

Introduction

For well over one hundred years goats have been used to manage unwanted vegetation in the United States. The role of goats in vegetation management is expected to expand dramatically in the near future due to a combination of factors including: environmental degradation created by past systems of farming; reduced efforts to control unwanted vegetation that have increased its spread and growth; the increasing expense of mechanical methods of vegetation control, most of which rely on the use of fossil fuel-driven machinery; and the increasing reluctance and moral unacceptability of the use of herbicides due to pollution hazards and potential long-term harm to the environment.

Dramatic changes in the goat industry over the last two decades have also paved the way for increased use of goats for vegetation management. The Angora goat boom in the mid and late 1980's moved goats from Texas into adjacent states. The dramatic influx of Boer goats in the early 1990's increased the number of states with significant numbers of goats and goat producers, especially in the South. Goat markets have become bigger and the price stronger in response to the demand for meat and other goat products from ethnic populations. During the last five years goat numbers have grown nearly exponentially for a myriad of reasons. Although goat numbers in most states are only 1-5% of cattle numbers, goats are becoming an accepted farm animal. As more people raise goats, the goat's natural dietary preference for brush and weeds is more publicly visible and becoming more appreciated.

Why Manage Vegetation?

The most common reason given by producers wanting to manage vegetation is to grow more grass to produce more beef. There may also be a desire to enhance the productivity of degraded range sites or improve landscape aesthetics. Another reason is to control invading plant species, such as kudzu in the South, sericea lespedeza in several states, red cedar, many oak species and many other invasive plant species which differ by location. Often large ranches may have some vegetation problems and allow free goat grazing or even pay for goat grazing to control weeds and brush.



Reduction of fire hazards due to excessive brush growth is another important reason for managing vegetation with goats. Excessive understory growth and accumulation of fine fuel and growth of flammable species such as red cedar can lead to fire hazards. A large amount of government land is in an advanced stage of brush and weed growth due to budgetary constraints. These areas are developing fire hazards that are of concern. The potential for free, or fee-based, grazing provided by different local, state, or federal government agencies exists and will grow in the future.

Dense understory brush can also destroy wildlife habitat, a situation that can be remedied through grazing by goats. Goats can also assist in increasing the biodiversity of grasslands, thereby helping owners to be good stewards of the land. It has been observed that goats help to

heal gullies and washes due to their behavior of walking in mass across these areas creating pockets with their feet where seeds can become established. In addition to restoring plant life and biodiversity, this also reduces water runoff and active erosion. Since goats do not like to walk in water, they do not pollute natural water sources with their waste as cattle do.

Factors in the Establishment of Unwanted Vegetation

Unfortunately, vegetation management is not as simple as removing undesirable plant species from a site. There are usually underlying problems that initially encouraged the growth of invasive or unwanted plant species. One of the biggest factors is erosion. Much of the severe erosion found in the southern United States is due to the cultivation of natural ecosystems, with crops, typically cotton. This cultivation entailed the use of such practices as clean tillage and planting rows vertically on slopes. Once the land could no longer grow profitable yields, it was abandoned and became “go-back land.” By then, erosion had removed the top several inches of soil containing most of the nutrients and organic matter needed for plant growth. The remaining soil had severely diminished productivity leading to reduced vigor of the grasses growing in it.

Water infiltration rate and holding capacity is also reduced by cultivation due to accelerated losses of organic matter and the creation of plow-pans and loss of soil structure. This results in a greater proportion of the infiltrated water being in the subsoil. Because woody species have deeper roots to obtain water and are good at sequestering plant nutrients, they are more competitive against grass in eroded areas than in the former non-eroded state. The loss of productivity potential of the soil limits expenditures that can be made for managing vegetation.

The second animal management factor that favors woody species is overgrazing. Overgrazing increases erosion, reduces water infiltration, and reduces the vigor of native grasses putting them at a competitive disadvantage to invading plant species. Another animal management factor leading to establishment of unwanted vegetation is grazing of an area by only one animal species, usually cattle. Cattle utilize predominantly grasses, a few forbs, and almost no browse. Grazed plants, especially overgrazed plants, are at a competitive disadvantage to ungrazed species (forbs and woody plant species) because of the loss of significant photosynthate. Another factor has been the suppression of periodic fires that would assist in reducing establishment of woody species. As a consequence of the above factors, permanent ecological changes have been created at many sites that give a competitive advantage to woody species. Thus, if there is a desire to maintain areas as savannahs or grazing lands, invasive woody and weedy plant species will have to be perpetually controlled.

Vegetation Management Options

Producers have several options available for managing undesired vegetation and the choice of method depends upon economics, potential for pollution, target species, and acceptability of herbicide use. These options include fire, mechanical (mowing, bulldozing, roller chopping, chaining or root plowing), chemical (spraying of herbicides), and animal impact (grazing with various species of animals with different grazing management practices).

Fire is an economical and effective tool for controlling many plant species, but some species readily sprout back from the roots or seed. Fire may be an effective pretreatment for goats, especially where the woody species are over ten feet tall. Fire can be dangerous if it gets out of control and liability concerns have limited its use in recent years. Most mechanical methods are too expensive and although they can quickly achieve dramatic results, these are often short-lived. Chemical control has been effective in the past, but has become more costly due to the increasing expense of chemicals and application. Runoff and/or spray drift from chemical application can be a problem. Chemical control is not usually specific and results in killing more than the targeted species. Spraying native range for weeds has resulted in a 20-30% reduction in grassland production presumably due to the herbicide killing nitrogen fixing legumes. Further, some individuals object to the use of chemicals based on their personal values. Animal impact involves control of grazing animal species (cattle, sheep, goats, horses, etc.), time of year of grazing, duration of grazing, and length of rest period for the site. Managing grazing in this manner can be effective in controlling some species of vegetation, but the required level of management is often unavailable.

Goats in Vegetation Management

Beneficial characteristics

Several characteristics of goats make them the animal of choice for vegetation management. Goats are a low-input animal, require a minimum investment for start-up, have low expenditures for maintenance, and require only a moderate level of labor for animal management. However, goats do require a high level of management knowledge. Goats have a diverse dietary preference and consume a wide variety of plants. They have very nimble lips allowing for selection and consumption of the most nutritious components of the available biomass. Goats have a preference for browse and can consume significant amounts of forbs. They can stand on their hind legs reaching over 6 feet into browse plants. Goats tolerate higher levels of tannins than cattle or sheep and rarely bloat. In addition, they have few problems from plant toxicity as the large number of plant species consumed daily generally prevents consumption of a toxic dose of any particular one. The diet diversity of goats probably minimizes their likelihood of mineral deficiencies.



Through their grazing habits, goats reduce the production of seeds by consuming seeding stems; the immature seeds consumed do not survive passage through the digestive tract. Goats may reduce woody vegetation through debarking, resulting in plant death. Through digestion and the passing of feces and urine, goats release plant nutrients tied up in unwanted vegetation making those nutrients available for other plant growth. Further, as goats make progress in controlling vegetation, ticks and snakes can be reduced due to reductions in their habitat. A final benefit of using goats to control vegetation is that while these animals consume undesirable plants they are producing a saleable product. Instead of spending between \$10.00 and \$25.00 per acre for chemical control, goats may provide a return of \$10.00 to \$25.00 per acre while controlling vegetation.

Dietary preferences

It is necessary for goats to consume a plant in order to control it. Therefore, the question is, “Will goats eat the target species?” This is not a simple question to answer because many factors affect what plant species a goat will consume. The greatest factor in determining what plant species a goat consumes is what they learned to eat from their mothers. Goats can also learn from their peers, although to a much lesser extent. The second biggest factor relates to year of birth in that animals born in a year in which there was a greater availability of a particular weed species, usually due to climatic conditions, will have learned to eat more of that species. These two factors account for different groups of goats having different dietary preferences.

Dietary preferences also change with time of year and location. In central Oklahoma goats eat significant amounts of red cedar only during the winter, but in Kansas and Missouri goats will consume red cedar in the summer. In many cases, goats will walk past a certain plant species for weeks and then one day decide that it is time to eat that species. Also, at some locations goats will eat a given species, but the same goats at another location will not consume that species, presumably due to differences in soil/climate factors affecting plant palatability. Thus, it is difficult to predict whether goats will consume a specific weed at a specific location.

There are many plant species that are preferred by goats regardless of location. Highly preferred plant species include blackberry, green briar, sumac, winged sumac, winged elm, poison ivy, ironweed, sericea lespedeza, and kudzu. Moderately preferred plant species include post oak, blackjack oak, multiflora rose, sunflower, buckbrush, and some thistles. Most grasses fall into this moderately preferred category. Lesser preferred plant species include Osage orange, Illinois bundleflower, hackberry, ragweed, and giant ragweed.



Goats will not provide the rapid control or eradication of undesirable vegetation seen with herbicides. However, one should see evidence of the target plant species being consumed by the end of the grazing season. Often, highly preferred vegetation may be grazed “into the ground” by summer’s end. Do not fret if the target plant species has not been grazed by the middle of summer. It is likely that the goats will graze it later in the season. If goats are not consuming the target plant species, there are two possible remedies. The first is to find some goats that consume that plant species and add them to the herd to teach the current animals to consume it. The second is to train some animals to eat that plant species. One researcher has been somewhat successful in training animals to eat weedy species and her techniques are located at



www.livestockforlandscapes.com. Trained animals also taught peers to eat the targeted plant. Further, goats will not penetrate tall vegetation readily and mowing strips through dense vegetation will help goats to penetrate it.

Vegetation control

Time is needed for goats to sustainably control brush and weeds. Brush and weeds are not as well adapted to repeated defoliation as are grasses and repeated defoliation stresses these plants and reduces carbohydrate reserves. This stress makes the plant more subject to damage or death through insect and disease attack. Finally, when the root carbohydrates are depleted, the plant will die. Stripping of bark by goats, such as seen in honey and black locust and red cedar, will kill woody trees. Some annual plants are controlled through the consumption of seed stems as mentioned previously. However, for most plants there is an accumulation of seeds in the soil (seed bank) that will sprout back for several years. If control continues, the number of sprouts will decrease yearly as the seeds lose their viability. Some plants that have “hard seed” such as vetch and lespedeza will remain in the ground and continue to sprout for more than 10 years. One study with sericea lespedeza showed that grazing by goats caused more seeds in the seed bank to sprout, depleting the seed bank faster.



As expected, goats are much more effective at controlling unwanted vegetation if they are utilized early in an infestation, providing quicker control. Usually, however, vegetation problems progress to the extreme before control is attempted. Woody species can be more readily controlled at heights of less than 10 feet than at heights of 20 feet or more. At the latter heights, control may require an extended period of time and/or pretreatment such as burning or chaining.

Some producers may choose to maintain brush as a renewable feed resource for their goats. To achieve this, don't allow goats to defoliate brush during the first month of spring growth, do not allow goats to defoliate it severely at any time, and allow 8 weeks recovery between defoliations. To fully recover and develop carbohydrate reserves for future regrowth, do not defoliate the month prior to expected frost. Conversely, if the goal is to kill brush, it should be defoliated early in the spring, repeatedly defoliated throughout the growing season not allowing it to recover, and grazed late in the fall. This is typically what happens under continuous grazing management.

Potential Production Systems

A major decision is the type of goat enterprise desired. Do you want to have a brood goat operation, a stocker goat operation, or have mature wethers? Do you want to co-graze with cattle, horses, or sheep?

A brood goat operation where does produce kids requires the greatest management input and encounters the most problems due to kidding and raising kids. This enterprise also has the potential for the greatest profits. Grazing pressure must be limited or animal production will suffer. The animals must be fed and managed the whole year, even when the brush is dormant.

Kidding time attracts predators because the kids are easy prey. Kidding time requires more labor and management.



Stocker goats reduce management requirements, but have the additional risk of bringing in sick animals that require doctoring. Predator problems are less than for brood goat production. Because of sale to market, stocker goats do not have to be fed through the winter. Profits are dependent on market timing. Stocker goat weight gains are variable ranging from slight weight loss when using high stocking densities for aggressive vegetation control to 6 lbs of gain per month under good pasture conditions. Weight gains vary depending on breed of goat with some

breeds having greater potential for gains and some breeds being more aggressive foragers.

Stocker goats will gain little to no weight during the first month following purchase while they are recovering from the stress of shipping. Generally, lightweight, growthy animals weighing 40 to 50 pounds are purchased at the beginning of the grazing season and all animals are sold at the end of the grazing season.

Mature wethers can be an appropriate grazing animal under certain cases. They require minimal management input and can be utilized for several years. Predator problems are the lowest of any production system. These animals can be “pushed” to eat undesirable species without adversely impacting revenues. These animals produce little income from sales and income realized is usually derived from savings in weed control or for being paid to use these animals for weed control. Animals must be replaced as they age.

Goats can graze in combination with cattle, horses, or sheep. Goats eat a diverse diet consisting predominantly of browse, and lesser amounts of grass and forbs whereas horses and cattle eat predominantly grass and sheep consume predominantly grass and forbs. Therefore, goats compete little with these other grazing species. Goats combine well with cattle in grazing systems and 0.5 to 2 goats can be grazed per cow. This co-grazing can enhance farm profitability and provide income diversification. Often, grass will replace the browse consumed by goats thereby enabling a future increase in cattle stocking rate. In pastures where forbs are a dominating unwanted plant, sheep may be a better choice to co-graze with cattle than goats. In terms of animal health, goats share very few parasites with cattle or horses and co-grazing these species can reduce parasite problems. However, goats do share parasites with sheep and co-grazing sheep and goats will not reduce parasite problems.

It is generally fairly easy for cattlemen to add goats to an operation. A main concern and expense is improving existing fencing to contain goats. Usually, only the outer fences need to be made “goat proof.” Inside the fenced area the goats will usually go to the weeds and brush without the need for additional pen/pasture fencing. This is particularly true if the cattleman is cell grazing cattle with one strand of electric fence. If cattle working facilities are used for goats, the lower part of fences, gates and panels will need upgrading to make them goat proof. Provisions for watering goats are needed. A mound of earth or rocks next to a livestock watering tank can help

the goats reach water. The tank may need a rock placed in it sufficiently large so that if a goat gets knocked into the water, he can climb out of the tank.

Goats for Custom Brush Control

Using goats for custom brush control is at times referred to as a “rent-a-goat” operation. Many landowners that need goats for vegetation management may not want to get into the goat business due to a lack of expertise, capital, time, or other resources. This provides potential for goat producers to capitalize on free grazing and/or get paid for grazing. Landowners needing these services include the federal government, such as the Forest Service or Army Corps of Engineers, state governments, and local governments that want to control brush in drainage areas, on lake dams, and to reduce fire hazards in residential areas. The Army Corps of Engineers and other government agencies have utilized the services of custom brush control by goats, but due to budgetary constraints have mainly provided only free grazing.

The main constraints to rent-a-goat businesses include cost of fencing, water supply, the need to check on animals daily, and a place to keep goats when not being used to control brush. The latter constraint applies particularly to government agencies that typically want their land free of goats by deer hunting season. In some free grazing situations provided by government entities, the hosting agency may be able to provide some assistance “in-kind.” This may be through providing a water source, varying degrees of fencing materials and/or labor, or the provision of a person to check on water and goats daily. However, the goat owner would still be expected to resolve any problems relating to escaped or sick animals. As fencing is a major hurdle in making a rent-a-goat operation work, this potential should be explored. Electric fence is cheap, but requires management. Existing fence can often be modified to contain goats; however, if new fencing is required funding will be the biggest challenge. If a private rancher is giving or paying a goat producer for weed and brush control, the above considerations will apply.

Establishing a Brush Control Business

If you want to use goats for brush control, how do you get into the business? The first step is to visit other producers, especially those that are using goats for weed and brush control to see if goats will control your type of vegetation. Find out information about their goat management practices. Work to learn all you can about goats from extension personnel, other producers, and the internet. A good source of information is the modules contained in this certification program. Make a farm plan and budget as described in the [Farm Business Planning](#) and [Goat Farm Budgeting](#) modules. You may need to secure financing and these documents will help you with loan applications.

Plan your production system and animal management practices. What type of enterprise (doe-kid operation, stocker operation or mature wether operation) will work best for you? How will predators and parasites be controlled? Establish a relationship with a veterinarian interested in goats and work with him to plan a herd health program. Plan a nutrition program including a yearly feed budget, mineral supplementation, and approximate feed costs. Conduct research on marketing in your area and develop a marketing plan. Time spent developing a good marketing

plan can result in a greater return on investment. What kind of fencing will you use? These factors and many others need to be considered before the first goat is purchased.

After the aforementioned aspects have been considered, find out where to purchase suitable goats. Most goats sold at auction are culls. A better option than buying auction animals is to purchase from producers that have a reputation for quality animals and raise animals similar to those desired. Begin with a herd size that is easily manageable and comfortable for you; the herd will multiply over the years. Several large ranches have started out with small groups and as the owners feel more comfortable with their management of goats buy larger groups of goats. As the goats accomplish weed and brush control, numbers can be reduced appropriately.

Considerations in Using Goats for Brush Control

Main considerations in using goats for vegetation management include adequate fencing, preventing predation, controlling internal parasites, and facilities.

Fencing

Often the cost of fencing is a major limitation to using goats for vegetation management. Sometimes existing fences can be modified cheaply to contain goats. Both conventional fence and electric fencing can be effectively used to fence goats but the use of electric fence requires a commitment to fence maintenance that some managers cannot make. Problems can occur with existing field fence that is of a net wire type with only six inches between vertical strands. Goats will be able to push their heads through the fence but cannot pull their head back through because the horns get caught. The goat will remain trapped in the fence until the manager frees the goat, a predator eats the goat, or the goat dies. To prevent this problem in short sections of fence, every other vertical strand of wire can be clipped with wire cutters. The most workable remedy is installation of several strands of electric fence in front of the net wire to prevent goats from reaching it or the complete removal of field fence and installation of more suitable goat fencing. More information on fencing can be found in the [Goat Facilities](#) module.

If five strand barbed wire fencing is present, there are several alternatives which are covered in more detail in a [Langston publication on fencing](#). Two or three strands of barbed wire can be added to the lower part of the fence with stay wires between posts. Goats most commonly escape by going under a fence, so ensure that the lowest strand of wire is within 7 inches of the ground. Washes, water gaps, and wildlife trails under fences need special attention. Modifying a barbed wire fence in this fashion is fairly cost effective, but requires significant labor. Another alternative is to use one or two strands of electric fence low to the ground about a foot in front of a five strand barbed wire fence. Step-in posts or fiberglass sucker rod posts can be used. Stand-off insulators work well but tend to be expensive. Solar powered chargers can work well in remote areas; although they are less powerful and more expensive for the same output as plug-in fence chargers. A plug-in fence charger is more reliable than a solar unit and should be used if possible.

If no fence is present, goat net wire fence can be installed. This type of fencing is called 10-47-12 Sheep and Goat Wire. It has 10 horizontal



strands, is 47 inches high, and has a 12 inch spacing of vertical wires. There are two versions of this fence, a standard low tensile type that is easily bent, and a newer, high tensile version in which the wire is difficult to bend and will to some extent spring back to its original shape. This high tensile version offers the advantage of retaining its shape if something moderately heavy, such as tree branches, falls on it. Installing high tensile fence requires more skill than the conventional version and corner posts must be well set.

Electric fencing is another option for goat producers. Four strands of electric fence 30 inches high have been proven to effectively hold goats. Some producers have used only 3 strands, but this is less secure. A variety of posts and insulators are available. There are three rules for the successful use of electric fence: 1) correct installation using quality materials; 2) train animals to the fence; and 3) check the fence voltage every day. Find someone who has successfully used electric fence to assist with selection of materials and provide proper construction techniques and recommendations. Animals can be trained to an electric fence by having the electric fence across the corner of a trap or pen that is goat proof. Another method of training goats to an electric fence is to suspend aluminum soft drink cans on the fence from top to bottom (dipping in molasses is optional). The cans will attract curious goats to test the fence and the goats will learn to respect it. By checking the fence daily to ensure a current of at least 4,500 volts, problems will be found and fixed before animals discover the fence is not “hot” and escape.

Predators

Predators are a serious problem when using goats for vegetation management as locations are often remote with habitat that provides natural cover for predators. Guard animals put with the goats can prevent predator attack. The number of guard animals needs to be sufficient to cover the area and terrain in which the goats are kept. If guard dogs are used, plans need to be made for feeding them. They can be fed using self feeders, but the goats need to be excluded from the feeder because goats can founder on dog food. Further, pet foods may contain ruminant by-products that are prohibited by law from being fed to other ruminant species, including goats. This is to prevent occurrences of transmissible spongiform encephalopathies, the most commonly known one being “mad cow disease” or BSE, from occurring in domesticated ruminants. Other information on guard animals can be found in the modules on [Livestock Guardian Dogs](#) and [Predator Control](#).

Parasites

Parasite problems are generally considerably less when using goats for vegetation management than when grazing conventional pastures. This is due to goats browsing and consuming feed that is above ground level. Many browse species also contain tannins which aid in parasite control. However, if the goats are patch grazing grass, they can develop serious parasite problems. If high stocking rates are used relative to available vegetation goats will be forced to graze close to the ground. Goats that are losing weight are more susceptible to parasites. Good management practices will include some type of parasite monitoring procedure such as fecal egg counts or visual examination of the mucous membranes, both detailed in the module on [Internal & External Parasites of Goats](#).

Facilities

Goats being used for vegetation control in the southern United States typically need little shelter. Often goats have enough shade and shelter from the rain by utilizing cover from existing trees during the summer. Goats need shelter from the wind during the winter which may be accomplished with a gully, pond bank, brushy mott, or brush pile. Standing brush or cedars can also provide shelter. Does should be bred to kid late enough in the spring so that shelter is not required. Does can kid in the field with minimal assistance. In northern climates, shelter may be necessary due to the cold weather. Goats have relatively little subcutaneous fat and are subject to being chilled. Some goat producers in northern climates kid in the barn before pastures emerge and release does and kids to pasture when it begins to grow. These producers often kid in small pens or “jugs” and after animals have bonded return them to the herd. This is labor intensive but some producers have learned to do it efficiently.

Observations in Oklahoma Using Goats for Vegetation Management

Browse species

Blackberry (*Rubus oklahomas*) - Goats relish blackberries and readily defoliate them. Control is usually obtained with three years browsing by goats.

Blackjack oak (*Quercus marilandica*) - Goats consume leaves and produce a browse line. While they will control sprouts, they generally cannot control trees over 12 ft tall.

Buckbrush (*Symphoricarpos orbiculatus*) - This species tends to be low on the goat’s preference list, but they will consume the foliage. There are reports in some areas of goats having a high preference for this species. Where goats have a low preference for this species, it may take five years or longer for control to be realized.

Eastern red cedar (*Juniperus virginiana*) - The time required for control varies with location. At some locations, goats have found this species readily palatable and defoliated and debarked it in the first year or two of grazing, resulting in good control. At other locations, the goats had a much lower preference for it, but consumed more in the winter. Even in these areas, as long as goats had access to the cedar during the winter, it was mostly controlled within five years except for the very largest trees.



Elm (*Ulmus spp.*) - Goats consumed leaves and produced a browse line. They controlled sprouts, but did not control trees over 12 ft. high.

Greenbriar (*Smilax bona-nox*) - Goats aggressively consume the leaves of greenbriar and may consume some of the stems. They are able to control greenbriar within three years.

Hackberry (*Celtis occidentalis*) - Goats consumed hackberry and left a browse line. They controlled sprouts, but did not control trees over 12 ft high.

Honey locust (*Gleditsia triacanthos*) and black locust (*Robinia pseudoacacia*) - Goats readily control these species in a year or two because they not only eat the leaves, but pull strips of bark from the trees to eat. This will kill even very tall trees.

Osage orange (*Maclura pomifera*) - Also called hedge or Bios d' arc. Goats readily consume the leaves and will put a browse line on the trees. However, goats do not debark trees and, therefore, do not provide control of large trees. Some goats will consume the fruit of the trees, called horse apples or hedge apples.

Poison ivy (*Toxicodendron radicans*) - Goats have a high preference for poison ivy and it is one of the first woody species to disappear when goats are introduced into an area.

Post oak (*Quercus stellata*) - Goats consume leaves and produce a browse line. While they will control sprouts, they generally cannot control trees over 12 ft tall.

Persimmon (*Diospyros virginiana*) - Goats may browse and control persimmon on some sites, but on others, it is poorly utilized.

Rose species, including multiflora rose (*Rosa spp.*) - Goats readily defoliated these plants and reduced plant vigor the first year. However, three or more years of grazing were required to fully control this species.

Roughleaf dogwood (*Cornus drummondii*) - Goats readily consume dogwood and even debark some stems, resulting in control in two or three years.

Sand plum (*Prunus augustifolia*) - Goats love sand plum and will immediately defoliate it when available, resulting in quick loss of vigor. However, the plant has good carbohydrate reserves in the roots and will continue to produce foliage for several years. This plant is readily controlled in three years.

Shinnery oak (*Quercus havardii*) - Goats consumed shinnery oak and gradually controlled it. One of the benefits of using goats was that plant nutrients were returned through the goat manure, increasing available nitrogen and phosphorus in the soil, facilitating establishment of grasses. Control is a long term effort, requiring more time if the stand is more mature. A study in Texas indicated that quicker control could be obtained if the shinnery oak was first mowed down, the goats then readily consumed the sprouts and maintained control of the species.

Smooth sumac (*Rhus glabra*) - Control of this species varied with location which must be the affect of plant palatability and the preference goats have for the species. At several locations, plants up to 12 foot tall were killed in one to two years whereas at one location goats refused to consume the species. At the locations where goats controlled the species, they consumed not only the foliage, but debarked many of the stems, hastening the death of many plants.



Winged elm (*Ulmus alata*) - Goats readily consumed winged elm and controlled it within two or three years.

Winged sumac (*Rhus copulina*) - Goats seem to have a greater preference for winged sumac than smooth sumac. They readily consume the foliage and may consume the bark, resulting in control in two or three years.

Herbaceous species

Several herbaceous species deserve comments because of their importance. Goats will normally consume most herbaceous species with a few exceptions, such as **mullein** (*Verbascum thapsus*) and **yellow crownbeard** (*Verbesena occidentalis*).

Sericia lespeceza (*Lespedeza cuneata*) - Goats often delayed consuming sericia lespedeza until mid-summer and then aggressively consumed it the remainder of the summer, often defoliating it to nearly level ground. Sericia has a large carbohydrate reserve in the roots of perennial plants and it takes three to five years for control. Goats usually consume the plants before viable seed is produced mitigating the problem of goats spreading the seed through fecal matter. This also aids in depleting seed in the soil seedbank and enhances long-term control. As goats graze and reduce the vigor of sericia lespedeza, grasses tend to fill in grazed areas.



Broomsedge bluestem (*Andropogon virginicus*) - Goats consume broomsedge and will gradually bring the species under control.

Western ragweed (*Ambrosia psilostachya*) - Goats generally consume little of the species although there are reports in some areas of goats consuming significant amounts. Sometimes, the goats will consume the reproductive portion of the plant which may reduce seed production, but in general, goats do not have a major impact on western ragweed.

Nightshade (*Solanum elaeagnifolium*) - This plant is toxic and goats do not consume it as long as there are other herbaceous species available. There are reports in Mexico of this plant being consumed in small quantities by goats.

Forbs

Goats will consume many forbs, including **amaranth, lambsquarter, ironweed, dock, bur dock** and others, providing good control of many of them.

Glossary

Biodiversity - the number of different plant species in an area; the more species of plants, the more productive and stable the ecosystem.

Browse - leaf and twig growth of woody species.

Forb - any non-woody broad leaf plant that is not a grass.>

Go-back land - land that was once cultivated and allowed to go back to grass and weeds usually for the purpose of being grazed by cattle.

Mott - a clump of small trees.

Range - an area of land that is populated with native species plants, often never cultivated.

Savannah - a site dominated by grass with occasional patches of woody plant species.

Seed bank - reference to weed and brush seeds that have accumulated in the soil over many years.