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Research Note
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Deer Habitat Use After Prescribed Burning in Northern California

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Prescribed burning was used to improve black-tailed deer *(Odocoileus hemionus columbianus)* habitat in Trinity County, northern California. Deer response was measured by comparing pellet group deposition on one burned and three unburned areas. Pellet group counts were highest on the burned area for 3 years after burning. One year after burning, pellet group deposition on unburned areas was lowest adjacent to the burned area and increased with distance from the burned area. Using control areas adjacent to the burn led to an overestimate of increase in deer activity. Prescribed burning caused some increase in deer activity, but it is difficult to quantify because annual deer habitat use and defecation rates vary. Any beneficial effects of burning did not appear to continue into the fourth year.

Retrieval terms: Black-tailed deer, *Odocoileus hemionus columbianus*, deer pellet groups, habitat improvement, prescribed burning

Prescribed burning to improve habitat for black-tailed deer *(Odocoileus hemionus columbianus)* has been underway since 1976 on land administered by the Shasta-Trinity National Forest, in Trinity County, California. These efforts have been part of a program to mitigate the loss of deer habitat that resulted from construction of Trinity and Lewiston reservoirs in the early 1960's.

To measure deer response to burning of their habitat, pellet group deposition on a burned area can be compared with preburn deposition on the same area. The basic assumptions of measuring deer habitat use by counting pellet groups have been well documented.[1] However, deer use of seasonal ranges varies annually. Deer remain on winter range in Trinity County significantly longer in years with cold, wet April weather, which may delay spring migration. Weather variables and spring pellet group counts were closely correlated at Hay Gulch in Trinity County, from 1964 to 1978, as shown by nonparametric correlation coefficients (Spearman's rho):

Month:	Average temperature	Precipitation
January	−0.07	−0.13
February	− .23	− .02
March	.07	− .06
April	− .44*	.56**

* $P < 0.05$.
** $P < 0.01$.

Comparison of deer pellet group counts before and after burning on one site is likely to confound the effects of burning with those of annual variations in weather and other factors. Alternatively, deer pellet group deposition on a burned area can be compared with that on a similar but unburned area. However, finding a similar unburned area to use as an experimental control may be difficult.

Relating pellet group counts to habitat improvement programs also presents certain interpretive problems. An increase in pellet-group concentration does not necessarily reveal a net increase in carrying capacity, but indicates an increase in deer activity.[2] However, differences in mean pellet group densities between areas suggest that more requirements of deer are met on one area than on the other.

In reviewing the effects of timber harvesting on habitat use by mule deer in Arizona, Patton[3] found that an increase in pellet group density does not necessarily indicate an increase in total number of animals; the increase can result from animals coming from adjacent areas, even though deer use on the adjacent areas may not decrease. However, if the changes are beneficial, deer numbers should increase over the long run.

This note reports on deposition of pellet groups after prescribed burning to improve deer habitat. One burned area and three unburned areas on black-tailed deer winter range in northern California were compared. Pellet group counts were highest on the burned area for 3 years after burning. One year after burning, pellet group deposition on the unburned areas was lowest adjacent to the burn and increased with distance from the burn. Deer appeared to be attracted into the burned area from the adjacent unburned areas. Any beneficial ef-

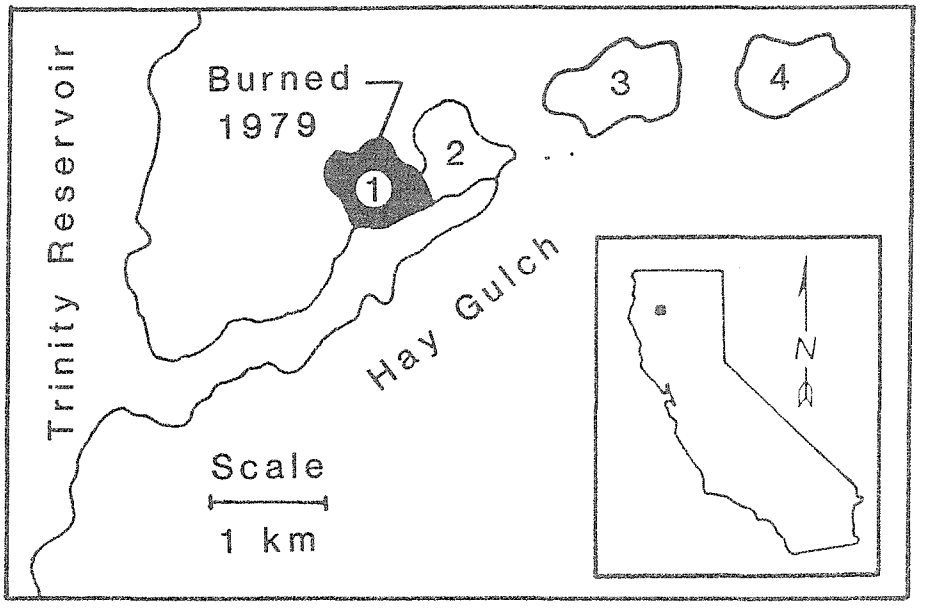

Figure 1—Location of deer-use sampling areas (1-4) in Hay Gulch.

fects of burning did not appear to continue into the fourth year after burning.

STUDY AREA AND METHODS

Temporary, circular 4-m² plots were systematically located during spring each year from 1980 to 1983, in four areas in Hay Gulch on the northeast side of Trinity Reservoir *(fig. 1)*. About 100 plots were located in each area each year. Each area encompassed 8-12 ha. Area 1 had been burned during spring 1979. Vegetation was similar on all areas, consisting of a scattered overstory of Digger pines *(Pinus sabiniana)* and oaks *(Quercus garryana, Q. kelloggii)*, with an open understory of wedgeleaf ceanothus *(Ceanothus cuneatus)*, mountain mahogany *(Cercocarpus betuloides)*, other shrubs, grasses, and forbs. All plots were on south-facing, gentle to moderately steep slopes, and were characterized as high quality winter deer habitat.

Use of temporary plots resulted in larger sample sizes than if the plots had been permanent because of the ease with which they can be established. Deer pellet groups persist for only about 6 to 9 months in Trinity County.[4] Therefore, temporary plots were suitable for counting current year's pellet groups. Data for area 3 were obtained from 40 permanent, cleared 100-m² plots established by staff of the Shasta-Trinity National Forest.[5] Sampling intensity ranged from 0.1 to 0.5 percent of the total area.

Pellet groups were counted, and confidence limits were placed on the estimates of mean number of pellet groups per plot by using maximum likelihood techniques for a negative binomial distribution.[6,7] The average number of pellet groups per plot and confidence limits in each area were expanded to a hectare basis.

RESULTS AND DISCUSSION

In the first year following burning or other habitat improvement, any deer response would be functional; no increase in total deer numbers, or numerical response, would be expected. Some deer may be drawn into the burned area from adjacent habitats. However, deer may be benefited both on the improved area because of more or better forage or both, and on the unimproved areas because fewer deer are feeding on a fixed amount of forage.[3] These benefits would presumably translate into lower deer mortality, higher reproductive rates, and increases in deer numbers over time.

In 1980, 1 year after burning, deer use on the burned area 1 was 3,315 pellet groups per hectare (PG/ha), but on the adjacent unburned area 2 it was only 1,966 PG/ha *(fig. 2)*. Of the three unburned areas, deer use was lowest on area 2 adjacent to the burn and increased with distance from the burn: 2,198 PG/ha on area 3, and 2,897 PG/ha on area 4. Deer appeared to be attracted into the burned area by the flush of new herbaceous growth in early spring.

Results were similar in 1981, although deer use in Hay Gulch was lower than during the previous year. Deer use averaged

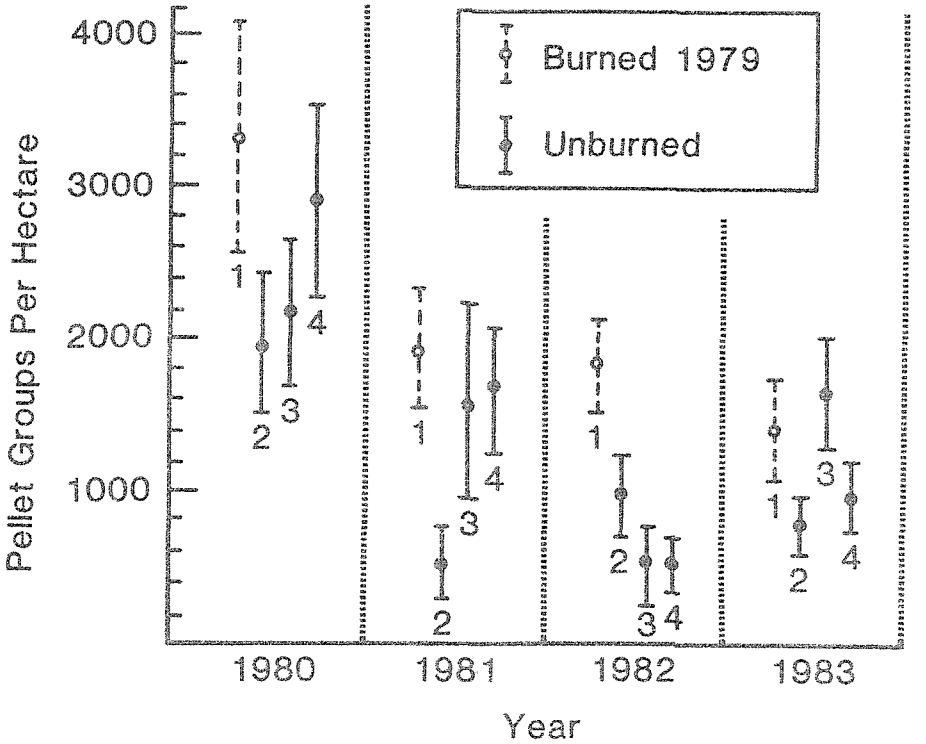

Figure 2—Mean numbers of deer pellet groups in areas 1-4 (numbers below each bar) at Hay Gulch during winters 1980 to 1983, with 90 percent confidence intervals.

1,939 (area 1), 509 (area 2), 1,581 (area 3), and 1,687 (area 4) PG/ha *(fig. 2)*.

Deer use was also low in 1982, averaging 1,828, 958, 518, and 511 PG/ha for the four areas *(fig. 2)*. However, deer did not appear to be drawn into area 1 directly from area 2. Area 1 still exhibited high deer use, but deer use on areas 2, 3, and 4 did not differ from that in previous years.

In 1983, 4 years after burning, deer use was estimated at 1,408, 741, 1,655, and 988 PG/ha for the four study areas. Deer use in area 1 did not differ from that in the three other areas combined. Any beneficial effects of the burning program did not appear to continue into the fourth year.

Had the success of the burning program in Hay Gulch been judged solely by deer pellet group depositions in areas 1 and 2 during 1980, the estimated increase in deer use would have been 1,349 PG/ha. However, the actual increase was somewhat less, because some deer were drawn from adjacent unburned habitat. If pellet group counts within the burned area are compared with those from area 4 in 1980 (eliminating areas 2 and 3 because of this effect), with those from areas 3 and 4 in 1981, and with those from areas 2, 3, and 4 in 1982, the estimated increases in deer use would be 418 PG/ha in 1980, 305 PG/ha in 1981, and 1,313 PG/ha for 1982. However, only the differences in 1982 are statistically significant *(fig. 2)*. Alternatively, if the data from these specific areas and years are combined and then averaged, the resulting estimated increase is 1,002 PG/ha.

Furthermore, deer defecation rates are not constant, but can increase as a result of good range conditions, high feed intake, and high forage moisture content[1]—all conditions expected after habitat improvement by prescribed burning. The higher observed numbers of deer pellet groups in 1980 after burning may be due in part to increased defecation rates.

CONCLUSIONS

Prescribed burning in Hay Gulch probably had some modest effect in increasing deer habitat use, although the increase is difficult to quantify. Any attempts to measure the success of similar deer habitat improvement programs with pellet group counts should not rely solely on control plots adjacent to improved areas, and such attempts should monitor deer response for several years following habitat manipulation. Finally, interpretation of pellet group counts should be regarded with a degree of uncertainty commensurate with the techniques by which they were collected.

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NOTES

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