defoliate 15 acres in one week with 3 paddock moves. It would take about 5 hours to set up each paddock, and 8 deliveries of goats to/from the site. This totals to around \$4,000/wk charged to the landowner. The service is in high demand. Businesses that provide this service include:

#### 23. Environmental Benefits

Brush cover and density are reduced by goats. Sun-loving herbaceous species increased with goat browsing, but invasives did not increase at this research site. Litter depth decreased from 15.7-11.6 cm, significant statistically, but sufficient to cover ground yet. Soil compaction measurements indicated no significant differences in 2011, 2012, or 2013.

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