FORESTLAND GRAZING: UNDERSTORY FORAGE MANAGEMENT

by
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INTRODUCTION

Forested ecosystems can provide a significant resource base for livestock grazing. Although forested land is opportunistically used for grazing it is rarely managed for both grazing potentials and wood production. The complexity of managing an overstory of trees as well as an understory of grasses, forbs and shrubs requires landowner sensitivity to the ecosystem processes that livestock grazing will impact. All of the challenges associated with range management such as minimizing soil compaction, stream degradation, weed introduction, increased erosion and decreased soil productivity are also found on forested land. In many instances, forest ecosystems are more sensitive to grazing because there is less ground cover to buffer the impacts of livestock use and the overstory of trees is profoundly influenced by alternations of the understory environment. Documented concerns are increased tree insect and disease occurrence, changes in natural seedling regeneration, tree growth reduction, changes in stand species composition and degradation of wildlife habitat. On the other hand, proper forest grazing can lessen fire hazards by reducing fine fuels such as cured grasses, and enhance tree growth and natural regeneration by reducing the competitive effects of understory plants, particularly on water limited sites.

FOREST UNDERSTORY PRODUCTIVITY

Potential understory forage productivity depends on the resources limiting plant growth on each specific site. The combined effects of climate, slope, aspect, and soil have the strongest influence on species distributions and their growth across the landscape. Throughout Montana, soil water availability and to a lesser extent soil nitrogen are the predominant limiting resources affecting plant growth. Any landscape feature or management practice that increases these two resources will result in higher plant productivity. Hence at lower elevations, north aspects (less drying from the sun) are often more productive sites than south aspects.

Dominant tree species present	Effective annual precip. (inches)	Major native grass species	Average potential forage (lbs/acre)
limber pine	10.4 - 14.6	bluebunch wheatgrass Idaho fescue	200 - 500
ponderosa pine	10.9 - 16.5	bluebunch wheatgrass Idaho & rough fescue	200 - 1100
ponderosa pine and Douglas-fir	17.8 - 19.4	bluebunch wheatgrass Idaho & rough fescue	200 - 1100
Douglas-fir	17.8 - 19.4	pine grass, elk sedge, rough fescue	200 - 1100
grand fir, Douglas-fir ponderosa pine, western red cedar, hemlock	30.0 - 34.0	pine grass, elk sedge Mutton blue grass Sandberg bluegrass	400 - 2000
subalpine fir, Douglas-fir, lodgepole pine	21.1 - 53.8	junegrass, pine grass elk sedge, tufted hairgrass	300 - 2000

Naturally occurring plant species can be used as indicators of site productivity as well. Some tree species such as ponderosa pine, are more drought tolerant than other tree species such as lodgepole pine, grand fir or subalpine fir. This provides a useful tool for getting rough estimates of potential site productivity. The preceding table (from Pfister et al. 1977, Mueggler and Stewart 1980) can be used to estimate the "effective" annual precipitation and ranges of forage productivity based upon the predominant tree cover for a particular location.

MANAGING FOR FORAGE

Soil water and nutrient availability largely determine overall plant community productivity and are a relatively fixed landscape phenomena. The amount of light reaching the forest floor is the most influential and manageable variable affecting understory forage production. Relationships regarding tree canopy density and understory plant growth have been developed for major forest cover types in Montana. In general, a tree canopy that covers more than 50% of the open sky will shade out most understory plants rendering the site unproductive for grazing. Decreasing the amount of forest canopy cover to less than 50% results in a proportional increase in forage production until the tree canopy cover has been reduced to 10 - 20%. Figure (1) demonstrates the results of canopy thinning on forage production for several typical forested sites in Montana. Understory vegetation from ponderosa pine forests increased proportionately to decreases in crown cover until a canopy cover of 20% was left. Further thinning resulted in no further understory increases. Canopy thinning in stands of Douglas-fir on the other hand showed continuous increases in forage production until the stand was clearcut . This type of variation in treatment response can be attributed to the combined influences of aspect, slope and the structural differences in tree species crown development.

Figure 1. Measured increases in forage production three years after thinning trees on three forested sites. The symbol (▲) represents tree spacing for corresponding canopy cover on one Douglas-fir site.

All of the conducted studies required three to four years for understory grasses and forbs to fully respond to an overstory thinning. In all cases little or no response was found after the first year. Seeding desired grass species resulted in an increase in response time and forage production of up to 50%.

The impacts of a forest canopy on understory plants can vary with aspect and slope (Figure 2). The effects of aspect most likely explain the different responses of understory forage production to thinning between the Douglas-fir and ponderosa pine sites in the previous example. Plants on southern aspects are exposed to direct sunlight and are therefore subjected to intense sun, which results in higher surface temperatures and a drier environment. Partial shading from trees can benefit forage production in these circumstances. Most of the sunlight on northern aspects, however, is reflected light from the atmosphere (called diffuse sunlight). Overstory shading on these aspects will benefit understory plants less. The difference in sunlight intensity between southern and northern aspects is more pronounced as slope steepness increases.

The effect of aspect on sunlight diffusion through a forest canopy

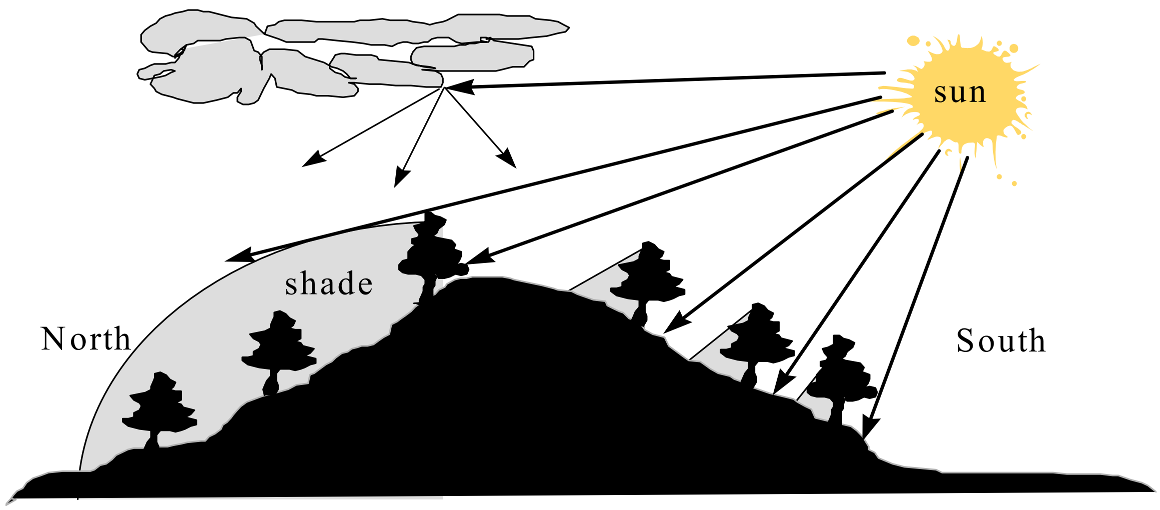

Figure 2. Competition for light can be more intense on north aspects because direct sun is more likely to be intercepted by tree crowns. Alternatively, the effects of shading on south aspects can be beneficial to understory plants.

Canopy cover can be estimated by visualizing a 42 ft. diameter circle (1/10th acre) on the ground and estimating how much of that circle has tree canopy directly over it. Depending on the tree species present and their age, some light is transmitted through the canopy. In general, ponderosa pine and lodgepole pines have open canopies and allow 25% light transmission, Douglas-fir 15% and grand fir and subalpine fir only about 5%. Based upon these estimates, a ponderosa pine canopy that covers 100% of the site will still allow 25% of the sunlight through, resulting in a 75% canopy coverage.
Although tree spacing can be roughly equated to tree canopy cover, caution must be used since individual tree crown size varies considerably. Stands of trees with a closed canopy (100% crown cover) thinned to a 20 x 20 foot spacing have shown increases of up to 200% in understory forage production. Although thinning stands to greater spacings can potentially increase forage production further, the risk of wind throw damage to the residual trees increases significantly. As a general rule, tree crown cover should not be reduced greater than 60% at any one time. The remaining trees will eventually grow larger crowns in which case another thinning can be initiated.

Aside from providing increased light transmission to the forest floor, thinning dense stands of trees also increases the effective precipitation reaching understory plants. Dense forest canopies intercept significant snow and rainfall throughout the year. Most of the intercepted precipitation evaporates directly into the atmosphere thereby reducing the amount of water reaching plant roots. Thinned stands of trees tend to collect snow, increasing the spring water supply to an area often as much as 100%. In drought prone areas this is another factor that affects both tree growth and potential forage production.

ECOLOGICAL IMPLICATIONS

Although thinning stands of trees to increase forage production is theoretically a simple operation, several potential impacts need to be considered. These include recruiting desirable understory plants, maintaining a healthy residual stand of trees and assessing the impacts on the watershed. Heavy soil surface disturbances can cause an increase in undesirable understory species and stress residual trees. Many plant species that are undesirable for grazing purposes store seeds in the soil that will germinate when exposed to light and warmer spring surface temperatures. In many forests, only 40% of the naturally occurring understory plant production is composed of palatable plant species. Although grasses tend to have the greatest response to increased light, logging activities often favor adventitious plants such as exotic weeds, thistles and brush species. A means of minimizing soil disturbance is to limit logging activities to the winter months when frozen soil and/or snow cover will protect the soil surface. Furthermore, winter logging will allow spring slash treatment such as burning and an opportunity to seed desirable grass species as soon as the snow melts.

A variety of non-native grass species will grow well in a forest understory environment. Species that initiate growth in spring such as timothy and orchard grass are recommended. Trees are significant competitors for soil moisture and are deeper rooted than grass species, giving them the advantage during the dry mid to late summer months. Seeded grasses that complete most of their growth cycle before the soil dries out will produce the highest yields and also compete more successfully against introduced weed species. Trials involving the best time of year to seed have shown that both spring and fall seeding have their advantages. Fall seeding (November) will allow seeds to germinate as soon as the snow melts in the spring thus taking advantage of early soil moisture. Since forested environments are also well inhabited by seed predators such as mice and songbirds, the risk of losing significant seed to predation is a possibility. Although spring seeding is a means of avoiding seed predation, getting seeds dispersed in time and under wet conditions can be challenging. In either case broadcast seeding by hand or off the back of smaller equipment such as four-wheelers is an effective means of seed dispersal.

Understories composed of native grass species such as pine grass and elk sedge have lower potential forage productivity, however they also tend to be more resistant to drought stress and invasion by exotic weeds. Ecophysiological studies have shown that elk sedge and pine grass are extremely drought tolerant, well beyond most tree species and non-native grasses thus providing a highly competitive environment that excludes exotics and prolific tree seedling establishment. Finding a commercial seed source for these species can be challenging however. By excluding grazing for a minimum of two years following tree thinning, native species will spread to logged areas. Ensuing forest grazing should be less intense than on nonforested rangeland since understory plants are continually competing for limited soil resources with overstory trees. Late spring grazing minimizes negative impacts on these species. Many of the historic forested parks evolved with seasonally limited grazing. This allowed native grass species to maintain their competetive advantage over forbs, brush and tree regeneration. With intensive grazing, many of these parks have converted to dense thickets of tree regeneration or brush fields. Although many forested areas have the potential for increased long term forage production, this resource is less forgiving than typical rangeland and should be carefully managed to enhance both grazing and tree growth.

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