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MOBILITY OF SOUTH DAKOTA DEER BETWEEN
BADLANDS NATIONAL PARK AND SURROUNDING AREAS, 1970-79

Completion Report
by
Arthur V. Carter

Pittman-Robertson Project ----- W-75-R-21
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ABSTRACT

Mobility of South Dakota Deer Between Badlands National Park and Surrounding Areas, 1970-79

Deer concentrate heavily within the Badlands National Park and adjacent areas. In 1970, a trapping and tagging project was initiated to gather information on movement of deer in and out of the Park, to determine origin of deer causing local crop-depredation, and to determine effects of hunting season regulations upon local deer herds.

Trapping and tagging operations were terminated after the 1972-73 winter, since the desired number of deer (134) had been marked. A radio telemetry study was initiated in 1974. Nineteen animals were radio-equipped.

Data show deer moved in and out of the Park, both on a daily and seasonal basis. Movement of 2 miles or less out of the Park to adjacent alfalfa and winter wheat fields or to stacked alfalfa hay was recorded. Travel, especially by bucks, to nearby juniper breaks located on National Grasslands was also noted. Deer concentrated in and along drainages and woody draws near Park boundary. This facilitated access to private lands.

Data from hunter recoveries show deer trapped outside the Park were not significantly more vulnerable to the gun than those trapped within the Park (Chi-square, $P > 0.05$). Returns also show deer dispersed from the area. Most dispersal was by deer collared as 6-8 month-old fawns. Approximately 50 and 75 percent of the females and males, respectively, marked as fawns dispersed. Data show dispersal occurred by the animal's second summer of life. Limited dispersal was noted by adult males and none by adult females. Dispersal averaged 43 miles with a range of 5-112.

Males had larger home ranges than females. Sage Creek females had smaller ranges than Big Buffalo Creek females.

Riparian habitats, collectively, were the most important cover type followed by juniper slope. Use of agricultural crops were relatively small, receiving only 0.4 and 5.8 percent use, respectively, in the Sage Creek and Big Buffalo Creek areas.

PREFACE

Data gathered throughout the 1970-78 fiscal periods under Pittman-Robertson Project W-17-R-13 through 20 for Study D-9.1 are presented in this completion report. For progress reports, see same study title for above fiscal periods.

TABLE OF CONTENTS

	Page
ABSTRACT -----	i
PREFACE -----	ii
TABLE OF CONTENTS -----	iii
LIST OF FIGURES -----	iv
LIST OF TABLES -----	iv
LIST OF APPENDIX TABLES -----	iv
INTRODUCTION -----	1
STUDY AREA -----	1
OBJECTIVES -----	3
METHODS -----	3
FINDINGS -----	4
CONCLUSIONS -----	10
LITERATURE CITED -----	11
APPENDIX -----	12

LIST OF FIGURES

Fig.		Page
1.	The study area, Badlands National Park and surrounding areas, western South Dakota -----	2
2.	Locations of marked deer observed six or more times from January 8, 1971 to June 30, 1978 within and surrounding the Badlands National Park -----	6

LIST OF TABLES

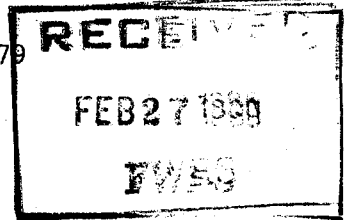
Table		Page
1.	Sex and age characteristics of marked deer (canvas collars, ear streamers), Badlands National Park and surrounding areas, South Dakota, 1971-73. -----	5
2.	Sex and age characteristics of radio-equipped mule deer, Badlands National Park and surrounding areas, South Dakota, 1975-77 -----	7
3.	Range and mean distances traveled by marked deer during dispersal, Badlands National Park, South Dakota, 1970-78 --	7
4.	Average activity radii (mi) of mule deer, Badlands National Park, South Dakota, 1970-78 -----	8
5.	Percentage of observations in habitat types of radioed mule deer in Sage Creek and Big Buffalo Creek basins, Badlands National Park, South Dakota, 1970-78 -----	9

LIST OF APPENDIX TABLES

Table		Page
1.	Habitat types identified on the study area, Badlands National Park and surrounding areas, South Dakota, 1970-79 -----	13

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INTRODUCTION

This study was one phase of a cooperative research project between South Dakota Department of Game, Fish and Parks; Badlands National Park of the National Park Service, United States Department of the Interior; and Rocky Mountain Forest and Range Experiment Station of the Forest Service, United States Department of Agriculture. The overall objective was to conduct certain wildlife habitat studies on prairie deer in South Dakota. The Game, Fish and Parks Department was responsible for assisting in capturing, tagging and/or radioing deer, and for determining movement of these deer.

Traditionally, deer concentrations have occurred within the Badlands National Park and surrounding areas. Consequently, moderate to heavy hunting pressure with resultant high deer harvest has occurred in areas adjacent to the Park, particularly on land administered by the United States Forest Service. Deer moved in and out of the Park, but the extent of this movement was unknown. Data from a marking and/or radio telemetry program assisted in determining seasonal movement patterns and origins of deer causing depredation on private lands bordering the Park. Defined movement patterns were also of value for recommending deer seasons in areas adjacent to the Park.

STUDY AREA

The study was conducted in west-central South Dakota within and surrounding the Badlands National Park (Fig. 1). The area lies within the 14-16 inch rainfall belt of the mixed grass prairie. Soils are primarily clayey and loamy with barren badlands being prominent. Rough terrain with vertical relief up to 90 feet exist.

Dominant grasses are western wheatgrass (Agropyron smithii), blue grama (Bouteloua gracilis) and buffalograss (Buchloe dactyloides). Important shrubs include skunkbush sumac (Rhus trilobata), chokecherry (Prunus virginianus), western snowberry (Symphoricarpos occidentalis), and silver buffaloberry (Shepherdia argentea). Trees such as Rocky Mountain juniper (Juniperus scopulorum), green ash (Fraxinus pennsylvanica), plains cottonwood (Populus deltoides), and willows (Salix spp.) are common, especially along drainages (Severson and Carter 1978).

The Park is managed for natural conditions with no farming and grazing by native ungulates only, e.g. mule deer (Odocoileus hemionus), whitetailed deer (O. virginianus), pronghorn antelope (Antilocapra americana) and American bison (Bison bison). Surrounding National Grasslands are grazed

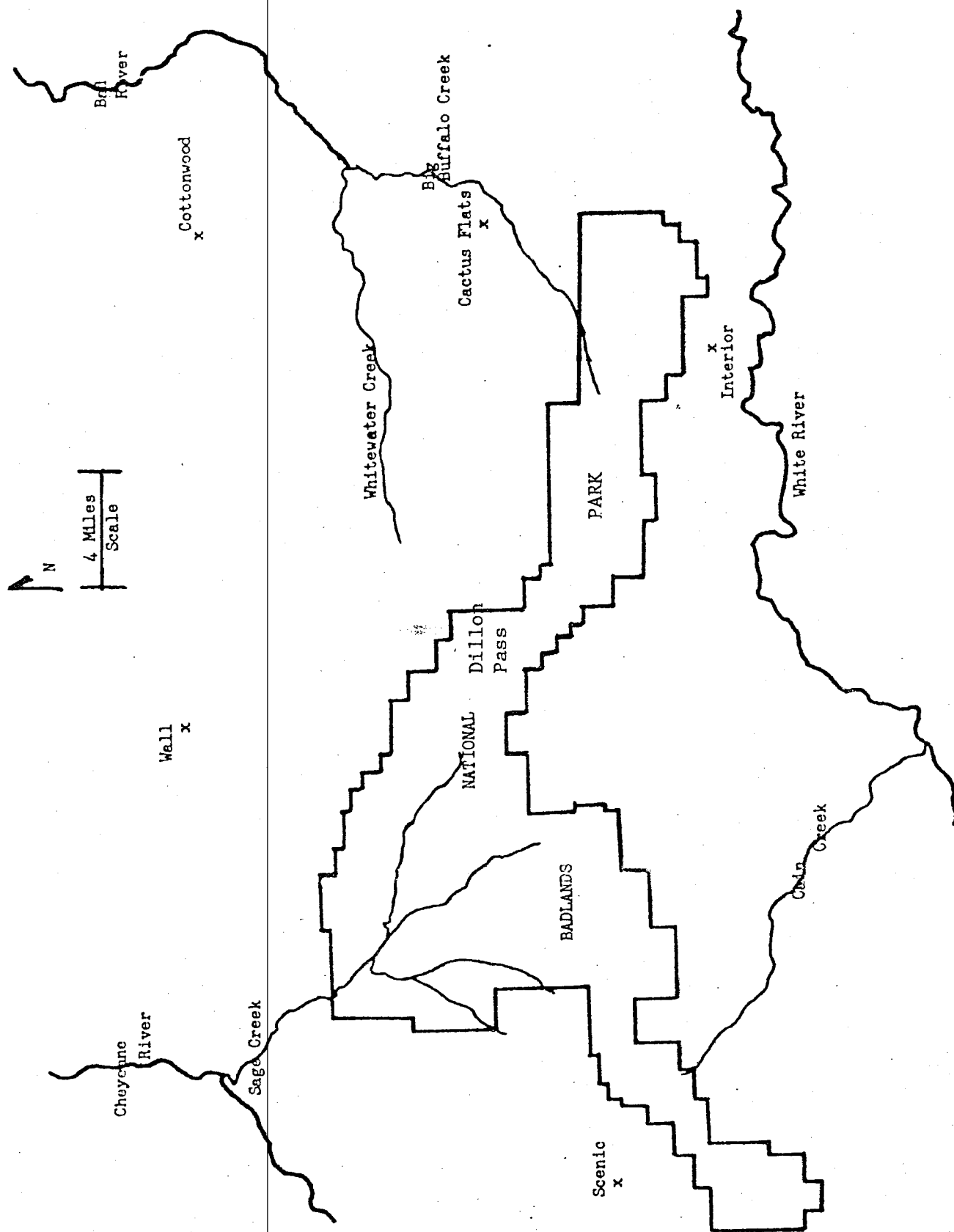


Fig. 1. The study area, Badlands National Park and surrounding areas, western South Dakota.

by wildlife species and domestic livestock. No farming is allowed. Private lands are both grazed and farmed, with winter wheat (Triticum aestivum) and alfalfa (Medicago sativa) being important crops.

OBJECTIVES

Objectives of this study were to determine daily and seasonal movements of deer within and between Badlands National Park and surrounding areas, to determine origin of deer causing local crop depredation, and to relate harvest of deer to presence of the restricted hunting areas.

METHODS

Deer herds were located during late fall and early winter. Major deer concentrations occurred in the Sage Creek and Big Buffalo Creek drainages with some in the Dillon Pass area (Fig. 1). Therefore, most trapping was conducted in these vicinities. Traps were located within Badlands National Park, National Grasslands and private lands adjacent to the Park. Areas with minimal human disturbance were desirable. When possible, traps were located near alfalfa stacks or winter wheat fields which attracted deer. Bottoms of brushy draws were also desirable sites.

Walk-in (Clover) traps baited with second-cutting alfalfa hay were used to capture deer. Initially both alfalfa and ear corn were used, but deer showed a definite preference for alfalfa; and because snow often covered corn, alfalfa was used primarily as bait after the first year. Occasionally, an apple-mash mixture was used in conjunction with alfalfa.

Trap sites were pre-baited 1 week or more until deer readily consumed the bait. Traps were checked daily. Those located on private land had to be moved when domestic livestock were placed in the pastures.

Limited use of tranquilizer guns was also employed for capturing animals. Several kinds of drugs were used including nicotine salicylate and succinylcholine chloride.

Animals were fitted with numbered, color-coded canvas collars, or ear streamers attached to large cattle ear tags (1971-73), or radio transmitter collars (1975-77).

Canvas collars were 4 inches wide and covered by a plastic or vinyl overlay. Numbers or symbols (2½ x 4 inches) readable up to 3/4 mile with a 20-power spotting scope were stitched on collars. Doe collars were 20 inches long with ends stitched together. Male collars were 22 inches long with grommated ends, which were fastened with three harness snaps the first year. However, collars were enlarged 2-3 inches the second year using plastic hardware bands to allow for additional neck swelling and ease of tagging. Because buck collars were large and would slip off fawns, plastic ear streamers 5-7 inches long were used during the first winter and initially the second. However, early in the second winter collars were made 3-4 inches smaller for immature bucks by stitching the collar together, forming a figure

eight with one large and one small loop. Light cotton thread was used so stitches would rot and break in a few months allowing the collar to enlarge to it's full size. Metal ear tags, with return addresses, were put on all captured deer. Systematic searches for canvas-collared deer were made from vehicles, on horseback, or on foot. Radioed deer were monitored every 7-10 days.

FINDINGS

One hundred thirty-four deer were marked with canvas collars or ear streamers (Table 1), and 19 were radio-equipped (Table 2).

Approximately 1,100 locations of marked deer were recorded. Major deer concentrations were located in west and east ends of the Park. Therefore, a high percentage of deer trapped and subsequently observed were in these areas (Fig. 2).

Year-long habitat requirements were generally available throughout the study area for these non-migratory deer. Thus, movements to locate essential cover types was minimal, especially on the west end.

Year-round observations of marked deer showed relatively short movements (2 miles or less) in and out of the Park. Movements were influenced largely by weather, presence of domestic livestock, and time of year.

Winter

During winter, movement on the east end of the Park was primarily northerly onto private lands. Stacked alfalfa hay attracted deer during cold temperatures and deep snows. Some depredation complaints were received at this time. Deer herds remained along drainages adjacent to the Park boundary near hay yards and readily moved to and from stacks until weather modified, permitting them to remain in the National Park.

Limited movement out of the Park to the south was also recorded. Movements were less frequent, but longer. A herd with two radioed does made two trips of 6 miles across the White River into the "breaks". The deer were monitored in a winter pasture in good range condition with several important browse plants present such as chokecherry and western snowberry. No depredation complaints were received.

On the west end most deer wintered inside the Park, but some (especially bucks) would travel approximately 2 miles outside the boundary fence to rough juniper breaks during mild weather. The absence of other ungulates may have influenced movement into this area.

Less depredation problems were experienced on the west end because of restricted travel and less availability of stacked alfalfa hay. It is believed rougher topography with better habitat conditions were also important factors in holding deer inside the Park on the west end.

Limited use of alfalfa fields was noted during winter. But with little or no detrimental affects upon the crop at this time, complaints were not received.

Table 1. Sex and age characteristics of marked deer (canvas collars, ear streamers), Badlands National Park and surrounding areas, South Dakota, 1971-73.

Deer	Bad River									
	Sage Creek			Big Buffalo (South)			Big Buffalo (North)			Dillon Pass
	1971	1972	1973	1971	1972	1973	1971	1972	1973	
Mule Deer:										
Male - Adult	13	5	8	5	1	0	0	0	0	33
Male - Fawn	4	6	3	7	10	2	0	0	2	34
Female - Adult	5	3	4	5	5	4	0	0	0	30
Female - Fawn	7	2	4	5	3	5	0	5	0	31
Sub-Totals	29	16	19	22	19	11	0	9	3	128
Whitetail:										
Male - Adult	0	0	0	0	0	0	0	0	0	0
Male - Fawn	0	0	0	3	0	0	0	0	0	3
Female - Adult	0	0	0	0	0	0	0	0	0	0
Female - Fawn	0	0	0	3	0	0	0	0	0	3
Sub-Totals	0	0	0	6	0	0	0	0	0	6
TOTALS	29	16	19	28	19	11	0	9	3	134

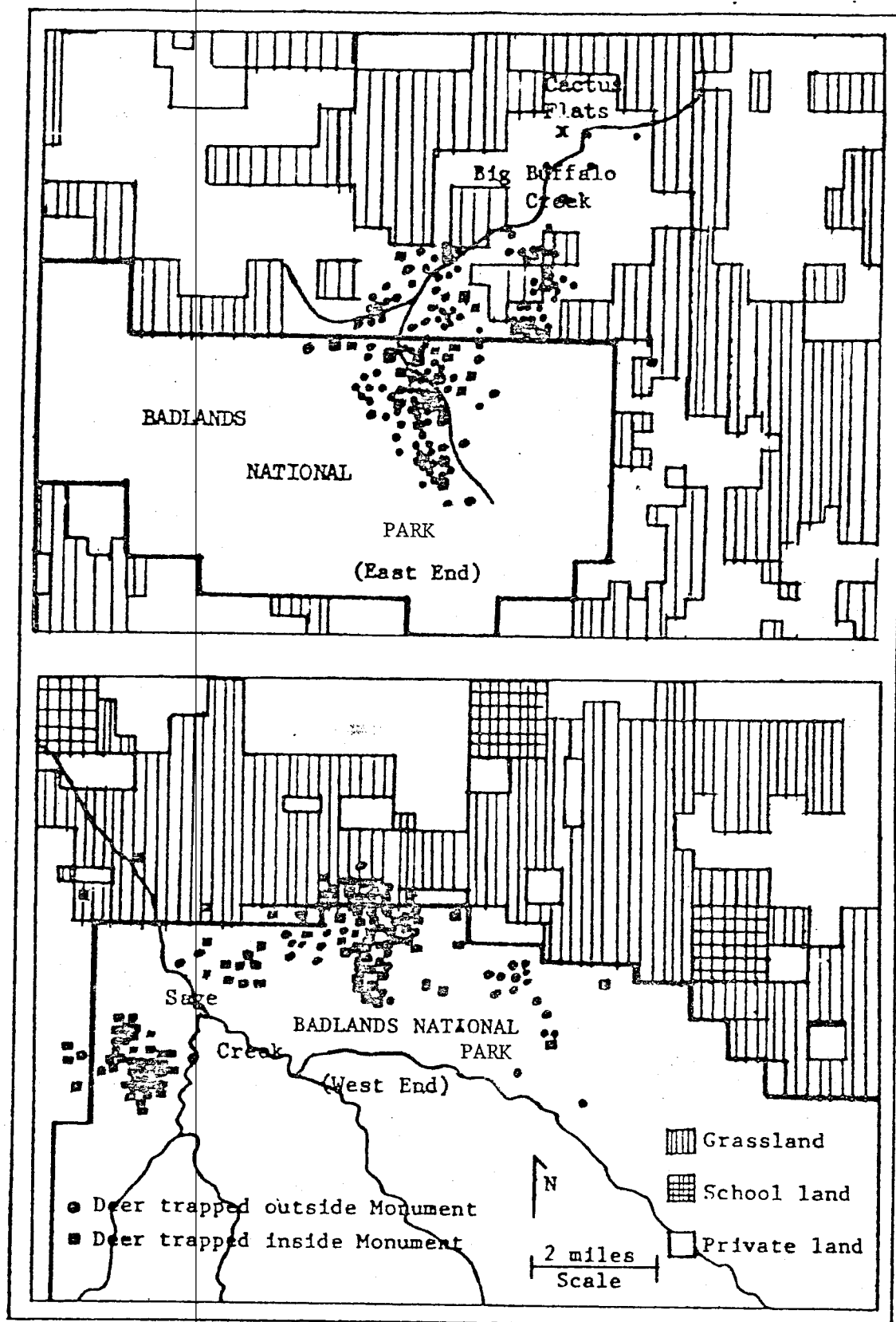


Fig. 2. Locations of marked deer observed six or more times from January 8, 1971 to June 30, 1978 within and surrounding the Badlands National Park.

Table 2. Sex and age characteristics of radio-equipped mule deer, Badlands National Park and surrounding areas, South Dakota, 1975-77.

Deer	Sage Creek			Big Buffalo Creek (South)			TOTALS
	1975	1976	1977	1975	1976	1977	
Male - Adult	2	4	1	0	0	1	8
Female - Adult	2	4	2	1	1	1	11
TOTALS	4	8	3	1	1	2	19

Spring-Summer

Relatively few observations of marked animals were recorded during spring and summer due to herd breakup and solitude by does during fawning. Heavy vegetation cover also made observation of canvas-collared deer difficult.

Some travel (2-3 miles) by marked animals to alfalfa and winter wheat fields were recorded during early spring. These crops were preferred (over native vegetation) at this time because of their early green-up characteristics.

Dispersal -- Furtherest movement by a marked deer away from the study area and back was 4.5 miles. Therefore, dispersal in this study was defined as a one-way movement that exceeded 5 miles.

Most dispersal was by deer collared as 6-8 month-old fawns (Table 3). Returns show that 50 percent of the females and 75 percent of the males marked as fawns dispersed (Severson and Carter 1978).

Table 3. Range and mean distances traveled by marked deer during dispersal, Badlands National Park, South Dakota, 1970-78.

Sex	No. of Animals	Age When Collared	Time Lapse Collar-Kill (yrs mos)	Distance Traveled (mi)	
				average	range
F	3	Fawn	1-4 to 1-10	86.0	63-112
M	12	Fawn	0-9 to 1-10	40.0	10- 93
M	3	Adult	0-9 to 1-11	9.0	8- 10

Data indicate most dispersal occurred by the animal's second summer of life. Nine of 15 deer tagged as fawns were killed the following fall at distances ranging from 10-90 miles from trapsites.

A 112-mile movement by a female was one of the longest reported for mule deer. Longest male movement was 93 miles.

Special effort was made to locate marked deer prior to the opening of the hunting season to help determine movement and vulnerability of deer to hunting.

Data from hunter recoveries show deer trapped outside the Park were not significantly more vulnerable to the gun than those trapped within the Park (Chi-square, $P > 0.05$). These data indicate that deer move in and out of the Park and are available for harvest.

Many times deer adjacent to the Park would move into the Park once hunting commenced. They would remain for several days, then move out during mid-week or following closure of the initial week of hunting. Frequently, bucks were shot the last 3 days of the split season in late November. Rutting season was on and may have contributed to movement and vulnerability of bucks to hunting.

Of the 153 deer tagged, reports show only 43 (34 males and 9 females) have been legally harvested and 11 (3 males and 8 females) have died to miscellaneous causes.

Home Range

Home range was defined as a proportion of an animal's activity within given distances from center of activity rather than in terms of diameter or specific acreage (Calhoun and Casby 1958). This definition recognizes increased use near the center of a home range with progressively less use away from such. Differences in average distances from center of activity (expressed as average activity radii) indicate corresponding differences in size of home range (Robinette 1966).

Inadequate sample size prevented statistical analysis among all animal classes. However, analysis of variance of groups of five or more animals was possible. Males had larger activity radii than females within their respective areas (Table 4). Differences were significant (5% level) for radioed deer, but not for canvas-collared ones. There was a significant difference in radii between Sage Creek radioed and canvas-collared bucks; radioed deer had larger home range (Severson and Carter 1978).

Table 4. Average activity radii (mi) of mule deer, Badlands National Park, South Dakota, 1970-78.

Location	Class	Average Activity Radii	
		Radio Collars	Canvas Collars
Sage Creek	Females, Fawns	0.5 ± 0.3 (132/6) ¹	0.5 ± 0.3 (136/19)
Sage Creek	Males	1.0 ± 0.8 (70/6)	0.6 ± 0.6 (42/10)
Big Buffalo	Females, Fawns	2.4 ± 1.6 (48/3)	0.8 ± 0.6 (168/19)
Big Buffalo	Males	none collared	1.2 ± 0.9 (14/ 2)

¹Values in parentheses indicate number of observations and number of deer. Plus/minus symbol indicates standard deviation.

Both canvas-collared males and females in Sage Creek had significantly (5% level) smaller radii than did those in Big Buffalo Creek. Differences in size of home range of deer between the west and east ends of the Park are believed due to varying distances between required cover types. Food, water, and cover are more abundant and better distributed.

Habitat Use

Twelve habitat types were described on the study area (Appendix Table 1). Riparian habitats, collectively, appeared to be the most important type (Table 5). Other cover types were used heavily where they occurred, but the various riparian types were well distributed, thus they received high use year-long. Tagged deer were located 74 percent of the time in riparian habitat on the east end and 42 percent on the west end (Severson and Carter 1978).

Table 5. Percentage of observations in habitat types of radioed mule deer in Sage Creek and Big Buffalo Creek basins, Badlands National Park, South Dakota, 1970-78.

Habitat Type	Percent of Observations	
	Sage Creek Basin	Big Buffalo Creek Basin
Riparian	42.2	73.8
Shrubby Riparian	13.0	12.9
Hardwood Riparian	8.7	5.3
Grass Riparian	3.9	12.9
Cottonwood Riparian	0.4	14.0
Badland Riparian	16.2	28.7
Juniper Slope	29.6	3.5
Open Slope	18.2	1.8
Grassland	3.2	2.9
Ridgetop	2.0	0.0
Badlands	2.4	1.7
Badland Buttes	2.0	10.5
Farmland	0.4	5.8
TOTALS	100.0 (253) ¹	100.0 (171) ¹

¹Total number of observations.

Juniper slope was the most important individual habitat type on the west end, receiving 30 percent of total use. This cover type was used heavily both during winter and summer, although snow depths dictated amount of use during winter. Open slope was important winter feeding area in Sage Creek Basin.

Utilization of other habitat types was relatively low. Use of agricultural crops (winter wheat and alfalfa) was small, receiving only 0.4 percent and 5.8 percent use in the Sage Creek and Big Buffalo Creek drainages, respectively. This use, however, occasionally generated complaints, especially during winter on stacked hay.

CONCLUSIONS

Deer move in and out of the Park both on a daily and seasonal basis. Movement was essentially 2 miles or less to agricultural crops or to rough juniper breaks. Although use of crops was comparatively light, it did precipitate depredation complaints. Most problems experienced were during deep snows and cold temperatures when deer moved onto private lands and fed on alfalfa stacks. During spring green-up, deer also moved onto winter wheat and alfalfa fields causing some concern. Proximity of deer concentrations and agricultural crops and haystacks compounded the problem.

Discretion in locating future agricultural crops adjacent to the Park should be used to minimize conflicts. Land and wildlife management agencies should develop plans to address depredation problems when they occur.

Hunter returns showed deer dispersed from the area. Most dispersal was by yearlings. Returns showed 50 percent of the females and 75 percent of the males marked as fawns dispersed. Only a few adult bucks dispersed and no adult does. Dispersal averaged 43 miles with a maximum of 112.

Data from hunter harvest (regarding movement of deer and buck:doe ratios) and from miscellaneous mortality indicate that an over-harvest of deer populations in areas surrounding the Badlands National Park is unlikely.

Males had larger home ranges than females. Sage Creek females had smaller ranges than Big Buffalo Creek females. Smaller home ranges in the Sage Creek area are believed due to better interspersions of required habitats.

Riparian habitats, collectively, was the most important cover type followed by juniper slope. Use of agricultural crops was light, but caused concern when it occurred.

Opportunity to provide better habitat on adjacent National Grasslands could possibly aid in decreasing depredation and provide additional hunting recreation. Range management programs to improve riparian cover should be aimed at proper livestock stocking and distribution. Cross-fencing and prescribed burning should be worked into such programs to help improve brushy draw status.

Earlier removal of livestock from adjacent Grasslands during fall may help encourage use by deer. This could help hunters harvest additional animals when desirable.

Implementation of the proposed wildlife management plan to develop the West Wall Allotment in the Sage Creek area is recommended. This plan advocates the multiple-use concept endorsed by the Forest Service for National Grasslands and could substantially improve riparian and other habitats for wildlife.

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A P P E N D I X

Appendix Table 1. Habitat types identified on the study area, Badlands National Monument and surrounding area, South Dakota, 1970-79.

Habitat Type	Definition
Juniper Slope	North-facing slopes with more than 25 percent Rocky Mountain Juniper.
Open Slope	South-facing slopes and some convex north slopes. Scattered juniper may have been present, but had less than 25 percent cover.
Ridgetop	Narrow ridge crests between drainages.
Grassland	Native, upland grassland sites.
Shrubby Riparian	Water influence zones in smaller drainages dominated by deciduous shrubs such as American plum, common chokecherry, and hawthorn.
Hardwood Riparian	Water influence zones in smaller drainages dominated by deciduous trees such as green ash and American elm (<i>Ulmus americana</i>). Deciduous shrubs were present in understory.
Grassy Riparian	Water influence zone in smaller drainages. Tall, warm-season grasses dominated. Kentucky bluegrass invaded when disturbed.
Cottonwood Riparian	Water influence zone of larger drainages (large enough or in terrain level enough to permit meandering). Plains cottonwood dominated with willows in understory. Silver sagebrush occurred on slightly elevated areas.
Badlands	Rough, nearly barren topographic features.
Badland Riparian	Water influence zones in smaller drainages within badland types. More xeric than other riparian types. Common shrubs of silver buffaloberry, rubber rabbitbrush, western snowberry, and silver sagebrush were present.
Badlands Buttes	Small, grassed, flat-topped benches in badlands. Blue grama and buffalograss dominated.
Farmland	Agricultural crops.