Grazing mixed conifer forests

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Grazing on the 13 million acres of mixed conifer forests in California could provide an income through grazing fees, reduce fire hazard, and enhance tree growth— while providing more efficient livestock production for foothill ranches.

Mixed-conifer forests, the largest vegetation type in California, cover more than 13 million acres (5.5 million hectares) and have many important uses. Timber production is the principal economic return, but watershed protection, recreation, and wildlife habitat are also important.

Livestock grazing in forests is compatible with these uses and provides important benefits. For example, such grazing can produce a regular annual income through grazing fees, can reduce fire hazard, and can enhance tree growth by reducing understory vegetation. Because forage quality on foothill ranges is usually declining just as the grazing season begins in forest ranges, forest grazing can fill a critical need for foothill ranches and thus increase their economic stability and aid in more efficient livestock production.

In view of these facts, forest grazing should increase in importance as the need for meat increases, and as direct human consumption increasingly competes for feed grains. Surprisingly, however, little recent research has been done on the grazing resource of mixed-conifer forests, and no comprehensive papers on mixed-conifer forage supply have been published. Unlike the primarily grass understory in pine forests, mixed-conifer forest understory consists mainly of shrubs, with herbaceous vegetation concentrated only along drainage areas too wet for tree growth. Results of research on pine forests have limited applicability to the much more heterogeneous mixture of forage in the mixed-conifer zone.

To understand forage production and use in the forest ecosystem and the interactions between silvicultural practices and grazing, work was begun in April 1977 at the University of California's Blodgett Forest Research Station in El Dorado County. Blodgett Forest, which lies within the mixed-conifer zone between 3900 and 4800 feet (1188 and 1462 meters) elevation, was established in 1933 pri-

marily to serve as a study site for management of young-growth timber. For this purpose, its 2961 acres (1186 hectares) are divided into 78 management compartments of about 40 acres (16 hectares) each. The compartments are equally divided between even-age, uneven-age, and reserve management practices. The study area included the southern 1500 acres (600 hectares) of the forest where 70 cows and heifers grazed from May 21 to September 26.

Objectives of the study at Blodgett are to survey the understory vegetation by forest management unit, to determine the effects of various timber management systems on understory species composition and production, and to determine meadow composition, condition, and production. Effects of cattle distribution and grazing on tree-seedling survival are also being studied, and results will be used to improve forest range-management guidelines.

Forest forage

From observations in the summer of 1977, the understory species at Blodgett have been divided into three basic groups (see table). Desirable species, such as deerbrush and many species of grasses and sedges, provide excellent forage, and cattle eat them all season long. Cattle browse less desirable species, such as greenleaf manzanita and mt. whitethorn early in the season where easily accessible, and bitter cherry late in the season when meadow forage is less abundant. Undesirable species, principally chinquapin, tanoak, mt. misery, and bracken fern, are not eaten.

Understory species composition was determined from 111 step-point transects within the 39 grazed-management compartments. Browse at Blodgett is found primarily along roads, skid trails, and in open clearcuts. Livestock utilize easily accessible browse in such places to a small extent all season long, although they spend the majority of their time in the meadows.

Preliminary data show that total percent cover of desirable species did not differ significantly between even-age (2.85 percent) and uneven-age (1.70 percent) management units. However, even-age stands contained a significantly greater percent cover of less desirable and undesirable species (13.66 versus 4.88 percent, and 30.96 versus 19.34 percent, respectively) than did uneven-age management units. Even-age units are expected to have more total cover because they include brushy young-growth clearcuts, as well as mature timber having little understory. Finer division of management units based on stand age as well as on timber-management goals will be employed later in the study.

Deerbrush is the most important browse species in the mixed-conifer zone and at Blodgett. It is a nitrogen fixer and remains high in protein from late May to the end of August. Deerbrush furnishes excellent wildlife and cattle browse, and has great potential for increasing the animal-carrying capacity of mixed-conifer forest ranges. Step-point transects

Fig. 1. Paired caged and grazed plots (above) are used to determine meadow forage production and utilization by cattle.

Fig. 2. Shrubs at the meadow edge (right) typify the complex understory grazed by livestock on mixed conifer forest range.

showed that deerbrush comprised 1.7 percent of the total understory cover in the forest. Browsing intensity averaged 38 percent of the current year's growth.

Preliminary results on meadow composition show that grass, sedge, clover (*Trifolium* spp.), and rush (*Juncus* spp.) areas intergrade within a given meadow system. Meadow production on 15 sites ranged between 320 and 2700 lb/acre (358 kg/ha.), with an average of 1328 lb/acre (1488 kg/ha.) as determined by paired grazed and ungrazed plots. Cattle utilized the meadows all season long, and utilization ranged between 26 and 87 percent.

Forage Value Groups for Primary Understory Plants at Blodgett Research Forest

Desirable	Less desirable	Undesirable
1. Deerbrush *(Ceanothus integerrimus)*	1. Manzanita *(Arctostaphylos patula)*	1. Chinquapin *(Castanopsis chrysophylla)*
2. Squaw carpet *(Ceanothus prostratus)*	2. Mt. whitethorn *(Ceanothus cordulatus)*	2. Tan-oak *(Lithocarpus densiflora)*
3. Sedge *(Carex sp.)*	3. Snowberry *(Symphoricarpos acutus)*	3. Azalea *(Rhododendron occidentale)*
4. Bentgrass *(Agrostis sp.)*	4. Bitter cherry *(Prunus emarginata)*	4. Mt. misery *(Chamaebatia foliolosa)*
5. 20 additional grasses		5. Bracken fern *(Pteridium aquilinum)*

Needs for further research

Results to date illustrate the variability in browse and meadow utilization and indicate the need for better animal distribution on grazed mixed-conifer forests. Although animal distribution is primarily determined by the nature and amount of available forage and water, improvements may be achieved by removing slash to open up areas otherwise inaccessible. Salting may also be used to influence animal distribution. Cross fencing to control animal access to meadow systems may be appropriate in some cases, although cost limits its applicability.

The mixed-conifer forest is a complex ecosystem of potentially many uses, and the key to its full development and proper management is research. Answers are needed to such questions as: What are the effects of livestock on tree reproduction? What is the value of the land for timber production, forage production, and simultaneous production of both? How does grazing affect water quality and wet-meadow vegetation? What are the effects of timber production and grazing on distribution of different kinds of understory forage? Our study will continue to address these questions.

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Men's shirts . . .

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washed with dark-colored shirts, but the color change was small and disappeared after a few wash cycles. In some cases fabrics of varying colors (including white) may be washed together without deletrious effects on color. This would allow consumers to wash fewer loads, and thus conserve energy and water.

Appearance and soil removal

Laundering in hot water as compared with warm water made some differences in soil removal and appearance (tables 2, 3). Garments washed in hot water had slightly better removal of soil and wrinkles resulting from wear, whereas garments washed in warm water retained better collar appearance. The differences were generally small and no distinct advantage was found for either wash temperature. These garments were subjected to 40 wash-wear cycles, a long enough period for any possible changes to occur.

Price-quality correlations

Comparisons of shirt prices with results of the wear study and laboratory evaluations indicated that the lower-priced shirts surpassed the higher-priced shirts in colorfastness, appearance, and fabric strength. Construction quality varied directly with price, but was satisfactory in all cases. Price and brand name would have been the only criteria for the consumer to use in selection, as the shirts were all similar in appearance. These results clearly demonstrate that informative labeling or use of a grading system would allow the consumer to choose more intelligently.

Responses from a questionnaire given the wearers at the end of the study were used to evaluate the consumer's perception of performance and quality. The wearer's ratings of the over-all appearance of his shirts showed a significant negative correlation with price, again supporting the conclusion that the lower-priced shirts were of better over-all quality.

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TABLE 1. Color Difference (ANLAB Units)* after Wear and Laundering at 130°F and 105°F

Number of wearings and launderings	Color difference 130°F	105°F
15	1.7	1.6
25	1.9	1.6
40	2.1	1.8

*An ANLAB unit is calculated from instrument readings on original and exposed fabrics (shirts). A value of 1.5 indicates a color change that is just perceptible.

TABLE 2. Percent Soil Removal from Collars after Laundering at 130°F and 105°F

Number of wearings and launderings	Percent Soil Removal 130°F	105°F
1	84.7	74.3
3	66.4	63.6
6	61.0	51.2
12	59.6	52.0
18	60.7	49.8
40	42.4	44.6

TABLE 3. Appearance Rating after Laundering at 130°F and 105°F

Evaluation	Number of wearings and launderings	Rating* 130°F	105°F
Fabric smoothness	1	3.9	4.3
	10	3.6	3.5
	40	3.8	3.4
Collar appearance	1	1.9	2.5
	10	1.2	1.6
	40	0.8	1.2

*5 = excellent; 1 = poor.