POPULATION AND HABITAT ECOLOGY OF DEER ON DEVILS TOWER NATIONAL MONUMENT

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INTRODUCTION

White-tailed (*Odocoileus virginianus*) and mule deer (*O. hemionus*) currently use Devils Tower National Monument and adjacent private agricultural lands year round or migrate from the Monument to other areas. In 1989, a game fence was constructed on the west and north borders of the Monument. Enclosure of the Monument by additional fencing could alter habitat use of deer substantially and create many of the problems associated with island reserves. National Park Service management policy directs the Monument to predict changes in the natural resources under its stewardship. Current deer use of the Monument is not well documented so that a baseline for monitoring long term changes is lacking.

The Department of Zoology and Physiology at the University of Wyoming and the Wyoming Cooperative Fish and Wildlife Research Unit, in cooperation with the Devils Tower National Monument, initiated a study in June 1990 to document current population numbers and habitat ecology of white-tailed and mule deer on the Monument. Objectives of this study are to:

- (1) Evaluate methods to estimate seasonal deer densities on the Monument.
- (2) Determine seasonal movement patterns and time spent on and off the Monument by radiocollared deer.

- (3) Determine deer habitat selection patterns of deer on the Monument.
- (4) Estimate the nutritional carrying capacity of the Monument for deer.

Preliminary data on population estimates, movement patterns, and habitat use patterns of deer using the Monument during 1990-1991 were presented in the 1991 Annual Progress Report. This report presents additional data on the population numbers for the period April 1992 to October 1992 and describes vegetation data collected but not yet analyzed.

STUDY AREA

Devils Tower National Monument is located in Crook County Wyoming, approximately 10 miles west of the Bear Lodge Mountains. The area comprises 5.45 km² within the Belle Fourche River drainage. It is well known for it's unique geological formation, a 264 m high monolith of igneous rock named Devils Tower. Because of the interest in the natural resources at Devils Tower, the area was proclaimed a National Monument in 1906. The management goal of the National Monument is to preserve the natural processes and cultural objects while providing for visitor enjoyment of the area.

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The Monument is characterized by varied topographic relief from steep slopes to flat bottomlands. The Belle Fourche River is the major waterway along the southeast border of the Monument. Elevation of the Monument area rises from 1173 m along the Belle Fourche River to 1341 m at the base of Devils Tower. Annual rainfall is 38 cm to 51 cm and maximum snowpack is 102 cm (National Park Service 1991).

Vegetation on the Monument includes interspersed stands of Ponderosa pine (*Pinus ponderosa*) forests, pine savannahs, bur oak (*Quercus macrocarpa*) woodlands, upland grasslands, and lowland floodplains. All land adjoining the Monument is privately owned except 160 acres along the southeastern border which is Wyoming state trust land. Land use is dominated by livestock grazing or alfalfa or grain production. Irrigated hay fields occur within less than a 1.5 km of both the south and east borders of the Monument.

METHODS

POPULATION NUMBERS

Three methods were used to estimate deer densities on the Monument during the reporting period. On 25 April 1992 and 10 October 1992 complete counts of deer on the Monument were conducted using a drive count approach. Observers were positioned at intervals along all borders of the Monument except along the western boundary that is bordered by an 2.6 m fence. Observers along the southern and eastern borders remained stationary while "drivers" walked from the northern border southward, maintaining a straight line as they moved. Consistency in movement and distance between "drivers" was facilitated by communication with hand-held radios among "leaders".

Deer that passed back through the "drivers" and between stationary observers along the Monument borders were counted. Observers counted deer passing only to their right to avoid duplicating the number of deer counted. Communication among participants decreased the possibility of counting the same deer more than once or not detecting escaping deer. Deer were classified by species or listed as unclassified. The second method used to estimate deer was pellet group counts. On 10 October 1992, 130 plots were sampled. Number of deer using the Monument was calculated assuming a deposition rate of 15 pellet groups per deer per day (Robinette et al. 1958), an area of the Monument of 5.43 km² (which excludes Devils Tower) and a period of 182 days. Estimation of sample sizes needed for 90% confidence intervals within 10% of the estimate were calculated following Christensen (1977).

The third approach to estimating deer densities was the line transect (Burnham et al. 1980). Transects were located within 3 evenly divided segments of the Monument, and oriented either north to south or east to west. Routes extended the approximately 2.4 km across the entire length of the Monument. Routes were walked between 0800 am and 1400 hours within a 10 day period. Eighteen transects were surveyed each month between May and October 1992.

Number of deer per group, species, sight distances to group centers, compass bearings to the group center, and predominant vegetation in which deer were observed were recorded for each group observed. Group location was plotted on an aerial photo. A group was defined as deer that were within 30 m of each other. Sight distances were measured using a range finder or visually estimated if < 46 m. Data were analyzed with the program DISTANCE (Laake et al. unpubl.) to estimate deer densities. Based on our field data, we used a negative exponential function to describe the probability of sighting deer groups. The average number of deer on the Monument during the sample period was calculated each month and season by multiplying density estimates by the measured area of the Monument excluding Devils Tower (5.32 km²). Coefficients of variation (C.V.) were calculated by the program to evaluate the relative precision of density estimates.

MOVEMENT

Deer movements were monitored by locating 12-14 radio-collared white-tailed deer and 2-4 mule deer 4 times during 2.5 day-intervals every 10 days in April through June. Locations were obtained during both the day and night for each deer. Locations will be entered into a geographic information system (GIS) to analyze seasonal home ranges and habitat

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selection patterns.

VEGETATION SAMPLING

Vegetation on the Monument was delineated into 8 different cover types according to overstory and understory species. Boundaries were digitized from a 1991 infra-red, aerial photograph and ground surveyed in March, July and August using a Global Positioning System (GPS, Trimble Navigation). Five non-vegetative types (Tower, pavement, water, etc.) were also defined. Location and boundary descriptions of cover types were entered into the GIS. Cover types were overlayed on a digital elevation model for the Monument.

We sampled additional sites within the 8 cover types during June and July to estimate forage availability on and adjacent to the Monument. Herbaceous biomass was clipped in eight 0.25 m² microplots located systematically along a 20 m transect within the cover type. Forb species were collected separately while grasses were composited, oven-dried, and weighed to the nearest 0.1 g. Shrub densities and number of twigs and leaves per plant were counted within 3 height strata (<0.25m, 0.26-0.5m, and 0.5-1.8m) within a 314 m² plot. Fifty twigs and leaves were collected from each site, ovendried, and weighted separately to the nearest 0.01 g.

FOOD HABITS

Pellet group samples were collected each month on the Monument from June 1991 to May 1992. Pellet samples will be analyzed microhistologically to identify forage species eaten by deer. Twenty fresh pellet groups were collected each month from each of 4 quadrants of the Monument (northwest, southwest, northeast, southeast). Four composited samples per month and 12 per season were obtained by combining 5 pellets from 5 pellet groups from each of the quadrants (n = 20 pellet groups/sample). After collection, pellets were oven-dried, ground to < 1 mm particle size, and sent to Colorado State University for analysis.

Collections of forage species for nutritive value (digestibility and crude protein) will be made seasonally during 1991 and 1992. Forage samples were oven-dried at < 50 ° C within 20 minutes of collection. These data will be used to make

preliminary estimates of nutrient availability within cover types.

♦ RESULTS AND DISCUSSION

DEER DRIVE COUNT

During the 25 April 1992 deer census, 162 white-tailed deer, 12 mule deer and 7 unclassified deer were counted using 33 participants. Twenty-five people were positioned as "drivers" and walked through the Monument spaced at approximately 100 m intervals. The drive was completed in 2.5 hours. Sixty-five more white-tailed deer and 10 more mule deer were counted on the Monument during the spring 1992 census than the spring of 1991 census. The increase in white-tailed deer may reflect an increase in the number of deer that survived the mild winter of 1991-92.

The drive count on 10 October 1992 used 40 people and took 3.0 hours. Thirty-five people were positioned along the northern border of the Monument at approximately 70 m intervals and served as "drivers". One hundred and twenty-nine white-tailed deer, 5 mule deer and 1 unclassified deer were counted. Twenty-nine less and 12 more whitetailed deer were observed during this fall census than the fall 1991 and fall 1990 census, respectively.

PELLET GROUP COUNTS

For the period between October 1991 to April 1992, an average 8.2 pellet groups were counted per plot. Number of deer using the Monument during this period was 122 with a coefficient of variation of 16%. Pellet group counts indicated more deer were using the Monument in the winter of 1991-92 than in the winter of 1990-1991. Average number of pellet groups counted per plot in October 1992 was 3.43. Estimated number of deer using the Monument during the period April 1992 to October 1992 was 68 deer with a coefficient of variation of 24%. Based on pellet counts, about the same number of deer used the Monument in the summer of 1992 as in the summer of 1991.

LINE-TRANSECT

Monthly estimates of white-tailed deer on the Monument during the summer of 1992 peaked at 137

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Month	Number of Lines	Total of Line Length (km)	Total Deer Counted	Number of Deer per Group	deer per km ²	CV	Estimate of Total Number of Deer ^b
Mar 92	18	36.6	65	2.83	28.9	28	154
Apr 92	18	38.6	63	2.42	17.4	38	95
May 92	18	38.6	50	2.17	16.1	38	87
Jun 92	18	38.6	35	1.52	13.8	39	75
Jul 92	18	38.6	55	1.96	25.3	25	137
Aug 92	18	38.6	43	1.87	19.3	41	105
Sep 92	18	38.6	82	3.15	13.1	53	71
Spring	54	115	178	2.51	12.6	25	67
Summer ^d	54	115	133	1.80	19.2	19	101

Table 1. Densities of white-tailed deer and coefficient of variation (C.V.) at Devils Tower National Monument estimated from line transects using the program DISTANCE (Laake et al. unpubl.).^a

* only deer within 200 m perpendicular distance of transect line are included in counts

^b calculated by multiplying the estimated number of deer per km² by the area of the Monument (5.32 km²)

^e combined months of March, April, and May (1992)

^d combined months of June, July, and August (1992)

in July and declined to 71 in the fall (Table 1).

Despite our increase from 12 to 18 transects per month, only seasonal estimates of white-tailed deer had acceptable coefficient of variations (< 20%). Monthly estimates of mule deer using the Monument ranged from 0 to 21, with estimates being highly imprecise (C.V. > 84 %). The lack of precision is due to the low mule deer densities.

MOVEMENT PATTERNS

Movement patterns of deer during the spring of 1992 were similar to those of past years. Two radiocollared white-tailed does (the same ones that moved last year) moved 8 km to the east of the Monument to summer. Two mule deer which wintered off the Monument the previous winter, returned to the Monument in June. These data suggest there are seasonal shifts of individual deer on and off the Monument.

COVER TYPE DESCRIPTION AND VEGETATION SAMPLING

We used the GPS to map locations of stands of bur oak, chokecherry (*Prunus virginiana*), american plum (*P. americana*), aspen (*Populus tremuloides*), and silver sage (*Artemisia cana*) on the Monument. We are currently processing the raw data generated by the GPS system to map these communities in the GIS. Data collected on forage availability within cover types has not yet been analyzed and will not be presented in this report.

FUTURE WORK

We completed most of our field sampling in October and have focused our efforts on data analysis. Because of the lack of snow last winter, field work this winter will include measuring snow accumulation at locations on the Monument which represent different vegetation and physiographic features.

We expect to complete our comparison of population monitoring techniques in March 1993 and our estimates of deer carrying capacity on the Monument in August 1993. Additional analyses of deer habitat selection will be available by December 1993.

♦ LITERATURE CITED

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