DEER AND CATTLE INTERACTIONS FOLLOWING A PRESCRIBED BURN IN CHAPARRAL

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Abstract: Browsing on chamise (Adenostoma fasciculatum) by mule deer (Odocoileus hemionus) and cattle was examined on a 4 ha prescribed burn in southern California, 1982-1985. Little difference in chamise growth was observed between the area browsed by cattle and deer versus the area browsed by deer only (0.25 ha exclosure). During the first two years post-burn there were significantly more deer pellets inside than outside the cattle exclosure. Deer and cattle apparently did not compete for post-burn forage, but cattle presence may have affected deer distribution. Deer displacement disappeared during the third year post-burn, following the removal of cattle. Wildlife managers interested in maximizing benefits to deer of prescribed burns in chaparral may wish to restrict cattle access to burns during the first one to two years of regrowth.

The California Department of Forestry (CDF 1981) and the U.S. Forest Service (USFS 1984) have published environmental impact documents that predict substantial gains in deer production and livestock grazing from prescribed burns in chaparral. These predictions assume that such gains are automatic, an assumption not fully supported by the literature for either deer (Longhurst and Connolly 1970) or cattle (Sampson and Burcham 1954). These predictions also assume that mule deer (Odocoileus hemionus) and cattle will use prescribed burn areas jointly, and partition forage resources so that each receives maximum benefit.

Deer and cattle generally partition forage with deer eating forbs and shrubs, cattle eating grass, and both sharing healthy ranges with few problems and mutual benefits (Wagnon 1963, Mackie 1978, Urness 1981, Green and Newell 1982). However, there are several conditions under which competition can occur: on depleted ranges (Lucich and Hansen 1979, Vavra et al. 1981); during certain seasons (MacMahan 1964, Hansen and Reid 1975, McLean and Willms 1981); or for a single mutually preferred forage (Currie et al. 1977, Austin et al. 1983). In the case of chaparral, deer and cattle preferred forage can be similar, particularly at certain times of the year, which raises the possibility of dietary overlap. Relevant to prescribed burning, increased availability of herbaceous forage is considered one of the principle post-fire benefits for deer (Taber and Dasmann 1985, Longhurst et al. 1979) and is also the goal of most range improvement burning (Nichols and Menke 1984).

Few studies have focused on the topic of social competition between cattle and deer. McIntosh and Krausman (1981) found evidence of social interference between deer and cattle in northern Arizona. However, Skovlin et al. (1980) observed no difference in deer-use patterns in relation to cattle grazing patterns in the Blue Mountains of Oregon.

This paper reports the results of a post-burn study conducted jointly by the U.S. Forest Service and California State Polytechnic University, Pomona, between 1982 and 1985. Results from the first two years of study were published previously (Roberts and Tiller 1985). At that time, no competition for forage was observed, yet some social competition appeared to be occurring. Intrigued by these results, we continued our sampling for an additional 16 months. In August of 1984, all cattle were removed from the area. This was done to further examine the effects of cattle removal on deer distribution within the burn.

STUDY AREA

The study area was on the San Bernardino National Forest in southern California, approximately 130 km east of Los Angeles. In June 1982, a prescribed burn was conducted adjacent to the Angeles

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Fuelbreak in the San Jacinto Mountains. The burn occurred at 1200 m elevation and was approximately 4 ha in size. Slopes were moderate, 5-20%, and cover was predominately chamise (Adenostoma fasciculatum) with some interspersed eastwood manzanita (Arctostaphylos glandulosa) (Munz 1974). Southern mule deer (Odocoileus hemionus) inhabit the area at densities ranging between 3-6 deer per square km. The area had not burned for more than 50 years, and the current fire effectively killed the above ground parts of all shrubs. The prescription for the burn was: fuel stick moisture 7-11%; relative humidity 20-50%; wind speed 5-22 km per hour; air temperature 10-27°C; and time of day 0900-1600. During the burn, the relative humidity averaged 50%, wind speed 13 km per hour, and air temperature 26°C.

METHODS

A 0.25 ha exclosure (barbed wire heights set from 40-100 cm) was constructed on the burn. This was designed to exclude cattle but allow free access to deer. Line intercept transects (Smith 1974) were established along several parallel sample lines through the exclosure. Data were not collected within 5 m of the fence to avoid confounding effects of cattle trailing along the fenceline. A control area (0.25 ha) was established adjacent to the cattle exclosure on the burn site and allowed deer and cattle free access.

Exclosure and control area transects each had 18 segments of 5 m length. All plant parts intersecting the transect were traced to the root crown and scored as occurring on the transect. Measurements were taken of total canopy intercept of the transect, number of plants contributing to the crown, and height of the first individual of each species encountered.

Vegetation was sampled in September, October, and December 1982; February, May, July, and November 1983; and March, July, and October 1985. Chamise and eastwood manzanita distribution were similar ($P > 0.05$) between control and exclosure site immediately after the fire. Computations of canopy heights, total cover, and density for chamise, eastwood manzanita, and chaparral whitethorn (Ceanothus leucodermis) were made in each sampling period in both study and control areas. Each plant was examined for recent browsing and scored as being browsed or unbrowsed. Differences in canopy height, total cover, and density were analyzed using a single-factor analysis of variance (Zar 1974). Differences in browsing frequency were examined using a 2x2 chi-square contingency table (Zar 1974).

Thirty Barzona breed cattle were released on the fuelbreak in August 1982 and remained until August 1984. The stocking rate was 2.2 ha/animal unit month, including both grass and brush areas. No formal cattle utilization data were collected during the study. Cattle presence was indicated by extensive trailing and trampling, and through visual observation. A 1 m diameter exclusion cone was set up on a perennial grass stand 300 m from the exclosure to help determine use of feed other than that available as a result of the burn. Use of perennial grasses was estimated visually and by comparing total production inside the cone with residual grass left by cattle at a randomly chosen equivalent area outside. The allotment was stocked heavily to ensure that cattle would not avoid the burn because of preferred grass forage elsewhere.

Pellet-group counts (Neff 1968) of the entire 0.25 ha exclosure and control were conducted in September 1982; February, August, and November 1983; March and July 1984; and January, March, July, and October 1985. Groups were spray-painted to avoid double counting during subsequent sampling periods. Differences in pellet-group density were analyzed using a two sample t-test (Zar 1974).

RESULTS AND DISCUSSION

Chamise was the most common resprouting shrub. At 24 months post-burn, with cattle present, chamise plants, heights, and total cover were similar ($P > 0.05$) between exclosed (deer only) and control (cattle and deer) areas (Table 1). Forage use was incomplete in both situations. If cattle and deer had both been utilizing chamise, then chamise biomass within the exclosure should have exceeded that outside. Our results (Table 2) also showed recent browsing activity was not significantly different ($P > 0.05$) inside and outside of the exclosure during the first 24 months post-burn. However, pellet data (Table 3) revealed that deer spent 42% ($P < 0.05$) more time in the exclosure than outside during the first 24 months after the burn. Thus, the presence of cattle may have influenced the distribution of deer, but competition for forage was unlikely.

Perennial grass use was visually estimated as being near 100% by November 1983. Although the cattle apparently were not browsing chamise, they were frequently on or moving through the burn. As grass forage declined, cattle used the burn extensively in traveling to annual grass

Table 1. Chamise growth-characteristics on cattle and deer (control) and deer only (enclosed) areas 24 and 40 months after a prescribed burn in southern California. Estimates based on 18 sample segments in each area, differences between areas within 24-month and 40-month groups are not significant (P > 0.05).

Months after burn	Area	No. of plants per sample Mean	SE	Chamise height (cm) Mean	SE	Total chamise cover (cm) per sample Mean	SE
24	Cattle and deer	2.83	0.305	54.89	2.87	185.00	20.37
	Deer only	2.17	0.364	67.94	5.14	153.90	19.82
40	Cattle and deer	2.89	0.322	70.00	5.09	217.50	19.92
	Deer only	2.89	0.350	84.17	10.17	201.50	21.81

areas on benches below the fuelbreak.

Chamise plants, heights, and total cover remained similar (P > 0.05) between the exclosure and control areas at 40 months post-burn, following 16 months of cattle exclusion (Table 1). Browsing activity within the exclosure and the control area declined in the absence of cattle, but the number of browsed plants became significantly higher (P < 0.05) outside the exclosure (Table 2).

Deer utilization of the burn increased 23% to 76% during the 16 months of cattle exclusion (Table 3). Deer pellet-group density was no longer significantly different (P > 0.05) between exclosed and control areas (Table 3). This indicates that deer were displaced by cattle presence in the burn.

Chamise grew rapidly during the second year post-burn and its growth slowed considerably during the last 16 months of study (Figure 1). By year three, chamise appeared similar to pre-burn stands. Deer utilization between exclosure and control leveled during the final 16 months of the study (Table 3). Thus, the displacement we observed may have disappeared with increasing cover, even had cattle remained on the burn.

MANAGEMENT IMPLICATIONS

Because of the amount of money spent on prescribed burning for wildlife, biologists must develop realistic and scientific means for estimating benefits. Cost-ineffective vegetation management with fire can, in the long run, discredit this habitat management tool. Promising the same benefits for both cattle and deer can result in conflicts between wildlife managers and ranchers.

Our results indicate that cattle and deer do not compete for chamise resprouts. Heavy deer use over the entire burn indicates that prescribed burning attracts deer from the surrounding unburned chap-

Table 2. Browsed and unbrowsed chamise plants in cattle and deer and deer only areas 0-24 months and 24-40 months after a prescribed burn. Differences between areas not significant at 0-24 months (P > 0.05) but significant at 24-40 months (P < 0.05).

Months after burn	Area	No. of chamise plants Unbrowsed	Browsed
0 - 24	Cattle and deer	85	128
	Deer only	67	136
24 - 40	Cattle and deer	49	104
	Deer only	27	132

Table 3. Deer pellet-groups per day on cattle and deer and deer only areas at 0-24 months and 24-40 months post-burn. Differences between areas significant at 0-24 months (P < 0.05) but not at 24-40 months (P > 0.05).

Months after burn	Area	Pellet groups per day Mean	SE
0 - 24	Cattle and deer	0.192	0.0267
	Deer only	0.273	0.0594
24 - 40	Cattle and deer	0.337	0.0883
	Deer only	0.335	0.0731

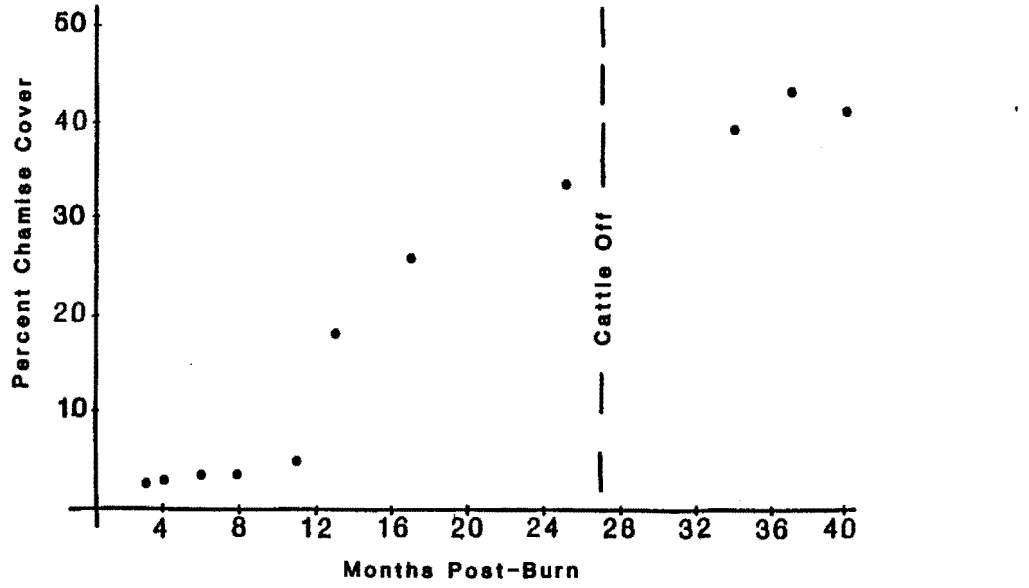

Fig. 1. Chamise growth following a prescribed burn in southern California chaparral.

arral but does not necessarily increase overall deer densities. This finding is supported by studies elsewhere (Stanton 1975, Kie 1984).

Although resprouting chamise was evidently little eaten by cattle, the presence of cattle seems to have an effect on deer distribution through the first two years post-burn. This problem has been noted by others (Dusek 1975, Neff 1981). Based on our findings, wildlife managers interested in maximizing the benefits to deer of prescribed burns in chaparral may wish to restrict cattle access during the first two years of regrowth.

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LITERATURE CITED

AUSTIN, D. D., P. J. URNESS, and L. D. FIERRO. 1983. Spring livestock grazing affects crested wheatgrass and winter use by deer. J. Range Manage. 36:589-593.

CDF. 1981. Chaparral management program, final environmental impact report. California Dept. of Forestry, Sacramento, CA. 152 pp.

CURRIE, P.O., D.W. REIGHERT, J.C. MALECHEK, and O.C. WALLMO. 1977. Forage selection comparisons for mule deer and cattle under managed ponderosa pine. J. Range Manage. 30:352-356

DUSEK, D.L. 1975. Range relations of mule deer and cattle in prairie habitat. J. Wild. Manage. 39:605-616

GREEN, L.R., and L.A. NEWELL. 1982. Using goats to control brush regrowth on fuelbreaks. U.S. Forest Service Gen. Tech. Rep. PSW-59. Berkeley, CA. 13 pp.

HANSEN, R.M., and L.D. REID. 1975. Diet overlap of deer, elk, and cattle in southern Colorado. J. Range. Manage. 28:43-47.

KIE, J.G. 1984. Deer habitat use after prescribed burning in northern California. U.S. Forest Service Res. Note PSW-369. Berkeley, CA. 3 pp.

LONGHURST, W.M., and G.E. CONNOLLY. 1970. The effects of brush burning on deer. Cal-Neva Wildlife Trans:130-155.

_____, G.E. CONNOLLY, B.M. BROWNING, and E.O. GARTON. 1979. Food interrelationships of deer and sheep in parts of Mendocino and Lake Counties, California. Hilgardia 47:191-247.

LUCICH, G. C., and R. M. HANSEN. 1979.

Autumn mule deer foods in heavily grazed cattle ranges in northwestern Colorado. J. Range Manage. 3:72-74.

MACMAHAN, C.H. 1964. Comparative food habits of deer and three classes of livestock. J. Range Manage. 28:798-808.

MACKIE, R.J. 1978. Impacts of livestock grazing on wild ungulates. Trans. N. Amer. Wildl. and Nat. Resources Conf. 43:462-476.

MCINTOSH, B.J., and P. R. KRAUSMAN. 1981. Elk and mule deer distributions after a cattle introduction in northern Arizona. Pages 545-552 in J.W. Peek and P.D. Dalke, eds. Wildlife-livestock relationships symposium. Univ. of Idaho. 614 pp.

MCLEAN, A., and W. WILLMS. 1981. Competition between cattle and mule deer on winter range in British Columbia. Pages 479-484. In J.W. Peek and P.D. Dalke, eds. Wildlife-livestock relationships symposium. Univ. of Idaho. 614 pp.

MUNZ, P. A. 1974. A flora of southern California. Univ. of Calif. Press, Berkeley, CA. 1086 pp.

NEFF, D.J. 1968. The pellet-group count technique for big game trend, census, and distribution: a Review. J. Wildl. Manage. 32:597-613.

_____. 1981. Effects of watershed treatments on deer and elk range use. Final Report Federal Aid in Wildlife Restoration Project W-78-R. Arizona Game and Fish Department, Phoenix, AZ. 37 pp.

NICHOLS, R., and J. MENKE. 1984. Effects of chaparral shrubland fire on terrestrial wildlife. Pages 74-97 in J.J. DeVries, ed. Shrublands in California: literature review and research needed for management. Water Resources Center Contribution No. 191, Univ. of California, Davis. 146 pp.

ROBERTS, T. A., and R. L. TILLER. 1985. Mule deer and cattle responses to a prescribed burn. Wild. Soc. Bull. 13:248-252.

SAMPSON, A. W., and L. T. BURCHAM. 1954. Costs and returns of controlled burning for range improvement in southern California. California Divison of Forestry, Range Improvement Studies No. 1. Sacramento, CA. 41 pp.

SKOVLIN, J.M., P. J. EDGERTON, and R. W. HARRIS. 1968. The influence of cattle management on deer and elk. Trans. N. Amer. Wildl. Conf. 33:169-181.

SMITH, R. L. 1974. Ecology and field biology. Harper and Row, NY. 850 pp.

STANTON, F. 1975. Fire impacts on wildlife and habitat. U.S. Bureau of Land Management, Denver, CO. 45 pp.

TABER R.D., and R.F. DASMANN. 1958. The black-tailed deer of the chaparral: its life history and management in the north coast range of California. Calif. Dept. of Fish and Game, Game Bull. No. 8. 163 pp.

URNESS, P. J. 1981. Livestock as tools for managing big game winter range in the intermountain west. Pages 20-31 in J.W. Peek and P.D. Dalke, eds. Wildlife-livestock relationships symposium. Univ. of Idaho. 614 pp.

USFS. 1981. Draft environmental impact statement - Pacific Southwest Regional Plan. U.S. Forest Service, San Francisco. 197 pp.

VAVRA, M., T. HILKEN, F. SNEVA, and J. SKOVLIN. 1981. Deer dietary relationships on deer winter ranges in eastern Oregon. Pages 105-115 in J.W. Peek and P.D. Dalke, eds. Wildlife-livestock relationships symposium. Univ. of Idaho. 614 pp.

WAGNON, K.A. 1963. Behavior of beef cows on a California range. California Agricultural Experiemnt Station Bull. No. 799. 58 pp.

ZAR, J.H. 1974. Biostatistical analysis. Prentice Hall, Inc. Englewood Cliffs, NJ. 650 pp.