

AnPeischel

Tennessee State University, Cooperative Extension Program

3500 J.A. Merritt Blvd., Box 9635, Nashville, TN, 37209-1561Nashville, TN

The goat is an extremely agile, gregarious, and opportunistic creature. Management, through innovation and creativity, can successfully use those characteristics for the enhancement of lands. The management goal encompasses all ecosystems, biological and environmental, and success depends on flexible management plans and the ability to re-plan. To accomplish this, biodiversity must be maintained, the physiology of plants and soil understood, and man must make environmentally, economically, and socially sound decisions (Savory, 1998). Goats, under control, are being used to enhance land productivity and encourage vegetative biodiversity.

The use of goats in vegetative management can take on many diverse avenues. Goats can be used for noxious weed abatement, rejuvenation of abandoned and eroded lands, edging of woody and forb species, fire breaking and fuel load reduction, poisonous/toxic plant eradication, and enhancement of timber-producing forests through silvopasture and agroforestry techniques eliminating competition of unwanted species. Goats can stabilize stream banks and riparian areas, clean along irrigation ditches, minimize old fence lines, clear farm ponds, create flyways for ducks and geese along with landscaping around homes, and clean land in citrus orchards, nut farms, and vineyards.

A management criterion is to know the nutritional value of plants and vegetative regrowth, and encourage a change from regression plant communities to succession plant communities. Biodiversity of vegetation provides year-round selection for goats avoiding problems such as those associated with monocultures.

The goat is truly an opportunity for man to manage.

Energy, in pastoral-type agriculture is universal and can be used, stored, concentrated, or spread with the primary source being the sun. To use the natural energy flow efficiently, it is vital to control: the time of grazing/browsing, the area to be grazed/browsed, the season of grazing/browsing, the plant species to be grazed/browsed and the goat(s) that are being used for land management applications (Smith, 1986).

Along with all of the goats’vegetative activities, they provide mankind with meat, milk, fiber, skins and many other products(soap, cheese, creams, drums, gloves, etc.) used to enhance our lives.

There are many factors affecting the vegetation distribution that make up various plant communities. The integration of knowledge from separate disciplines (ecology, plant physiology, hydrology, climatology, forestry, soils, economics, animal science, sociology, and wildlife) equals the ecosystem foundation blocks (water and mineral cycles, succession and energy).

The basic forces that act on an agricultural enterprise are small amounts of energy. This input acts as an amplification factor, thereby increasing the amount of sunlight harvested, converted to a useable form, and marketed.

The biotic component is that of living organisms, plants, and animals. The herbivore, through browsing and grazing, affects frequency of plants grazed/browsed, the degree of vegetation removal, plant species selected, and the qualityand quantity of vegetation grazed. Other factors include pollination and seed scattering by animals. Decomposition takes place through other organisms (earthworms, nematodes, protozoa, bacteria, actinomycetes) which consume dead material and render it useful.

The abiotic component (non-living environment and exchange materials) affects vegetative distribution. These factors include the topography, altitude, exposure,insolation,precipitation, evaporation, evapotranspiration, and soil. The water cycle is driven by energy from the sun and its distribution affects vegetation more than any other single environmental factor. There is acontinuum between the soil, plants, animals,and the atmosphere.

Plant growth requirements are sunlight and the ability of the soil to provide moisture, support, protection, and nutrients. Vegetation that develops in an area is determined by soil characteristics such as texture, depth, slope, organic matter, pH, and chemical composition. These soil characteristics are determined by soil formation affected by climate, vegetation, parent material, topography, time, and soil organisms.

There are many environmental factors that affect vegetation distribution in relation to pasturelands and rangelands’ management. To be considered are topography, slope, precipitation, wind erosion and soil mineral content. Important land enhancement management decisions are influenced by the plant community and the factors that influence those communities.

Soil fertility can be enhanced by grazing/browsing management as it increases the amount of organic matter in the soil. As the percent of organic matter by weight increases, the percent of water-holding capacity by volume increases as does the extensive root system of plants. If a specific nutrient is lacking, it can be added to the goat’s free choice chelated loose mineral supplement. Soil nutrients get into the soil from the weathering of parent material, cropping practices, rain, dust, wind and are recycled by plant roots in the subsoil. Livestock deposit mineral supplements in manure as they eat about 50 pounds of mineral per year with 90% passing through as dung and urine. Livestock redistribute nutrients in a browsing system. Of the variation in species browsed, so varies the depth of the root system of the different plants and their ability to uptake different mineral elements. Therefore,use good rotation management (Gerrish, 1999). Manure helps increase the physical characteristics of the soil (aggregation, friability, tilth, increases water infiltration and retention and decreases root-knot nematodes and other plant root pests). Healthy pastures, healthy soil microorganisms equalshigh quality vegetation.

The quality and quantity of vegetation produced in a given time is dependent upon the amount of sun energy a plant can capture and convert to tissue (Table I). Plants need a leaf area to photosynthesize but a canopy cover of more than 30% can decrease vegetation production. As plants are browsed, recovery time is dependent upon soil fertility, season of year, soil moisture content, temperature, degree of defoliation, time of removal, animal species browsing and residual dry matter.

Residual dry matter is the forage dry matter remaining after a pasture/rangeland/woodland has been grazed or browsed. Different plant species (grasses/forbs/shrubs/brush/trees) vary in recovery time and climate effects’ recovery time. When using goats in vegetation management, there are many times when the available species are three-dimensional. The correct amount of residual is needed for rapid regrowth yielding higher quality forage so that livestock per acre can be increased as well as animal performance. There is a point of no return, approximately 2,000 pounds of residual dry matter per acre. High residual may also slow recovery rate, as sunlight is hard to capture, old leaves are less efficient producers than new leaves, the ratio of non-photosynthetic material to green material, and the leaf: stem ratio is stressed. As the amount of mature vegetation increases in a system, digestibility decreases, crude protein decreases and rumen turnover rate increases, all having a dramatic effect on body condition of the goats. In lightly-grazed paddocks with a high residual dry matter, a decreased rate of net photosynthesis available for new growth, and the old leaves, shade the new ones decreasing production. Leaf Area Index (LAI) is a valuable tool for assessing plant health.

The livestock used in a browsing regime must be under control – where they need to be, how long they are to be there and the number of animals that need to be there. The rate of plant species removal will affect the species returning to take its place in the ecosystem. Perennial vegetation should be encouraged due to depth of root zone, ability to absorb and store water and build organic matter. One does not want to over-browse the plant and deplete root reserves, nor over-rest the plants and decrease biodiversity. Caution is warranted at all times to avoid erosion and the creating of hydrophobic soils. In browsing management, use of animal behavior and herd effect allows concentrated animal energy input into a small area for a short period of time. Animals of the same physiological condition need to be foraged as a mob and the quality of feed on offer needs to satisfy their physiological requirements.

The physiological and psychological effects of stress on the goat have a major impact on production performance and health. It is therefore critical to have a basic understanding of goat behavior (social, nutritional, environmental, etc.) so as to enhance the welfare and well-being of the goat. The stockman needs to be observant, patient and understand that individual or small mob dynamics do not necessarily work with large commercial mobs; therefore, use caution when drawing conclusions.

When using goats for ladder fuel reduction, firebreaking, weed abatement, riparian area restoration…..there are basic behavioral patterns that can be used to enhance utilization of the goats or to curtail problems before they arise.

The selection of environmentally-adapted goats and goats in good physical condition with structurally correct conformation is conducive to success. When placing goats into a new area (fenced with portable solar powered electric polywire, or netting, parked on horseback with herding dogs) let the livestock guardian dogs check out the area first. As the dogs complete their rounds, then let the goats in. Once in the new area, the goats will circle the fence line and check out the vegetation. Then they will begin browsing.

In plant selection, goats eat from the tip of the plant toward the base selecting the highest quality plant and plant part the first time around (Table II). They eat the seed heads from grasses and forbs and select flowers of thistles and some brush species. Mobile lips and bipedal capabilities afford them the ability to select young buds, create a 6 to 8 foot browse line, and knock down larger diameter vegetation high in cellulose and lignin.

When browsing, they are always on the move – nibbling on one plant but on the lookout for the next selection. They consume vegetation from the outside perimeter toward the center of an area, cautious not to put themselves in a situation they cannot see out of. This behavior relates back to the predator/prey concept they have evolved with. Goats will turn, face an attacker, and become aggressive. When herding on foot or with herding dogs, be cautious with the amount of pressure exerted as it forces them into the attack mode and they will attempt to escape. If an escape happens, let the individual return to the mob on itsown accord. The goat is a social animal (bonded to the mob), wants to be part of a group and does not want to be out there alone. The stockman needs to know why the individual left the mob and correct the situation immediately so as to not encourage others to escape. Be conscious in rolling, hilly terrain to move goats uphill, or at an angle across a slope when coming downhill. They naturally select the highest spot geographically for afternoon naps and night camps,it affords safety without obstruction.

Besure the goats are trained to an electric fence before expecting them to respect the fence. Take into consideration when using “fencing” that browsing behavior, time spent browsing, rumination time, lounging time, and flow pattern of motion will change. Fresh water needs to be provided at all times in smaller troughs with a high rate of recharge. Goats can consume more than a gallon to a gallon and a half of water a day when it is hot, dry, and/or the vegetation is decadent, highly lignified, or fibrous. This consumption helps keep the rumen microflora colonized, increasing the digestion of cellulose and lignin. If you are in a situation where night corralling is to be used, it is important to have on offer a supplement, preferable a forage, as intake will be decreased and body condition score will decline; goats are continuous browsers. They browse for several hours, chew their cud, and return to browsing.

Goats have minimal subcutaneous fat and are susceptible to climatic changes of wet and cold. They will seek shelter during inclement weather so besure a brush canopy, trees, or rock outcroppings are accessible. If not, be responsible and creative with portable shelter. Older goats with a high body condition score can manage about 48 hours of extreme weather but younger animals and goats in poor body condition can succumb to death in about 12 hours. They cope with heat and humidity quite well but change browsing patterns and time of browsing (including plant selection) as the temperature soars. Trees and rock outcroppings afford some relief.

There is a dominance structure within the mob and they will form small familial “groups” within the larger social structure of the mob itself. This is very crucial for young animals as bonding teaches browse selection, establishes browsing territories, encourages various athletic habits, and increases survival rate (Kilgour and Dalton, 1984).

Sensory capacity of the goat comprises smell, taste, sound (above the range of human hearing), vision (enhanced peripheral vision), vocalization, body language, touch, and group size.

Time and patience is a virtue. Goats can be taught to adapt to change: herding on horseback or bicycle, loading readily into a stock trailer, decrease of social interacting space, and the ability to cope with individual stress for a short period of time. Temperament is not only a heritable trait (25%), but can be enhanced by imprinting at birth and creative insight of the herdsman. Give the goats time to assess the situation, they do make calculated decisions.

Environmental stresses (heat and cold, weather – precipitation and humidity, nutrient density, quality of feed on offer, predation, travel – activity and topography) will cause economic loss. The major losses are decreased reproductive performance of both males and females, inability to maintain body condition score, decreased growth rate of offspring, increased incidences of internal parasitism and a suppressed immune system.

Before starting a land enhancement project with goats, a goal for the land is established based on site analysis, water catchment, and erosion consequences. Soil texture should be noted as it affects rainfall infiltration and soil percolation capabilities. The final landscape goal is described along with the individual(s) owning the lands. It is at this point in time when an experienced service provider will do an initial site survey analysis, stay in communication with the landowner, and make the final decision as to whether livestock are the best solution to attain the final landscape goal. The management goal encompasses the use of all ecosystems with the success of the project centering around the flexibility of management plans and the ability to re-plan.

As a service provider (owner of the livestock), you must be successful not only as a land and livestock production manager but also as a business manager. The most important first step of any business venture is a plan. If you do not have a plan, how do you know in which direction to proceed and how do you know when you’ve gotten there? And during the planning process, research is conducted and a lot of first-hand contacts made. You need a financial plan so that enterprise evaluation can be incorporated into the business decisions. With a financial plan, a profit and loss statement is generated indicating gross margin – gross income and variable and fixed expenses. In the planning process, stock flow, stock allocation and the valuation of the different classes of stock are obtained in a “before and after” inventory assessment.

Why bother to do a business analysis? Since consistency and predictability of production management is the major goal, it will produce the gross revenue generated for each businessfactionwithin your plan. The analysis will show the cost of generating the revenue and the net profit for each business segment. The important factor is obtaining reasonable return for the time spent and the ability to consider your effectiveness and, if necessary, the information that might lead you to pursue other options.

As you are progressing with your business plan, you will be developing goals and objectives for the business. The goals you set should be realistic, attainable, and your production management land enhancement business sustainable. You are developing a business that must be marketable, economically feasible and able to produce the resultsfor prospective clients. To successfully solicit the business, an understanding of many facets of “paid to graze/browse” are necessary (Peischel, 2006).

A major determining factor to the success of the business is that innate ability of the provider to do a quality assessment of the environmentally adapted plant communities on site. From this information will come a browse preference list including the time of year the livestock (and class of livestock) are most likely to select or prefer the vegetation in the water catchment area. In the identification of vegetation composition and succession plant communities, poisonous plants and their toxins need to be identified along with the target plants. Soil texture and rainfall factor into erosion consequences if the percolation and infiltration capabilities are not understood. The sites need to be monitored, including an initial set of monitoring points. Vegetation monitoring can be through the use of photo points, transects, LandEKG(Orchard and Mehus, 2001), greenline vegetation composition measurements (USDI, 2000), water quality, the list is endless. Within this monitoring process, basal and canopy cover are assessed as is ladder fuel and fuel continuity.

The provider needs to know the amount or total of browsable/grazable biomass as part of costing out the project. It is the provider’s responsibility to ask about the previous history of the site in question (previous livestock usage to reference disease potential, soil or water contaminants).

A base map of the area and specific sites under consideration is required. On this map, the perimeter is defined, ecological constraints and exclusions are noted and the topography detailed. This equates to the understanding of fire ecology and identification of shelter for inclement weather. Wetland(s) regulations need to be championed, EPA and NEPA requirements fulfilled, the ESP endorsed, Fish and Game Conservation corridors and zoning restrictions respected. Neighbors and adjacent landowners need to be fully informed as to the intentions of the landowner anticipating the use of livestock lands’ enhancement.

Animal welfare and the issues related to the health and well-being of livestock are the first and foremost priority of the provider. A health maintenance program should be in place, internal parasite assessment current and no known zoonotic diseases or other transmissible diseases present. Body condition scoring (BCS) is a top priority before going into a browsing project and monitoring the condition of the goats throughout the duration. The body condition of the goats at the initiation should be a BCS 6 (out of a possible BCS 9) and not drop below a BCS 4. Healthy animals are an asset to a land enhancement endeavor.

It is also important for the provider to select the correct species, breed, age, and class oflivestock to be used in a prescribed herbivory venture. Animals that are adapted to the environment, climax vegetation, and topography are an asset. Those individuals or a mob that has experience working on previous projects is of great value (Provenza, 1992).

Effective livestock guardians are of utmost value when working in an extensive, isolated, or predator-infested habitat. Remember that the most dangerous of all predators are domestic dogs that have joined as a pack to kill for the “thrill.” The species and breed of the guardian required will be dependent upon the class of livestock to be protected, topography, and type of predator (nocturnal or diurnal). Age, level of experience, and number of guardians needed is based upon species and aggression of predator, herd size and management practice (portable, solar powered electric fencing/herding). A livestock guardian dog, less than two years of age, should not be asked to put their life on the line for livestock. Let them have the time to gain experience from a successful, competent mentor and be used as visual backup until they are at least two years old. As the number of guardians in use increases, each dog will find its niche in the working scheme of the mob. Understand each dog’s duty within the mob before adding or deleting a dog from a functioning group. Livestock guardian dogs will need to be fed a high energy, high protein food daily. The dog food should not have ruminant animal protein as an ingredient. Each dog requires its own feeder spaced to prevent squabbling at feeding time.

Forest Management

There are various tools that can be used to minimize the damage done by fire to grasslands, rangelands, forests, homes and personal property. The tools rangefrom mechanical (bulldozers, masticator machines), hand cleaning (Weed Eaters, chainsaws), wildfire landscape design, herbicides (labeled for forbs/shrubs/woodyspecies), prescribed burns and livestock. Each tool has a specific use and place in management. A vegetative survey analysis is done, and an assessment made for the use of each tool.

Fire protection and mitigation is a factor that should be built into the management plan of ranches, farms (crops, trees, livestock), subdivisions and secluded home sites but particularly the urban/wildland interface. This interface (the I-Zone) havea policy for zoning and the establishment of subdivisions (Slaughter, 1996).Self-help, neighborhood teamwork and an understanding of nature make for mitigation approachable. The consequences of fire: erosion, floods, biological devastation (vegetative, wildlife) should be curtailed instead of accepted as the outcome of fire.

Fire prevention (and minimizing the damage) encompasses selecting the correct home site, zoning ordinances that are respected, landscape planning and design with mixed plant species, fuel discontinuity, fuel load reduction and fire breaking. All approaches must take into consideration climate, topography (slope, soil, elevation), vegetation (drought-tolerant plants, plants adapted to fire and plants that can be managed to minimize fire travel) and fire frequency in the area.

Goats are only one in many management scenarios that can be used to curtail the devastating loss created by fire(Peischel, 2004).

Fuel Load Reduction. Fuel load reduction references a reduction and lowering of ladder fuels (through pruning) and minimizing down material (through removal or mulching). Ladder fuel is vegetation growing under (understory, basal canopy) or in stands of trees that will ignite, travel up the tree and crown fire. Crown fires can generate their own weather and consume thousands of acres. They are extremely difficult for fire suppression teams to contain. The reduction of down material can be accomplished by removing “snags” out of standing timber, firewood cutting of downed trees, the physical removal of downed trees, or the use of livestock to break down and mulch-in slash material.

Goats used for fuel load reduction are managed to remove dense understory (brush, shrubs, forbs) and lower branches to prevent “laddering.” This technique takes time, and time relates to the biological control of reduction and returning to sites being reduced. On occasion, it can mean the supplementation of protein or energy for the goats (depending upon the class of goat used and time of year). A free choice, loose chelated mineral mix needs to be available. It is balanced based upon profiles of soil, vegetation and livestock analyses. Depending upon the vegetation, young tree plantations or older plantations, the management can be over several years. Management includes a return maintenance program. Depending on the vegetation type, sheep or beef cattle may need to be added to the regime.

Eliminating the ladder fuel gradually prevents soil erosion, and enhances rainfall infiltration and even percolation through the soil interface. As the goats work through an area, they are also working the understory – old pine needles and leaves, breaking lower branches and splitting apart old downed branch material. Vegetation that returns can be perennial grasses, some annual grass species, evergreens, and many forb species.

Fuel Discontinuity. This management approach of fuels breaks the continuity of flammable cover. The special distance of canopy cover between trees and shrubs is managed to keep a potential fire low and non-crowning. The reduction (and/or removal) of the lower growing species can also be minimized. The vegetation is managed to maintain a low profile, controllable so that backfiring is easier, or kept in a growth phase enhancing a higher water holding capacity within the plant. Once an area has been brushed by the goats, it can be maintained to be a ”living” green belt.

Fire breaking. Management of vegetation in an area to establish a firebreak is intensive both on the vegetation and livestock phases. In a fire break regime, the goal is to prevent a fire from going any further – not to cross or jump the breakline, a controllable situation. This technique requires an understanding of fire behavior to determine where the breaks need to be established.

An assessment takes into consideration an evaluation of fuel flammability, heat intensity and duration, ignition temperatures (airflow and rate of heating), heat of ignition (fuel size distribution, live:dead material ration, moisture content of fuel) and heat transfer (interaction with topography). For example, tunnels and chimneys in canyon or saddle areas need completely different types of firebreaks than grass or rangelands.

With the goats, the goal is elimination of vegetation to slow the oncoming fire down, decrease the intensity and allow a fire crew access to an area so they can successfully contain a fire. Surveillance of goats to maintain a positive BCS is critical. BCS cannot fall below a BCS 3 when using experienced wethers. A good firebreak will help the “mop-up crew” coming in after a fire. After the mop-up crew, a fire site analysis has to be completed, erosion containment planned, reseeding, replanting, wildlife habitat re-established, water tested for quality and stream health assessed.

Utilization of goats as a tool to assist in fire prevention, mitigation and/or control is not an overnight remedy. Proper planning, site evaluation and working goats takes time. The number one concern is maintaining the health, welfare and body condition score of the goats.

StreamBank Restoration

In the process of restoring a dry stream to a perennial stream, ecological phases are changed slowly over time (Peischel, 2004). The process can take from one to three years to approach the ephemeral stream phase depending on steepness of banks and density and type of vegetative species. It may take another four years until the ephemeral stream begins to flow as a perennial stream. The process is “in and out” throughout the seasons and over the years. Factors taken into consideration are: angle of the stream bank, soil type and structure, physical size and weight of the goats, time of year (erosion avoidance), the plants that need to be minimized and when the goats prefer to consume them, species of vegetation returning to stabilize the stream banks, rate of water flow, temperature of the water, and turbidity.

Once the stream bank has become stabilized, it can be maintained by the management of vegetation with goats to keep the water flowing, minimize insect populations and improve the quality of the water. It is advisable to not let goats consume water from streams or ponds but to provide access to fresh water daily.

Eradication of Noxious Vegetation

Before starting an eradication process, understand the physiology of the plant selected, the reason it is present within the area and the probable vegetative species that will take its place in the landscape mosaic. It is at this point in time where class of goat becomes relevant (Peischel, 2004).

Yellow star thistle (YST, *Centaureasolstitialis)* consumes hundreds of thousands of acres in California and other western states. It is an invasive plant that invites itself into over-grazed and under-rested pastures. Goats and sheep can be used to readily minimize the plant but it is not preferred by cattle. YST does not handle browsing pressure and does not like shading; therefore, as the small ruminants graze it down and other vegetation begins to return, the YST minimizes. Although, it is a high quality plant and under the right situation can be used for weight gain on wean-offs and flushing does before breeding.

Dog fennel (DF,*Anthemiscotula*) grows quite aggressively in shaded areas, has a rank odor and is preferred by young buckling. During a growing season, it can be eliminated from along old hedge rows and within Christmas tree plantings.

Poison oak (PO, *Toxicodendronpubescens*) is very toxic to humans with an allergic reaction to the oils of the plant, whether touched or fumes from being burned. Mature goats will eat the dead leaves and growing tips of the plant whereas the young kids will eat young buds and fresh young leaves. Therefore, it is advantageous to run does with kids through an area where poison oak eradication is needed.

Vinca (*Vinca minor)* is not readily selected by goats, they prefer to pass it by when cruising an area for browsing. The plant cannot tolerate trampling and can therefore be pugged (intentional walked on) out in a short period of time. If pugging is done before flowering, the process will be more successful.

Ferns (consisting of hundreds of genera and thousands of species) are very abundant in woodlands of the eastern and western regions of the U.S., therefore it is pertinent that identification be obtained before engaging in land enhancement. Some ferns are toxic, others have anthelmintic properties and some are hematologic. Goats can be used to minimize ferns in the understory of forests but only after identification, knowledge of toxic element and exact time to browse the plant.

It should be noted, as a browsing plan is put into place, that for every 400 feet in elevation, there is a 4-day delay in plant physiology.

The most important concept to remember – sustainability through BIODIVERSITY must persist over generations and flexibility enhanced. Renewable resources are to be used wisely with pollution rate kept to a minimum. Brush, range and pasture management is based on the physiology of the plant and the ability of man to make social, environmental and economically-sound decisions.

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**Table 1. Chemical Composition of Various Plants Browsed by Goats (%)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Browse Type | Crude Protein | Neutral Detergent  Fiber | Calcium | Phosphorus | |
| Multiflora Rose  *Rosa multiflora* | 18.8 | 34.5 | 0.99 | 0.32 | |
| Honeysuckle  *Lonicera* | 12.8 | 34.5 | 1.12 | 0.30 | |
| Brambles  *Rubus* | 15.9 | 24.5 | 0.23 | 0.84 | |
| Black Locust  *Robiniapseudoacacia* | 23.0 | 44.0 | 1.26 | 0.21 | |
| Privet  *Ligustrum* | 18.0 | 26.8 | 0.89 | 0.34 | |
| Green Briar  *Smilax* | 17.0 | 39.5 | 0.60 | 0.18 | |
| Trumpet Creeper  *Campsis* | 16.7 | 43.1 | 0.42 | | 0.22 |

**Table 2. Browsing Calendar(based on the goat)**

|  |  |  |  |
| --- | --- | --- | --- |
| Species | Preferred Time | Not Preferred | Notes |
| Yellow Star Thistle  *Centaureasolstitialis* | Leaf phase through  seedhead production | Cane heads are dead  and empty | All ages and classes select 1st at various growth phases |
| Scotch Broom  *Cytisusscoparius* | Before flowering and after fall die back | Flowering | Caution using young doelings and pregnant does |
| Chamise  *Adenostomafasciculatum* | Fall, winter, spring | Mid to late summer |  |
| Buckeye  *Aesculuscalifornica* | Fall as leaves die back and seeds drop | Green and productive | Toxic when green |
| Tamarisk  *Tamarix* | New shoots and young branches | Old decayed plants | Continuously barking and trampling |