# Effect of grazing by sheep on the quantity and quality of forage available to big game in Oregon's Coast Range

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## Abstract

**Effects of sheep grazing in Douglas-fir *(Pseudotsuga menziesii)* plantations in Oregon's Coast Range were studied in 1981 through 1983 to determine the impact of grazing on big game habitat. Biomass, dry matter digestibility, and crude protein content of forage present on grazed vs. ungrazed areas were determined in October and March both years. Sheep grazing reduced total current year's phytomass of browse and forbs ($p<.10$) in October. October phytomass of graminoids was not affected by grazing. Forage from grazed areas in October generally had higher crude protein levels and dry matter digestibility than forage from ungrazed areas in October. Few differences in either crude protein or dry matter digestibility of forage from grazed vs. ungrazed areas were evident in March. However, a greater quantity ($p<.10$) of new, succulent forage was generally present in grazed areas compared to ungrazed areas. These data suggest that sheep grazing can improve big game forage supply in Oregon's Coast Range by improving forage quality in the fall and by increasing the quantity of high quality forage in the spring.**


**Key Words: deer, elk, forest grazing, agroforestry**

Black-tailed deer *(Odocoileus hemionus columbianus)* and Roosevelt elk *(Cervus edaphus roosevelti)* are important big game species in Oregon's Coast Range. Sheep grazing in Douglas-fir *(Pseudotsuga menziesii)* plantations has been proposed as a silvicultural tool to control brush. Therefore, it is important to understand the vegetational response to such grazing and its impact on big game habitat.

Cut-over forest lands provide important feeding areas for deer and elk (Crouch 1974, Hines 1975, Hanley 1983). A reduction in the quantity of forage and/or alteration of forage quality could have significant impacts on the value of these areas as big game habitat. In addition, changes in forage available to wildlife may affect their degree of browsing on young conifer trees. Both of these issues are especially crucial in the Coast Range because deer and elk are year-round residents and thus need forage the entire year.

Livestock have been suggested as a tool to improve big game habitat. For example, Anderson and Scherzinger (1975) reported a 260% increase in elk numbers following implementation of planned cattle grazing in northeastern Oregon. Jensen et al. (1972) and Neal (1982) suggested that properly controlled livestock grazing can increase yields of important browse species used by deer in the winter. Longhurst et al. (1982) stated that sheep grazing has great potential for improving wildlife habitat throughout the western U.S. Very little work has been done, however, on livestock-wildlife interactions on vegetation types particular to Oregon's Coast Range.

Consideration of animal nutritional needs is paramount in the evaluation of big game habitat. Wallmo et al. (1977) developed a model which stressed the importance of nutrition in the evaluation of big game habitat. They pointed out that the 2 major factors of habitat quality are forage quantity and quality. These 2 factors are especially important to reproduction within big game populations. Reproductive rates of deer directly correlate with forage quality and quantity (Verme 1969, Pederson and Harper 1978).

The objective of this study was to evaluate the effect of sheep grazing on the biomass, crude protein content, and dry matter digestibility of forage potentially available to big game in Oregon's Coast Range.

## Methods

Five 2- to 6-year-old Douglas-fir plantations in the Alsea Ranger District, Siuslaw National Forest, were selected for study. The study area was located approximately 15 km west of Alsea, Ore. Climate is maritime with cool, rainy winters and warm, dry summers. Average annual precipitation is approximately 250 cm (Corliss 1973). Elevation of the study area ranged from 75 to 450 m above mean sea level.

Vegetation type on the study area was the vine maple *(Acer circinatum)*—sword fern *(Polystichum munitum)* community (Corliss and Dyrness 1975), which is the major vegetation type in the Alsea District. Other important browse species include salmonberry *(Rubus spectabilis)*, thimbleberry *(R. parviflorus)*, California dewberry *(R. ursinus)*, and red alder *(Alnus rubra)*. Dominant herbaceous species include orchardgrass *(Dactylis glomerata)*, common velvetgrass *(Holcus lanatus)*, bentgrass (*Agrostis* spp.), common pearlyeverlasting *(Anaphalis margaritacea)*, and big lotus *(Lotus crassifolius)*.

A 900-m² livestock exclosure was established on each study plantation in 1980. These served as control plots, allowing comparisons to be made on adjacent areas which were grazed and ungrazed. Exclosures were constructed of 0.8 m high woven wire in order to allow wildlife continued access to the exclosed areas. Study plantations had no history of sheep grazing prior to our study.

A band of 600 ewes with lambs and a band of 900 dry ewes grazed the forest in 1981 and 1982, respectively. The grazing season was from May to September both years. Stocking rate averaged 125 and 143 ewe days per hectare in 1981 and 1982, respectively. Each year, a series of plantations, ranging in size from 10 to 40 ha, was grazed according to a predetermined schedule. Within this schedule, 4 study plantations were grazed once and 1 study plantation was grazed twice each year.

Two sampling periods, October and March, were chosen as critical times for evaluation. October was chosen because little fall through winter growth occurs after that time. The forage present in October is, therefore, representative of what is available as winter food for wildlife, excluding leaves of deciduous species. Moreover, the amount and quality of forage in the fall determines whether animals begin utilizing summer reserves before the onset of winter (Mautz 1978). The March sampling period was chosen to provide information about the quantity and quality of forage available during the budbreak of shrubs prior to the rapid growth phase of forbs and grasses in the spring. This is an important time of the year for deer and elk, as nutritional demands of late gestation require

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abundant high quality forage and the forage supply is generally at its lowest level of the year. Actual collection dates were October 10–17, 1981; March 23–23, 1982; October 8-10, 1982; and March 21-22, 1983.

In October, sixteen 0.45-m² quadrats were randomly located both inside and outside the exclosure on each study plantation. For the March sampling, 10 such quadrats were randomly chosen. Species composition of each quadrat (as percent oven-dry weight) was ocularly estimated. Current year's growth within each quadrat was then clipped, oven-dried for 48 hours at 50° C, and weighed. An estimate of biomass by species was calculated for each quadrat by multiplying the estimated species composition by the measured quadrat weight.

Ten plant species were collected for quality determinations from grazed and ungrazed portions of each study plantation. Selection of these species was based on their importance in the diets of big game (Leslie 1982) and the preference which sheep displayed for them (Leininger and Sharrow 1987). A composite sample of leaves from each shrub and the entire plant of herbaceous species was collected from 5–10 randomly chosen plants per sample. Samples were dried at 50° C, then ground and analyzed in duplicate for percent crude protein by the micro-Kjeldahl technique (AOAC 1980) and for in vitro dry matter digestibility (IVDMD) using the two-stage in vitro digestion technique of Tilley and Terry (1963). In vitro digestion determinations were performed using rumen fluid from 3 fistulated sheep which were fed a grass hay diet prior to and throughout the collection period.

Data were analyzed as a split-plot-in-time (Steel and Torrie, 1980) with grazing as main plots and year as subplots in a randomized block design using the 5 study plantations as replications. Differences between treatments were assessed for significance at $P<0.10$.

## Results and Discussion

Sheep grazing reduced total October forage phytomass by approximately 40% (Table 1). Forage classes were not affected uniformly by grazing, however. October phytomass of graminoids was unaffected by grazing, while grazing reduced the phytomass of forbs and browse plants by 55 and 45%, respectively. Differences between forage classes in response to grazing may reflect the inherent ability of different types of plants to regrow quickly following defoliation.

Grazing increased both crude protein content and dry matter digestibility of most grasses and forbs examined in October (Table 2). Grazing had no discernable effect on either crude protein or dry matter digestibility of shrubs.

**Table 1. Current year's forage phytomass (kg/ha) present in October on grazed (G) and ungrazed (U) portions of Douglas-fir plantations.**

| | 1981 | | 1982 | | 2-Year Mean | |
|---|---|---|---|---|---|---|
| Forage class | G | U | G | U | G | U |
| Graminoids | 340 | 470 | 410 | 290 | 375 | 380 |
| Forbs | 280+ | 600 | 290 | 660 | 285* | 630 |
| Browse | 370 | 660 | 480 | 890 | 425+ | 775 |
| Total | 990* | 1730 | 1180* | 1840 | 1085* | 1785 |

+,*Grazed differs from ungrazed <.10, <.05, respectively.

These data suggest that although sheep grazing in spring-summer reduces the total amount of forage available in fall, it increases forage quality. As plants mature, they generally decrease in both dry matter digestibility and percentage crude protein due to an accumulation of digestion-resistant carbohydrates and lignin (Kilcher 1981). Since there is essentially no immature foliage present on ungrazed plantations in the fall, animals must select their diet from this mature material. Grazing during the growing season interrupts plant maturation and the concommittant decline in forage quality. Plant phenological changes are thereby postponed, and regrowth present in autumn contains higher than normal levels of nutrients (Anderson and Scherzinger 1974). In many cases, big game performance on winter range is limited by the quality rather than the quantity of forage present (Wallmo et al. 1977). Four of the 6 herbaceous plants collected from ungrazed portions of the plantations would not meet the minimum protein requirements of deer (approximately 7%: French et al. 1956) and elk (6%: Nelson and Leege 1982). Relatively low dry matter digestibility values of all plants on ungrazed areas imply that digestible energy may also be inadequate during the fall-winter. Deer and elk are opportunistic feeders, generally selecting the most nutritious forages available to them (Swift 1948, Smith et al. 1979). Presumably, the higher digestibility and crude protein content of plants in grazed plantations during the fall will assist animals in selecting a diet which more nearly meets their nutritional needs.

Grazing had no effect on either the crude protein content or dry matter digestibility of forage plants the following March (Table 2). This is not surprising as plants are in the early vegetative stages of growth at that time and are at or near their highest digestibility and crude protein content for the year, regardless of grazing treatment.

**Table 2. Two-year average percent crude protein content (CP) and percent in vitro dry matter digestibility (IVDMD) of plants from grazed (G) and ungrazed (U) portions of Douglas-fir plantations.**

| | October | | | | | | March | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CP | | | IVDMD | | | CP | | IVDMD | |
| Category/Plant | G | | U | G | | U | G | U | G | U |
| Graminoids | | | | | | | | | | |
| orchardgrass | 12.8 | * | 5.1 | 60 | * | 32 | 24.2 | 24.0 | 73 | 72 |
| bentgrass | 9.7 | * | 3.9 | 51 | * | 35 | 17.6 | 17.3 | 68 | 56 |
| velvet grass | 6.8 | | 5.6 | 44 | * | 35 | 16.7 | 16.1 | 75 | 71 |
| Forbs | | | | | | | | | | |
| Pearly everlasting | 9.5 | * | 5.4 | 41 | * | 27 | 22.7 | 23.5 | 60 | 60 |
| Big lotus | 13.2 | * | 11.2 | 22 | + | 9.4 | -- | -- | -- | -- |
| California figwort | 14.6 | * | 12.3 | 68 | + | 50 | 25.3 | 22.3 | 70 | 69 |
| Browse | | | | | | | | | | |
| Thimbleberry | 8.0 | | 7.9 | 34 | | 36 | 21.1 | 22.6 | 46 | 46 |
| Salmonberry | 8.5 | | 8.0 | 31 | | 29 | 24.4 | 21.6 | 38 | 38 |
| California dewberry | 9.8 | | 7.1 | 30 | | 31 | 20.2 | 20.0 | 42 | 43 |
| Vine maple | 6.5 | | 5.4 | 40 | | 36 | -- | -- | -- | -- |

+,*Grazed differs from ungrazed $p<.10$ and $p<.05$, respectively.

Grazing the previous year tended to increase the amount of current year's phytomass of graminoids present in the early spring (Table 3). Grasses appeared to commence growth slightly earlier in the spring on grazed than on ungrazed areas. Earlier growth on grazed areas likely resulted from a combination of factors, including increased soil temperatures where sheep have removed the

**Table 3. Current year's forage phytomass (kg/ha) present in October on grazed (G) and ungrazed (U) portions of Douglas-fir plantations.**

| | 1982 | | 1983 | | 2-Year * Mean | |
|---|---|---|---|---|---|---|
| Forage class | G | U | G | U | G | U |
| Graminoids | 310 + | 200 | 170 * | 60 | 240 * | 130 |
| Forbs | 90 | 150 | 130 | 120 | 110 | 135 |
| Browse | 50 | 40 | 20 | 20 | 35 | 30 |
| Total | 450 | 390 | 320 * | 200 | 385 + | 295 |

+,*Grazed differs from ungrazed $p<.10$, $p<.05$, respectively.

overstory of past year's old shrubby and herbaceous growth and deposition of nutrients in sheep dung and urine which increased soil fertility. The biological significance of increased early spring graminoid phytomass to deer and elk nutrition may be much greater than the relatively modest increase ascribed to grazing would suggest. Grasses are an important late winter through early spring forage for both deer (Crouch 1981) and elk (Leslie 1982). Most of the forage available to big game in the early spring is old, weathered material which is carried over from past season's growth. Both the digestibility and nutrient content of such forage is typically quite low. Deer and elk need substantial quantities of high quality forage during this period to meet the needs of late gestation or early lactation. Stimulation of high quality early spring grass growth by grazing may, therefore, be highly beneficial to the nutrition of both deer and elk.

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