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TERRY BADLANDS NONGAME SURVEY AND INVENTORY
FINAL REPORT

(May 1979 - July 1980)

Research Conducted by:

Montana Department of Fish, Wildlife and Parks
Research Bureau

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Prepared by:

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Research Biologist
November 1980

This report is dedicated to
the memory of my summer assistant
Dallas E. Haley

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ABSTRACT

A nongame wildlife survey and inventory was conducted in the Terry Badlands adjacent to the Yellowstone River, southeastern Montana, from May, 1979 to July, 1980. Four major vegetation types (grassland, sage-grassland, creek, badlands) and two subtypes (ponderosa pine badlands, limber pine badlands) were delineated for the area. Occurrence, distribution and relative abundance were determined for 109 species of birds, 30 species of mammals, and 13 species of herpetiles. Surveys of breeding bird densities were conducted on belt transects (2000 m x 100 m) in each of the four major vegetation types in 1979 and 1980. Results of these surveys in 1980 indicated declines of 73%, 54%, 37% and 6% in the sage-grassland, grassland, badland and creek types, respectively, from densities observed in 1979. The extreme drought conditions which occurred in the spring of 1980 are believed to be the major reason for this decline. Wintering bird surveys were conducted on the area from 12-16 January and 15-19 February, 1980. General observations indicated a lack of wintering birds on the area. Small mammals were surveyed in the four major vegetation types, two subtypes and grassland coulees utilizing a combination of snap traps, live traps and pitfalls. Captures per 100 trap nights were highest in the badland (12.28) and creek (5.58) types. Two rare species of reptiles (plains hognose snake and milk snake) were observed on the area. The peregrine falcon and bald eagle, both endangered species, were also observed on the area during the study. Habitat conflicts and problems, and species in need of further study are discussed.

INTRODUCTION

In recent years there has been a vast increase in the demands placed on public lands in the United States. As a result of the current energy situation, rising human populations and increased leisure time, this trend is likely to continue. The Bureau of Land Management (BLM) is the federal agency charged with managing large portions of public lands in eastern Montana. Valid decisions regarding the best possible use of these public lands will require new information in a variety of areas. This is particularly true for nongame wildlife. Increased public awareness of wildlife values, and environmental concerns in general, have brought nongame wildlife values into the decision-making process. Studies of nongame wildlife in eastern Montana are few (Martin 1978, Swenson 1978, Martin and DuBois 1980, Matthews 1979, Munson 1979). Efforts to date have been directed at gathering baseline data on a wide variety of species. Such data are a necessary first step for land-use decisions but often prove inadequate for site specific management decisions.

Several possibilities exist for varying types of land use on the Terry Badlands study area. A portion of the study area is presently being considered for wilderness designation; while, other portions are under active exploration for mineral resources. The majority of the study area is currently being utilized for livestock grazing.

This study was initiated in April, 1979 pursuant to contract YA-512-CT8-217 between BLM and the Montana Department of Fish, Wildlife and Parks. The specific objective was to conduct a nongame wildlife survey and inventory in the Terry Badlands. This objective was met using the following approach:

1. Constructing a general cover map of vegetation types on the study area;
2. Sampling nongame species composition within the various vegetation types for each season;
3. Identifying species and/or community associations of particular value; and
4. Evaluating potential impacts of energy development on the various communities.

Results of this study will be used to assist the BLM with broad based land management decisions for the area.

DESCRIPTION OF THE STUDY AREA

The 650 sq. km study area is located 24 km northeast of Miles City, Montana, in northcentral Custer County and southcentral Prairie County (Fig. 1). The study area lies within the following boundaries: the Yellowstone River to the south, Route 253 on the east, Cherry Creek Road on the north, and the Caprock Road on the west. The study area consists of broken, sparsely vegetated terrain dissected by numerous coulees and intermittent streams.

Relatively low rainfall and relative humidity along with extremes in summer and winter temperatures typify the semi-arid climate of the area. Precipitation records from the Miles City FAA AP weather station are presented in Appendix Table 9. Precipitation during the entire study was considerably less than normal and by the spring of 1980 the area was impacted by a severe drought. Above normal precipitation in 1978 mitigated somewhat the effects of the 1979 drought. Minimal snow cover was present during the winter of 1979-80. The effects of these climatological conditions on nongame wildlife are discussed in detail in the text of the report. January is the coldest month with an average temperature of -9.2°C and July is the warmest month with an average temperature of 23.6°C (Climatological Data, 1978).

The study area and vicinity were subject to widespread grazing beginning in the late 1800's. Human population on the area peaked in the early 1900's when portions of the area were homesteaded and some upland sites cultivated. Droughts and other factors led to the abandonment of many homesteads in the 1920's and 30's. Livestock grazing has been the major land use since settlement and continues to be with cattle, horses and a few sheep utilizing the area. For an excellent historical account of the settlement of this area see Haughian, 1977.

The vegetation generally reflects the edaphic and climatic conditions occurring on the area. Grasslands are dominated by needle and thread (*Stipa comata*) and western wheatgrass (*Agropyron smithii*), sagebrush-grassland by big sagebrush (*Artemisia tridentata*) and major creek bottoms by silver sagebrush (*Artemisia cana*). Badland areas are characterized by bare slopes, ridges and coulees. Vegetation cover ranges from nonexistent to dense, with plant species composition variable depending on localized site conditions. Timbered badlands are dominated by Rocky Mountain juniper (*Juniperus scopulorum*) in association with either ponderosa pine (*Pinus ponderosa*) or limber pine (*Pinus flexilis*). Four major vegetation types and two subtypes were recognized on the area (Fig. 2). General descriptions of the types were derived from vegetation frequency measurements (see Methods and Appendix Table 10) and are presented as follows:¹

Grassland Vegetation Type

This type occupied approximately 7 percent of the study area and is generally restricted to level or gently rolling upland areas (Fig. 3). The majority of this type occurs on the northern portions of the study area. Common grass species are needle and thread, western wheatgrass, blue grama (*Bouteloua gracilis*)

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¹Extreme drought conditions resulted in the undersampling or non-sampling of many normally occurring species.

Figure 1. Map of the study area showing boundaries and major drainages.

Figure 3. Grassland vegetation type.

and threadleaf sedge (*Carex filifolia*). Hood's phlox (*Phlox hoodii*) and scarlet globemallow (*Sphaeralcea coccinia*) are the most abundant forbs found in the grassland type. The grassland areas are generally devoid of shrubs although scattered silver sage is found on more mesic sites, and creeping juniper (*Juniperus horizontalis*) on broken zeric areas. Grazing pressure is moderate to heavy in this type.

Major Creek Vegetation Type

The major creek vegetation type (hereafter known as the creek type) occurred on 9 percent of the study area (Fig. 4). The intermittent nature of water-flows in this vegetation type results in a poorly developed riparian habitat. It is characterized by a dense growth of silver sagebrush with scattered plains cottonwood (*Populus deltoides*). Cottonwood trees are generally confined to the lower reaches of major drainages. Western wheatgrass, needle and thread and saltgrass (*Distichlis stricta*) are the common grasses in this type and major forb species are gaura (*Gaura coccinea*), golden aster (*Chrysopsis villosa*) and yellow sweetclover (*Melilotus officinale*). As a result of the general availability of water sources in the form of stock reservoirs this type receives some of the heaviest grazing pressure occurring on the study area.

Sage-Grassland Vegetation Type

This type, occurring on 19 percent of the study area, is generally confined to the southern and central portions on level and moderately broken areas

Figure 4. Major Creek Vegetation Type.

areas (Fig. 5). The shrub layer is dominated by big sagebrush which ranges in density from small areas with dense clumps to large grassy areas with few plants. In the more broken areas the shrub layer is sparse and the frequency of greasewood (*Sarcobatus vermiculatus*) increases, sometimes equalling that of big sagebrush. Common grasses in this type were western wheatgrass, blue grama and needle and thread. Forbs occurring most frequently were prickly pear (*Opuntia polyacantha*) and scarlet globemallow (*Sphaeralcea coccinea*). This type also receives a substantial portion of the grazing pressure which occurs on the area.

Badlands Vegetation Type

Occurring on 62 percent of the study area this type consists of a mosaic of vegetation communities (Fig. 6). Generally the slopes, ridges and coulees are sparsely vegetated. On certain areas such as flat ridgetops and small level areas the vegetation is more typical of that found in the grassland and sage-grassland types. Dominant shrub species in this type are big sagebrush, broom snakewood (*Gutierrezia sarothrae*), saltbush (*Artiplex nuttallii*) and greasewood. Sandstone outcrops and some of the heads of coulees in this type contain scattered stands of Rocky Mountain juniper. Bluebunch wheatgrass (*Agropyron spicatum*), blue grama, western wheatgrass and prairie sandreed (*Calamovilfa longifolia*) are the most frequently encountered grass species and Hood's phlox, monolepis (*Monolepis nuttalliana*), and mountain muhly (*Muhlenbergia cuspidata*) the most frequently encountered forbs. Rugged topography, lack of water sources and sparse vegetation result in light grazing pressure in the badlands type.

Figure 5. Sage-grassland vegetation type.

Figure 6. Badlands vegetation type.

Badlands Vegetation Type: *Ponderosa Pine Subtype*

Ponderosa pine distribution is very limited, occurring on 0.2 percent of the area, and confined to a small area of higher elevation and generally rocky terrain in the northeast corner of the study area (Fig. 7). A few scattered ponderosa pine were also found in the southcentral portion of the study area in an area known locally as the "cedar hills" but the pine were so limited as to fail to justify including this area in the subtype. Dominant plants in the overstory are ponderosa pine and Rocky Mountain juniper with a few scattered limber pine in some places. Understory vegetation in this subtype is generally similar to that found in the badlands vegetation type. As with all badlands types, this area is lightly utilized by livestock.

Figure 7. Badlands vegetation type: *Ponderosa Pine Subtype*

Badlands Vegetation Type: *Limber Pine Subtype*

This limited subtype (2% of the study area) is also located on areas of higher elevation and rocky substrate (Fig. 8). Dominant plants in the overstory are limber pine and Rocky Mountain juniper. This area is a transitional area between the badlands and grasslands. The understory on level and gently rolling areas resembles that of the grassland while steeper areas have the same plants found in the badlands, although in greater abundance. This area is unique in

Figure 8. Badlands vegetation type: *Limber Pine Subtype*

that the normal range of limber pine lies 300 to 400 miles to the west. Even so, the stands of pine appear to be regenerating and possibly even expanding.

Agricultural Vegetation Type

This type occurs on only a small portion of the study area (2%). It consists of areas of cultivated irrigated and nonirrigated croplands and dryland hay. Most of the agricultural lands are confined to the Yellowstone River flood plain. No extensive survey work was conducted on these areas.

MATERIALS AND METHODS

Breeding Bird Survey

A survey of the nongame breeding birds on the area was conducted from 4 June 1979 to 7 July 1979 and 30 May 1980 to 25 June 1980. Methods employed were similar to those used by Hickey and Mikol (1979). Breeding bird survey belt transects 2000 m long and 100 m wide were established in each major vegetation type (creek, badlands, grasslands, sage-grasslands). Survey lines were as straight as possible with slight modifications in the creek type to stay within the habitat. All lines were staked down the center at 50 m intervals and flagged on the outside edges to assist with accurate data recordings. Each line was traversed on 7 separate mornings during the course of the survey. Surveys were conducted between one-half hour before sunrise and 9:00 a.m. on days with calm winds (< 8 kmph) and no precipitation. Generally two lines could be traversed in one morning during the prescribed time limitations. All birds seen or heard were recorded on prepared data sheets in a manner similar to that recommended by the International Bird Census Committee (1970).

Species, sex (with special attention to singing males), and location on the transect were recorded for all birds seen or heard. Results of these surveys were summarized and the total number of singing males for each species on each replication was tabulated. An average was then calculated for each species over the seven replications and this figure was used to calculate the density of breeding pairs per 100 ha for each vegetation type. Locations of the breeding bird survey lines are presented in Appendix Table 19.

Wintering Bird Survey

A wintering bird survey was conducted on the area during 12-16 January 1980 and 15-19 February 1980. Each major vegetation type and one subtype was traversed on foot for one full day (sunrise to sunset). Species, numbers, and flock size were recorded for all nongame bird observations.

Raptors

Four aerial and numerous ground searches were conducted on the area to locate as many raptor nests as possible. Aerial surveys were conducted during spring before trees became foliated and again in the fall after defoliation. Potential and actual raptor nesting sites, initially located from the air, were subsequently checked on foot. All raptor nest sites thus located were recorded on a map of the study area. Additional time was spent observing as many sites as possible to determine their status (i.e. occupied, number of young, etc.). Other field work precluded detailed observations of fledglings, dispersal areas and so forth.

Small Mammal Sampling

Summer small mammal sampling was conducted in July and August using methods similar to those employed by Flath (1979b). Two trap lines, at least 0.5 km apart, were set in each major vegetation type, and one trap line was set in each of the two subtypes. An additional line was set in the head of a grassland

coulee because of the possibility the area might hold unique species not found in the other types. Exact locations of all small mammal trap lines appear in Appendix Table 19. Each line consisted of 25 stations 10 m apart with 1 sunken can pitfall (dia. 15.5 cm), 2 snap traps and 1 Sherman live trap at each station. Snap traps and live traps were baited with a 50-50 mixture of peanut butter and rolled oats. Pitfalls contained approximately 3 cm of water to drown the small mammals captured. Trap lines, once set, were checked daily for a minimum of 5 consecutive days. Species, sex, standard body measurements, station number and trap type were recorded for each specimen. Testes, ovaries, and the uterine horns were examined macroscopically for evidence of reproductive activity. Snap traps that had been sprung and live traps closed without captures were also recorded. Traps were checked as early in the morning as possible to retrieve specimens before decomposition became severe. All unidentifiable or unique specimens were frozen for later identification. Study skins were prepared and skulls were cleaned for representative specimens of all species captured. Specimens were deposited in the Department's nongame mammal collection in Bozeman.

Fall small mammal sampling was conducted during the last week of October using methods similar to those employed by Matthews (1979). During the fall season only one line was placed in each of the four major vegetation types. Each line consisted of 25 stations 10 m apart with three snap traps and one Sherman live trap per station. In addition one of the snap traps at every third station (i.e. 1, 4, 7, 10...) was replaced with a Victor rat trap. Peanut butter and rolled oats were used for bait and fall trapping was terminated after three consecutive days for each type. All specimens and data were handled in the same manner as previously reported for the summer survey.

The number of nonfunctional traps (snapped or closed without capture) was subtracted from the total number of trap nights before calculation of the number of captures per 100 trap nights.

Other Wildlife Species

All observations of nongame wildlife on the study area, whether direct or indirect (tracks, scats, etc.), were recorded. For each observation, the date, time, species, location, vegetation type, age, sex (if possible), total number and activity were recorded. Wildlife identification was aided by 7 x 35x binoculars, a 35x spotting scope, various field guides (Burt and Grossenheider 1964, Robbins et al. 1966, Stebbins 1966, Murie 1975), and cassette recordings of bird songs.

Unusual specimens of reptiles and amphibians encountered during travel of the area were collected and preserved in a 10 percent Formalin solution for later identification.

Bats were collected using 1.3 cm mesh mist nets and a 20 ga. shotgun. Most collecting occurred near water sources (stock tanks, ponds, etc.) at dusk. Nets were left in place and checked regularly for a period of four hours. Gunning terminated approximately one hour after sunset. For all bats collected, the sex was determined and standard body measurements were recorded. Specimens were then frozen for later identification.

Other species of small mammals such as cottontail rabbits (*Sylvilagus* spp.) and thirteen lined ground squirrels (*Spermophilus tridecemlineatus*) were collected with a .22 caliber rifle for species identification and verification.

Additional time was spent searching reservoirs, prairie dog towns, etc. for unusual species. Ten of the largest prairie dog towns were completely searched on foot in an effort to locate possible evidence of black-footed ferret (*Mustela nigripes*) and burrowing owl (*Athene cunicularia*) activity.

All species listed as being of special interest or concern for Montana are from a list compiled by Flath (1979a).

Scientific names in this report are from the following sources (with a few minor exceptions): vegetation, Hitchcock and Cronquist (1976); birds, Skaar (1980); mammals, Hoffmann and Pattie (1968); reptiles and amphibians, Stebbins (1966).

Vegetation Descriptions

The vegetation map of the study area was developed through modifications of the infrared aerial photography vegetation interpretations (Ecological Consulting Services Division, Helena, Montana) provided for the Prairie and Kinsey planning units (the study area occupies portions of these units). Modifications included separating the upland-grassland type into the sage-grassland and grassland types, and delineating a major creek type. These modifications resulted after aerial and ground reconnaissance of the study area revealed that separation of these types was justified.

Vegetation frequency (% occurrence in 100 2 x 5 dm frames) measurements were made by placing a 2 x 5 dm frame at 20 m intervals along the 2000 m bird transect lines in each major vegetation type. Only living plants which were rooted within the frame were counted. Extreme drought conditions resulted in the undersampling or non-sampling of many normally occurring species.

Relative Abundance

The relative abundance of nongame species on the area was determined by the number of observations, variety of vegetation types utilized, season of observation, and breeding status. This information was compiled and the following method of delineating relative abundance developed:

- Abundant: >75 observations on the area and occurring in most vegetation types.
- Common: Observed 10-75 times and occurring in at least two of the vegetation types.
- Uncommon: Observed 3-10 times and usually restricted to one vegetation type.
- Rare: Observed 1-3 times on the area and limited to one vegetation type.

Exceptions to the above are explained in the text of the report (e.g. species that undoubtedly occur on the area but were not seen during the course of the study due to low observability and other variables, etc.).

RESULTS AND DISCUSSION

NONGAME BIRDS OF THE STUDY AREA (EXCLUDING RAPTORS)

A list of all the nongame birds observed on the area, their relative abundance (present and historical), breeding status and the vegetation type in which they were most frequently observed is presented in Table 1. The historical relative abundance presented is derived from Cameron (1907, 1908) and the author refers those who wish to know in more detail the historical status of nongame birds in this and surrounding areas to these excellent papers. Some of the changes occurring since the late 1800's and early 1900's along with a brief discussion of unique and "special interest or concern" species recorded during this study, is presented below.

Although Cameron's work included areas other than the study area it still provides a basis for general comparisons of relative abundance. It should be noted, however, that man had already changed the status of several species prior to Cameron's work. Therefore, the status as presented by Cameron does not imply, necessarily, the pristine conditions. Species such as raptors and black-billed magpies were being seriously depleted by the numerous poison baits placed on the area for wolf control. Effects of these baits on various raptor species will be discussed further in that section of this report. Certain species that are found in riparian habitats and listed by Cameron as abundant were found to be uncommon or rare (i.e. yellow warbler, American redstart, etc.). This is undoubtedly due to a lack of well developed riparian habitats on this study area and probably does not reflect an actual change in abundance over the region. Changes in relative abundance that have occurred were most notable in the shorebird and waterfowl categories. Before the development of the numerous stock ponds that now exist, little water was available in eastern Montana with the exception of major river and tributary systems (i.e. Yellowstone, Missouri, Tongue and Powder). The majority of Cameron's observations of shorebirds and waterfowl were on the Yellowstone River or "prairie ponds" which formed after snowmelt and heavy rains. These ponds were highly ephemeral and were primarily utilized by nongame birds as resting areas. Cameron even reports finding shorebirds resting on the prairie when no ponds existed. Development of stock ponds has enhanced waterfowl and shorebird use of the area. It is plausible that some shorebird species have been induced to breed in the area where previously such an opportunity did not exist.

Several observations of rare nongame birds occurred during this study. Mockingbirds were sighted on two occasions on the study area. The first observation was in the first half of May 1979. The second was in the third week of June, 1980 and occurred in a brushy grassland coulee. This observation could indicate breeding by this species on the area. Another species of interest is the Sprague's pipit. This species was common in the grassland habitat during 1979 (see breeding bird surveys) but few were seen or heard in 1980. It is believed that a reduction of residual vegetation from drought had an adverse impact on this species. The Philadelphia vireo was sighted during the last week of May 1980 in the ponderosa pine subtype. Very few records of this species occurrence exist for Montana. Skaar (1980) questions the records of this species for the latilong in which this observation occurred. Timing of this observation probably indicates a migrant bird.

Table 1. Habitat and status matrix for nongame birds (excluding raptors) observed on the study area.

Species	Vegetation type most frequently observed in				Relative Abundance ¹	Historical Abundance ²	Status ³	Classification ⁴
	Badlands	Grassland	Sage-Grassland	Creek				
White Pelican <i>Pelicanus erythrorhynchos</i>				X	C	R	t	N
Double-Crested Cormorant <i>Phalacrocorax auritus</i>				X	C	R	t	N
Great Blue Heron <i>Ardea herodias</i>				X	C	C	B	N
Black-Crowned Night Heron <i>Nycticorax nycticorax</i>				X	U		t	N
Sandhill Crane <i>Grus canadensis</i>				X	U	U	t	G
Killdeer <i>Charadrius vociferus</i>			X	X	A	A	B	N
Mountain Plover <i>Charadrius montanus</i>			X		R	U	t	SI
Long-Billed Curlew <i>Numenius americanus</i>		X	X		U	VC	B	SI
Upland Sandpiper <i>Bartramia longicauda</i>			X		U		t	SI
Spotted Sandpiper <i>Actitis macularia</i>				X	U	C	b	N
Solitary Sandpiper <i>Tringa solitaria</i>				X	U	C	t	N
Willet <i>Catoptrophorus semipalmatus</i>				X	R	OM	t	N
Greater Yellowlegs <i>Tringa melanoleuca</i>			X	X	U	U	t	N
Lesser Yellowlegs <i>Tringa flavipes</i>				X	U	C	t	N
Least Sandpiper <i>Calidris minutilla</i>				X	U	OM	t	N
Long-Billed Dowitcher <i>Limnodromus scolopaceus</i>				X	R		t	N
Semipalmated Sandpiper <i>Calidris pusilla</i>				X	R	R	t	N

Table 1. Continued.

Species	Vegetation type most frequently observed in				Rel- ative Abun- dance ¹	His- torical Abun- dance ²	Status ³	Classifi- cation ⁴
	Badlands	Grassland	Sage- Grassland	Creek				
Marbled Godwit <i>Limosa fedoa</i>				X	U		t	N
American Avocet <i>Recurvirostra americana</i>				X	U	U	t	N
Wilson's Phalarope <i>Steganopus tricolor</i>				X	C	OM	t	N
Bonaparte's Gull <i>Larus philadelphia</i>				X	U	R	t	N
Common Tern <i>Sterna hirundo</i>				X	R		t	N
Black Tern <i>Chlidonias niger</i>				X	R	U	t	N
Rock Dove <i>Columba livia</i>			X		U		B	N
Mourning Dove <i>Zenaida macroura</i>	X			X	A	A	B	N
Common Nighthawk <i>Chordeiles minor</i>				X	C	A	B	N
Belted Kingfisher <i>Megasceryle alcyon</i>				X	C	UC	b	N
Common Flicker <i>Colaptes auratus</i>				X	C	C	B,W	N
Red-Headed Woodpecker <i>Melanerpes erythrocephalus</i>				X	U	A	b	N
Downy Woodpecker <i>Picoides pubescens</i>				X	R		t	N
Eastern Kingbird <i>Tyrannus tyrannus</i>				X	C	C	b	N
Western Kingbird <i>Tyrannus verticalis</i>				X	C	A	b	N
Say's Pheobe <i>Sayornis saya</i>	X				C	C	B	N
Least Flycatcher <i>Empidonax minimus</i>	X				R	R	t	N
Horned Lark <i>Eremophila alpestris</i>		X			A	A	B,W	N

Table 1. Continued.

Status	Vegetation type most frequently observed in				Rel- ative Abun- dance ¹	His- torical Abun- dance ²	Status ³	Classifi- cation ⁴
	Badlands	Grassland	Sage- Grassland	Creek				
Violet-Green Swallow <i>Tachycineta thalassina</i>	X			X	C	R	b	N
Tree Swallow <i>Iridoprocne bicolor</i>				X	U	R	b	N
Rough-Winged Swallow <i>Stelgidopteryx ruficollis</i>				X	U		b	N
Barn Swallow <i>Hirundo rustica</i>			X	X	C	C	B	N
Cliff Swallow <i>Petrochelidon pyrrhonota</i>	X			X	A	A	B	N
Black-Billed Magpie <i>Pica pica</i>	X				C	C	B,W	N
Common Crow <i>Corvus brachyrhynchos</i>	X			X	U	U	t	N
Piñon Jay <i>Gymnorhinus cyanocephalus</i>	X				C	C	b,W	N
Red-Breasted Nuthatch <i>Sitta canadensis</i>	X				R		t	N
House Wren <i>Troglodytes aedon</i>				X	C	C	B	N
Rock Wren <i>Salpinctes obsoletus</i>	X				A	A	b	N
Mockingbird <i>Mimus polyglottos</i>	X				R		t	N
Brown Thrasher <i>Toxostoma rufum</i>				X	U	C	b	N
American Robin <i>Turdus migratorius</i>				X	C	C	B,W	N
Swainson's Thrush <i>Catharus ustulatus</i>	X				R	U	b	N
Mountain Bluebird <i>Sialia currucoides</i>	X				C	U	b	SI
Townsend Solitaire <i>Myadestes townsendi</i>	X				U	U	W	N
Sprague's Pipit <i>Anthus spragueii</i>		X			C		b	N

Table 1. Continued.

Species	Vegetation type most frequently observed in				Rel- ative Abun- dance ¹	His- torical Abun- dance ²	Status ³	Classifi- cation ⁴
	Badlands	Grassland	Sage- Grassland	Creek				
Bohemian Waxwing <i>Bombycilla garrulus</i>	X				C	A	W	N
Loggerhead Shrike <i>Lanius ludovicianus</i>	X		X		C	C	b	N
Starling <i>Sturnus vulgaris</i>				X	U		B,W	N
Philadelphia Vireo <i>Vireo philadelphicus</i>	X				R		t	N
Orange-Crowned Warbler <i>Vermivora celata</i>				X	U	U	t	N
Yellow Warbler <i>Dendroica petechia</i>				X	R	A	b	N
Yellow-Rumped Warbler <i>Dendroica coronata</i>	X			X	C	C	t	N
American Redstart <i>Setophaga ruticilla</i>	X				R	C	t	N
House Sparrow <i>Passer domesticus</i>				X	C	C	B,W	N
Western Meadowlark <i>Agelaius phoeniceus</i>	X		X	X	A	A	B,W	N
Yellow-Headed Blackbird <i>Xanthocephalus xanthocephalus</i>				X	U	C	t	N
Red-Winged Blackbird <i>Agelaius phoeniceus</i>				X	C	C	B	N
Orchard Oriole <i>Icterus spurius</i>				X	U		b	N
Northern Oriole <i>Icterus galbula</i>				X	U	C	b	N
Brewer's Blackbird <i>Euphaga cyanocephalus</i>				X	C	A	b	N
Common Grackle <i>Quiscalus quiscula</i>				X	C	C	b	N
Brown-Headed Cowbird <i>Molothrus ater</i>				X	C	A	b	N
Western Tanager <i>Piranga ludoviciana</i>	X				R		t	N

Table 1. Continued.

Species	Vegetation type most frequently observed in				Rel- ative Abun- dance	His- torical Abun- dance	Status	Classifi- cation
	Badlands	Grassland	Sage- Grassland	Creek				
American Goldfinch <i>Spinus tristis</i>			X	X	U	C	b,W	N
Red Crossbill <i>Loxia curvirostra</i>	X				U	C	b,W	N
Rufous-Sided Towhee <i>Pipilo erythrophthalmus</i>	X				R		b	N
Lark Bunting <i>Calamospiza melanocorys</i>			X		C	C	B	N
Savannah Sparrow <i>Passerculus sandwichensis</i>		X	X		U	U	t	N
Grasshopper Sparrow <i>Passerculus savannarum</i>		X			C	R	b	N
Baird's Sparrow <i>Ammodramus bairdii</i>			X		R	OM	t	N
Vesper Sparrow <i>Poocetes gramineus</i>			X		C	C	b	N
Lark Sparrow <i>Chondestes grammacus</i>	X		X		A	A	B	N
Dark-Eyed Junco <i>Junco hyemalis</i>	X				U	C	b	N
Tree Sparrow <i>Spizella arborea</i>			X	X	C	A	t	N
Chipping Sparrow <i>Spizella passerina</i>	X				C	A	b	N
Clay-Colored Sparrow <i>Spizella pallida</i>		X		X	U	C	t	SI
Brewer's Sparrow <i>Spizella breweri</i>			X		C	R	b	SI
Field Sparrow <i>Spizella pusilla</i>			X	X	U		t	SI
Harris' Sparrow <i>Zonotrichia querula</i>				X	R	R	t	N
White-Crowned Sparrow <i>Zonotrichia leucophrys</i>			X	X	U	C	t	N

Table 1. Continued.

Species	Vegetation type most frequently observed in				Rel- ative Abun- dance ¹	His- torical Abun- dance ²	Status ³	Classifi- cation ⁴
	Badlands	Grassland	Sage- Grassland	Creek				
McCown's Longspur <i>Calcarius mccownii</i>		X			U	A	b	N
Chestnut-Collared Longspur <i>Calcarius ornatus</i>		X			C	C	b	N
Snow Bunting <i>Plectrophenax nivalis</i>			X		U	A	t	N

¹ A = Abundant (>75 observations)
C = Common (10-75 observations)
U = Uncommon (3-10 observations)
R = Rare (1-3 observations)

² A = Abundant
VC= Very Common
C = Common
U = Uncommon
OM= Occasional migrant
R = Rare
Data from Cameron 1907, 1908

³ B = Known breeding
b = Circumstantial evidence of breeding
t = Known occurrence
W = Known wintering

⁴ N = Nongame
SI= Special interest or concern
G = Game species

Order Charadriiformes

All three species (mountain plover, long-billed curlew, upland sandpiper) listed as being of "special interest or concern" for this order are known to occur on the study area. The mountain plover was observed on one occasion in a prairie dog town on 15 August 1979. Timing of this observation would suggest that this was a migratory bird although the abundance and distribution of prairie dog towns on the area have the potential of supporting breeding birds of this species. Cameron (1907) states that this species was a "regular summer visitor,

but scarce," and that two or three pairs nested on the prairie dog towns in the vicinity of Terry. The long-billed curlew was observed on six occasions in the grassland and sage-grassland types. Curlews are known to breed on the area as two adults were observed with two prefledgling young during July 1979. This species was listed by Cameron (1907) as being a "very common summer visitor." He also stated that curlews nested all over the prairie and in the fenced pastures of ranches. This is no longer the case and reasons for the decline are unknown. The upland sandpiper was observed on three occasions in the sage-grassland and once in the grassland type. These observations took place during their breeding season (May and June). It appears therefore that they may breed on the area. Historically, this species was common (Cameron, 1907), particularly, on large prairie flats in the area and breeding was known to occur.

Order Passeriformes

Of the nine species listed as being of "special interest or concern" for this order, four (mountain bluebird, clay-colored sparrow, Brewer's sparrow, field sparrow) are known to occur on the area. The mountain bluebird was observed on several occasions and circumstantial evidence indicated breeding occurred on the study area. This species was most commonly observed in the badlands type, especially in areas with pine and/or patches of juniper. Cameron (1908) found, as in this study, that they are one of the earliest spring arrivals (may be seen as early as March). He stated that they were not common except during migration, but found that several pairs remained to nest in the pine hills. The clay-colored sparrow was observed on several occasions both singly and in small flocks during spring migration both years. Although none were observed during the breeding season, it is possible they breed on the area. Cameron (1908) listed this species as common on spring migration and rare at other times. Brewer's sparrows were frequently observed in the sage-grassland type and were known to breed in fairly high densities (27.2 pairs/100 ha) during 1979. Numbers were drastically reduced in 1980 (1.5 pairs/100 ha) in the sage-grassland and on the area as a whole. This is probably due in part to effects of the drought. Thorne (1895) listed the Brewer's sparrow as a common breeding species. While Cameron (1908) stated he had not "recognized" the species. Finally, several field sparrows were seen on the area during the spring migration. Sanders (1916) mentioned one specimen of this species collected on 11 May 1902 in Miles City. Skaar (1980) listed the field sparrow as a species with circumstantial evidence of breeding in this area. It is possible, therefore, that they do breed on the study area.

RAPTORS

Table 2 lists the raptor species found on the area, as well as the vegetation type in which they were most frequently observed, relative abundance (present and historical), status, and classification. In addition, general locations of all raptor nests from 1979 and 1980 are presented in Figure 9 and Figure 10, respectively (a more detailed description of nest location, status and nest structure is presented in Appendix Tables 20 and 21. Terminology utilized when describing nest status (i.e. active, occupied, inactive, etc.) follows Postupalsky (1974). Historical relative abundance is derived from studies conducted by Cameron (1907). Because of the importance placed on raptors when making land use decisions, a species-by-species account is presented below.

Table 2. Habitat and status matrix for raptors found on the study area.

Species	Vegetation type most frequently observed in				Relative Abundance ¹	Historical Abundance ²	Status ³	Classification ⁴
	Badlands	Grassland	Sage-Grassland	Creek				
Turkey Vulture <i>Cathartes aura</i>	X				R	R	t	N
Sharp-Shinned Hawk <i>Accipiter striatus</i>				X	R	C	t	N
Cooper's Hawk <i>Accipiter cooperii</i>	X				R	R	t	SI
Red-Tailed Hawk <i>Buteo jamaicensis</i>			X	X	A	C	B	N
Swainson's Hawk <i>Buteo swainsoni</i>			X		R	C	t	SI
Rough-Legged Hawk <i>Buteo lagopus</i>			X		U	U	t,W	N
Ferruginous Hawk <i>Buteo regalis</i>		X			R	U	t	SI
Golden Eagle <i>Aquila chrysaetos</i>	X		X		C	R	B,W	SI
Bald Eagle <i>Haliaeetus leucocephalus</i>			X		U	OM	t	E
Marsh Hawk <i>Circus cyaneus</i>		X	X	X	C	C	b,W	N
Osprey <i>Pandion haliaetus</i>			X		R		t	SI
Prairie Falcon <i>Falco mexicanus</i>	X				C	C	B,W	SI
Peregrine Falcon <i>Falco peregrinus</i>	X				R	R	t	E
Merlin <i>Falco columbarius</i>	X				R	C	b	SI
American Kestrel <i>Falco sparverius</i>			X	X	A	A	B,W	N
Great Horned Owl <i>Bubo virginianus</i>	X			X	C	C	B,W	N
Burrowing Owl <i>Athene cunicularia</i>			X		U	C	b	SI
Short Eared Owl <i>Asio flammeus</i>		X			C	OM	b,W	N

Table 2. Continued.

-
- ¹ A = Abundant (>75 observations)
C = Common (10-75 observations)
U = Uncommon (3-10 observations)
R = Rare (1-3 observations)
- ² A = Abundant
C = Common
U = Uncommon
OM= Occasional migrant
R = Rare
Data from Cameron 1907, 1908
- ³ B = Known breeding
b = Circumstantial evidence of breeding
t = Known occurrence
W = Known wintering
- ⁴ N = Nongame
SI= Special interest or concern
E = Endangered
-

Turkey Vulture (*Cathartes aura*) - Turkey vultures were observed on three occasions, twice in the badlands type (15, 18 May 1980) and once in the sage-grassland type (5 May 1980). All three observations occurred on areas immediately adjacent to the Yellowstone River. No evidence of breeding was found. Skaar (1980) lists circumstantial evidence of breeding by this species in the latilong which includes the study area. Historically, this species was considered rare. Cameron (1907) states that the only time they were numerous was in 1883 after the slaughter of the northern bison (*Bison bison*) herd and after which they declined so that by 1906 they were regarded as accidental wanderers.

Sharp-Shinned Hawk (*Accipiter striatus*) - All of the sharp-shinned hawks observed on the area were perched in cottonwood trees in the creek type. Three were seen together during the fall migration in 1979 and one was sighted during the spring migration of 1980. As it was only observed during migration it is unlikely the species breeds on the area and it was therefore listed as rare. Cameron (1907) listed it as "tolerably common and undoubtedly breeds," although he never located a nest. Because his observations were over a wider area than this study, it is unlikely his comments reflect the historical situation on this study area.

Cooper's Hawk (*Accipiter cooperii*) - One female Cooper's hawk was sighted during the spring migration of 1980 perched in a small cottonwood on the edge of the limber pine badlands. It is unlikely this species breeds here, consequently it was listed as rare for this area. This species is of "special interest or concern" for Montana. Cameron (1907) also listed this species as rare for the area having observed it only three times in sixteen years.

Figure 9. Location of known raptor nests on and adjacent to the study area, 1979.

Red-Tailed Hawk (*Buteo jamaicensis*) - Red-tailed hawks were most frequently observed in the creek type where numerous nests were found in the scattered cottonwoods. A total of eight and thirteen active nests were located on and adjacent to the study area in 1979 and 1980, respectively. All nests were located in cottonwoods and were very visible in the spring and fall but difficult to spot during summer. Most active nests had one to three inactive (i.e. old) nests in the immediate vicinity. Red-tailed hawks were known to evict a pair of great horned owls which occupied an old red-tail nest. One red-tailed hawk nest which had been active was abandoned when seismographic surveys and associated disturbances occurred in the vicinity. Hunting by adults usually occurred in the surrounding badlands and sage-grassland types. Red-tailed hawks are one of the most common raptor species found on the area in summer months. Migrations from and through the area took place in October. As red-tailed hawks left the area, a corresponding increase in rough-legged hawks was noted. Historically red-tails were common on this area (Cameron 1907).

Swainson's Hawk (*Buteo swainsoni*) - The only Swainson's hawk observation on the study area took place during the spring migration of 1979. No evidence of breeding was observed on the area although potential for breeding does exist. The lack of sightings was the basis for listing this "special interest or concern" species as rare for the area. Paucity of Swainson's hawks is possibly related to habitat factors which better serve the needs of red-tailed hawks. Historically this species was common in this area and Cameron (1907) described a migration of several thousand Swainson's hawks through this part of Montana.

Rough-Legged Hawk (*Buteo lagopus*) - All observations of rough-legged hawks occurred during fall and winter. A reduction in the numbers of red-tailed hawks with fall migration corresponded with an increase in the numbers of rough-legged hawks observed. This species was observed using the sage-grassland type for foraging and was often seen perched on fence posts and telephone poles in this type. Because the records of this species are wintering records, and even then not in great numbers, it was listed as uncommon for this area. The effect on this species of a more severe winter could not be ascertained. Historically it was a common winter resident but became very scarce when traps and poison were put out for wolves (Cameron 1907).

Ferruginous Hawk (*Buteo regalis*) - The majority of the sightings of this species occurred during spring migration. The only active nest of this species on the area was located on a scoria butte on the edge of the badlands. Adults from this nest were observed hunting on the adjacent grassland vegetation type. Because only one active nest was located, and sightings during migration were not common, this "special interest or concern" species was listed as rare for this area. Cameron (1907) listed this species as "a resident but never common."

Golden Eagle (*Aquila chrysaetos*) - Three active nests of this species were located in 1979. Two active and two occupied (but inactive) nests were located in 1980. In addition, golden eagles were frequently observed in the sage-grassland type, particularly around prairie dog towns, and are known to winter on this area. Because of these factors this "special interest or concern" species was listed as common for this area. Cameron (1907) stated this species was formerly very common but that it had been almost exterminated by traps and poisons set out for wolves.

Bald Eagle (*Haliaetus leucocephalus*) - See the endangered species section of this report.

Marsh Hawk (*Circus cyaneus*) - Marsh hawks were frequently observed hunting in a wide variety of vegetation types. During 1979 they were very common on the area, but during 1980 observations dropped dramatically. This can probably be attributed, at least in part, to the severe drought. Still, they were listed as common for this area. Although no nests were located, it is likely they breed here. Historically it was one of the most abundant hawks, being second in abundance only to the kestrel (Cameron, 1907).

Osprey (*Pandion haliaetus*) - This species was observed on several occasions on the study area. Ospreys were usually seen flying adjacent to the Yellowstone River although one was observed at a large reservoir on the area. All of the birds seen were probably migrants and it is unlikely that they breed on this area. This, coupled with the lack of sightings, indicated this species of "special interest or concern" was rare for this area.

Prairie Falcon (*Falco mexicanus*) - In 1979 two active nests of this species were located on the area; however, in 1980 additional efforts were expended and eight active nests were located. Even so, it is unlikely that all active nests have been found. All of the nests were located in cavities in sandstone cliffs with ledges overhanging the majority of nests. The one exception was a nest that was located in a cavity in a scoria butte. The majority of nests were located in and on the fringe of the badlands type and most prairie falcons were observed around known nest sites. Adults were often observed using the sage-grassland and grassland types for hunting. This common species is known to winter on the area and was listed as being of "special interest or concern" for Montana. In the past this species was a "tolerably common resident" (Cameron, 1907).

Peregrine Falcon (*Falco peregrinus*) - See the endangered species section of this report.

Merlin (*Falco columbarius*) - Only one merlin, a "special interest or concern" species, was observed on the study area in 1979 and this was most likely a migratory bird. In 1980 however, a breeding pair was located in the badlands type. In spite of the fact that the area was visited on three occasions, and behavior of the adults indicated the nest site was close, it was never located. It should be noted, however, that a sandstone outcrop with numerous ledges and large cavities as well as several small cottonwoods with abandoned magpie nests occurred in the immediate area. Bent (1938) and Ellis (1976) stated such sites were used for nesting by this species. Cameron (1907) listed this species as a "tolerably common fall migrant" but also reported seeing a group of five birds on 20 August 1899 and on 21 July 1904 which indicated their presence in this area during the summer. Because only three individuals of this species were seen it was listed as rare for this area.

American Kestrel (*Falco sparverius*) - The creek and sage-grassland types were the areas where this abundant species was most frequently sighted; however, they were common in the other types as well. Two active nests were located in 1979 and three in 1980. All nests were in cavities in large cottonwoods and many more nests undoubtedly existed but were not located. Cameron (1907) stated this

species was a "summer visitor, everywhere abundant," and in fact was the most common hawk in eastern Montana. He also stated that all birds were gone by the middle of October. The wintering observations which were recorded for this species during this study were probably related to the mild open winter.

Great Horned Owl (*Bubo virginianus*) - Great horned owls were commonly observed on the area in the sage-grassland and badland types. In addition, seven active nests were located in both 1979 and 1980 in a wide variety of situations (i.e. old house, cliffs, old red-tailed hawk nest, ledge in grassland coulee, etc.). Wintering by this species was also known to occur on the area and in view of this fact, and the wide variety of nest sites employed, it was listed as being common. Cameron (1907) stated that the horned owl was a common and year-long resident of this area.

Burrowing Owl (*Athene cunicularia*) - In 1980 two active nests of this species were located in the prairie dog towns of the area. Nests were recognized by observing the adults in the vicinity, and by scattered broken cow chips around the burrow entrance. Bent (1938) stated that the nests of this species were profusely lined with finely chipped, dry horse or cow droppings and that this lining, which usually showed at the entrance of the burrow, seemed to be characteristic of occupied nests. In addition to the two nests, approximately six observations of other birds occurred each year and it is probable that more nests were located on the area. Nichols (pers. comm.) also indicated that the study area was used for breeding by this species. All observations of burrowing owls during this study occurred on or immediately adjacent to prairie dog towns in the sage-grassland type. Because sightings of this "special interest or concern" species were not numerous it was listed as uncommon for this area. Historically, it was listed as a "common resident" (Cameron 1907) but no evidence of wintering by this species was observed during this study. The species is generally migratory in the northern parts of its range (Bent 1938).

Short-Eared Owl (*Asio flammeus*) - This common species was observed most often in the grassland type and in grassy areas in the sage-grassland type. Although no nests were located, several fledgling young were seen and breeding undoubtedly occurred on the study area. Approximately 30 observations of this species occurred in 1979 while in 1980 that number dropped to only two. Again, it is possible this was a reflection of the adverse effects of the drought. This species was known to winter on the area and historically Cameron (1907) listed it as an "erratic winter visitor, tolerably common some winters and in others not observed." It was interesting to note that he makes no mention of breeding or summering. In fact, he states that May 7 is the latest data he observed this species.

BREEDING BIRD SURVEY

A summary of the results of the breeding bird surveys for both years is presented in Table 3. Individual transect results are presented in Appendix Tables 11-18. In 1979 the sage-grassland type had the highest average density of breeding pairs (146.8 per 100 ha), while the creek type had the greatest diversity² of breeding pairs (14 species). During 1980, however, the creek

¹Diversity is used in this report as a synonym for the "numbers of species."

Table 3. Summary of breeding bird surveys by vegetation type (numbers indicate the number of breeding pairs/100 ha).

Species with singing males on strip	VEGETATION TYPE							
	Sage- Grassland		Grassland		Badlands		Creek	
	1979	1980	1979	1980	1979	1980	1979	1980
Killdeer							23.6	14.3
Spotted Sandpiper							1.5	
Mourning Dove	5.0				4.3	3.6		2.2
Belted Kingfisher							0.7	2.9
Common Flicker							3.6	5.0
Red-Headed Woodpecker							2.9	0.7
Eastern Kingbird							5.7	9.3
Western Kingbird							7.2	1.5
Say's Phoebe					1.5	2.9		
Horned Lark	1.5	2.2	35.0	37.9				
House Wren							0.7	
Rock Wren					10.0	4.3		
Brown Thrasher								0.7
Sprague's Pipit	1.5		12.2					
Loggerhead Shrike		0.7			2.9	2.9		
Western Meadowlark	52.2	30.0	29.3	15.7	37.9	21.5	51.5	50.0
Red-Winged Blackbird							2.2	5.0
Northern Oriole							1.5	
Brewer's Blackbird				0.7				0.7
Common Grackle								0.7
Brown-Headed Cowbird								3.6
Lark Bunting	38.6							
Grasshopper Sparrow	7.2		34.3	1.5			3.6	1.5
Vesper Sparrow	0.7			0.7				
Lark Sparrow	12.9	5.7	2.2	0.7	19.3	12.2	6.5	6.5
Brewer's Sparrow	27.2	1.5		1.5			2.2	1.5
Chestnut-Collared Longspur			20.0	2.9				
Total Number of Breeding Pairs/100 Ha.	146.8	40.1	133.0	61.6	75.9	47.4	113.4	106.1
Number of Species with Breeding Pairs on Strip	9	5	6	8	6	6	14	16
Numbers of Species Observed on Strip	15	11	8	10	11	9	23	25

type had both the highest density (106.1 pairs/100 ha) and the highest diversity (16 species). The western meadowlark was the most abundant breeding bird in three of the four major vegetation types (badlands, creek and sage-grassland). They were outnumbered in the grassland type by horned larks and grasshopper sparrows in 1979 and horned larks in 1980. A brief summary of the results for each of the four major vegetation types follows:

Sage-grassland

1979: The results from the 1979 survey in this type indicated it contained the highest breeding pair density (146.8 pairs/100 ha) and the second highest diversity (nine species). An additional six species of birds were observed on the sample strip, although no singing males were recorded for these species. Meadowlarks were the most abundant breeding bird with an average of 52.2 pairs/100 ha. Lark buntings and Brewer's sparrows followed with averages of 38.6 pairs/100 ha and 27.2 pairs/100 ha, respectively. All three species reached their greatest levels of abundance in the sage-grassland type.

1980: Results from the 1980 survey revealed a decline of 73% in breeding bird densities in the sage-grassland type. Density in this type was the lowest of all types sampled (40.1 pairs/100 ha), as was diversity with five species. Species with singing males on the strip that were recorded in 1979 but not 1980 were as follows: mourning dove, Sprague's pipit, lark bunting, grasshopper sparrow and vesper sparrow. A major reason for the decline in density and diversity observed in this type was the extreme drought compounded by the fact that cattle were wintered on and adjacent to the strip. The combined effect of these two factors was a drastic reduction of residual cover and vegetative structural diversity.

The Brewer's sparrow and clay-colored sparrow observed in this type are species of "special interest or concern" for Montana. Destruction of the sagebrush component in this type may result in a species density and composition resembling that of the grassland type. A similar situation may exist in large grassy areas with little sagebrush which are sometimes found in this type.

Grassland

1979: Breeding bird densities observed in this type were moderate (133.0 pairs/100 ha); however, diversity (six species) was low when compared with other types. Lack of vegetative structural diversity as compared with other types probably accounts for this, although the grasslands were in good condition with large amounts of residual vegetation at the time of the survey. Horned larks were the most abundant breeding bird in this type with an average of 35 pairs/100 ha. They were followed by grasshopper sparrows and meadowlarks with densities of 34.3 pairs/100 ha and 29.3 pairs/100 ha, respectively. Relatively high breeding densities of Sprague's pipits and chestnut-collared longspurs were recorded in and for the most part confined to this type.

1980: Breeding bird densities declined drastically (54%) to 61.6 pairs/100 ha in 1980. Diversity, however, increased from six to eight species. This increase was a result of one pair of vesper sparrows and a pair of Brewer's sparrows which established territories on the strip. Horned larks were again the most abundant breeding bird with a density approximately equal to that which occurred

in 1979. They were followed in abundance by western meadowlarks, which as well as Sprague's pipits, grasshopper sparrows and chestnut-collared longspurs all showed a drastic decline in densities. The decline in densities of these species was probably related to a need for substantial residual grass cover. Here, as with other types, residual cover was reduced by the drought and cattle grazing. Results of these surveys also indicated that heavy grazing would reduce densities and change or reduce species composition on these areas.

The long-billed curlew and upland sandpiper observed in this type are "special interest or concern" species for Montana. Scattered silver sagebrush occurred on some mesic sites in the grassland type. Where such sites are large enough the breeding bird density and diversity may be similar to that of the sage-grasslands.

Badlands

1979: This type had the lowest overall density with 75.9 pairs/100 ha and also low diversity with only six species. Five additional species without singing males were observed on the sample strip which resulted in a slightly higher number of total species for this area as compared with the grassland type (11 species vs. eight species). Western meadowlarks were the most abundant species in this type with a density of 37.9 pairs/100 ha. Following in decreasing order were lark sparrows (19.3 pairs/100 ha) and rock wrens (10 pairs/100 ha).

1980: Breeding bird densities declined 37% to 47.4 pairs/100 ha although the same six species of the previous year were present. Densities of all species declined or stayed approximately the same. Once again, the drought was believed to be the major factor in the decline. It was interesting to note that the diversity remained the same which suggested that the species found here are well adapted to the extremely dry conditions which typically occur in badland areas. In addition, the effects of the drought on vegetative structure probably was not as great as on areas more accessible to heavy livestock pressure.

Of the species observed in this type, two in particular were confined to the badlands vegetation type. Rock wrens and Say's pheobe were commonly found around sandstone outcrops and more rugged areas in the badlands. Overall, a general lack of vegetation in badlands areas is one plausible explanation for the low breeding bird densities and diversities observed.

Creek

1979: Of the four types sampled, the creek type contained the highest diversity with a total of 14 species. Density was moderate with an average of 113.4 pairs/100 ha. In addition, nine other species without singing males were observed on the strip. Again, western meadowlarks were the most common species with a density of 51.5 pairs/100 ha. This figure was second only to that found for meadowlarks in the sage-grassland type (52.2 pairs/100 ha). Meadowlarks were followed by killdeer and western kingbirds with densities of 23.6 pairs/100 ha and 7.2 pairs/100 ha, respectively.

1980: This type had both the highest density (106.1 pairs/100 ha) and diversity (16 species) of the major vegetation types surveyed in 1980, and showed the smallest decline (6%) from the previous year. As in 1979, an additional nine species

without singing males were observed on the strip. Species with the highest densities were western meadowlarks (50.0 pairs/100 ha), killdeer (14.3 pairs/100 ha) and eastern kingbirds (9.3 pairs/100 ha).

A possible explanation as to why this type was least affected both in density and diversity by the effects of the drought was that a majority of the nongame birds found here were associated with the scattered cottonwoods which occurred there (e.g. common flicker, red-headed woodpecker, kingbirds, house wrens, etc.). In addition, the drainages received what little water was available from snow melt and some new growth occurred. Also, constant grazing pressure on this type could have the effect of lowering the values observed below what would have occurred had the area remained ungrazed. Destruction of the cottonwoods found in this type would have a very adverse affect on both densities and diversities of nongame birds.

Limber and Ponderosa Pine Subtypes

Although no survey transects were conducted in these subtypes, time was spent searching the areas to locate nongame bird species. Species unique to these subtypes were the least flycatcher, pinon jay, red-breasted nuthatch, Swainson's thrush, Philadelphia vireo, American redstart, western tanager, red crossbill, and dark-eyed juncos. In addition, certain other species were found in their greatest abundance in these timbered types (e.g. yellow-rumped warblers, chipping sparrows and mountain bluebirds). Destruction of the timbered types on the study area would result in elimination of species unique to these types and drastic reductions in the numbers of those species found in greatest abundance here.

WINTERING BIRD SURVEY

Results of the wintering bird surveys are presented in Table 4. These surveys were conducted in January and February to avoid including late fall stragglers and early spring migrants. Conditions were mild and open during the winter of 1979-80 and this probably increased the number of species observed over that which occur in a severe winter. Data from only one winter make such conjectures open to question. General observations, however, indicate a lack of birds wintering on the area. Species of "special interest or concern" known to winter on the area were the golden eagle and prairie falcon (wintering by bald eagles, an endangered species, is covered in that section of the report).

MAMMALS OF THE STUDY AREA

A list of mammal species occurring on the study area, the vegetation type in which they were most frequently observed, relative abundance and classification is presented in Table 5. In addition, a discussion of individual species is presented below.

Merriam's Shrew (*Sorex merriami*) - Only one specimen of this species was captured on the study area; therefore, it was listed as rare. Although this specimen was captured in the creek vegetation type it generally inhabits arid sagebrush desert, sagebrush-grass semi-desert, and occasionally dry grassland habitats (Hoffmann and Pattie 1968). A possible explanation for the capture in the creek

Table 4. Wintering bird survey results by vegetation type (numbers indicate total numbers of individuals observed).

Species	Vegetation Type Observed In						
	Creek	Badlands	Grassland	Sage-Grassland	Ponderosa pine Subtype	Limber Pine Subtype	Agri-cultural
Rough-Legged Hawk <i>Buteo lagopus</i>	1			1			
Golden Eagle <i>Aquila chrysaetos</i>			4	1			
Marsh Hawk <i>Circus cyaneus</i>							1
Prairie Falcon <i>Falco mexicanus</i>			1				
American Kestrel <i>Falco sparverius</i>							1
Sharp-Tailed Grouse <i>Pediacetes phasianellus</i>	7				1	1	
Sage Grouse <i>Centrocercus urophasianus</i>			1	14			
Ring-Necked Pheasant <i>Phasianus colchicus</i>	1						
Gray Partridge <i>Perdix perdix</i>				10			
Great Horned Owl <i>Bubo virginianus</i>		1		1	1		
Short-Eared Owl <i>Asio flammeus</i>			1				
Common Flicker <i>Colaptes auritus</i>	1						
Horned Lark <i>Eremophila alpestris</i>			2	62			
Black-Billed Magpie <i>Pica pica</i>		4	2	5	4		
Pinon Jay <i>Gymnorhinus cyanocephalus</i>					20		
American Robin <i>Turdus migratorius</i>	24	3					3
Townsend's Solitaire <i>Myadestes townsendi</i>					4		
Bohemian Waxwing <i>Bombycilla garrulus</i>					90		
Starling <i>Sturnus vulgaris</i>							40
House Sparrow <i>Passer domesticus</i>	12						
Western Meadowlark <i>Sturnella neglecta</i>							1
American Goldfinch <i>Carduelis tristis</i>							35
Red Crossbill <i>Loxia leucoptera</i>					4		

Table 5. Mammals of the study area and their vegetation use, relative abundance and classification.

Species	Vegetation type most frequently observed in				Relative Abundance ¹	Classification ²
	Badlands	Grassland	Sage-Grassland	Creek		
Merriam's Shrew <i>Sorex merriami</i>				X	R	SI
Big Brown Bat <i>Eptesicus fuscus</i>				X	C	N
Small-Footed Bat <i>Myotis leibii</i>			X		R	N
White-Tailed Jack Rabbit <i>Lepus townsendi</i>			X		C	N
Desert Cottontail <i>Sylvilagus auduboni</i>	X		X		C	N
Porcupine <i>Erethizon dorsatum</i>	X				U	N
Beaver <i>Castor canadensis</i>				X	U	F
Northern Pocket Gopher <i>Thomomys talpoides</i>		X		X	C	N
Ord's Kangaroo Rat <i>Dipodomys ordi</i>			X		C	N
Wyoming Pocket Mouse <i>Perognathus fasciatus</i>			X		U, C	N
Least Chipmunk <i>Eutamias minimus</i>	X				U	N
Black-Tailed Prairie Dog <i>Cynomys ludovicianus</i>			X		C	SI
Thirteen-Lined Ground Squirrel <i>Spermophilis tridecemlineatus</i>			X	X	U	N
Eastern Fox Squirrel <i>Sciurus niger</i>		River Bottom			R	N
Bushy-Tailed Wood Rat <i>Neotoma cinerea</i>	X				C	N
Western Harvest Mouse <i>Reithrodontomys megalotis</i>			X		U	N
Deer Mouse <i>Peromyscus maniculatus</i>	X	X	X	X	A	N

Table 5. Continued.

Species	Vegetation type most Frequently observed in				Relative Abundance ¹	Classification ²
	Badlands	Grassland	Sage- Grassland	Creek		
Muskrat <i>Ondatra zibethica</i>				X	U	F
Prairie Vole <i>Microtus ochrogaster</i>		X		X	C	N
House Mouse <i>Mus musculus</i>	Agricultural				locally common	N
Bobcat <i>Lynx rufus</i>	X				U	F
Raccoon <i>Procyon lotor</i>				X	U	P
Red Fox <i>Vulpes fulva</i>			X	X	U	P
Coyote <i>Canis latrans</i>	X	X	X		C	P
Badger <i>Taxidea taxus</i>			X		U	P
Striped Skunk <i>Mephitis mephitis</i>				X	U	P
Long-Tailed Weasel <i>Mustela frenata</i>	X				U	P
Pronghorn <i>Antilocapra americana</i>		X	X		A	G
White-Tailed Deer <i>Odocoileus virginianus</i>			X		U	G
Mule Deer <i>Odocoileus hemionus</i>	X		X		C	G

- ¹ A = Abundant (>75 observations)
 C = Common (10-75 observations)
 U = Uncommon (3-10 observations)
 R = Rare (1-3 observations)

The same criteria are employed for observable species (e.g. coyotes) and trappable species (e.g. mice).

- ² N = Nongame
 SI = Special Interest or Concern
 F = Furbearer
 B = Game
 P = Predator

type was that these areas have a poorly developed riparian habitat. Hoffmann and Pattie (1968) stated that sunken can traps would probably turn up many specimens of this hitherto "rare" shrew and, indeed, the specimen was captured in a pitfall trap. In all probability, this "special interest or concern" species would have been missed if pitfall traps were not employed.

Big Brown Bat (*Eptesicus fescus*) - Ten specimens of the big brown bat were collected on the area and many more were observed. Collection of these specimens occurred at widely separated sites and indicated this species was common on the area. Breeding colonies were located at two sites and more sites undoubtedly existed. Sandstone outcrops and caves were utilized for breeding and roosting; while stock reservoirs were used for feeding sites.

Small-Footed Bat (*Myotis leibii*) - Only one specimen of the small-footed bat was captured on the study area, therefore, it was listed as rare. This specimen was captured in a mist net placed at an artesian stock tank in the sage-grassland type. Swenson (1970) reported several specimens of this species were taken in Miles City, Montana and one was captured in Glendive, Montana. The present study area was between these two localities and this specimen serves to further define the range of this species in Montana.

White-Tailed Jackrabbit (*Lepus townsendi*) - This species occurred most frequently in the sage-grassland type. The numerous observations of this species which were obtained at night and while walking the area during daylight hours justified listing it as common for the area. Local landowners stated that in peak population years this species becomes abundant on the area. Coyotes, golden eagles and red-tailed hawks were observed utilizing this species as prey and other predatory species undoubtedly do likewise.

Desert Cottontail (*Sylvilagus auduboni*) - Thirteen desert cottontails were collected on the area and many more were observed. They were most often found in the badlands and sage-grassland coulees. This species was listed as common for the area and was known to be an important food source for the predatory mammals and birds occurring here.

Several cottontails were observed adjacent to the Yellowstone River bottomland which resembled the mountain cottontail (*S. nuttalli*) but no specimens were collected and the identification could not be verified. The study area lies within the range of this species (Hoffmann and Pattie, 1968) and they stated that in eastern Montana where desert and mountain cottontails are sympatric, the latter is restricted to riparian shrubs along streams and river banks. Also, presence of the mountain cottontail was documented considerably east of the present study area (Matthews, 1979).

Porcupine (*Erethizon dorsatum*) - Evidence of porcupines on the area was obtained from one direct observation in the sage-grassland and indirect observations (gnaw marks on trees, tracks) in the limber and ponderosa pine badlands. Nowhere was sign abundant and this, in conjunction with the lack of direct observations and limited extent of pine habitats, justified listing this species as uncommon.

Beaver (*Castor canadensis*) - This furbearer was found exclusively in the creek type at one large reservoir, and only in small numbers. It was therefore listed as uncommon for this area. Damage to the scattered cottonwoods occurring on the area and the damming of irrigation channels often results in destruction of individuals by the local landowners.

Northern Pocket Gopher (*Thomomys talpoides*) - The two specimens of this species collected during this study were from a local rancher who trapped them in a hay meadow. This species was also known to occur most frequently in the grassland type and creek type as evidenced by active mounds. Some evidence of their activity was also observed on grassy areas in the badlands but to a more limited extent than the previously mentioned types. Based on evidence of their activity, the pocket gopher was listed as common for this area.

Ord's Kangaroo Rat (*Dipodomys ordi*) - This species was frequently observed at night while traversing roads in the sage-grassland type. Observations indicated this species prefers sites with sandy soils and probably occurs on these areas in other vegetation types as well. All specimens taken were hand captured on and adjacent to roads at night. Numerous sightings led to this species being listed as common for this area.

Wyoming Pocket Mouse (*Perognathus fasciatus*) - This species was captured in greatest numbers in the sage-grassland type and was the most abundant small mammal in these areas. It also occurred in the creek and grassland types, although in lower numbers. Trapping data indicated that this species was most susceptible to capture in sunken can pitfalls. It was uncommon-to-common on this area.

Least Chipmunk (*Eutamias minimus*) - This species was mainly confined to the heads of grassland coulees and areas of the badlands containing pine and/or juniper. Some specimens of this species were captured during small mammal sampling while others were taken with a .22 caliber rifle. Even though this species was locally common on certain sites, it was listed as uncommon for the area.

Black-Tailed Prairie Dog (*Cynomys ludovicianus*) - The distribution and size of prairie dog towns on the area is presented in Figure 11. The majority of dog towns on the area were in the sage-grassland area, immediately adjacent to the creek types. Heavy cattle grazing in these areas may be important in maintaining and increasing prairie dog distribution (Knowles, pers. comm.). The importance of prairie dogs in the prairie ecosystem is well documented (Henderson et al. 1974, Flath 1978). Numerous species (burrowing owls, black-footed ferrets, mountain plovers) depend on these sites for their perpetuation. Also, evidence from direct observation indicated the importance of these areas as a food source for the predators and raptors of the study area. The large numbers and wide distribution of prairie dogs on this area contributed to the density and diversity of predatory mammals and birds observed. Prairie dogs, a "special interest or concern" species, have been and continue to be a very controversial species. Presently, there is an increasing demand from the landowners of the area for some form of prairie dog control. A survey of landowner attitudes, both on and adjacent to the study area, was conducted both orally and in the form of a confidential written questionnaire (see Appendix Table 22) to determine the level of prairie dog populations they would tolerate on their lands and public lands under their control. Results of these surveys indicated most landowners prefer total extirpation of this species in this area. Reasons expressed for this lie in the elimination of potential livestock hazards (i.e. burrows) and the perceived benefits of increased livestock forage production and decreased erosion. To follow this course of action would have many adverse impacts on the nongame species dependent on and associated with prairie dog towns. Therefore, it is

recommended that studies of the general ecology and biology of prairie dogs be conducted and actual benefits of control efforts be determined before any intensive control work is conducted. Studies such as these should be conducted with landowner cooperation and support if possible. Until the time such investigations can be accomplished, cooperative agreements should be worked out with individual landowners for limited prairie dog control. Although there might be some negative impacts on certain nongame species in the short term, if the landowners can be convinced to assist in an overall program for nongame perpetuation, much will have been accomplished.

Thirteen-Lined Ground Squirrel (*Spermophilis tridecimlineatus*) - Although no specimens of this species were captured in the course of the trapping effort, several were observed and collected in the sage-grassland and creek types. This species occupied the more grassy areas in the sage-grassland and creek types. The relative abundance of this species was not accurately sampled with the techniques employed. Therefore, it was listed as uncommon on the area.

Eastern Fox Squirrel (*Sciurus niger*) - Evidence of the occurrence of this species was from three leaf nests observed in cottonwoods adjacent to the Yellowstone River. This species was confined to the Yellowstone River bottomlands and Hinz (pers. comm.) reported observing fox squirrels approximately 10 miles east of the study area. In addition, Hoffmann et al. (1969) lists records of this species west of this area as well.

Bushy-Tail Woodrat (*Neotoma cinerea*) - Broken sandstone outcrops and abandoned homesites were the areas where this species was commonly observed. It follows, therefore, that it occurred most frequently in the badlands type, although it can be found in broken rocky areas in other types. In view of the fact it occupies most of the aforementioned sites, it was listed as common for the area.

Western Harvest Mouse (*Reithrodontomys megalotis*) - This species was relatively uncommon on the area and was generally found in the sage-grassland vegetation type although one specimen was captured in the creek type. Trapping data indicated this species was more susceptible to capture in the fall than during summer.

Deer Mouse (*Peromyscus maniculatus*) - This ubiquitous species was the most abundant mammal on the study area. It was trapped in all vegetation types and was usually the most abundant mammal trapped. Trapping data indicated the broken, rugged terrain of the badlands type provided the most suitable habitat for this species on the area.

Muskrat (*Ondatra zibethica*) - This furbearer was also confined to the major creek types on the area, although a few were found at large reservoirs removed from this type. Although it was listed as uncommon for this area, it was locally common at reservoirs where suitable conditions existed.

Prairie Vole (*Microtus ochrogaster*) - This species was most frequently captured in the creek vegetation type and secondly in the grassland type. Specimens were also taken in the limber pine badlands although not with the frequency of the other types. It was the only vole captured on the area although Matthews (1980) reported capturing *Microtus pennsylvanicus* immediately east of the area and it was probable that this species occurred on this study area as well.

House Mouse (*Mus musculus*) - The only specimen of this species captured on the study area was at the residence of one of the local landowners. This species was probably confined to areas of human habitation, agriculture, and immediately adjacent localities.

Bobcat (*Lynx rufus*) - Evidence of this species on the area is from one sighting in the sage-grassland type, tracks in the badlands, and specimens captured by local trappers. All of the bobcat sign and the majority of cats trapped were from the badlands type. Because of the lack of actual sightings and the limited nature of indirect evidence, this species was listed as uncommon on this area. Local landowners stated that the bobcat was previously more common, but high fur prices and intense trapping pressure had dramatically reduced their numbers.

Raccoon (*Procyon lotor*) - Evidence of the occurrence of this species on the area was from indirect (tracks) observations, one sighting in the sage-grassland, and landowner contacts. Tracks of this species were found in the creek type and this species was largely confined to these areas. Because only one direct sighting was made and tracks were seldom located, this species was listed as uncommon for the area. This species was much more common on the Yellowstone River bottomland adjacent to the study area.

Red Fox (*Vulpes fulva*) - This species was largely confined to the Yellowstone River bottomlands and areas immediately adjacent to them. It was also known to occur in the deciduous coulees on the northern and western fringes of the area, but in lesser numbers. Only one sighting of a red fox was made on the study area. Therefore it was listed as uncommon. Historically, this species probably did not occur on this area as the following statement from the Terry Tribune March 22, 1945 illustrates: "A red fox killed by a cyanide cartridge less than a mile upstream from the Powder River bridge (just south of the present study area) was brought into town by A. C. Drew, predatory animal hunter. These animals are a rarity in this country, several old timers remarking that they had never seen one before."

Coyote (*Canis latrans*) - Coyotes were observed all seasons and in all vegetation types of the study area. However, they were most frequently observed in the badland and sage-grassland types. Domestic sheep graze parts of the study area and this usually results in efforts to control coyotes. M44 cyanide guns and aerial gunning were used for control on portions of the area. In spite of control efforts, it was not unusual to see coyotes or indirect evidence (scats, tracks, etc.) of coyotes on the area.

Badger (*Taxidea taxus*) - This species was observed on three occasions in, or adjacent to prairie dog towns and once in the grassland type. Other indirect evidence (diggings, tracks, etc.) was noted in several dog towns where no individuals were observed. Infrequent sightings justified listing this species as uncommon for the area. This may be an artifact of their low visibility and the species may be more common than indicated.

Striped Skunk (*Mephitis mephitis*) - This species was seldom sighted on this area because of its nocturnal habits. When found, it was usually located in the creek type or areas immediately adjacent to them. Most direct observations of this species were road kills on the fringes of the area.

Long-Tailed Weasel (*Mustela frenata*) - No individuals were observed on the study area, but they were observed immediately west and north of it. Therefore, it is probable that they occur on the study area. Sightings off of the area were in the badlands type, immediately adjacent to sage-grassland types. Because there were no observations on the study area, this species was listed as uncommon.

Mule Deer (*Odocoileus hemionus*), White Tailed Deer (*Odocoileus virginianus*), Pronghorn (*Antilocapra americana*) - These three species of big game animals occur on the area and can be locally common. White-tailed deer are largely confined to the Yellowstone River bottomlands, areas immediately adjacent to it, and the deciduous coulees to the north of the area. Antelope are generally in the sage-grassland and grassland types. Mule deer are most often observed in badland areas. A detailed description of the game species occurring on the area will be prepared by the BLM after completion of their studies.

SUMMER SMALL MAMMAL TRAP DATA

Results of the summer small mammal sampling effort for each major vegetation type, the two subtypes and grassland coulees are presented in Table 6. Techniques employed during this study did not effectively record some of the small mammal species known to occur on the area. Species such as kangaroo rats, thirteen-lined ground squirrels and northern pocket golfers were sampled by other means and were discussed in the mammals section of this report. A brief summary of results by vegetation type follows.

Table 6 . Results of summer small mammal trapping.

Vegetation Type	Captures/100 trap nights Line 1	Captures/100 trap nights Line 2	Total trap nights	Total captures/ 100 trap nights	No. Species Captured
Badlands	10.76	13.78	1173	12.28	1
Grasslands	1.53	1.69	1179	1.61	4
Sage-Grasslands	1.06	1.48	1338	1.27	3
Creek	7.26	3.87	1093	5.58	4
Ponderosa Pine Badlands	5.39		482	5.39	2
Limber Pine Badlands	4.12		583	4.12	2
Grassland Coulees	4.06		493	4.06	3

Grassland - A total effort of 1,179 trap nights resulted in the capture of 19 small mammals in this type. Of these, eight were deer mice (*Peromyscus maniculatus*), five prairie voles (*Microtus ochrogaster*), five Wyoming pocket mice (*Perognathus fasciatus*) and one western harvest mouse (*Reithrodontomys megalotis*). Total captures per 100 trap nights, 1.61, was low in this type, although diversity was high with four species.

Sage-Grassland - A total effort of 1,338 trap nights resulted in the capture of 17 small mammals in this type. Of these, nine were Wyoming pocket mice, seven deer mice, and one western harvest mouse. Captures per 100 trap nights (1.27) were the lowest of all types sampled, but diversity was moderate with three species. The Wyoming pocket mouse was dominant in this type while in all of the other types sampled, the deer mouse was the most abundant species.

Badlands - A total effort of 1,173 trap nights resulted in the capture of 144 small mammals in this type. All specimens captured were deer mice, resulting in the lowest diversity of all types sampled; however, captures per 100 trap nights (12.28) were the highest recorded for any of the vegetation types sampled.

Creek - A total effort of 1,093 trap nights resulted in the capture of 61 small mammals in this type. Of these, there were 47 deer mice, nine prairie voles, four Wyoming pocket mice and one Merriam's shrew (*Sorex merriami*). In addition, the fall sampling effort resulted in the capture of one western harvest mouse bringing the number of species found in this type to five and making it the most diverse of all the types sampled. Captures per 100 trap nights (5.58) in this type were second only to that of the badlands type (12.28). Of the five species captured in this type only the Merriam's shrew is listed as being a species of "special interest or concern" for Montana. This specimen was the first of its species captured in a creek vegetation type (Flath, pers. comm.). The number of prairie voles captured in this type is of interest in that they were fairly common and voles were shown to be an important item in the diets of predatory birds and mammals (Riechel 1976, Flath 1979c).

Ponderosa Pine Badlands Subtype - A total effort of 482 trap nights resulted in the capture of 26 small mammals. Of these, 25 were deer mice and one was a least chipmunk (*Eutamias minimus*). Captures per 100 trap nights (5.39) were high, though diversity with only two species was low. The small mammal species composition was similar to that found in the badlands type but densities were lower.

Limber Pine Badlands Subtype - Five hundred and eighty-three trap nights in this type resulted in the capture of 24 small mammals. Of these, 21 were deer mice and three were prairie voles. Captures per 100 trap nights were moderate (4.12) although the number of species (2) was low. The presence of prairie voles in this type can probably be accounted for by its proximity to the grassland type and the grassy habitats that occur between the stands of pine.

Grassland Coulee - These areas were sampled because it was felt that the unique vegetation found in grassland coulees might support species of small mammals not found in other types. The presence of snowberry (*Symphoricarpos* spp.), rose (*Rosa* spp.), creeping juniper (*Juniperus horizontalis*) and skunkbrush sumac (*Rhus trilobata*) provided a unique habitat situation. A total effort of

493 trap nights resulted in the capture of 20 small mammals. Of these 17 were deer mice, two least chipmunks and one prairie vole. Captures per 100 trap nights (4.06) were moderate as was diversity at three species. Deer mice were more common in grassland coulees than grassland in general, probably as a result of the numerous cracks and crevasses found in the coulees. In addition, the presence of least chipmunks may possibly be related to the brushy nature of vegetation found in this type.

FALL SMALL MAMMAL TRAP DATA

Results of the fall sampling effort for the four major vegetation types are presented in Table 7. The fall small mammal sampling effort resulted in no new species of small mammals captured. However, the western harvest mouse was added to the creek vegetation type where it had not previously been recorded. Only two species of small mammals (deer mice and western harvest mice) were captured and captures per 100 trap nights were not significantly different than that found during summer small mammal sampling.

Table 7. Results of fall small mammal sampling.

Vegetation type	Total Trap Nights	Total Captures/ 100 trap nights	No. Species Captured
Badlands	289	14.19	1
Grasslands	299	.67	1
Sage-Grassland	292	4.11	2
Creek	297	3.37	2

REPTILES AND AMPHIBIANS

Table 8 presents a list of the reptile and amphibian species, vegetation type in which they were most frequently observed, relative abundance and classification. A brief discussion of each species follows.

Turtles (*Testudinata*)

Painted Turtle (*Chrysemys picta*) - This was the only species of turtle located on the study area. It was usually found at large intermittent pools on creeks and at stock reservoirs, and can become locally common in these areas.

No observations of snapping turtles (*Chelydra serpentina*) or spiny softshell turtles (*Trionyx spiniferus*) (both "special interest or concern" species) were recorded on the area but the potential exists for their occurrence at stock ponds and large pools in the major creeks of the area, especially where these

Table 8. A list of the reptile and amphibian species found on the area along with the vegetation type most commonly observed in, relative abundance and classification.

Species	Vegetation Type Most Frequently Observed In				Relative Abundance ¹	Classification ²
	Badlands	Grassland	Sage-Grassland	Creek		
Painted Turtle <i>Chrysemys picta</i>				X	U	N
Racer <i>Coluber constrictor</i>	X		X	X	C	N
Plains Hognose Snake <i>Heterodon nasicus</i>			X		R	SI
Milk Snake <i>Lampropeltis triangulum</i>			X		R	SI
Bull Snake <i>Pituophis melanoleucus</i>		X	X		C	N
Plains Garter Snake <i>Thamnophis radix</i>				X	U	N
Prairie Rattlesnake <i>Crotalus viridis</i>	X		X		C	N
Short-Horned Lizard <i>Phrynosoma douglassi</i>			X		U	N
Plains Spadefoot Toad <i>Scaphiopus bombifrons</i>			X		U	N
Rocky Mountain Toad <i>Bufo woodhousei</i>			X	X	A	N
Northern Chorus Frog <i>Pseudacris triseriata</i>				X	A	N
Leopard Frog <i>Rana pipiens</i>				X	C	N
Tiger Salamander <i>Ambystoma tigrinum</i>			X	X	C	N

¹ A = Abundant (>75 observations)
C = Common (10-75 observations)
U = Uncommon (3-10 observations)
R = Rare (1-3 observations)

² N = Nongame
SI = Special Interest or Concern

areas occur adjacent to the Yellowstone River. A local landowner (Reukhauf pers. comm.) reported that a large snapping turtle frequented the area on the northern vicinity of the present study area many years ago and that, at one time "tortoises" (probably western box turtles; *Terrapene ornata*) occurred on the area, but none have been seen in the past twenty years. Documentation of the latter species for Montana is lacking.

Snakes and Lizards (Squamata)

A total of six species of snakes and one specie of lizard were observed on the study area.

Racer (*Coluber constrictor*) - This species was observed in all vegetation types on the area and was quite common. It was most often observed in the badlands and creek types and was known to den with rattlesnakes in badland areas.

Plains Hognose Snake (*Heterodon nasicus*) - This species was located once during this study in the sage-grassland type. This species is listed as being of "special interest or concern" for Montana and was rare on this area. Matthews (1980) also captured two hognose snakes to the immediate east of the present study area.

Milk Snake (*Lampropeltis triangulum*) - One specimen of the milk snake was captured in the sage-grassland type during this study. It was listed as rare for this area and is a species of "special interest or concern" for Montana. Little is known about this species or its distribution in Montana.

Bull Snake (*Pituophis melanoleucus*) - Members of this species were most frequently encountered in the sage-grassland and grassland types. A total of 14 individuals were recorded on the area during this study and, therefore, it was listed as common.

Plains Garter Snake (*Thamnophis radix*) - This species was uncommon on the area and was usually found in the creek type or in sage-grassland areas adjacent to it. Only six individuals of this species were observed during this study.

Prairie Rattlesnake (*Crotalus viridis*) - Rattlesnakes were observed in all vegetation types on the area. They were most common in the badlands type and two active dens were found in these areas. Rattlesnakes were common on this area and were abundant at certain localities around den sites during spring and fall. It was noted that the number of observations in 1980 dropped substantially from 1979 and the possibility exists that this was related to the drought conditions which occurred.

Short-Horned Lizard (*Phrynosoma douglassi*) - Two observations of the short-horned lizard occurred on the study area in the sage-grassland type. This species was probably more common than the data indicated, but they are secretive and difficult to locate.

It should be noted here that the potential exists for the occurrence of sage-brush lizards (*Sceloporus graciosus*) on this area. A proprietor of a cafe in Terry who was born and raised on the study area stated that as a child he used to climb in the rocks of the badlands and catch "sand lizards". When asked to identify the lizards by leafing through the color plates in the Field Guide to

Western Reptiles and Amphibians (Stebbins, 1966), he immediately pointed to the sagebrush lizard. Several visits were made to the general area where he had captured these lizards but none were located. His observations of lizards, other than short-horned lizards (i.e. horny toads), was corroborated by a new arrival to Terry who mentioned he too had seen a small lizard in the badlands.

Frogs and Toads (*Salientia*)

Two species of toads and two species of frogs were found on the area. None of the species found were listed as "special interest or concern" species for Montana.

Plains Spadefoot Toad (*Scaphiopus bombifrons*) - This species was observed at a small pool below a seep in the badlands type. It is probably locally common when conditions for breeding are correct (Black, 1970). Because of the lack of precipitation on the area during the study, they were never found in great numbers.

Rocky Mountain Toad (*Bufo woodhousei*) - This was the most common toad found on the study area. Numerous specimens were collected in all vegetation types. It was generally found around pools of water formed after thundershowers and at moist locations on the area, including pools in creeks and at stock reservoirs.

Although it was not observed on the study area, it is likely that the great plains toad (*Bufo cognatus*) occurs here. Specimens of this species were collected twenty miles to the west of the present study area (Dood unpublished data) in habitat situations similar to that found on this area (i.e. sage-grassland vegetation type).

Northern Chorus Frog (*Pseudacris triseriata*) - Chorus frogs were common on the area and most notable in the spring when every reservoir and intermittent pond resounded with their voices. Their presence was less noticeable as summer progressed and singing terminated. They were found in every vegetation type in situations where sufficient water existed.

Leopard Frog (*Rana pipiens*) - Leopard frogs were observed most often in the creek type in pools with sufficient water to last through the summer and where riparian growth was dense enough to provide concealment. They were also observed around stock reservoirs and were at least locally common on the area where year-round water supplies existed.

Salamanders (*Caudata*)

Tiger Salamander (*Ambystoma tigrinum*) - The tiger salamander was the only species in this order captured on the study area. Three specimens were captured in pitfalls set for small mammals in the sage-grassland and one in a pitfall in the grassland coulee. In addition, four dead larvae were found at a stock pond in the sage-grassland that was rapidly disappearing from the effects of the drought. Indications were that this species is uncommon but this was probably due in large part to their secretive nature. It is likely that they were common or even locally abundant at stock ponds, especially during the spring.

ENDANGERED SPECIES

Of the five species listed as endangered in Montana (grey wolf, whooping crane, black-footed ferret, peregrine falcon and bald eagle), two are known to occur

on the area (peregrine falcon and bald eagle). In addition, the potential existed for the occurrence of the black-footed ferret on this area. A brief discussion of these species is presented below.

Black-footed Ferret (*Mustela nigripes*) - Reliance of the black-footed ferret on prairie dogs was documented by Henderson et al. (1974) and others. The density and distribution of prairie dog towns and the relative isolation of the area contributes to the possibility of ferrets occurring here. Time was spent during the study in the active search of prairie dog towns for ferrets and evidence of ferret activity (trenches, plugged burrows, etc.). No positive sign was located, nor were any individuals observed. More intensive work will be required to document their occurrence on this area. For any ferret management program to be successful, the ecological needs and biology of prairie dogs must first be evaluated. Problems with prairie dog management were discussed earlier in this report. A generally negative attitude towards ferrets was expressed by landowners of the study area (data from questionnaire returns and personal interviews). The attitudes are not the result of any dislike of ferrets per se but have developed from fear of political fallout if a ferret sighting occurred in this area. For a ferret management program to be successful, these fears must be allayed and the cooperation of the landowners must be insured.

Grey Wolf (*Canis lupus*) - In the period before settlement grey wolves were common on this area. The situation changed dramatically with the destruction of the bison herds and the introduction of domestic livestock. Concurrent with this change a great deal of control was exerted on wolves and other predators in this area. Control measures ranged from shooting and trapping to poison baits. Adverse affects of these baits on wolves and other species, most notably the raptorial birds, were noted by Cameron (1907, 1908). By the early 1900's the wolves in the area were under control and, in fact, declining rapidly. Presented below are bounty claims for Prairie County and excerpts from the Terry Tribune which tell the story of the wolf's last years in this area (data compiled by Ken Hamlin).

Bounty claims for Prairie County, from the County Courthouse

May 10-Dec. 7, 1915	6 adults and 1 pup
Full year 1916	8 adults and 10 pups
Full year 1917	6 adults
Full year 1918	1 adult
Full year 1919	2 adults
Full year 1920	4 adults
Full year 1921	1 adult
Full year 1922	1 adult
Jan.-May 1923	0 bounty ended at this time

Terry Tribune:

1910 - 6 wolves reported in the Red Hills.

June 18, 1915 - "Wolves killed a calf on Cherry Creek, they are quite a menace this summer."

June 25, 1915 - Cherry Creek - 4 colts lost to wolves, went wolfing and got 4 pups.

October 22, 1915 - "Ed Guenther from Saugus, (authors note: on the current study area) a few days ago killed one of the largest wolves ever seen in the Saugus section, it measured 7 feet in length. For the past few years, wolves have been rather bold in the Saugus section."

January 18, 1918 - wolves and coyotes killing a lot of stock on the northside (authors note: Cherry Creek area).

February 21, 1919 - Many young cattle and horses killed by wolves on northside (badlands).

March 7, 1919 - Hunters looking for wolves - none killed, 3 seen.

July 13, 1923 - the leader of a band of wolves on Cottonwood Creek was killed.

August 24, 1923 - "owing to the fact that wolves and coyotes are getting numerous on northside ranges and are taking a heavy toll of young stock, the Terry Sportsmen have arranged a wolf hunt."

The last wolf known to have been killed on this study area was in 1922 by government trapper Ed Guenther (Haughian, 1977) and may have been the final wolf which was bountied in Prairie County. No wolves have been seen on this area since that kill and it is extremely unlikely any occur, or have occurred since that time. The most recent wolf kill in eastern Montana occurred 24 miles north of Glasgow, Montana (Montana Outdoors, 1979) in October 1978. This is far north of the present study area. Reintroduction of wolves into this area is not biologically or politically feasible.

Bald Eagle (*Haliaeetus leucocephalus*) - All the observations of bald eagles occurred during the period from December to March. The greatest number that were observed in a single day occurred on 27 March 1980 when 3 adults and 4 sub-adults were located on the study area adjacent to the Yellowstone River. This species was known to winter on the Yellowstone River in this area but no summer records were recorded and no evidence of breeding was found. Bald eagles probably winter here as long as the river remains free of ice. Swenson (pers. comm.) stated that wintering survey flights conducted in southeastern Montana indicated that the majority of wintering occurs on river bottoms and that upland wintering is uncommon and usually within 15 km of a river. Historically, this species was listed as an occasional visitor which formerly bred here (Cameron 1907). Cameron also reported a nest on the Powder River (south of the present study area (15-20 km) and stated that two adults were found dead on the Powder River after eating poison baits put out for wolves.

Peregrine Falcon (*Falco peregrinus*) - Only one sighting of a peregrine falcon was made on the study area. This observation was recorded by BLM biologist William Matthews 8 May 1979 and was probably a migrant bird. No evidence of breeding by this species was recorded on the area during this study, however, this species was known to breed here in the early 1900's (Cameron 1907). Cameron

stated this species was a scarce resident and mentioned an eyrie on the north side of the river about 2 km west of the Terry ferry crossing (The ferry was located at approximately the same location as the present bridge across the Yellowstone River at the town of Terry) which places the nest on the present study area.

Whooping Crane (*Grus americana*) - No known documented sightings of whooping cranes occurred on this area. In view of current population levels and lack of well developed riparian habitats, it is unlikely the area would be utilized by cranes, even as a resting area during migration, except for rare "accidental" occurrences. Whooping crane migration routes lie considerably to the east of this area (Whooping Crane Recovery Team, 1979).

HABITAT PROBLEMS AND MANAGEMENT RECOMMENDATIONS

Any evaluation of potential habitat conflicts resulting from increased human activity and development must consider the basic biology and general ecology of the species involved. Very little data is available in these areas for the majority of nongame species observed on this area. It is recommended, therefore, that species-specific studies be initiated to more precisely describe biological and ecological parameters of the nongame species occurring on the area. The specific species found on the area which are most desperately in need of such basic studies, generally, are those listed as being of "special interest or concern" for Montana. A particular need is to better understand the black-tailed prairie dog and animals associated with them (i.e., burrowing owls, black-footed ferrets). Also, the ecological requirements of raptors on the area need to be further defined. Four species in need of immediate attention are the prairie falcon, bald and golden eagles, and Ferruginous hawk. Studies should be directed at determining food habits, territorial requirements, behavior (especially the tolerance to man-made disturbances), etc. Evidence from the observation of numerous nongame species suggests that a variety of vegetation types are required to sustain them. For example, protection of raptor nest sites without consideration of other aspects of the biology of the animal may be meaningless if foraging areas, territorial requirements, etc. are compromised.

Once such species-specific information is available it will be possible to better evaluate the potential impacts of various land use decisions, and to make decisions which will permit the maintenance and/or enhancement of nongame wildlife. When the impacts of various land use decisions are evaluated, care should be taken not to overlook the insidious aspects of habitat conflicts (i.e., disturbance factors, etc.).

Because data on nongame species are so limited, it is difficult to determine the potential impacts of the various types of land uses. Data from this study shows that extreme drought conditions has adverse impacts on many species of nongame wildlife. Heavy livestock grazing during such periods probably increases the impacts of drought. Consideration should be given to reduced or restricted grazing during periods of drought to lessen impacts on nongame wildlife. Observations during this study have also shown that even a small increase in human activity can adversely affect some nongame species. In view of this, current energy exploration (seismograph work, test wells, etc.) should be confined to the period of October through March to minimize impacts on nongame wildlife. Also, work should be conducted in such a manner so as to prevent disturbance of wintering bald eagles on the Yellowstone River.

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APPENDIX

Table 9. Precipitation records from U.S. Department of Commerce
Climatological Data, Miles City FAA AP station.

	Precipitation (cm)	Deviation from normal (cm)
1978		
January	1.30	0.05
February	3.02	1.73
March	0.31	-1.35
April	1.19	-2.01
May	17.30	12.07
June	3.53	-4.90
July	6.38	2.44
August	2.06	-0.99
September	8.64	5.61
October	0.69	-1.12
November	5.51	4.22
December	<u>1.60</u>	<u>0.38</u>
TOTAL	51.53	16.13
1979		
January	0.84	-0.41
February	2.90	1.60
March	0.66	-0.99
April	1.93	-1.27
May	3.45	-1.79
June	1.96	-6.48
July	7.09	3.15
August	1.70	-1.35
September	0.08	-2.95
October	0.81	-0.99
November	0.51	-0.79
December	<u>0.13</u>	<u>-1.09</u>
TOTAL	22.06	-13.36
1980		
January	0.84	-0.41
February	0.84	-0.46
March	0.71	-0.94
April	1.68	-1.52
May	0.71	-4.52
June	7.67	-0.76

Table 10. Vegetation frequency (% occurrence in 100 2x5 dm frames) for the four major vegetation types.

SPECIES	Vegetation Type			
	Grassland	Sage-Grassland	Creek	Badlands
GRAMINOIDS				
<i>Agropyron dasystachyum</i> (thickspike wheatgrass)			5	6
<i>Agropyron cristatum</i> (crested wheatgrass)	3			
<i>Agropyron smithii</i> (western wheatgrass)	54	70	64	12
<i>Agropyron spicatum</i> (bluebunch wheatgrass)	3	1		22
<i>Agropyron trachycaulum</i>			2	
<i>Andropogon scoparius</i> (little bluestem)	2			9
<i>Bouteloua gracilis</i> (blue grama)	36	52	18	14
<i>Bromus tectorum</i> (cheatgrass)		3		
<i>Calamovilfa longifolia</i> (prairie sandreed)	5	7	7	11
<i>Carex filifolia</i> (threadleaf sedge)	26	4		8
<i>Carex</i> sp. (sedge)			4	
<i>Distichlis stricta</i> (saltgrass)		6	22	5
<i>Festuca octoflora</i> (six weeks fescue)		1		.
<i>Hordeum jubatum</i> (foxtail barley)			1	
<i>Koeleria cristata</i> (prairie junegrass)	11	1		1
<i>Poa compressa</i>			4	
<i>Poa sandbergii</i> (sandberg bluegrass)	9	14	5	2
<i>Schedonnardus paniculatus</i> (tumblegrass)		7	1	
<i>Stipa comata</i> (needle and thread)	80	42	24	10
<i>Stipa viridula</i> (green needlegrass)	2			
FORBS				
<i>Astragalus gilviflorus</i> (milkvetch)	1			
<i>Chaenactis douglasii</i> (dusty maiden)				1
<i>Chenopodium</i> sp. (lamb's quarter)		1		
<i>Chrysopsis villosa</i> (golden aster)			7	
<i>Comandra umbellata</i> (bastard toadflax)	3			
<i>Gaura coccinea</i> (gaura)			9	
<i>Glycyrrhiza lepidota</i> (wild licorice)			2	
<i>Grindelia squarrosa</i> (gumweed)			1	

Table 10. Continued.

SPECIES	Vegetation Type			
	Grassland	Sage-Grassland	Creek	Badlands
FORBS CON'T				
<i>Lygodesmia juncea</i> (skeletonweed)	4		1	
<i>Mammillaria vivipara</i> (pink pincushion cactus)		1		
<i>Melilotus officinale</i> (yellow sweetclover)			6	
<i>Monolepis nuttalliana</i> (mololepis)				4
<i>Muhlenbergia cuspidata</i> (mountain muhly)	4			4
<i>Opuntia polyacantha</i> (prickly pear)	1	11	2	3
<i>Phlox hoodii</i> (Hood's phlox)	16	3		6
<i>Plantago elongata</i> (plantain)		1		
<i>Salsola kali</i> (Russian thistle)			1	
<i>Sphaeralcea coccinea</i> (scarlet globemallow)	12	9		1
<i>Sporobolus airoides</i> (alkali sacaton)			4	
<i>Sporobolus cryptandrus</i> (sand dropseed)				3
<i>Taraxacum officinale</i> (dandelion)	3		5	
<i>Thermopsis rhombifolia</i> (golden pea)				1
<i>Vicia americana</i> (American vetch)	4	1		
SHRUBS AND SUBSHRUBS				
<i>Artemisia cana</i> (silver sage)			22	
<i>Artemisia frigida</i> (fringed sage)	22		15	4
<i>Artemisia longifolia</i> (longleaf sage)				1
<i>Artemisia ludoviciana</i> (cudweed sagewort)			2	
<i>Artemisia tridentata</i> (big sagebrush)		10	1	8
<i>Atriplex confertifolia</i> (shadscale saltbrush)				1
<i>Atriplex dioica</i>				1
<i>Atriplex nuttallii</i> (saltbrush)				6
<i>Eurotia lanata</i> (winterfat)	5			
<i>Gutierrezia sarothrae</i> (broom snakeweed)	3		1	7
<i>Sarcobatus vermiculatus</i> (greasewood)				3
NON-FLOWERING PLANTS				
<i>Equisetum arvense</i> (snakegrass)			1	

Table 11. Results of the 1979 breeding bird survey in the creek vegetation type.

Date	Species (singing males) ^{ab}													
	Western Meadowlark	Killdeer	Lark Sparrow	Eastern Kingbird	Western Kingbird	Grasshopper Sparrow	Common Flicker	Red-Winged Blackbird	Red-Headed Woodpecker	Northern Oriole	Brewer's Sparrow	Belted Kingfisher	Spotted Sandpiper	House Wren
6-6-79	10	6	1	0	3	1	0	0	1	0	0	0	1	0
6-8-79	10	7	0	2	0	1	1	0	0	0	1	0	0	0
6-9-79	10	4	2	2	2	0	1	1	1	0	1	0	0	0
6-10-79	8	5	2	2	1	0	2	1	1	1	0	0	0	1
6-19-79	8	4	0	1	0	1	1	0	1	0	0	1	1	0
6-21-79	15	4	2	0	2	2	0	1	0	1	0	0	0	0
6-22-79	11	3	2	1	2	0	0	0	0	0	1	0	0	0
Maximum No. Singing Males	15	7	2	2	3	2	2	1	1	1	1	1	1	1
Average No. Singing Males	10.29	4.71	1.29	1.14	1.43	.71	.71	.43	.57	.29	.43	.14	.29	.14
No. Breeding Pairs/100ha	51.5	23.6	6.5	5.7	7.2	3.6	3.6	2.2	2.9	1.5	2.2	0.7	1.5	0.7

a
Species without singing males observed on strip; Horned Lark, Mourning Dove, Kestrel, Brown-Headed Cowbird, Starling, Savannah Sparrow, Lark Bunting, Cliff Swallow, Brewer's Blackbird.

b
Additional species observed (off the strip) while running route; Rock Wren, Say's Phoebe, Red-Tailed Hawk.

Table 12. Results of the 1980 breeding bird survey in the creek vegetation type.

Date	Species (singing males) ^{ab}															
	Western Meadowlark	Killdeer	Eastern Kingbird	Lark Sparrow	Red-Winged Blackbird	Common Flicker	Brown-Headed Cowbird	Belted Kingfisher	Mourning Dove	Western Kingbird	Brewer's Sparrow	Grasshopper Sparrow	Red-Headed Woodpecker	Common Grackle	Brewer's Blackbird	Brown Thrasher
5-30-80	12	5	5	3	0	2	3	1	0	0	0	0	0	0	0	0
5-31-80	9	3	1	0	0	0	0	0	0	0	1	0	0	0	0	0
6- 1-80	15	2	1	2	1	0	0	1	0	0	0	0	0	0	0	0
6- 2-80	5	3	1	1	2	1	0	1	0	0	1	0	0	0	0	1
6- 3-80	10	3	1	2	1	1	1	0	0	1	0	1	1	1	0	0
6- 4-80	9	2	2	1	2	0	1	0	1	1	0	0	0	0	0	0
6- 5-80	10	2	2	0	1	1	0	1	2	0	0	1	0	0	1	0
Maximum number singing males	15	5	5	3	2	2	3	1	2	1	1	1	1	1	1	1
Average number singing males	10	2.86	1.86	1.29	1.0	1.0	.71	.57	.43	.29	.29	.29	.14	.14	.14	.14
Number breeding pairs/100 ha.	50.0	14.3	9.3	6.5	5.0	5.0	3.6	2.9	2.2	1.5	1.5	1.5	0.7	0.7	0.7	0.7

^a Species without singing males observed on strip; Horned Lark, Mallard, Starling, Violet-Green Swallow, Cliff Swallow, Common Nighthawk, Kestrel, American Goldfinch, Sage Grouse.

^b Additional species observed (off the strip) while running route; Rock Wren, Northern Oriole, Sprague's Pipit.

Table 13. Results of the 1979 breeding bird survey in the sage-grassland vegetation type.

Date	Species (singing males) ^{ab}								
	Western Meadowlark	Lark Bunting	Brewer's Sparrow	Lark Sparrow	Sprague's pipit	Grasshopper Sparrow	Horned Lark	Mourning Dove	Vesper Sparrow
6-4-79	14	6	6	2	0	1	1	0	0
6-5-79	13	6	10	3	1	5	0	1	0
6-8-79	11	16	7	0	0	1	0	1	0
6-9-79	13	11	3	5	0	1	0	0	0
6-10-79	7	9	6	5	0	2	0	2	0
6-17-79	8	0	4	1	0	0	1	1	0
6-19-79	7	6	2	2	1	0	0	2	1
Max. No. Singing Males	14	16	10	5	1	5	1	2	1
Ave. No. Singing Males	10.43	7.71	5.43	2.57	.29	1.43	.29	1.0	.14
No. Breeding Pairs/100 ha.	52.2	38.6	27.2	12.9	1.5	7.2	1.5	5	0.7

^a Species without singing males observed on strip; Common Nighthawk, Brewer's Blackbird, Black-Billed Magpie, Short-Eared Owl, Cliff Swallow, Killdeer.

^b Additional species observed (off the strip) while running route; Clay-Colored Sparrow.

Table 14. Results of the 1980 breeding bird survey in the sage-grassland vegetation type.

Date	Species (singing males) ^{ab}				
	Western Meadowlark	Lark Sparrow	Horned Lark	Brewer's Sparrow	Loggerhead Shrike
5-30-80	9	0	0	0	0
5-31-80	6	2	0	0	0
6- 1-80	7	2	0	0	0
6- 2-80	2	1	1	0	0
6- 3-80	5	1	1	2	0
6- 4-80	5	0	0	0	1
6- 5-80	8	2	1	0	0
Maximum number singing males	9	2	1	2	1
Average Number singing males	6.0	1.14	.43	.29	.14
Number Breeding Pairs/100 ha.	30.0	5.7	2.2	1.5	0.7

^a Species without singing males observed on strip; Lark Bunting, Brown-Headed Cowbird, Mourning Dove, Killdeer, Black-Billed Magpie, Red-Winged Blackbird.

^b Additional species observed (off the strip) while running route; Rock Wren, Ring-Necked Pheasant, Canada Goose.

Table 15. Results of the 1979 breeding bird survey in the grassland vegetation type.

Date	Species (singing males) ^{ab}					
	Western Meadowlark	Horned Lark	Grasshopper Sparrow	Sprague's Pipit	Chestnut Collared Longspur	Lark Sparrow
6-21-79	4	4	4	1	4	0
6-22-79	7	4	5	6	5	0
6-23-79	5	6	12	4	3	0
6-26-79	8	13	10	2	6	1
6-27-79	9	4	9	2	5	2
6-28-79	3	5	4	1	3	0
7- 2-79	5	13	4	1	2	0
Maximum Number Singing Males	9	13	12	6	6	2
Average Number Singing Males	5.86	7.0	6.86	2.43	4.0	.43
Number Breeding Pairs/100 ha.	29.3	35	34.3	12.2	20	2.2

^a Species without singing males observed on strip; Brewer's Blackbird, Lark Bunting.

^b Additional species observed (off the strip) while running route; Killdeer, Upland Sandpiper.

Table 16. Results of the 1980 breeding bird survey in the grassland vegetation type.

Date	Species (singing males) ^{ab}							
	Horned Lark	Western Meadowlark	Chestnut-Collared Longspur	Grasshopper Sparrow	Brewer's Sparrow	Lark Sparrow	Vesper Sparrow	Brewer's Blackbird
6-10-80	8	5	2	0	0	0	0	1
6-17-80	9	4	2	0	0	0	0	0
6-18-80	9	2	0	0	1	0	1	0
6-19-80	7	3	0	1	0	0	0	0
6-20-80	7	2	0	1	1	1	0	0
6-24-80	6	3	0	0	0	0	0	0
6-25-80	7	3	0	0	0	0	0	0
Maximum Number Singing Males	9	5	2	1	1	1	1	1
Average Number Singing Males	7.57	3.14	.57	.29	.29	.14	.14	.14
Number Breeding Pairs/100 ha.	37.9	15.7	2.9	1.5	1.5	0.7	0.7	0.7

^a Species without singing males observed on strip; Cliff Swallow, Killdeer.

^b Additional species observed (off the strip) while running route; Long-Billed Curlew, Common Crow, Kestrel, Brown-Headed Cowbird.

Table 17. Results of the 1979 breeding bird survey in the badlands vegetation type.

Date	Species (singing males) ^a					
	Western Meadowlark	Rock Wren	Lark Sparrow	Mourning Dove	Say's Pheobe	Loggerhead Shrike
6-23-79	17	2	3	1	0	0
6-26-79	5	2	1	1	1	1
6-27-79	7	0	4	0	1	1
6-28-79	9	3	7	1	0	0
6-29-79	4	2	5	1	0	1
7- 2-79	9	3	4	1	0	0
7- 7-79	2	2	3	1	0	1
Maximum Number Singing Males	17	3	7	1	1	1
Average Number Singing Males	7.57	2.0	3.86	.86	.29	.57
Number Breeding Pairs/100 ha.	37.9	10.0	19.3	4.3	1.5	2.9

^a Species without singing males observed on strip; Brewer's Blackbird, Black-Billed Magpie, Common Nighthawk, Brown Thrasher, American Goldfinch.

Table 18. Results of the 1980 breeding bird survey in the badlands vegetation type.

Date	Species (singing males) ^{ab}					
	Western Meadowlark	Lark Sparrow	Rock Wren	Mourning Dove	Say's Phoebe	Loggerhead Shrike
6-10-80	2	2	2	1	1	1
6-17-80	5	2	1	1	0	0
6-18-80	7	3	2	0	1	1
6-19-80	5	3	0	0	2	1
6-20-80	5	3	0	2	0	0
6-24-80	2	2	1	1	0	0
6-25-80	4	2	0	0	0	1
Maximum Number Singing Males	7	3	2	2	2	1
Average Number Singing Males	4.29	2.43	.86	.71	.57	.57
Number Breeding Pairs/100 ha.	21.5	12.2	4.3	3.6	2.9	2.9

^a Species without singing males observed on strip; Brewer's Blackbird, Kestrel, Red-Winged Blackbird.

^b Additional species observed (off the strip) while running route; Common Nighthawk, Ring-Necked Pheasant, Black-Billed Magpie.

Table 19. Exact locations of breeding bird and small mammal lines.

Breeding Bird Lines

Sage-grassland	T10NR48E	start Sec. 13NW $\frac{1}{4}$	end Sec. 12NW $\frac{1}{4}$
Grassland	T13NR48E	start Sec. 32NE $\frac{1}{4}$	end Sec. 28NE $\frac{1}{4}$
Badlands	T12NR51E	start Sec. 5SE $\frac{1}{4}$	end Sec. 6SE $\frac{1}{4}$
Creek	T11NR49E	start Sec. 16NW $\frac{1}{4}$	end Sec. 8NE $\frac{1}{4}$

Summer Small Mammal Lines

	<u>Line #1</u>	<u>Line #2</u>
Sage-grassland	T10NR48ES13NW $\frac{1}{4}$	T10NR48ES12SW $\frac{1}{4}$
Grassland	T13NR48ES32NE $\frac{1}{4}$	T13NR48ES29SE $\frac{1}{4}$
Badlands	T12NR51ES5SE $\frac{1}{4}$	T12NR51ES5NW $\frac{1}{4}$
Creek	T11NR49ES22NE $\frac{1}{4}$	T11NR49ES9SW $\frac{1}{4}$
Ponderosa Pine Badland	T13NR50ES34SW $\frac{1}{4}$	
Limber Pine Badland	T12NR49ES5SW $\frac{1}{4}$	
Grassland Coulees	T13NR48ES32SE $\frac{1}{4}$	

Fall Small Mammal Lines

Sage-grassland	T10NR49ES5SE $\frac{1}{4}$
Grassland	T13NR49ES12SW $\frac{1}{4}$
Badlands	T13NR50ES34SW $\frac{1}{4}$
Creek	T10NR48ES10NE $\frac{1}{4}$

Table 20. Exact location and status of all known raptor nests on the study area in 1979.

Species	Location	Status	Nest Structure
Red-Tailed Hawk	T13NR48ES11SE $\frac{1}{4}$	Active 1+ young	Cottonwood tree
	T13NR48ES12SE $\frac{1}{4}$	Active 1+ young	Cottonwood tree
	T13NR49ES17NW $\frac{1}{4}$	Active 1+ young	Cottonwood tree
	T13NR49ES14SW $\frac{1}{4}$	Active 2+ young	Cottonwood tree
	T12NR50ES22NW $\frac{1}{4}$	Active 1+ young	Cottonwood tree
	T11NR49ES5SE $\frac{1}{4}$	Active 1+ young	Cottonwood tree
	T12NR48ES35SE $\frac{1}{4}$	Active 1+ young	Cottonwood tree
	T11NR48ES29NW $\frac{1}{4}$	Active, presence of young unknown	Cottonwood tree
Great Horned Owl	T13NR48ES11SE $\frac{1}{4}$	Active 2 young	Cavity in cottonwood
	T12NR50ES28NW $\frac{1}{4}$	Active 1+ young	Sandstone outcrop
	T12NR49ES36NW $\frac{1}{4}$	Active 3 young	Sandstone outcrop
	T13NR48ES32SE $\frac{1}{4}$	Active 3 young	Sandstone ledge in grassland coulee
	T11NR49ES16NW $\frac{1}{4}$	Active 1+ young	Sandstone outcrop
	T11NR48ES2NE $\frac{1}{4}$	Active 1 young	Old red-tailed nest in cottonwood
	T10NR49ES30NW $\frac{1}{4}$	Active 3 young	Abandoned building
Golden Eagle	T12NR50ES1NW $\frac{1}{4}$	Active 1 young	Cliff
	T11NR49ES23SW $\frac{1}{4}$	Active 1 young	Cliff-portion of cliff with nest broke away in October
	T10NR49ES4NW $\frac{1}{4}$	Nest found after young had fledged	Cliff
Prairie Falcon	T13NR49ES26SE $\frac{1}{4}$	Active 2+ young	Cavity in sandstone outcrop
	T11NR48ES25NW $\frac{1}{4}$	Active 2+ young	Cavity in sandstone outcrop
American Kestrel	T13NR49ES14SW $\frac{1}{4}$	Active	Cavity in cottonwood
	T12NR50ES22SE $\frac{1}{4}$	Active	Cavity in cottonwood
Inactive	T13NR50ES26NE $\frac{1}{4}$	Probably red-tailed hawk	Cottonwood tree
	T11NR49ES15SW $\frac{1}{4}$		Cottonwood tree
	T11NR48ES23SE $\frac{1}{4}$	Probably golden eagle	Sandstone pinnacle
	T11NR48ES32SE $\frac{1}{4}$	Probably red-tailed hawk	Cottonwood tree
	T10NR48ES4NW $\frac{1}{4}$	Golden eagle	Cliff
Unknown	T13NR49ES15NW $\frac{1}{4}$		Cottonwood tree
	T13NR50ES19NW $\frac{1}{4}$		Cottonwood tree
	T12NR51ES8SW $\frac{1}{4}$		Cottonwood tree
	T12NR50ES13NW $\frac{1}{4}$		Cottonwood tree
	T12NR48ES26SW $\frac{1}{4}$	Probably red-tailed hawk	Cottonwood tree
	T12NR48ES26NW $\frac{1}{4}$	Probably red-tailed hawk	Cottonwood tree
	T12NR48ES22SE $\frac{1}{4}$	Probably red-tailed hawk	Cottonwood tree
	T12NR48ES28SE $\frac{1}{4}$		Cottonwood tree
	T12NR48ES30NE $\frac{1}{4}$		Cottonwood tree

Table 21. Exact location and status of all known raptor nests on the study area in 1980.

Species	Location	Status	Nest Structure
Red-Tailed Hawk	T11NR48ES16SE $\frac{1}{4}$	Active	Cottonwood tree
	T11NR48ES6SE $\frac{1}{4}$	Active	Cottonwood tree
	T12NR48ES30NE $\frac{1}{4}$	Active	Cottonwood tree
	T12NR48ES26SW $\frac{1}{4}$	Active	Cottonwood tree
	T12NR48ES22SE $\frac{1}{4}$	Active, then abandoned	Cottonwood tree
	T11NR50ES4SW $\frac{1}{4}$	Active	Cottonwood tree
	T12NR50ES13NW $\frac{1}{4}$	Active	Cottonwood tree
	T12NR51ES8SW $\frac{1}{4}$	Active	Cottonwood tree
	T13NR50ES19NW $\frac{1}{4}$	Active	Cottonwood tree
	T13NR49ES14SW $\frac{1}{4}$	Active	Cottonwood tree
	T13NR49ES17NW $\frac{1}{4}$	Active	Cottonwood tree
	T13NR48ES11SE $\frac{1}{4}$	Active	Cottonwood tree
	T13NR48ES12SE $\frac{1}{4}$	Active, displaced Great Horned Owls which had occupied the nest	Cottonwood tree
Great Horned Owl	T10NR49ES30NW $\frac{1}{4}$	Active 3 young fledged	Abandoned building
	T11NR48ES36NW $\frac{1}{4}$	Active	Abandoned red-tailed nest in cottonwood
	T11NR49ES16NW $\frac{1}{4}$	Active 1+ young	Sandstone outcrop
	T11NR49ES7NE $\frac{1}{4}$	Active	Abandoned red-tailed nest in cottonwood
	T11NR48ES2NE $\frac{1}{4}$	Active 1+ young	Abandoned red-tailed nest in cottonwood
	T12NR50ES28NW $\frac{1}{4}$	Active	Sandstone outcrop
Golden Eagle	T11NR48ES32SE $\frac{1}{4}$	Occupied inactive	Cottonwood tree
	T11NR48ES23SE $\frac{1}{4}$	Active	Sandstone pinnacle
	T10NR49ES4NW $\frac{1}{4}$	Active 1 young fledged	Cliff
	T12NR50ES1NW $\frac{1}{4}$	Occupied inactive	Cliff
Prairie Falcon	T10NR48ES22NE $\frac{1}{4}$	Active	Cavity in sandstone outcropping
	T11NR48ES25NW $\frac{1}{4}$	Active	Cavity in sandstone outcropping
	T11NR49ES30NW $\frac{1}{4}$	Active	Cavity in sandstone outcropping
	T12NR48ES3SE $\frac{1}{4}$	Probably active, nest located after young fledged	Cavity in sandstone outcropping
	T12NR49ES5SW $\frac{1}{4}$	Active 5 young fledged	Cavity in scoria outcrop
	T12NR49ES28NE $\frac{1}{4}$	Active	Cavity in sandstone outcrop
	T12NR51ES7SW $\frac{1}{4}$	Active	Cavity in cliff
	T13NR49ES26SE $\frac{1}{4}$	Active 1+ young	Cavity in sandstone pinnacle

Table 21. Continued.

Species	Location	Status	Nest Structure
American Kestrel	T10NR49ES19SW $\frac{1}{4}$	Active	Cavity in cotton-wood tree
	T11NR48ES2NE $\frac{1}{4}$	Active	Cavity in cotton-wood tree
	T12NR50ES22SE $\frac{1}{4}$	Active	Cavity in cotton-wood tree
Burrowing Owl	T11NR49ES25NW $\frac{1}{4}$	Active	Prairie dog burrow
	T11NR48ES12SE $\frac{1}{4}$	Active	Prairie dog burrow
Ferruginous Hawk	T13NR48ES34SW $\frac{1}{4}$	Active	Scoria butte
Merlin	T13NR49ES36NW $\frac{1}{4}$	Actual nest not located	
Inactive	T10NR48ES13SW $\frac{1}{4}$		Cliff
	T10NR48ES4NW $\frac{1}{4}$	Golden Eagle	Cliff
	T11NR48ES29NW $\frac{1}{4}$	Red-Tailed Hawk	Cottonwood tree
	T10NR49ES17NW $\frac{1}{4}$	Probably Red-Tailed Hawk	Cottonwood tree
	T11NR49ES15SW $\frac{1}{4}$		Cottonwood tree
	T11NR49ES5SE $\frac{1}{4}$	Red-Tailed Hawk	Cottonwood tree
	T11NR49ES6SE $\frac{1}{4}$	Probably Red-Tailed Hawk	Cottonwood tree
	T12NR48ES35SE $\frac{1}{4}$	Red-Tailed Hawk	Cottonwood tree
	T12NR48ES34NW $\frac{1}{4}$	Probably Red-Tailed Hawk	Cottonwood tree
	T12NR48ES28SE $\frac{1}{4}$	Probably Red-Tailed Hawk	Cottonwood tree
	T12NR48ES26NW $\frac{1}{4}$	Probably Red-Tailed Hawk	Cottonwood tree
	T12NR48ES15SW $\frac{1}{4}$	Probably Red-Tailed Hawk	Cottonwood tree
	T12NR48ES3NE $\frac{1}{4}$	Ferruginous Hawk (active 1977)	Sandstone butte
	T13NR48ES34SE $\frac{1}{4}$	Ferruginous Hawk	Scoria butte
	T12NR49ES5SE $\frac{1}{4}$	Golden Eagle	Limber pine
	T12NR50ES14SE $\frac{1}{4}$	Probably Red-Tailed Hawk	Cottonwood tree
	T12NR51ES8NE $\frac{1}{4}$	Possibly used by Great Horned Owl in early spring	Cottonwood tree
	T13NR50ES26NE $\frac{1}{4}$	Probably Red-Tailed Hawk	Cottonwood tree
	T13NR50ES23SW $\frac{1}{4}$	Probably Red-Tailed Hawk	Cottonwood tree
	T13NR49ES15NW $\frac{1}{4}$	Probably Red-Tailed Hawk	Cottonwood tree

Table 22. QUESTIONNAIRE.

1. List your order of preference for the land uses listed below.
  - ____ A. Existing land use (i.e. grazing, ranching).
  - ____ B. Future energy developments (coal mines, oil wells, etc.)
  - ____ C. Wilderness designation (for that portion of the area from Custer Creek east to Terry).
2. How would you feel about wilderness designation for the area if you would still be allowed to maintain and use existing roads, wells, fences, etc.
3. What are your feelings about nongame wildlife (i.e. songbirds, hawks, snakes, mice, etc.). Do you enjoy them, feel indifferent, etc.
4. What are your feelings on prairie dogs? What level (how many acres) of dog towns would you tolerate on your ranch (none, 300 acres, 1 section, etc.)
5. Would you support programs to enhance and/or maintain certain species of nongame wildlife on your ranch and if so under what conditions?
6. What are your feelings with regard to recreational users of you ranch and how many users would be a tolerable level (i.e. none, 20 or more per year, etc.).
7. What are your feelings toward endangered species (black footed ferret, bald eagles, peregrine falcon)? Would you like to see them protected? And would you be willing to give up some existing practices to save them?

Table 22. Continued.

8. If active energy developments were initiated, what restrictions would you like to see placed on such developments.
9. The following space is provided for any additional comments or suggestions you may have regarding the Terry Badlands nongame survey.

Thank you very much for your cooperation and ideas.