4M 3-31-72

D

Forest Grazing

Extension Circular 798
January 1972

Cooperative Extension Service
Oregon State University, Corvallis

Contents

Forest Grazing

Ben Wood, *Range Management Specialist*
Oregon State University

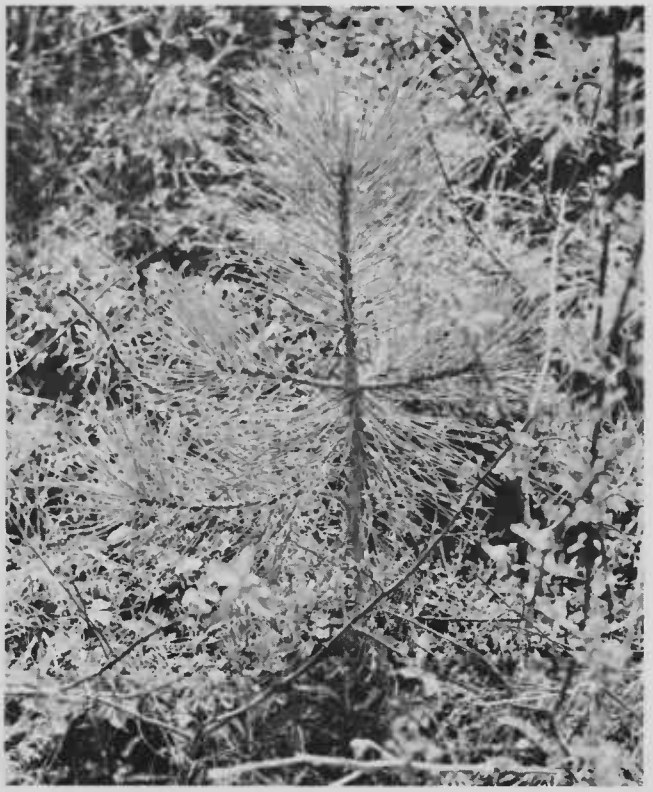
Introduction

Past research in western Oregon and concurrent research in northeastern Oregon has shown that livestock grazing and forestry practices can be compatible and complementary. However, there are two ever-present problems, i.e., (1) uneven distribution of livestock, which results in forages being wasted in some areas and other areas being overused, and (2) competition from herbaceous and woody species with desired coniferous species.

The performance of coniferous seedlings is strongly related to their crown size and their height position relative to competing species. Conifers in high moisture areas will almost never emerge from a dense brush cover within any period of time acceptable for forest management.

Research in white oak areas of western Oregon has shown the Douglas-fir seedling will grow more rapidly under a regime of carefully controlled light to moderate spring grazing by sheep than under a regime of no grazing. After three years of short-term spring grazing, the height of Douglas-fir was significantly higher on the grazed plots. When the trees were remeasured after ten years had elapsed, they averaged 25 inches or 27 percent higher than their counterparts on the ungrazed plots. This differential in height was attributed to the removal of competing species by judicious management of grazing animals. Reducing the competition of herbaceous species by grazing helps provide more moisture for seedling establishment and growth. Higher levels of soil moisture at 5 and 12 inches deep on the grazed plots correlated well with the removal of herbage by sheep.

Ponderosa pine growing in plots where competing vegetation has been controlled by cattle grazing. (Tree is 34 inches tall.)



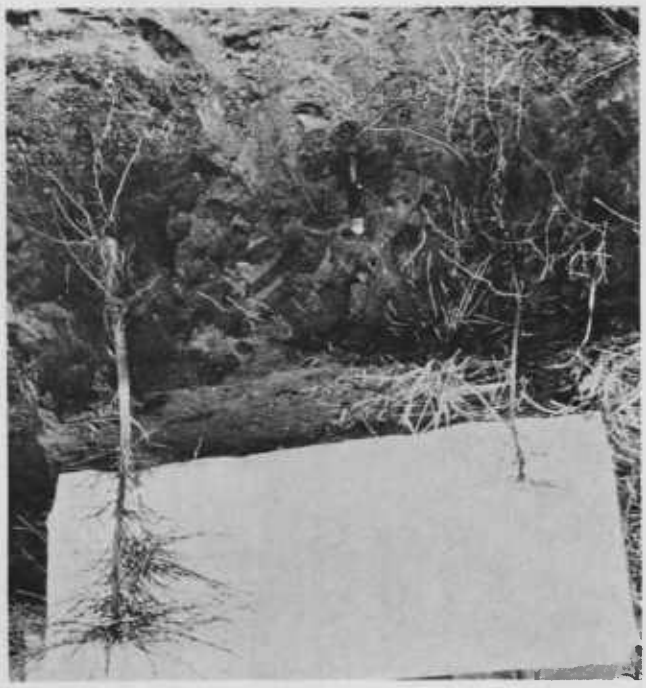
Ponderosa pine growing in plots where competing vegetation has not been controlled. (Tree is 18 inches tall.)

The results of the on-going forest grazing project at Eastern Oregon Experiment Station also confirm that management of grazing can be successfully used to reduce competition of undesirable herbaceous and shrubby species, thereby enhancing the establishment and growth of desirable coniferous species. Such grazing management also minimizes invasion of unpalatable species and encourages the growth of desired grass species. This helps to maximize the amount of forage available, but still encourages forest regeneration. This kind of management will also enhance environmental quality by minimizing erosion hazards.

Mixed-Coniferous Forest

Methods of obtaining uniform animal distribution in forested areas can be aided by discussion of some of the forestry problems associated with a particular Douglas-fir-ponderosa forest type of eastern Oregon. This vegetation zone which receives about 20 inches of precipitation represents much of the foothill areas of the Wallowa and Blue Mountains. Within this zone is a mixed-coniferous forest type which comprises about 10 percent of the total forested area in northeastern Oregon and adjacent Washington. This type is found on deep ash soil on rather steep north to northeastern facing slopes. The stands of trees which are comprised of grand fir, Douglas-fir, and western larch with some ponderosa pine are quite dense and present the most difficult problems with respect to management of grazing.

In the mixed-coniferous forest type, Douglas-fir and ponderosa pine are most common under moderately dense and open overstory canopies, respectively. Grand fir tends to be dominant under every degree of undisturbed forest canopy, and it is the only species reproducing under dense canopies. Hence, these two situations strongly suggest that the mixed-coniferous forest type is potentially a grand fir forest type.



Effect of grass competition upon root development of ponderosa pine.

Implication from Past Management and Research

Logging practices over the years have selectively removed the most valuable lumber species, viz., Douglas-fir and ponderosa pine. This type of harvest has hastened the dominance toward grand fir on many areas. Even though the demand for grand fir lumber is high at times, the supply is usually limited because this species is highly susceptible to heart rot.

Forested lands of northeastern Oregon which are typical of many grazing allotments.

Research reported from Washington has indicated Douglas-fir and ponderosa pine actually grow more rapidly on mixed-coniferous forest sites than on sites where they normally tend to be dominant. This means managing for these species on mixed-coniferous sites would result in better timber harvests in a shorter period of time.

Mixed-coniferous sites have a high potential of productivity because the soils are usually 4 to 6 feet deep and have a high moisture holding capacity. This soil moisture is readily available for plant growth.

Densed stands of trees which are common in the mixed-coniferous forest type greatly decrease the timber values. Also, note the tall shrubs, such as oceanspray and ninebark, which produce little available forage.

Forage Production vs. Overstory Canopy Coverage

Forage production on these sites is low because the overstory canopy is characteristically dense. On the average, the shrubs will produce a total of about 8,000 pounds (air-dry basis) of organic matter per acre, of which only an average of 85 pounds per acre will be current annual growth. In other words, it takes about 100 pounds of shrubs per acre to produce 1 pound of potentially usable forage. The greatest amount of this growth is produced under crown covers of less than 40 percent.

Shrubs, whether tall or low, and the herbaceous vegetation are found predominantly in low-density crown cover areas. In particular, tall shrubs such as ninebark, oceanspray, and willow are concentrated beneath the margins of openings in the tree canopy.

The area occupied by the mixed-coniferous forest on the Hall Ranch of Eastern Oregon Experiment Station has been stratified according to overstory canopy as follows:

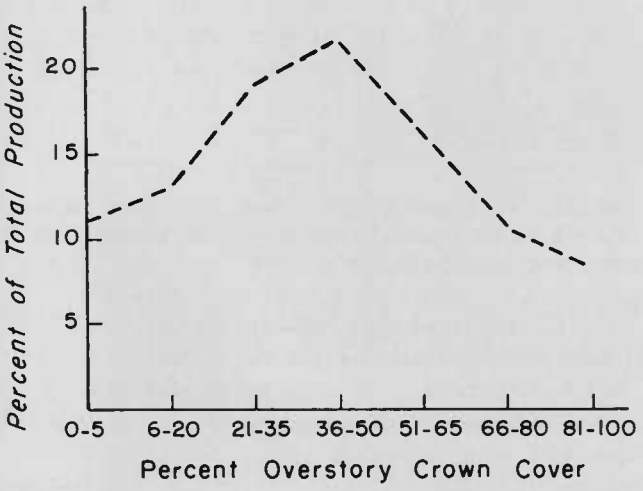
Open canopy (sun spots)	20%
Moderate shade	30%
Heavy shade	50%

These three cover classes are defined: (1) open—0-20% overstory cover, (2) moderate—21-40% overstory cover, and (3) heavy—greater than 40% overstory cover.

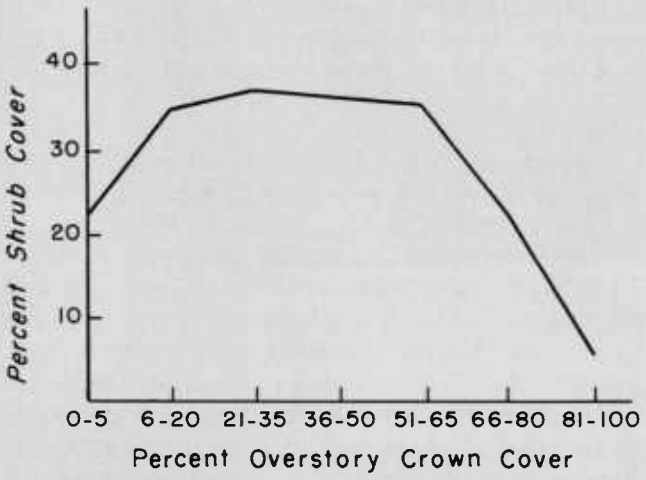
The sun spots can be as much as four times as productive as the heavy shade areas. However, when the production of all three areas is weighted in relation to the total area, each one contributes about equally to the amount of forage available.

The total herbage production on an air-dry basis, which includes the current annual growth of the shrubs, varies approximately from 500 pounds per acre in open stands to 100 pounds per acre in dense stands. This means the usable forage production is between 250 and 50 pounds per acre, if the rule of thumb take-half, leave-half is applied.

From the graphs illustrating the relationship between overstory tree canopy and weight or crown cover of the shrubs, it is obvious that there is a negative association between overstory cover and forage production. In fact, the overstory accounts for more of the variation in herbage yield than either basal area of trees or stems per acre.



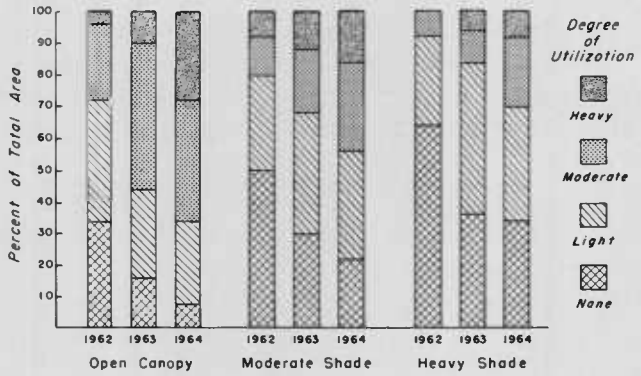
Relationship of total weight of shrubs to overstory crown cover in the mixed coniferous forest. (Adapted from Hedrick, D. W., et al. 1968. Effects of forest and grazing practices on mixed-coniferous forests in northeastern Oregon. Oregon State University Agricultural Experiment Station Tech. Bulletin 103. 24 p.)



Relationship between tree overstory and shrub crown cover in the mixed coniferous forest. (Adapted from Hedrick et al. 1968.)

Forage Utilization

Livestock prefer areas in the following descending order of use: (1) open areas, (2) edges of tree stands where they shade up, and (3) areas under dense canopies. The relationship between the overstory canopy of the trees and forage utilization is illustrated in the bar graph below.



Relation of overstory to forage utilization estimates throughout the mixed coniferous forest on the Hall Ranch. (Adapted from Hedrick et al. 1968.)

It is apparent that light or no use is common under heavily shaded areas. Conversely, moderate and heavy use are more generally the rule under open canopies. Understanding this relationship is the key to developing range management programs in forested areas. This means that grazing will have to be planned according to availability of existing and new graze. Resource managers must also take into consideration plant changes with time. These changes or plant succession will change the vegetal aspect of a logged area from grasses and forbs to shrubs, and eventually to trees. Therefore, the needs of the grazier, the logger, wildlife, and the recreationist must be integrated into each management plan where desirable and compatible.

Abundant growth of elk sedge in a new opening created in a stand of mixed-coniferous forest. Four years previous the understory vegetation was very sparse.

Management Prescriptions

How can the low-output of usable forage and timber be corrected, thus realizing the high potential of this forest type? In other words, how can range and forestry practices be integrated to overcome the effects of dense canopy and disease?

Logging

The answer seems to be to initiate logging practices that favor the growth of Douglas-fir and/or ponderosa pine. This usually means some kind of an intensive, selective cutting program or clear-cutting. It is well known that thinning, which is actually the result of a selection-cut, will increase forage and browse production as well as tree growth. All forage species generally increase where old openings are enlarged and new openings are created. A three-fold increase in forage production can be expected on properly managed sites.

The total production of shrubs on logged areas is not as great as that on unlogged areas, but the amount of current annual growth is greater. For example, data reported from Eastern Oregon Experiment Station are as follows:

	Logged	*Unlogged*
	pounds/acre	
Mean shrub weight	4,100	6,900
Mean current annual growth	190	70

These comparisons were made four years after logging had occurred. The amount of potential forage production increased 171 percent. Most of this increase was attributed to tall shrubs such as ninebark and oceanspray.

Soil Disturbance

Logging has an adverse as well as beneficial effect upon forage production. Areas where the subsoil has been exposed by logging activities may produce only one-third as much herbage as areas where the soil surface has not been greatly dis-

turbed. Heavily disturbed areas usually vary from 15 to 25 percent of the total area which is logged. These areas recover slowly and are often occupied for several years by annual and biennial species. These kinds of species are not reliable sources of forages and are usually unpalatable to domestic and wild animals. The effect of soil disturbance upon herbage production is reported in the following data:

Degree of Soil Disturbance	*Herbage Production (lbs/A)*
No disturbance	240
Light-moderate disturbance	320
Heavy disturbance	80

The most efficient and practical means to overcome the inevitable soil disturbance associated with logging is seeding these areas with adapted grass species compatible with forest regeneration. Blue wildrye, mountain brome, and orchardgrass are good species to use. Timothy and tall meadow oatgrass can be used, but these species may increase rodent problems because rodents relish the swollen stem bases of these grasses. Sod forming grasses like intermediate wheatgrass would not be recommended.

Animal Distribution

Accumulations of logging debris may greatly affect animal distribution and even forage production. Any advantage of increased forage production resulting from opening up the forest canopy can be completely negated by slash piles. These piles can be effective barriers to animal movement and uniform distribution of animals. The end result may be that the area is utilized by livestock in the same or similar manner prior to logging, that is, the livestock will preferentially use the openings, regardless of season. This preference for open areas is probably related to a great extent to the fact that unshaded plants produce more sugars than plants growing under the forest canopy. There is also a positive association between the amount of forage production and the degree of use.

Cattle will get over and around logging debris if they are left in an area long enough. They will eventually move from the openings to less accessible areas when forages become scarce. The net result is that the desired forage species are heavily grazed. The unpalatable species are used only to a limited extent; consequently, they are the plants which produce seeds. The excessive trampling associated with overuse prepares an ideal seedbed in ash soils for species such as cudweed, pearly everlasting, mountain pea, and slender and tufted hairgrasses. Therefore, it is recommended that logging slash be removed and logs which are not removed be left lying on or near the ground and positioned up and down slope in order to facilitate ease of animal movement throughout the logged area.

Ways to Improve Forage Utilization

The basic idea of improving livestock distribution, hence utilization, is to effectively enlarge the area of properly grazed ranges. If livestock are allowed to graze at will, they will seek out only those areas which are readily accessible. This, of course, places the burden of grazing upon the best areas while forages are wasted in less accessible areas. This same situation even occurs when the number of animals is reduced. Decreasing the number without improving distribution only decreases the amount of area overused and increases the amount of area underutilized.

Effectively grazing underutilized or non-used areas usually results in some kind of deferment of the most productive sites. This kind of grazing is often the best tool of management to bring about improvement in the health of a range.

Fences

The patterns of animal movement on each management unit should be plotted on detailed maps and critically analyzed. Such information is prerequisite to developing any sound fencing program. In general, fencing should be used to control seasonal drift of livestock and regulate use among different forage types. This latter point means that the highest producing sites, e.g., meadows and open forests, should be used separately from the lower producing sites, e.g., mixed-coniferous forested areas.

As a rule of thumb, fencing should not be closer to water than the distance cattle normally graze from it. This helps to alleviate or reduce the amount of time spent at the water hole. Cross fencing is used to divide areas into rotational pastures,

and drift fences are used to control animal movements in an elevational sense.

Water

Even in forested areas water development is important. This is because water is the center of grazing activity. The distance the livestock will travel from their source of water to graze determines the size of a usable range. Steep, dissected topography requires that water be easily available. The distances to water will vary according to the lay of the land, but one-half to one-fourth mile is often used as the standard distance in mountainous country. This, of course, can be better evaluated using maps showing in detail the patterns of use within each management unit.

Salt

Cattle utilize salt as part of their daily grazing routine. Research has shown that cattle will average 7 hours between salt and water when the distance between the two is about three-fourths mile. Because cattle normally take salt every day, placement of salt in the less desirable areas can be a management tool to help bring about better animal distribution.

Access Routes

Both salt and water should be accessible and usable without undue inconvenience, or else they will not be management tools. This means access routes along trails, skid roads, and roads should be free from debris and obstacles. Often trails need to be provided in order to get the animals off roads.

Riding

Livestock tend to migrate to certain areas in spite of adequate water development, access routes, and "salting the forage." This is particularly true if the animals are left untended throughout the grazing season.

Periodically changing salt grounds, and introducing the animals to unused areas, is required to make the best use of most mountainous sites. This is especially true for mixed coniferous forests. If these changes are made by "family" groups they tend to be more successful because the animals will be more content.

Riding also provides the operator with the opportunity to evaluate patterns of forage utilization and make adjustments or changes in the grazing prescription accordingly.

The following system for estimating forage utilization has been successfully used at Eastern Oregon Experiment Station:

No Use	No use of forage evident and little or no evidence of livestock using the area.
Light Use	Less than 50 percent of preferred species utilized, e.g., elk sedge.
Moderate Use	Approximately 50 percent of the current annual growth of the preferred species has been removed.
Heavy Use	Greater than 50 percent utilization of preferred species, but uneven use on other species, e.g., elk sedge and pinegrass, respectively.
Very Heavy Use	Greater than 50 percent and even use on all forage species.

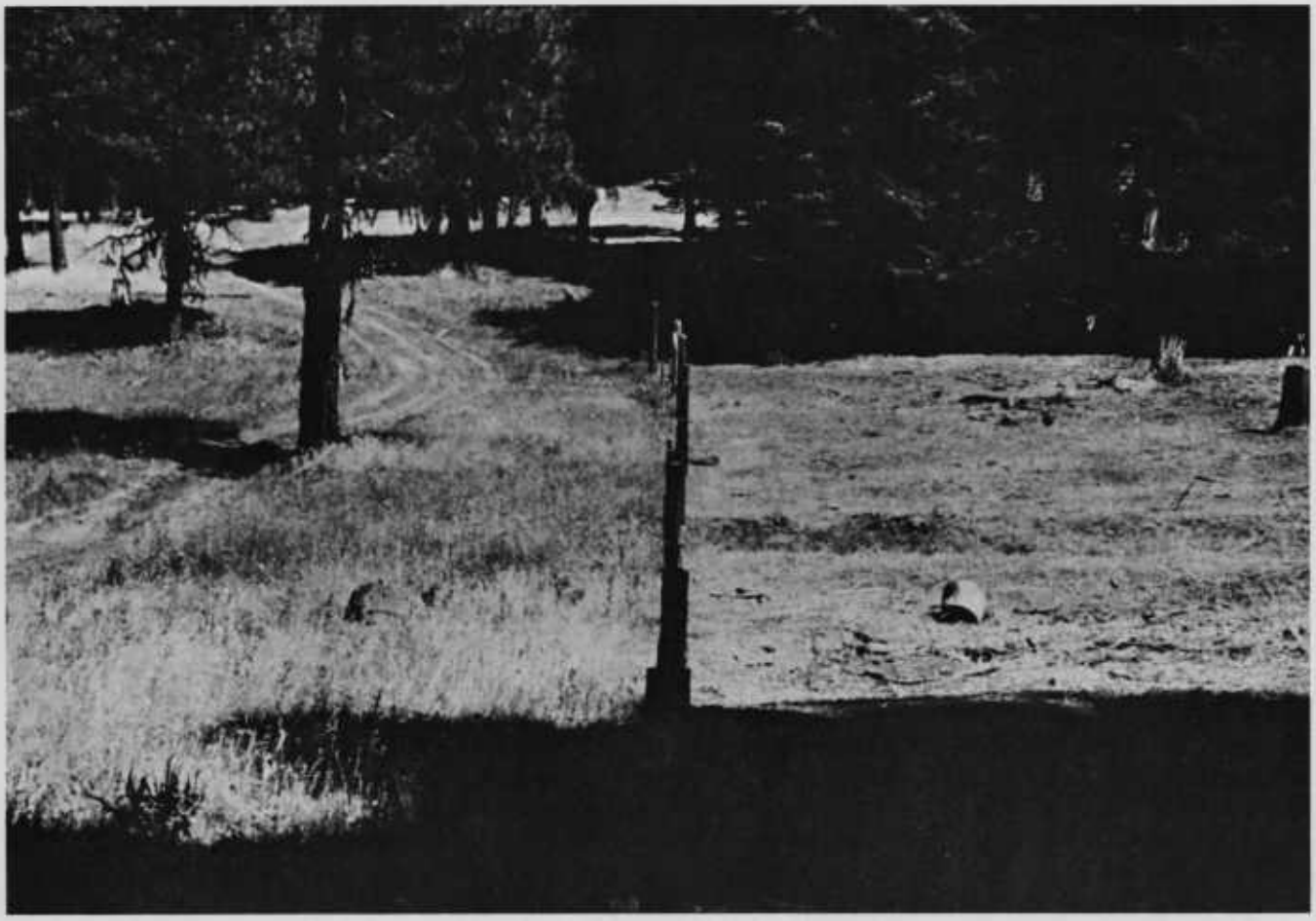
Season of Use

Traditionally many forested areas at lower elevations are used after some of the more common forage species have matured. For example, the open, more accessible areas are usually used first and the forested areas are used late in the grazing season, or not at all. In northeastern Oregon the herbaceous layer of the forested sites is often dominated by pinegrass, elk sedge, and native vetches. If these sites are used late in the season, the legume species have withered and have little grazing value, and the pinegrass is relatively unpalatable and low in protein in mid-August. Consequently, the sedge will be preferentially grazed to its detriment. Therefore, it seems logical that the traditional patterns of use should be altered to use the pinegrass sites first, and then use the adjoining meadows. This practice would utilize valuable forage which otherwise is wasted.

Class of Livestock

It is almost impossible to use forested areas effectively with cows and their calves. Steers, replacement heifers, and cows without calves will use forested areas more effectively than other classes of livestock.

Steers and heifers should use these areas in late spring and early summer when forages are of the highest quality. This coincides with the peak of plant growth. The animals will probably not make good gains early in the season because the



The pasture on the right was used in early summer while the pinegrass was still palatable. This species was not effectively used when the animals grazed the pasture on the left during the late summer.

lush plants limit intake of adequate amount of energy. The best gains are obtained at the peak of plant growth when the dry matter content is at a maximum.

The protein content of the forages steadily declines after the flush of spring growth, but it will remain adequate until seed maturity, which occurs in late August to early September. At least by this time the market animals should be moved to better quality forages, or should be supplemented to maintain their rate of gain.

Light-weight steers tend to make better daily gains on forested sites than heavy steers. With proper stocking (this will vary from 3 to 5 acres per AUM[1]) and a grazing season from mid-May to September, this class of animals will remove 30-40 percent of the available forage.

Cows without their calves should be placed in the forested areas in late summer to harvest the remaining forage. Cows are good rustlers, especially if they have used the area as replacement heifers. They not only make use of the cured herbaceous species, but also use the browse species. This combination of forages provides a diet adequate only for maintenance. This means the calves should be weaned early and moved to forages which are commensurate with the management objectives.

The use of the browse species actually increases the carrying capacity of forested ranges. Over a seven-year period researchers at Eastern Oregon Experiment Station have been able to maintain a stocking rate of 3 acres per AUM in mixed-coniferous types. Much of this is attributed to the use of pinegrass and native legumes in late spring and to the use of browse species in late summer-early fall.

Of course, the total gains will vary from year to year according to the amount of graze available. A good average that could be expected is about 19 pounds of total gain per acre for a grazing season lasting approximately 135 days. This may vary from a low of 11 pounds per acre to a high of 29

[1] AUM, or animal unit month, is the amount of forage required to maintain a mature cow with calf, or their equivalent for one month.

pounds, depending upon current annual production.

By way of comparison, grazing studies on lodgepole pine-pinegrass pastures in British Columbia have produced approximately the same total gain per acre, but daily gains were higher. Therefore, the grazing season was also shorter—an average of 103 days. The average daily gain was 1.75 pounds, whereas the average daily gain reported from Oregon was 1 pound.

Ponderosa Pine Forest

The management prescriptions and methods used to improve forage utilization discussed above for the dense forest types also apply equally well to more open forests. The value of grazing, timber, and wildlife resources is dependent on how the overstory canopy is managed. Even on less than average forest sites, tree spacing is a primary factor influencing these values. Overstocked stands of regenerating ponderosa pine occupy about 5 million acres on ponderosa pine forest land east of the Cascades in Washington and Oregon. When these stands are thinned to the proper distance between trees, the understory vegetation partially utilizes the area formerly occupied by trees. This increases the usefulness of the forest for both wood and forage production. Judicial management of grazing will enhance tree growth by controlling the understory vegetation. Grazing is also often required to maintain the several grass and browse species acceptable to big-game animals.

Grazing revenues from ponderosa pine forests are often of the same magnitude as the timber values when compared on an annual income basis. These revenues help cover the costs of land and timber management and supplement the income of the landowner; hence, grazing is in fact a stabilizing factor to that segment of the lumber industry dependent upon ponderosa pine forests.

Adjoining Meadows

The meadows adjoining forested areas should be used separately. The use should be prescribed to obtain the best quality forages possible. Often these areas are not producing their potential because of past use, which probably has been quite heavy.

The following tabulation gives the adaptability of several species which were grown in a dry woodland meadow typical of lower elevations in northeastern Oregon:

Low adaptability (short-lived)
- Crested wheatgrass
- Timothy
- Sherman big bluegrass

Low adaptability (low producers)
- Pubescent wheatgrass
- Whitmar beardless wheatgrass

Low adaptability (highly variable producer)
- Tall wheatgrass

High adaptability (good producer)
- Creeping meadow foxtail
- Intermediate wheatgrass
- Nomad alfalfa
- Granger birdsfoot trefoil
- Hard fescue

Under a regime of limited fertility, intermediate wheatgrass with and without a legume such as alfalfa or birdsfoot trefoil is a very good producer of palatable forage. Creeping meadow foxtail is also a good producer. This species becomes relatively more productive during the emergent or late spring growth stage, if fertilized with nitrogen. This was determined using 60 pounds of N and 40 pounds of P_2O_5 per acre on well-drained, medium-textured soil, viz., Couse series.

Hard fescue is well adapted to dry meadows. It is one of the best producers in dry years. However, it is not very palatable during the growing season.

A 15-year summary of the hay yields from plots of Eastern Oregon Experiment Station has shown the yields of grass-legume mixtures are far superior to grasses alone. Intermediate wheatgrass and hard fescue are the most consistent producers of all single species.

The nutrient analyses i.e., crude protein and phosphorus, are similar to the yield trends. However, the content of these nutrients is generally above the minimum nutritional requirements of livestock during the normal grazing season.

Conclusions

As the intensity of management increases on forested ranges, the utilization of these areas increases. Nevertheless, the degree of utilization is associated with the amount of overstory canopy present. Better utilization, then, means more area of a given management unit is grazed at a moderate intensity and less at a heavy intensity.

Any one of the management tools is relatively ineffective if used alone. On the other hand, the effects of several practices are additive; a combination of them produces the best results—that is, adequate, uniform harvest of the forage resources available.

Research in northeastern Oregon has demonstrated: (1) sites disturbed by logging should be seeded to adapted species which are compatible to reforestation, (2) slash should be removed, disposed of, or lie on the ground in an up and down slope direction in order to facilitate animal movement and distribution, and (3) a combination of management practices are required to enlarge the grazing area in forested sites. Adequate fencing, both cross and drift fences, water development, salting and riding, proper season of use, and class of livestock must be considered in developing action programs for using forested areas. Also, if practical, the forested areas should be used separately from adjoining meadow lands.

Not all of the forages in logged areas will be used or available because of season of use, animal preferences, and height of plants. In order to achieve the best results through manipulating the existing vegetation, logging plans and grazing management must be carefully coordinated with each other as well as other land uses. Cattle production, timber production, and wildlife are all compatible on forested sites. This type of integrated management will enable the landowner to obtain additional income from forage resources. In effect, the output of a management unit can be increased without changing the actual acreage.

Appendix

Species Common to Mixed-Coniferous Forests of Northeastern Oregon

Common Name	*Scientific Name*
Trees:	
Grand fir	Abies grandis
Douglas-fir	Pseudotsuga menziesii
Western larch	Larix occidentalis
Ponderosa pine	Pinus ponderosa
Shrubs:	
Ninebark	Physocarpus malvaceous
Oceanspray	Holodiscus discolor
Snowberry	Symphoricarpos albus
Wild rose	Rosa gymnocarpa
Huckleberry	Vaccinium membranaceum
Spirea	Spiraea betulifolia
Grasses and Sedges:	
Pinegrass	Calamagrostis rubescens
Blue wildrye	Elymus glaucus
Mountain brome	Bromus marginatus
Elk sedge	Carex geyeri
Oniongrass	Melica bulbosa

Forbs:	
Meadowrue	Thalictrum fendleri
Cusick peavine	Lathyrus nevadensis var. cusickii
Bigleaf lupine	Lupinus polyphyllus
White hawkweed	Hieracium albiflorum
Little head clover	Trifolium microcephalum
Adenocaulon or trail-plant	Adenocaulon bicolor
Heartleaf arnica	Arnica cordifolia
Twin flower	Linnaea borealis longiflora
Hook violet	Viola adunca adunca
Piper anemone	Anemone piperi
Bracken fern	Pteridium aquilinum
Starry solomonplume	Smilacina stellata
Introduced Species:	
Intermediate wheatgrass	Agropyron intermedium
Creeping meadow foxtail	Alopecurus arundinaceus
Hard fescue	Festuca ovina var. duriuscula
Granger birdsfoot trefoil	Lotus corniculatus
Nomad alfalfa	Medicago sp.

Cooperative Extension work in Agriculture and Home Economics, Lee Kolmer, director. Oregon State University and the United States Department of Agriculture cooperating. Printed and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914.