

Interaction of cattle and deer on mountain rangeland

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Moderate grazing by cattle on Sierra summer ranges minimizes effects on deer habitat

Summer grazing allotments on National Forest lands above 5,000 feet in the Cascade Range and Sierra Nevada of California supply forage to many beef cattle operations. Ranchers transport their cows and calves to the mountains to graze nutritious green forage, particularly in meadows and riparian areas along creeks, after lower elevation foothill ranges have matured and dried. Depending on the snowpack, the grazing season typically begins in late June and continues into late September.

Summer ranges also provide habitat for California mule deer (*Odocoileus hemionus californicus*), which migrate up from foothill winter ranges in the spring. Pregnant does give birth to their fawns on these summer ranges during June and July, and the meadow-riparian habitats are important fawning and fawn-rearing areas. This dual pattern of use in late spring and summer creates a potential for interspecific competition.

After the discovery of gold in 1849 until about 1920, many higher elevation summer ranges were indiscriminately overgrazed by sheep and cattle. In some mountain meadows, loss of sod-forming grasses and sedges, followed by soil erosion and gullying, caused meadows to dry and allowed shrub and tree invasion. Logging without artificial restocking of trees, uncontrolled burning by man, and wildfire also caused greater shrub dominance at high and mid-elevations.

Paradoxically, after this high disturbance ended until about 25 years ago, deer populations were the highest ever recorded in California. Before the periods of disturbance, frontiersmen reported that deer were scarce at high elevations. Deer thrive on disturbed forest habitats, because the nutritious herbaceous and shrub regrowth provides high-quality forage. They also need less disturbed habitat, however, for hiding cover from predators and humans and shade during summer. In recent years, mule deer herds have declined, both because greater fire control and less logging have reduced habitat disturbance and because intense browsing pressure by the deer themselves has caused shrubs to decline.

Although livestock grazing has declined during this period of decreased disturbance, primarily because of increased trucking costs, new concern has arisen over whether cattle are now competing with deer for habitat or are destroying hiding cover. Such cover is especially important to young fawns, whose only means of eluding predators or humans is to drop low to the ground in or under cover and remain motionless. Lactating does with fawns are believed to require habitat near water, and so adequate hiding cover near meadow-riparian areas very likely contributes to fawn survival. Probable increases in coyote and mountain lion populations and recreation-related human disturbance now make hiding cover more important.

To determine the effects of cattle on summer hiding cover for deer, we are monitoring aspen (*Populus tremuloides*) understory, corn lily (*Veratrum californicum*), and willow (*Salix* sp.) meadow-riparian habitats under three cattle stocking rates. Without pre-livestock-era information regarding deer habitat preferences, it is difficult to determine which habitats deer require. We can, however, observe which modified habitats they are now choosing after more than 100 years of coexistence with cattle on summer ranges. By locating radio-collared cattle and deer for 24-hour sample periods over a range of cattle stocking rates, we are determining how the stocking rate influences deer and cattle activity and spatial use patterns throughout the summer.

Procedures

The study is being conducted in the McCormick Creek Basin of the Stanislaus National Forest at a 7,300-foot elevation, 40 miles northeast of Sonora, California. The approximately 1,500-acre study area has been divided into three fenced grazing units 330 to 450 acres in size. Cattle stocking rate varies among the three units: no grazing, moderate or normal grazing, and heavy grazing.

Six major habitat types have been mapped in the basin. Meadow-riparian and aspen habitats cover about 13 and 4 percent of the study area, respectively.

They occur mainly on gently sloping land near McCormick Creek and along ephemeral creeks in the low-lying areas of the basin, but some stringer and hanging meadows occupy slopes as steep as 35 percent. Both provide abundant forage and deer hiding cover, and aspen also provides shade used by deer and cattle. Dry meadow habitat, covering about 1 percent of the study area, occurs on the basin floor and provides some early-season forage but no hiding cover or shade. Salt licks, which attract both species, have traditionally been maintained on these areas. Montane shrub and conifer habitat types are the most common, covering 37 and 30 percent of the study area, respectively. The shrub type includes considerable acreage of bare granite rock and primarily occupies slopes that rim the basin. It provides an abundance of browse and cover for deer away from the main cattle grazing areas. The conifer type is in small stands in the basin and large blocks outside the basin. It offers shade for cattle and deer during warm summer days and some hiding cover, but provides little forage except in canopy openings and along its edges. Finally, the timberline sagebrush (*Artemisia rothrockii*) habitat type, about 15 percent of the study area, is scattered throughout the basin and has limited amounts of forage and little cover value.

We measured hiding cover in aspen, corn lily, and willow vegetation inside and outside areas from which cattle were excluded throughout the summer. We also monitored browsing frequency on tagged stems of willow shrubs inside and outside the exclosures. Finally, we monitored standing herbage, excluding corn lily plants, in meadow-riparian areas, using paired clipped plots inside and outside cattle exclosures in each grazing unit.

We radio-collared 14 cow-calf pairs and 20 adult female mule deer and located them hourly from permanent antenna sites for 24-hour periods, one to two days a week during the summers of 1983 and 1984. At least five cows in each grazed unit were radio-collared, and additional cow-calf pairs were added to impose the desired stocking rate. The radio-collared does provide samples of five to seven ani-



California ranchers use Sierra mountain rangelands for summer grazing after lower foothill ranges have dried up. The summer ranges also provide habitat for California mule deer. Six habitat types were mapped in the McCormick Creek Basin above Sonora in the Stanislaus National Forest to determine effects of cattle on hiding cover for deer. Cow-calf pairs and adult female deer fitted with radio-collars were monitored hourly for 24-hour periods during the summers of 1983 and 1984.



imals that maintain summer home ranges largely within each grazing unit. Since the does tend to rear their fawns in the same area each year, radio-monitored deer will experience all three levels of cattle grazing over three summers. Deer also are monitored for two to three weeks before the start of cattle grazing to determine any transient responses at the beginning of the grazing season.

We are plotting location data on large-scale aerial photographs, where coordinates and habitat type are determined and recorded for computer analysis. Habitat preference ranks for cattle and deer are calculated from use and availability data where use is the proportion of radio-locations in each habitat type, and availability is based on the proportion of each type within a deer home range, area of cattle use, or grazing unit.

Effects on vegetation

In areas heavily used by cattle, hiding cover for fawns and adult deer was reduced sooner and to a greater degree than in ungrazed areas, where cover was maintained or increased into early August (fig.

1). Herbaceous vegetation under 18 inches tall was the most severely affected.

Dense stands of corn lilies offer valuable hiding cover in meadow-riparian habitats. Cattle primarily graze the associated grasses, sedges, and forbs in these stands. But while grazing, they trample the plants; whether in large or small numbers, cattle appear to trample corn lilies to a similar degree. By the last month of summer, significantly more cover remained in the unit ungrazed by cattle. Ironically, corn lily appears to be a poor competitor and may be present because of repeated cattle grazing of the associated herbaceous species.

Under heavy cattle grazing, willow hiding cover dropped sharply near the end of the grazing season because of increased browsing and trampling. Willow browsing increased significantly as the season progressed and herbaceous forage became less available and less palatable (fig. 2). Deer used browse within the cattle exclosures to a greater extent under heavy than under moderate cattle stocking. With no cattle grazing, deer apparently had little desire to use browse in the

exclosures, because forage was abundant outside.

Standing herbage in the ungrazed unit was similar inside and outside cattle exclosure plots throughout the summer (fig. 2). Under moderate grazing, stimulation of herbage production was apparent, yet by mid-September cattle had removed all but 460 pounds per acre. Standing herbage outside the exclosure in the heavily grazed unit was reduced to about 35 percent of that inside within 10 days after cattle grazing began and remained at about the 460-pound level throughout the grazing season. The similar utilization for moderate and heavy stocking rates suggests a shift to more shrub browsing later in the season in the heavily grazed unit.

Habitat preference

Habitat that is highly preferred by cattle and by deer is the logical place to begin a search for positive or negative interactions. Preferred and avoided habitats can be compared by multivariate analysis to ascertain which characteristics best explain the differences in preference. We plan to do much of this type of analysis

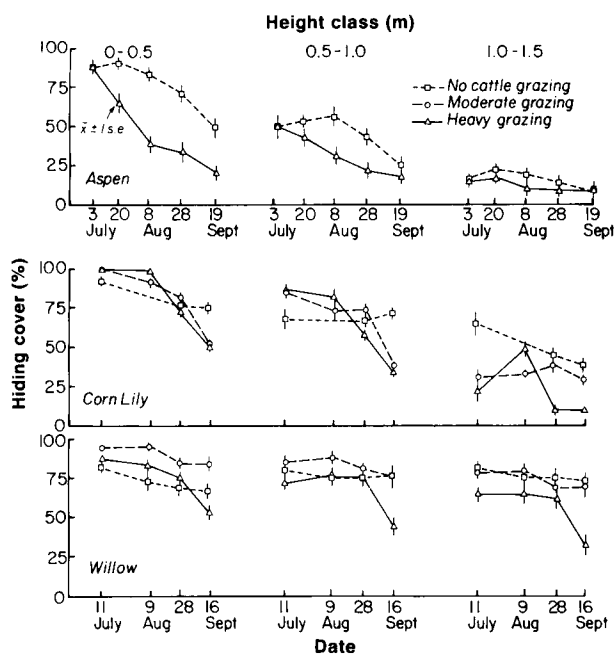


Fig. 1. Measurement of hiding cover provided by vegetation at three height levels showed that in areas heavily stocked with cattle, deer cover was reduced sooner and to a greater extent than under moderate or no grazing.

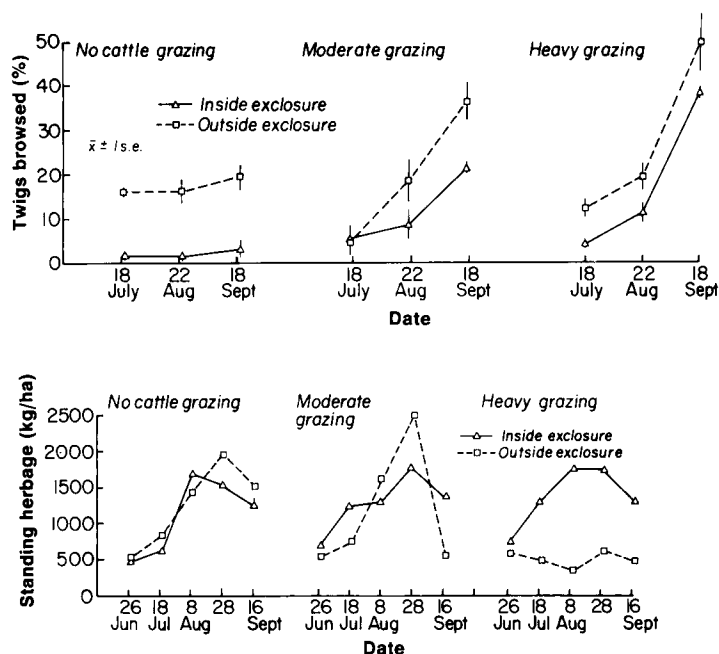


Fig. 2. Comparison of willow twig browsing and standing herbage inside and outside fenced cattle enclosures suggests that deer and cattle shifted to more shrub browsing later in the season in heavily grazed areas of meadow-riparian habitat in the summer of 1984.

TABLE 1. Average habitat availability, use, and relative preference ranks for deer and cattle under three stocking rates during three time periods over the summer, 1984

		Jun 25-Jul 5 before cattle		Jul 10-31 with cattle		Aug 10-30 with cattle	
Habitat	Availability	Use	Pref. rank	Use	Pref. rank	Use	Pref. rank
	%	%		%		%	
<i>Deer</i>							
<i>Heavy cattle grazing</i>							
Meadow-riparian	16.2	26.9	1 a*	22.1	1 a	19.1	1 a
Aspen	5.2	6.6	2 ab	4.5	6 b	4.3	5 b
Dry meadow	4.3	4.1	3 bc	3.3	2 a	2.5	4 b
Montane shrub	44.8	37.1	4 bc	44.5	3 b	43.5	3 bc
Conifer	13.3	12.0	5 bc	14.4	4 b	15.5	2 a
Sagebrush	16.2	13.3	6 c	11.3	5 b	15.0	6 c
<i>Moderate cattle grazing</i>							
Meadow-riparian	14.5	24.3	1 a	25.7	1 a	23.2	1 a
Aspen	0.0	—		—		—	
Dry meadow	0.0	—		—		—	
Montane shrub	40.6	31.1	4 b	28.1	4 c	33.2	4 b
Conifer	26.4	32.4	2 a	36.1	2 b	33.2	2 a
Sagebrush	18.5	12.2	3 b	10.1	3 b	10.4	3 ab
<i>Ungrazed by cattle</i>							
Meadow-riparian	18.0	26.9	2 a	25.6	2 ab	21.9	2 a
Aspen	7.3	8.6	1 a	7.1	3 b	7.8	1 a
Dry meadow	1.4	0.0	6 c	2.7	1 a	0.0	6 b
Montane shrub	39.7	33.1	4 b	35.1	6 b	31.5	5 a
Conifer	17.8	18.8	5 ab	16.6	4 b	19.9	4 a
Sagebrush	15.7	12.6	3 ab	12.9	5 b	18.9	3 a
<i>Cattle</i>							
<i>Heavy grazing</i>							
Meadow-riparian	18.6			36.0	2 a	33.2	3 a
Aspen	7.8			11.6	3 a	8.1	4 b
Dry meadow	8.0			18.6	1 a	16.6	2 a
Montane shrub	38.2			21.0	5 bc	13.7	6 c
Conifer	11.0			7.7	4 b	22.0	1 a
Sagebrush	16.4			5.1	6 c	6.4	5 c
<i>Moderate grazing</i>							
Meadow-riparian	17.1			38.9	1 a	27.1	1 a
Aspen	0.0			—		—	
Dry meadow	0.0			—		—	
Montane shrub	21.9			7.6	4 b	20.1	4 c
Conifer	44.5			46.5	3 a	39.3	3 c
Sagebrush	16.5			7.0	2 b	13.5	2 b

* Waller-Duncan multiple comparison test, ranks in a column within a stocking rate followed by the same letter are not significantly different ($p > 0.05$).

after gathering the final summer's data. We used a numerical index to quantify cattle and deer habitat preferences. The "relative preference rank" is based on the difference between ranks of use minus availability for each radio-collared cow or deer within each grazing treatment.

Deer preferred meadow-riparian habitat regardless of cattle grazing treatment in 1984 but decreased their use of this type during the summer, especially in the heavily grazed unit (table 1). Aspen habitat was highly preferred by deer before cattle grazing began, but use and preference rank declined sharply in the heavily grazed unit. Deer in this unit responded similarly under moderate cattle grazing in 1983, which again indicates that preferred habitats receive heavy use by cattle under both stocking rates. Conversely, aspen remained among the more preferred habitats for deer in the ungrazed unit, because it provided suitable cover and forage all summer.

In the heavily grazed unit, deer showed the highest preference for the dry meadow type during the first three weeks of cattle grazing, when cattle also most preferred this type. In the ungrazed unit, which has little of the dry meadow type and no salt lick, deer traveled into the heavily grazed unit to use the lick. Our impression is that does probably use the dry meadow type because of their mineral requirements during lactation, and the presence of cattle has no effect on their use of the salt.

Conifer stands provide full shade and were increasingly preferred by deer in the

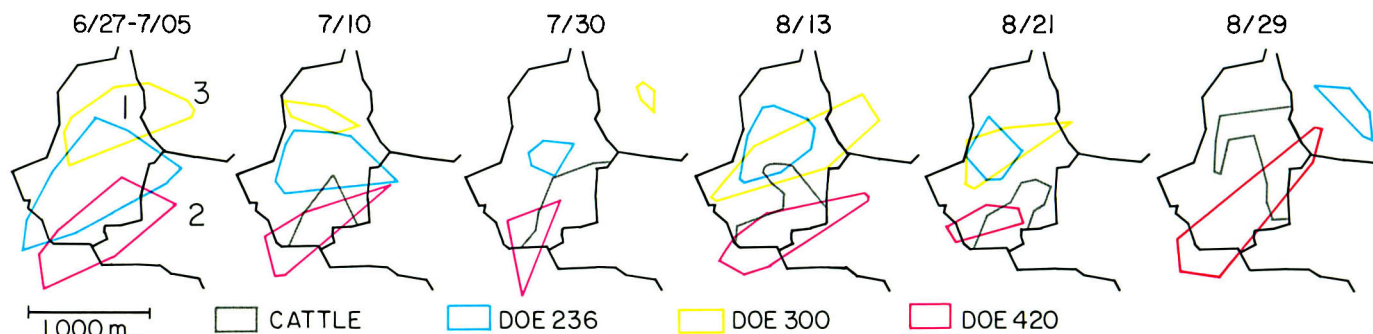


Fig. 3. Radio tracking of three does and four cow-calf pairs on 1,500 acres of mountain rangeland revealed varying deer response to cattle. Diagrams above show portion of fenced study area used by deer. First diagram (far left) shows movement of

deer before cattle arrived. Doe 236 left the area when cattle were brought in and did not return. Does 300 and 420 were not as strongly affected. In diagrams, area 1 indicates heavy grazing by cattle, area 2 no grazing, and area 3 moderate grazing.

heavily grazed unit during the summer. In the moderately grazed unit, deer preferred conifer habitat second only to the meadow-riparian type, while in the ungrazed unit, deer showed little preference for conifer stands. Although both cattle and deer periodically chose the conifer habitat, cattle tended to use the same patches of timber near the basin floor, while deer used more isolated stands up-slope.

Deer preferred montane shrub habitat somewhat more under heavy cattle grazing than at lower stocking rates. Since cattle use of this habitat was generally low except under heavy stocking rates late in the season, deer appeared to use this type as a refuge. Deer preference for the sagebrush habitat remained about the same through the summer of 1984, although use increased during August relative to late July in the heavily grazed and ungrazed units. Deer probably turned to this type for forage late in the season.

Cattle preferred meadow-riparian, aspen, and dry meadow habitats (table 1). Like deer, cattle appeared to use the dry meadow type primarily for the salt lick, since little forage and no cover was available. Under the heavy stocking rate, cattle distributed themselves more widely than under the moderate rate but maintained their high use of meadow-riparian habitat by using stringer and hanging meadows. By the end of August 1984, cattle use of conifer habitats in the heavily grazed unit had tripled, probably because of the warm summer days and reduced forage in the heavily grazed meadow-riparian and aspen habitats. During late summer in 1983 and 1984, cattle in moderately grazed units increased their use of montane shrub and sagebrush types while slightly decreasing their use of the meadow-riparian and conifer types, which suggests a switch to other more available forage in these habitats.

Spatial relationships

The presence of cattle may alter deer activity patterns and use of specific

areas. By attaching radio-collars equipped with tip switches that vary signal pulse rate as head position changes, we can distinguish three animal activity classes: feeding, traveling, and resting.

Estimated cattle activities were verified by recording telemetry data and visual observations for radio-collared cattle at the U.S. Forest Service San Joaquin Experimental Range during the spring of 1984. Signal pulse rates and signal strength variability were recorded at 1-minute intervals on one datalogger, while a second datalogger was used to record observed cattle activity. For any cumulative behavior class exceeding 20 minutes, observed and estimated behavior agreed closely. Additional verification was carried out with cattle at McCormick Creek during August 1984.

This automated technique of collecting cattle and deer activity information is allowing us to correlate habitat preferences with activity. For example, when feeding in August, cattle spent most of the time in wet meadow-riparian habitats and less time in montane shrub, dry meadow, conifer, and aspen habitats, in that order. Deer selected similar habitats when feeding but spent less time in dry meadows and aspen stands in grazed range units than they did in the ungrazed unit. When resting, cattle used all habitats, but deer rested more frequently in wet meadow-riparian and montane shrub types.

Differences in total time spent in each activity by animals in the different range units are providing information on the behavioral interactions between cattle and deer. Our preliminary analysis of 1984 data indicates that cattle in the heavily grazed range unit spent about 45 to 50 percent of the time feeding throughout the summer. In the moderately grazed unit, they spent about 40 percent of the time feeding in early summer and 45 percent in late summer. In the unit heavily grazed by cattle, deer spent about 35 percent of the time feeding in the summer and 50 percent in late summer. In the moderately grazed and nongrazed range units, deer

spent 35 percent or less of the time feeding during the summer.

Deer response to the presence of cattle varies: some showed little or no apparent effect, but one deer left the study area when cattle were brought in. Before cattle grazing, doe 236 used much of the meadow-riparian habitat in the basin floor during three 24-hour periods (see example of response to heavy cattle grazing, fig. 3). When cattle were brought into the unit, they concentrated in the same area, and doe 236 did not return to that area during five subsequent sampling periods. In late August, the cattle moved up-slope into habitat occupied by doe 236, apparently causing her to move across the basin into the moderately grazed unit. Does 300 and 420 were not as strongly affected but they did not overlap with cattle as much initially in range use as did doe 236.

Preliminary results indicate that the most serious negative effects we have documented result from a heavy cattle stocking rate, considerably heavier than would ever be recommended by federal resource managers. Under moderate grazing, the effects decrease, although meadow-riparian and aspen habitats are heavily used by cattle. Deer also prefer to use these habitats and do so until the vegetation becomes severely degraded. Cattle herding practices that reduce heavy use of meadow-riparian and aspen habitats until fawns are at heel with their mothers will aid in maintaining the habitats in a condition desirable to both cattle and deer.

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