RAPTOR INVENTORY OF COAL AREAS

IN WESTERN NORTH DAKOTA

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INTRODUCTION

The general purpose of this study was to gather wildlife resource data to be used in the Bureau of Land Management planning process for future energy development activities in western North Dakota. Principal emphasis was placed on locating and identifying the nesting sites of raptors which are specifically recognized by the Fish and Wildlife Service as "birds of high federal interest" in the coal unsuitability criteria. The primary species considered in this survey were the golden eagle (Aquila chrysaetos), ferruginous hawk (Buteo regalis), prairie falcon (Falco mexicanus), burrowing owl (Athene cunicularia), and merlin (Falco columbarius). In addition, miscellaneous wildlife observations on species that were of special interest to the state and federal governments were recorded.

Although raptor populations had previously been sampled in western North Dakota, none of the workers had attempted to census such a large block of land. Also, most of the previous census work was conducted on the federal lands, including the Little Missouri Grasslands and Theodore Roosevelt National Park. Little survey work had been conducted on the private lands adjacent to the large federal holdings.

Stewart and Kantrud (1972, 1973) and Stewart (1975) documented general distribution of raptors in North Dakota. More recently, Seabloom et al. (1978) sampled bird populations in western North Dakota. The only intensive raptor study was conducted by Postovit (1979) on a small portion of the Little Missouri Badlands in Dunn County. The above reports formed the foundation for this study. The major difference between this project and the other raptor studies mentioned above is that we attempted

to census a large study area rather than a sample portion of it. Specific objectives of this study were: (1) to locate and identify raptor nests and describe raptor habitat for the concerned species within the prescribed study area, and (2) to record incidental observations of high interest species and associated habitats, e.g., prairie dog (Cynomys ludovicianus) towns, elk (Cervus canadensis), and bighorn sheep (Ovis canadensis) within the study area. These miscellaneous wildlife observations are provided as a supplement to this report.

The Bismarck Field Office of the U.S. Fish and Wildlife Service is the repository for the raw data and site specific information. Any request for this data should be directed to this office.

Many individuals contributed their skills to make this project a success. Bob Twist, Lee Metcalf National Wildlife Refuge, was invaluable as both an experienced pilot and wildlife biologist. Pilots Tom Baker, Dayton Burholder, and Dean Warinner from Dickinson Air Service provided excellent service. Brian Stotts, U.S. Forest Service, guided us through unfamiliar territory. John Squires did the initial ground work and aerial surveys. Marv Hoffer, Bureau of Land Management, provided maps, nest locations, and prairie dog town locations. We would like to thank the staff of Theodore Roosevelt National Park - North Unit for providing us with a base camp and warm hospitality. Stan Anderson and Jonnie Hoggan of the Wyoming Cooperative Fishery and Wildlife Unit were extemely helpful in coordinating the project through the University of Wyoming. We thank Pam Nagel, Sheridan Field Station, for her patience in assembling and typing this report. The U.S. Fish and Wildlife Service - Coal Operations was the funding source for this project. Roger Collins, Energy/Coal Coordinator was the project officer.

THE STUDY AREA

Our study area comprised 22,274 km^2 (8,590 mi^2) (171 USGS 7.5 minute quads) of western North Dakota (Fig. 1). The area was subdivided into 5 geographic units which we identified as: McKenzie-Williams, Bennie Pierre, Dickinson Addition, Southwest, and Little Missouri River Breaks (Fig. 2). A listing of the quad maps comprising each unit is provided in Appendix A.

The McKenzie-Williams unit is topographically diverse covering 7,138 km^2 (2,753 mi^2) within Williams and McKenzie counties. The northern most part of Williams county represents the prairie pothole region. The prairie pothole region is of glacial origin, and is characterized by flat expanses of glacial till dotted with small permanent prairie ponds and lakes. This area is primarily agricultural land; a few stands of trees cover less than 1% of the region (Stewart 1975). Trees that could be utilized by raptors for nesting are limited to hedgerows and windbreaks on farms, and to narrow rings encircling prairie or cropland ponds.

The remainder of the McKenzie-Williams unit contains Lake Sakakawea (Garrison Reservoir) and the Missouri River Breaks. The Badlands Community Complex dominates the entire area and is composed of sandstone cliffs, glacial till cut banks (Lake Sakakawea), and badly erroded clay-scoria slopes vegetated with scattered low shrubs. Principal shrub species include creeping juniper (Juniperus horizontalis) and silver sage (Artemisia cana). Rocky mountain juniper (J. scopulorum) is the most common tree, but ponderosa pine (Pinus ponderosa) is also present.

Besides the badlands, there are a number of prominant buttes within the McKenzie-Williams unit including Chimney, Table Rock, and Blue Buttes.

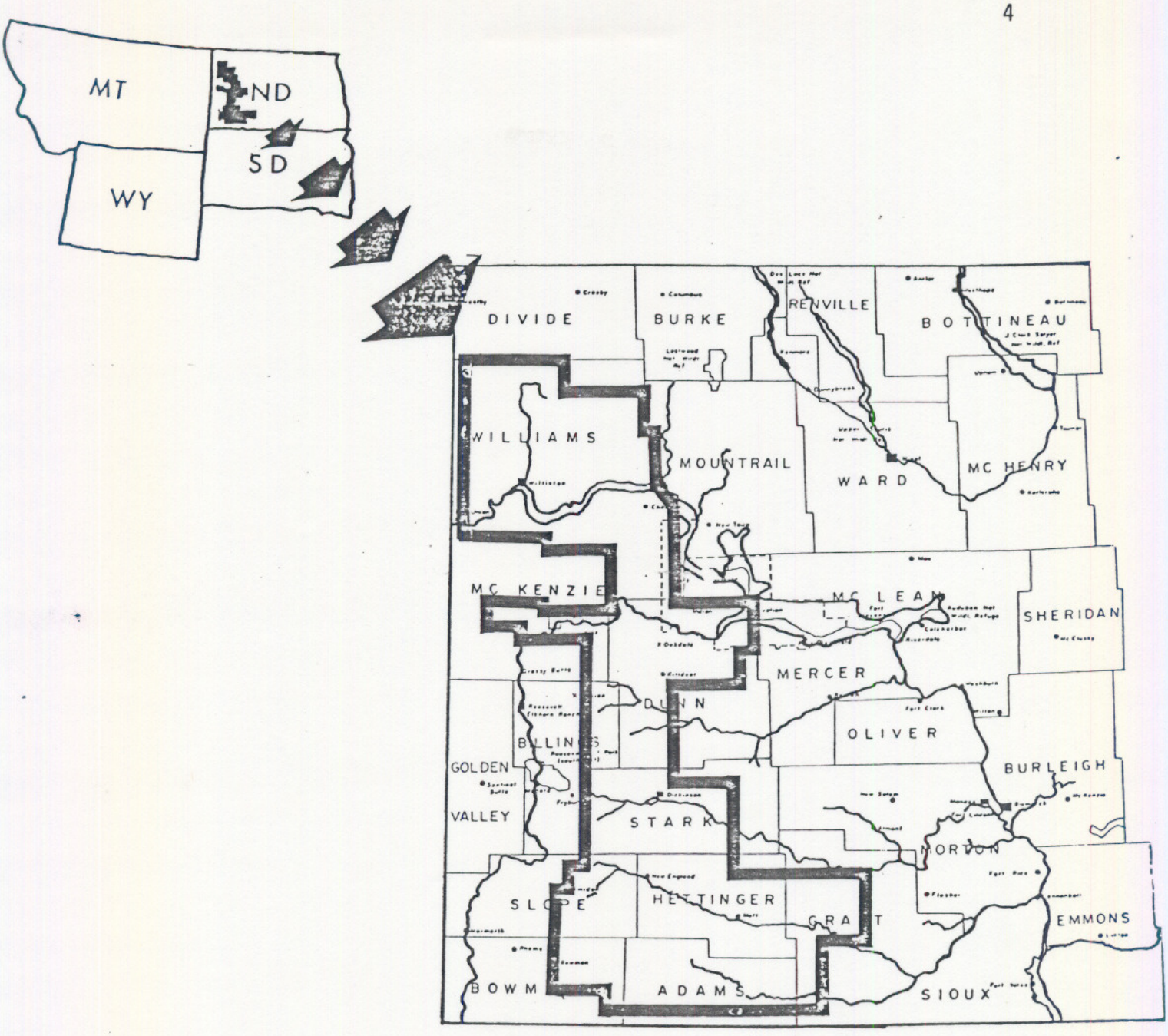


Figure 1. North Dakota raptor inventory area.

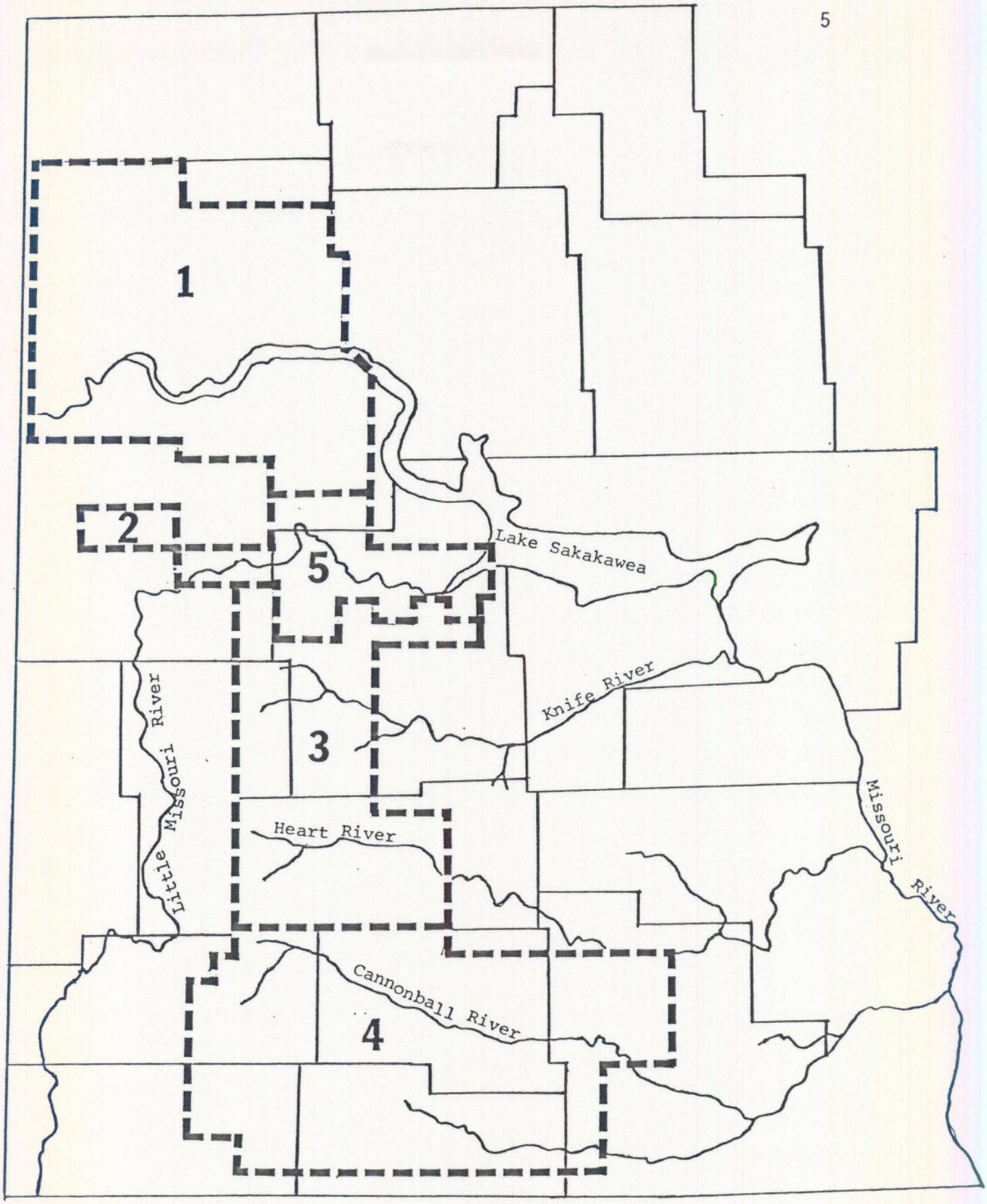


Figure 2. North Dakota raptor inventory area delineated into geographic units.

1. McKenzie-Williams; 2. Bennie Pierre; 3. Dickinson Addition;

4. Southwest; 5. Little Missouri River and Breaks

The Bennie Pierre unit was the smallest segment of the study area comprising only 392 km^2 (151 mi^2), all within McKenzie county. The area is characterized by rolling mixed-grass prairie interspersed among sandstone and scoria capped buttes and ridges. Sparse riparian vegetation is found along Horse Creek and the west branch of Charbonneau Creek. Cottonwood (Populus spp.) is the dominant tree.

The Dickinson Addition encompasses 4,447 km^2 (1,715 mi^2) of McKenzie, Dunn, Billings, and Stark counties. Mixed-grass prairie surrounds isolated buttes such as Rattlesnake and White Butte. Within Stark county, erosion of shale and sandstone outcrops (USDA 1968) has created a series of breaks called the Little Badlands. These Badlands are a prominent land form within an expanse of cultivated land. Most of the area is used for agricultural purposes including livestock grazing and the production of hay and wheat. Deciduous tree species dominated by cottonwood occupy drainages along Antelope Creek and the Heart, Knife, and Green Rivers.

The Southwest unit is the largest within the study area, totaling 8,073 km^2 (3,113 mi^2). The smooth rolling landscape includes parts of Stark, Slope, Hettinger, Bowman, Grant, and Adams counties. Soils throughout the unit are fertile resulting in large areas of cultivated land. In the southwest portion of the unit, ridges and small buttes have a cover of pseudoquartizite (chert) boulders, which protect the underlying sediment from erosion (Bluemle 1977). Mixed-grass prairie is interspersed among the cultivated fields and pastures. Scattered throughout the unit are sandstone, chert, and scoria capped buttes. Among the major buttes are the Rainy, Chalky, Pearl, Long, and Black Buttes. Cottonwoods, ashes (Fraxinus spp.), and elms (Ulmus spp.) border drainages such as the Cannonball River, Antelope Creek, and Cedar Creek.

The Little Missouri River Breaks unit comprises 2,224 km^2 (858 mi^2) from Red Wing Creek up the Little Missouri River to Lake Sakakawea. This region of McKenzie and Dunn counties displays a heterogenous array of habitats. The Badlands Community Complex discussed earlier is the predominent habitat type. Some larger tracts of western upland deciduous forest are found in the area. One example is a tract of several hundred acres located in the Killdeer Mountains in northwestern Dunn county. Bur oak (Quercus macrocarpa) and green ash (Fraxinus pennsylvanica) are the dominant species. The Killdeer Mountains also are an example of a limestone capped butte, providing a stable substrate for raptor nests. Dense stands of cottonwoods dominate the flood plain along the Little Missouri River, Red Wing Creek, and other major drainages. Cottonwoods become more widely spaced in the smaller drainages supporting riparian habitat. Mixed-grass prairies are intermingled with badlands community and riparian habitats. On upper slopes and summits of dry ridges and buttes, remnants of the short-grass prairie exist (Stewart 1975).

METHODS

Field work on this study began in early March and terminated in mid-July 1982. Most of the survey work for eagles, ferruginous hawks, and prairie falcons was accomplished using several types of fixed-wing aircraft, including a Cessna 172, 177, 182, 206, and 210. All flights were made with 2 observers in the aircraft. Raptor nesting habitat was systematically flown at an altitude generally less than 200'. Agricultural lands were flown at a somewhat higher altitude, approximately 500' - 750'. Some areas with diverse and rugged terrain were repeatedly surveyed until

we were satisfied the census was complete. Areas with deciduous trees were flown prior to leaf-out. In addition, a few "test areas" were ground checked to determine the accuracy of the aerial work. The estimated number of breeding pairs occupying a survey unit was the basis for determining densities of golden eagles in a particular area. However, ferruginous hawk densities were based on the distance to the closest neighboring occupied nest following the procedure described by Ratcliffe (1962). A sample of active nests was later revisited to gather productivity data. Productivity terminology and calculations used in this report follow the procedures outlined by Postupalsky (1974).

Burrowing owls were located by scanning with binoculars and walking 76% of the reported black-tailed prairie dog towns on the study area. Due to time constraints, surveys of prairie dog towns occurred before burrowing owl young emerged above ground. Therefore, burrow entrance characteristics were utilized as our criteria for determing active burrowing owl nests. Burrowing owls characteristically line the burrow entrance, tunnel, and nest cavity with shreds of dried cow and horse dung, grass, feathers, or portions of prey items (Zarn 1974). Prairie dog burrows were systematically searched for fresh burrowing owl sign. When a burrow entrance exhibited the characteristic nest debris as well as fresh pellets, droppings, feathers, and prey remains, it was considered an active nest.

All raptor nest sites were plotted on 1:24,000 quad maps. Fish and Wildlife Service and North Dakota Game and Fish Department record cards were completed for each nest location (Appendix B).

Nest site characteristics including exposure and position of the nest on the substrate were recorded. We assumed that equal numbers of

sites were available for all aspects. Cliffs and hills used as nesting sites by raptors were vertically stratified into quarter sections (Fig. 3) to determine if a particular portion of the substrate was selected for nesting. Chi-square tests were utilized for all statistical comparisons mentioned in this report. The 0.05 level of significance was used.

Our limited data allowed estimation of the nesting periods for the species being censused. The majority of our data came from a few individual nests that were monitored during the course of periodic aerial surveys. Incidental observations on the breeding chronology of other raptors also were recorded.

RESULTS AND DISCUSSION

Abundance and General Distribution of Raptor Nests

Golden Eagles. A total of 124 nests representing 46 golden eagle territories were found on the study area (Table 1). Only 25 of these nests were occupied in 1982. Many inactive nests were in close proximity to active nests and therefore, were assumed to be alternates. In some cases we located several inactive nests without finding an active site. These situations either represented vacant eagle territories, or some active nests were missed during the survey.

Golden eagles usually have a number of alternate nests, ranging from 1 to 14, although 2 to 3 is the usual number (Snow 1973). Some eagles use the same nest in consecutive years for laying their eggs and repair alternate nests, while other eagles use alternate nests in alternate years (Boeker and

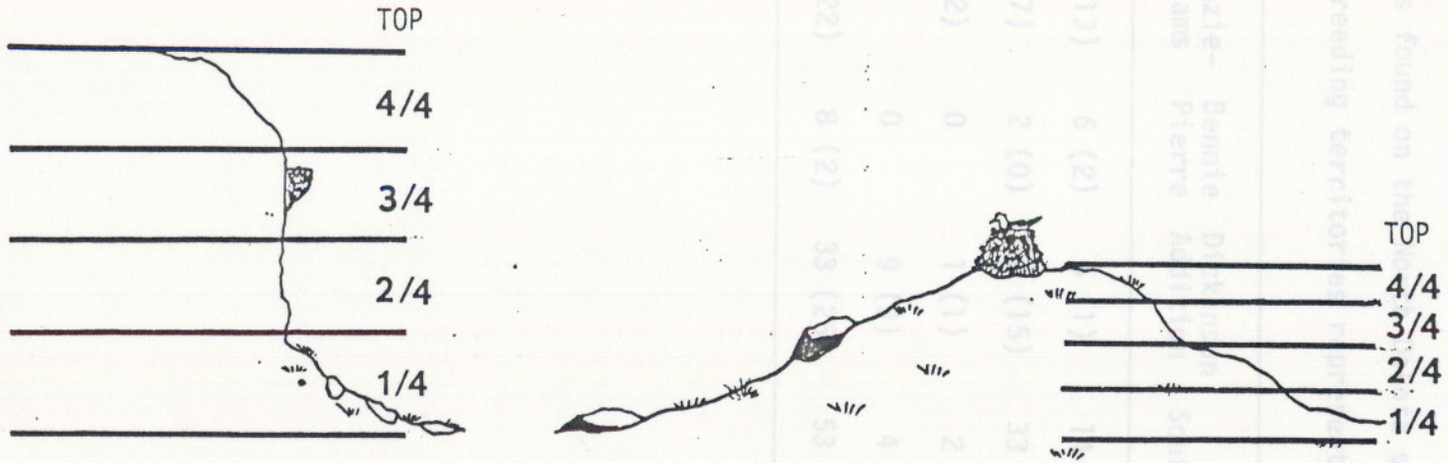


Figure 3. Substrate quarter sections for raptor nests located on the study area.

Ray 1971). In several cases we found 1 active nest surrounded by 3 alternate nests. This occurred most frequently where eagles were nesting on cliffs along Lake Sakakawea and the Little Missouri River, and on isolated buttes in the Bennie Pierre unit and western portion of the Southwest unit. Few alternate nests were found in the areas where nesting occurred in trees.

The most abundant golden eagle nesting habitat was located along the western portion of the Southwest area, the Little Missouri River, and Lake Sakakawea (Figs. 4, 5, and 6). The Little Missouri Breaks had the highest eagle density on the study area (1 pair/171 km^2) (66 mi^2). However, this density was generally lower than nest densities that have been reported by other researchers (Table 2). Within this survey unit, the mean distance between adjacent active nests was 4.2 km (2.6 mi). Stewart (1975) stated that nesting golden eagles were rare in most portions of the McKenzie-Williams area; however, we found several eagle nests inland from Lake Sakakawea (150 m to 11 km) (0.99 mi to 6.8 mi). The density for this unit was 1 pair/714 km^2 (275 mi^2).

Only 4 eagle pairs were found in the western portion of the Southwest area (1 pair/2,691 km^2) (1,038 mi^2). Unlike the 2 northern areas, golden eagle populations in this area appeared to be limited by agricultural disturbance. This area is predominantly flat open farmland that is bisected by several drainages. These drainages are bordered by hardwood trees which are suitable nesting sites for golden eagles. However, because of the intensive cultivation of land that was formerly rangeland, wheatfields now border the streambanks. These habitats were devoid of eagle nests. In a similar habitat type in northeastern Wyoming, where ranching rather than farming is the dominant land use, eagles typically nest in fairly high densities (Phillips and Beske 1982).

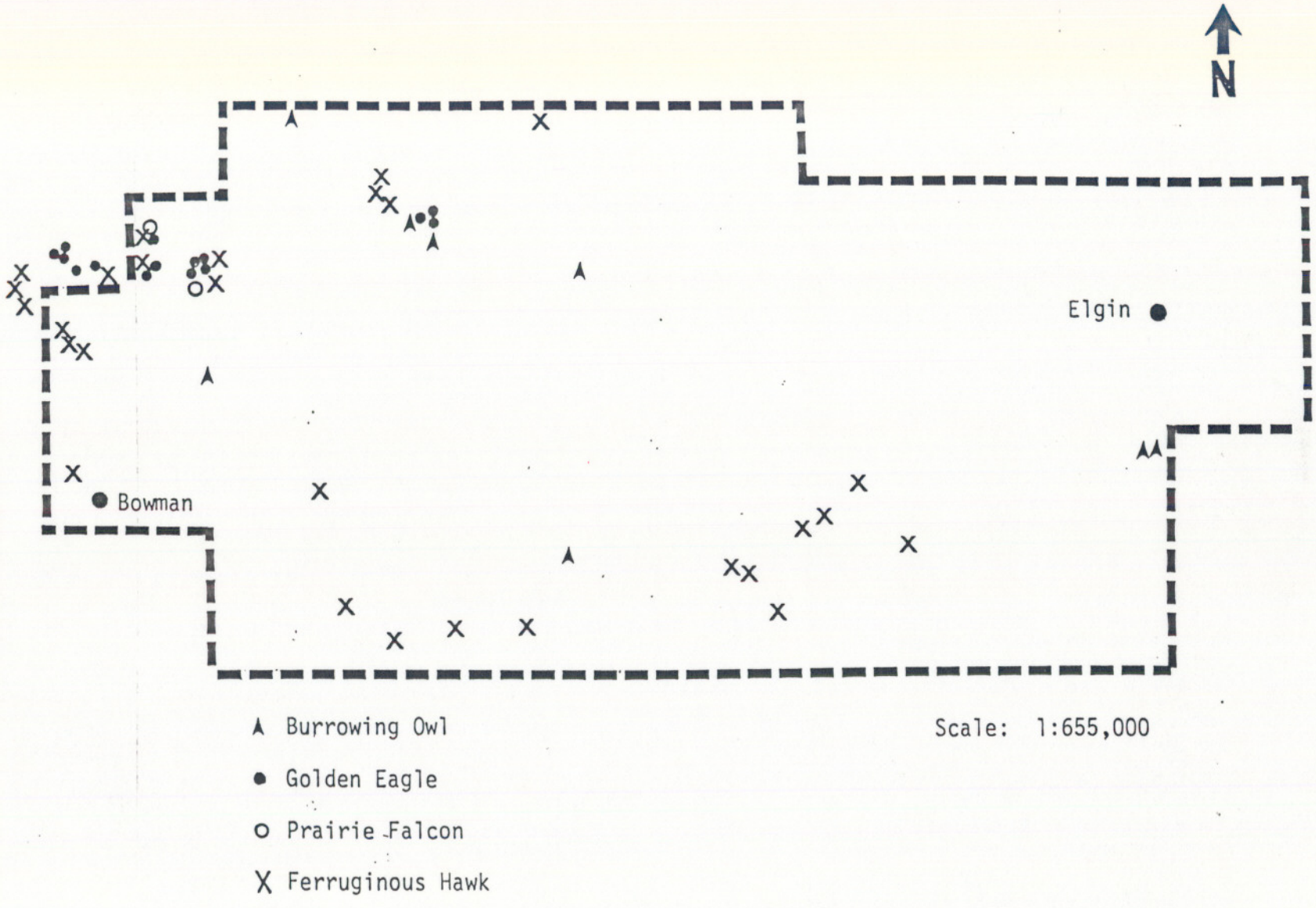
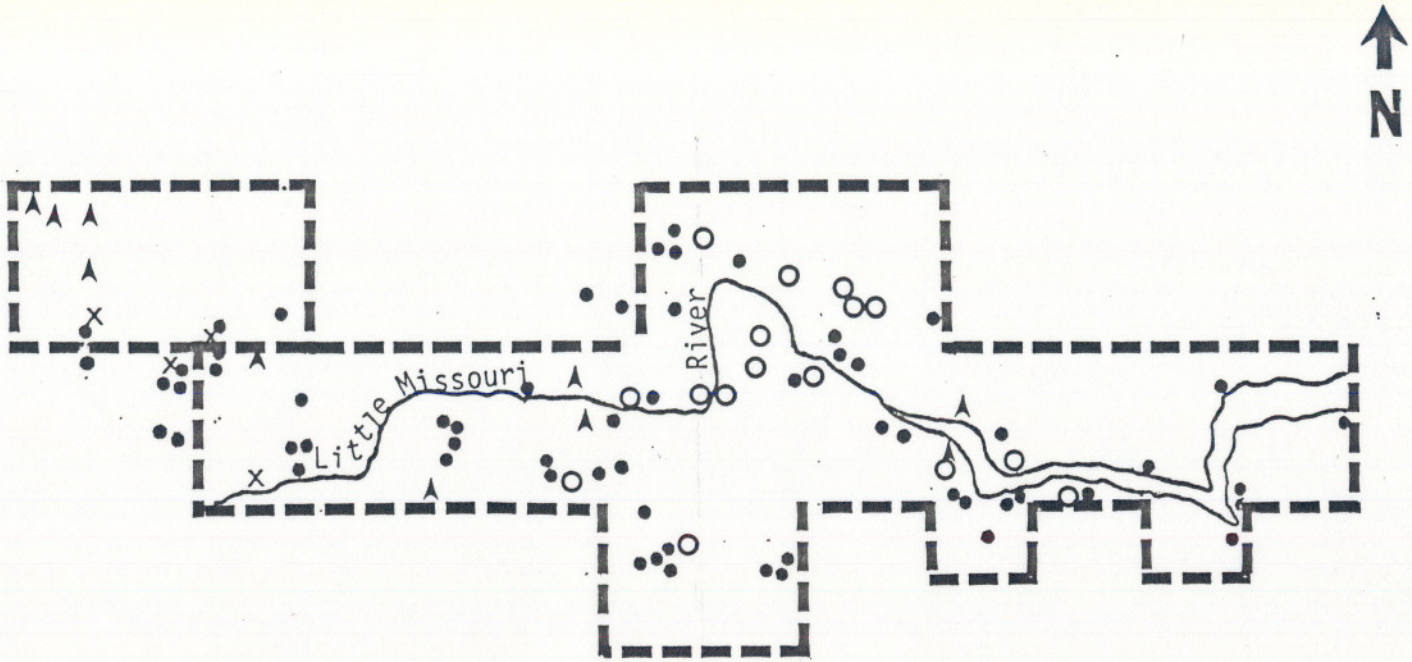


Figure 4. Distribution of raptor nest sites in the Southwest coal area.



▲ Burrowing Owl

● Golden Eagle

○ Prairie Falcon

X Ferruginous Hawk

Scale: 1:655,000

Figure 5. Distribution of raptor nest sites in the Bennie Pierre and Missouri River Breaks area.

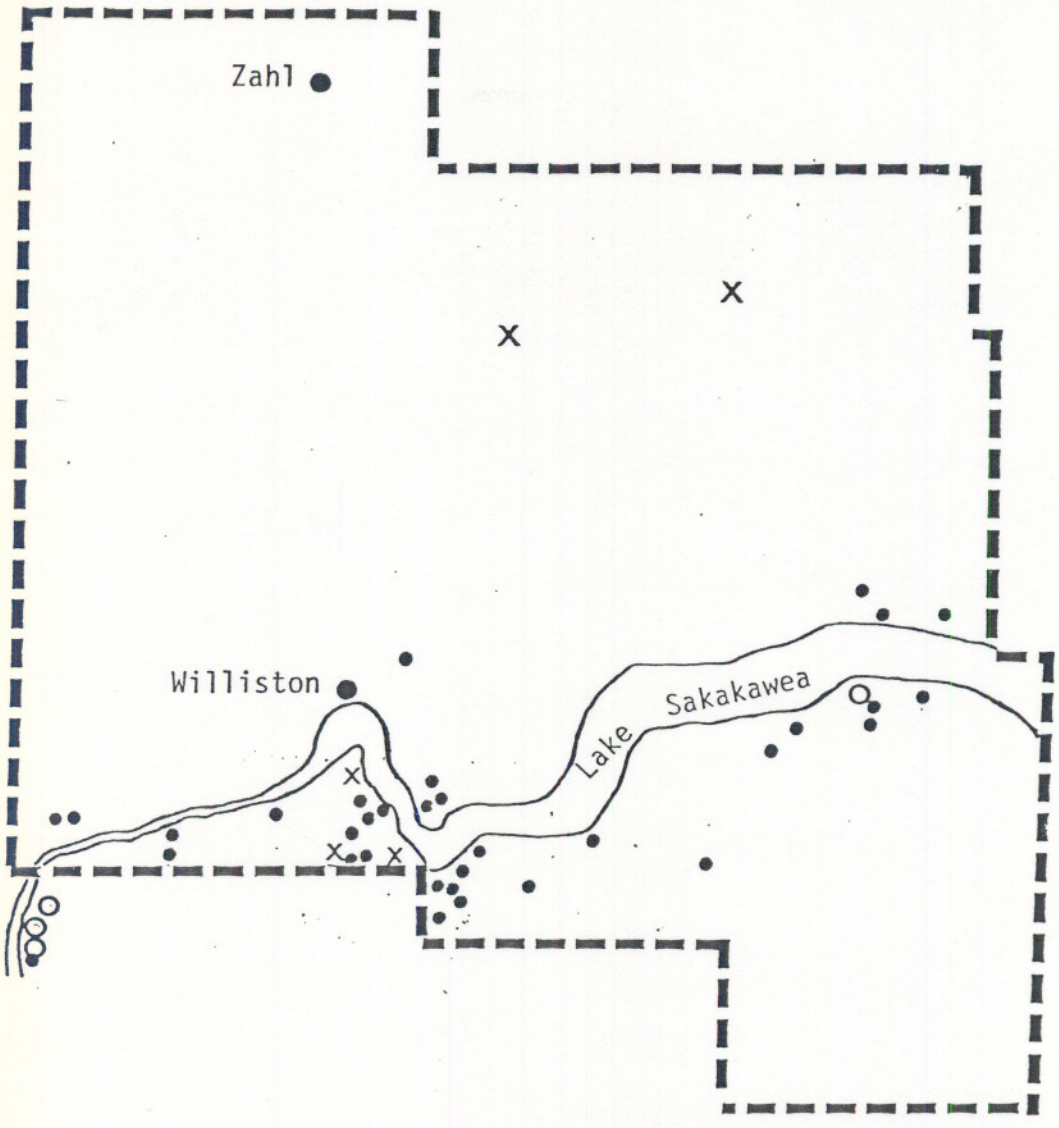


Figure 6. Distribution of raptor nest sites in the McKenzie-Williams coal area.

Table 2. A comparison of golden eagle nesting densities in various regions.

Location	Source	Habitat Description	Density* Index
Northern Colorado	Arnold (1964)	Grassland	93
California	Dixon (1937)	Mountain Foothills	93
Southern Wyoming	FWS Unpublished Data	Sagebrush/rimrock	49
South Central Montana	Reynolds (1966)	Mountain Foothills	142
Scotland	Lockie (1964)	Moorland	57
Scotland	Watson (1957)	Moorland	41
Campbell County Wyoming	FWS Unpublished Data	Sagebrush/grassland w/scatterd ponderosa pine	67
Little Missouri Breaks	This Study	Badlands	171

*This figure is the number of km^2 of the study area divided by the number of observed breeding pairs of eagles on that area.

Ferruginous Hawks. Stewart (1975) listed the ferruginous hawk as either rare or uncommon on our study area. We found this raptor to be uncommon in the northern units, but common in the 2 southern units. Only 9 nests were located (1 occupied) north of the Dickinson Addition, the remaining 55 nests were located in the Southwest unit and the Dickinson Addition (Figs. 4 and 7). Mean density for all occupied nests in these 2 areas was 1 pair/47 km^2 (18 mi^2). On these 2 areas, ferruginous hawks tended to nest on isolated buttes or hills surrounded by native prairie. Land disturbance from intensive farming appeared to affect the distribution of nesting ferruginous hawks. One area near Black Butte, where land disturbance was minimal, averaged 1 pair/9 km^2 (3.5 mi^2) (n = 6 active nests). In a short-grass prairie area of northern Colorado, Olendorff (1972) found the nesting densities of ferruginous hawks to average 1 pair/ 83 km^2 (32 mi^2).

Prairie Falcons. Prairie falcons were mostly confined to the Little Missouri River Breaks (Fig. 6). Two active eyries were located on the McKenzie-Williams and 2 on the Southwest areas (Fig 4). Stewart (1975) listed the prairie falcon as uncommon or rare along the Little Missouri River and Missouri River flood plains. Seabloom et al. (1978) found prairie falcons to be locally common in the badlands areas, but rare elsewhere in southwestern North Dakota.

Due to the small sample size, no densities were calculated for this species. The 2 active eyries located closest together were on the Chalky Buttes (Southwest unit) and were separated by 8 km (5 mi). Distance between active prairie falcon eyries on the Snake River Birds of Prey Area averaged 0.647 km (0.402 mi) (USDI 1979). On the Black Butte area in southern Wyoming, Lockhart et al. (1980) found the average distance between prairie falcon eyries to be 1.48 km (0.92 mi).

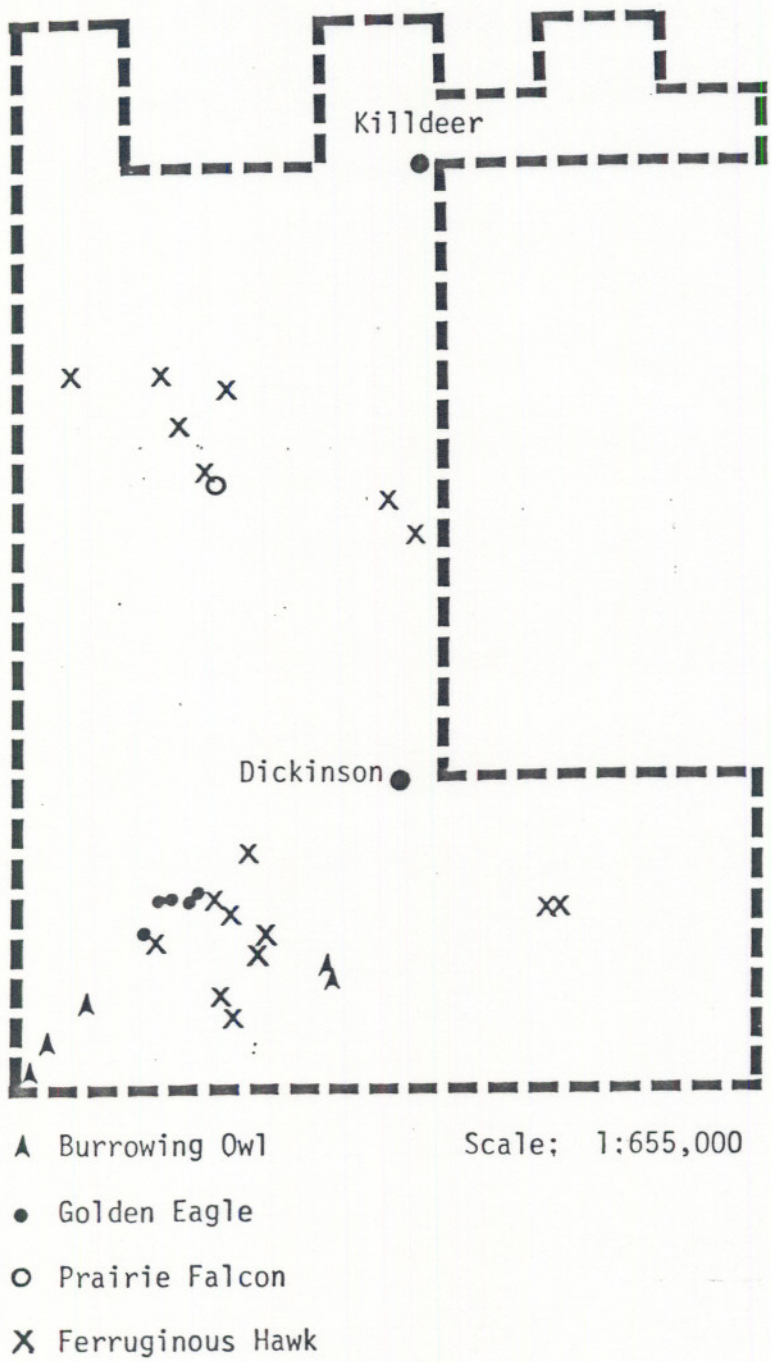


Figure 7. Distribution of raptor nest sites in the Dickinson Addition coal area.

Burrowing Owls. Historically, burrowing owls were numerous and generally distributed in North Dakota (Stewart 1975). They were considered to be very common in Stark, Dunn, and Hettinger counties in 1918 (Gabrielson and Jewett 1924). Sixteen (64%) of the active and 3 (50%) of the inactive prairie dog towns visited supported burrowing owls. We made 25 sightings of burrowing owls on the study area consisting of 73 individuals. We estimated these individuals to represent 18 nesting pairs on the basis of the distribution of the sightings (Table 3). Our sightings were on both private land (58%) and state and federal land (42%).

Burrowing owls have been known to construct their own nest cavity (Thomsen 1971), but Marks and Ball (1981) concluded that burrow availability is the primary factor controlling distribution of burrowing owls. The utilization of prairie dog burrows by burrowing owls declines within 3 months to 3 years following disappearance of the prairie dogs (Butts 1973, Ross 1974) if the town is not plowed over that year. Butts (1973) concluded that burrowing owl use of abandoned prairie dog towns was minimal and that active dog towns were the primary habitat for the owls. Five out of 8 recently poisoned towns on our study area still supported burrowing owls, but prairie dogs were still present in 2 towns out of those 5. Secondary poisoning of burrowing owls by rodenticides may occur (Marks and Ball 1981). Coulombe (1971) maintains that burrowing owls consume carrion available to them near their burrows. Coulombe (1971), Tyler (1968), and Butts (1973) all acknowledge the importance of secondary poisoning of burrowing owls.

Merlins. No merlin nests were located on the study area. Merlins frequently nest in abandoned magpie (Pica pica) nests in hardwood draws

Table 3. Burrowing owl and black-tailed prairie dog town distribution.

Ownership	No. Of Prairie Dog Towns	No. Of Active Towns	No. Of Towns With Burrowing Owl Sightings	No. Of Hectares	Prairie dog town area (%)	
					Raptor Inventory 1982	Seabloom et al. 1978
Private	59	15	11	880	33.5	73.0
State	2	2	1	164.3	11.2	1.5
National Grasslands	15	3	5	21.0	1.4	19.0
National Park Service	5	3	1	305.2	20.9	5.0
Private-Federal	--	--	--	--	--	1.0
Private-State	2	--	--	--	--	0.5
Indian Reservation	3	1	1	45.8	6.3	--
Unknown	21	--	--	--	--	--
Total	107	24	19	1316.3		

or juniper trees. With this in mind, we spent 70 man-hours searching portions of the Little Missouri River and adjacent drainages on foot. An additional prairie falcon eyrie, 4 active kestrel (Falco sparverius) territories, and 2 accipiter nests were located using this method. Postovit (1979), while censusing all raptors in a sample area of northwest Dunn County, located 1 merlin nest in 1977 and 3 in 1978. All 4 were located in magpie nests on juniper covered slopes. Stewart (1975) listed no information on nesting merlins for North Dakota.

Characteristics of Raptor Nesting Habitat

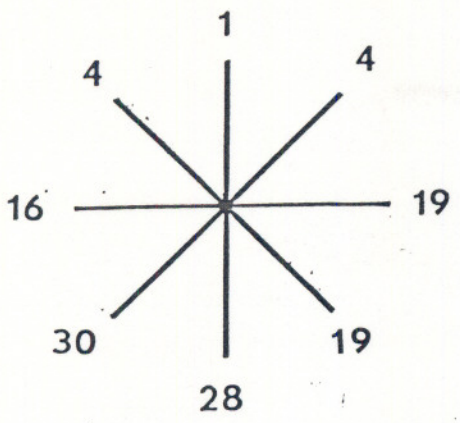
The Little Missouri River unit contained the largest number of raptor nests followed by the Southwest, McKenzie-Williams, Dickinson Addition, and Bennie Pierre units respectively (Table 1). The rugged terrain of the Little Missouri Breaks provided undisturbed nesting sites for many raptor species. Overall, we found more nests on cliffs than all other substrates combined (Table 4). Other nesting substrates included deciduous trees, rock outcrops and columns, and a variety of hill types (Appendix C). All prairie falcon eyries were located on cliffs and eagles also utilized cliffs for the majority (85%) of their nest sites. Trees, hillsides, and mud banks were used to a lesser extent by eagles (Table 4). Ferruginous hawks also nested on a variety of substrates, but most frequently used hilltops, hillsides, and cliffs.

Significantly more nests of golden eagles ($x^2 = 58.56$, $p < 0.005$), ferruginous hawks ($x^2 = 6.76$, $p < 0.01$), and prairie falcons ($x^2 = 5.33$, $p < 0.025$) were found on southerly facing slopes than slopes of northerly aspect (Fig. 8). Lockhart et al. (1980) found similar results for golden eagles nesting on cliffs in the Black Butte area of southern Wyoming.

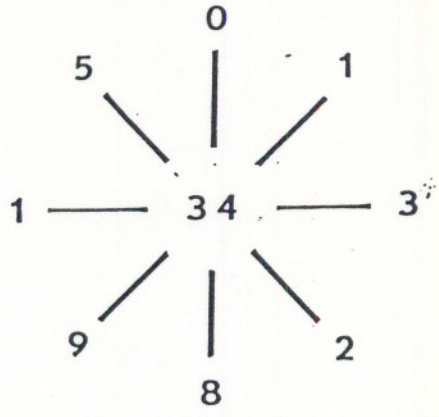
Table 4. Summary of ferruginous hawk and golden eagle nesting substrates for each geographic unit.

Geographic Unit	SUBSTRATE																							
	Cliff		Tree		Ground/ Mud Bank		Pinnacle		Rock Outcrop		Hilltop		Knob		Hillside		Rock Column		Cliff Top		Total Nest	
	Ferr	GE	Ferr	GE	Ferr	GE	Ferr	GE	Ferr	GE	Ferr	GE	Ferr	GE	Ferr	GE	Ferr	GE	Ferr	GE	Ferr	GE		
McKenzie-Williams	3	23	2	8	-	1					3	-	1	-	-	5					9	37		
Bennie Pierre	-	6					1	-			1	-									2	6		
Dickinson Addition	4	5	1	-			4	1			1	-	3	-	1	-			4	-	18	5		
Southwest	2	12	2	-	1	-	2	-	6	-	6	-	3	-	9	2	2	-			33	14		
Little Missouri River Breaks	-	59	-	2			2	-							-	1					2	62		
Total	9	105	5	10	1	1	9	-	6	-	11	-	7	-	10	8	2	-	4	-	64	124		
Percent	14	85	8	8	1	1	14	-	10	-	17	-	11	-	16	6	3	-	6	-	100	100		

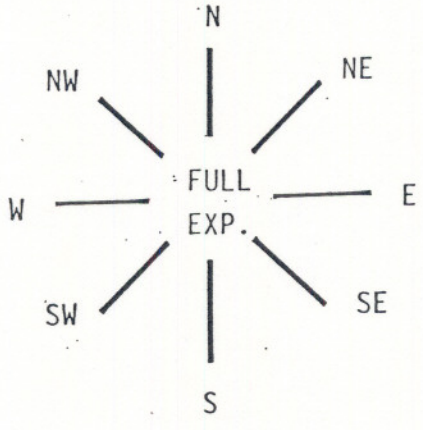
Ferr = Ferruginous Hawk
GE = Golden Eagle



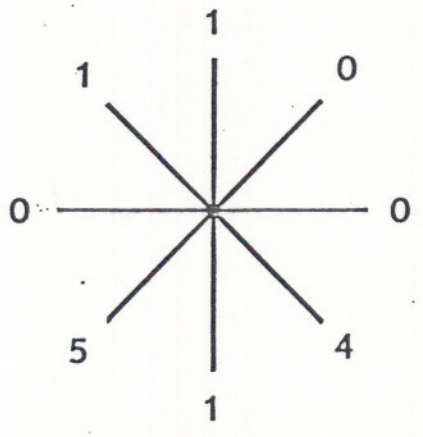
Golden Eagle



Ferruginous Hawk



EXPOSURE



Prairie Falcon*

Figure 8. Exposures of raptor nests located on the North Dakota Study area.

* Includes natural and active artificial eyries.

McGahan (1968) felt that nest site preference was influenced by the direction of the sun's rays. He felt that exposure was important during the early spring months for the incubating adults and eggs since the temperatures were often below freezing. Other reports also show golden eagles significantly favoring southerly exposures (Snow 1973).

Prairie falcons also appeared to be selecting southerly exposures in nesting sites. Eighty-three percent of the prairie falcon eyries located in this study were on south-facing edges. In San Joaquin Valley, California, Tyler (1923) found that most prairie falcon eyries he observed had northern exposures and no south-facing ledges were used. However, Enderson (1964) in Colorado found a majority of nesting prairie falcons to use southerly facing ledges (22), and only 5 using northerly exposed ledges. This selection by raptors may be dependent upon latitude (Snow 1973); at more northerly latitudes, some raptor species seem to increase their rate of selection of southerly exposed nest sites. More than half (54%) of the ferruginous hawk nests we located were on the exposed tops of hills and rocks. In the Great Basin, west of Utah Lake, Wolfinder (1975) examined 56 ferruginous hawk nests. Almost half of these nests were unshaded throughout the day. The nests on steep slopes received some shade only in the morning and afternoon, depending on aspect. Tomback and Murphy (1981) concluded that shade availability is not a nest site requirement for this species.

Ninety percent of the cliff nests used by golden eagles located were either on the 3/4 section or 4/4 section (Table 5). From visual observation throughout the study period it appeared that suitable nesting substrate (e.g., ledges, crevices, etc.) on the cliffs occurred more often on the 2/4 and 3/4 sections. The 4/4 section was usually well weathered

Table 5. Distribution of golden eagle, ferruginous hawk, and prairie falcon nest sites by quarter section location on cliffs and hills in western North Dakota.

	Number Of Nests By Species		
Quarter Section	Golden Eagle	Ferruginous Hawk	Prairie Falcon
Top	0	30	0
4/4	49	10	9
3/4	62	20	5
2/4	8	0	1
1/4	4	0	0

and rounded off providing no stable means for the eagles to "anchor" their nest. This may be why more eagle nests were found on the 3/4 section than on the 4/4 section. Ninety-three percent of the prairie falcon eyries (natural and occupied artificial eyries) were located on the upper half of the cliffs. Sixty percent of these total eyries were on the 4/4 section. Ferruginous hawks were the only species found nesting on top of any substrates. All the ferruginous hawk nests located (excluding tree nests) were on the upper 1/2 of the nesting substrate. Fifty percent of these were on top of the nesting substrates. Stewart (1975) listed detailed descriptions of 61 ferruginous hawk nests. Forty-five percent of these were situated on the ground, and most of them were located on boulder-strewn slopes near the crest of hills and ridges or on tops of knolls. Lockhart et al. (1980) also found golden eagles, prairie falcons, and ferruginous hawks using the upper half of their substrates for nesting.

Productivity

Thirteen of the 25 occupied golden eagle nests were revisited during the study period. Three of these, which had eagles incubating, failed during the egg or early eaglet stage. Two adult eagles and greenery were sighted at another nest, but no eggs were observed. The remaining 9 nests contained a total of 16 eaglets (1.8/nest) of various ages. At least 6 of these eaglets from 4 nests were near fledging age (10 - 12 weeks), and are presumed to have fledged. These limited productivity data compare favorably with other eagle studies (Table 6).

We were only able to recheck 2 of 11 active prairie falcon eyries for productivity information (Table 7). Each site contained at least 3 young and all were fledged. One artificial eyrie was near an area

Table 6. Summary of golden eagle productivity rates in various regions throughout the western United States.

Location	Source	Number of Successful Nests	Number young Fledged/ Successful Nest	Number years of Study	Year Measured
Colorado	Olendorff (1975)	30	1.5	3 (1970-1972)	Combined
Idaho	Beecham and Kochert (1975)	93	1.6	3 (1969-1971)	Combined
Idaho	USDI Bureau of Land Management (1979)	198	1.6	9 (1970-1978)	Combined
Southwestern United States	Boeker and Ray (1971)	213	1.4	6 (1964-1969)	Combined
Montana	McGahan (1968)	45	1.6	2 (1963-1964)	Combined
Wyoming - Montana	FWS/PKS unpublished data	68	1.5	7 (1975-1981)	Combined
Wyoming (Black Butte)	Lockhart et al. (1980)	17	1.4	2 (1978-1979)	Combined
Northeastern Wyoming	Phillips and Beske (1982)	46	1.3	1	1981
Western North Dakota	This study	4	1.5	1	1982

Table 7. Reproductive performance of raptors found on the North Dakota study area.

Species	No. of Observed Breeding Attempts	No. of Nests Revisited for Producivity Info.	No. of Observed Failures	No. of Nests Observed with Chicks	Mean No. of Chicks Per Nest w/Chicks	No. of Nests Observed Fledging Young	Mean No. Fledged Per Successful Nest
Golden Eagles	25	13	3	9	1.8	6	1.5
Ferruginous Hawk	19	2	1	2	1.5	0	--
Prairie Falcon	11	2	0	2	$\geq$3	2	$\geq$3
Burrowing Owl*	18	0	0	0	0	0	0
Red-tailed Hawk**	22	0	0	1	2	0	--
Swainson's Hawk**	11	0	0	0	0	0	--
Great Horned Owl**	26	0	0	10	2.4	5	2.4

* Surveys of prairie dog towns occured before burrowing owl young emerged above ground.

** Nest were only observed once during aerial surveys since these species were not priority species.

-- Chicks were still in the nest at the end of the study.

where a construction crew was laying pipe for the Northern Pipeline; this activity lasted the entire nesting period (Fig. 9). We visited the eyrie on 4 occasions; during the last visit (13 July 1982) we observed 3 young falcons being fed by 1 of the parents on top of the cliff. At this time the pipeline crews were operating no more than 444 - 500 m (0.28 - 0.31 mi) away.

Nineteen active ferruginous hawk nests were located during the study, but only 2 were revisited. One of these nests contained 2 chicks (1 - 2 weeks old) and the other nest contained 1 chick (1 - 2 weeks old) and 2 unhatched eggs. We recorded 3 nests containing eggs during the study with an average clutch size of 2.6. Stewart (1975) lists clutch sizes of 3 - 6 ($\bar{x}$ = 3.9) for 35 nests in North Dakota. Because of the timing of our study, no data was collected on fledging success for ferruginous hawks.

Nesting Chronology

Based upon direct observations (and projected estimations in Bent 1938), great horned owls (Bubo virginianus) were the 1st raptor to begin incubation followed by golden eagles, ferruginous hawks, prairie falcons, red-tailed hawks (Buteo jamaicensis), and Swainson's hawks (Buteo swainsoni) respectively (Fig. 10). Raptors in northern Wyoming follow this order although the entire nesting chronology in North Dakota is delayed approximately 2 - 3 weeks for all species (McEneaney 1981).

Stewart (1975) lists extreme nesting dates for many raptor species in North Dakota. He notes that golden eagles are incubating from 27 March to 1 May and eaglets are in the nest from 29 April to 22 July. Ferruginous hawks had eggs in their nests from 17 April to 7 June and chicks were in

Figure 9. Location of prairie falcon eyrie near Northern Pipeline construction site.



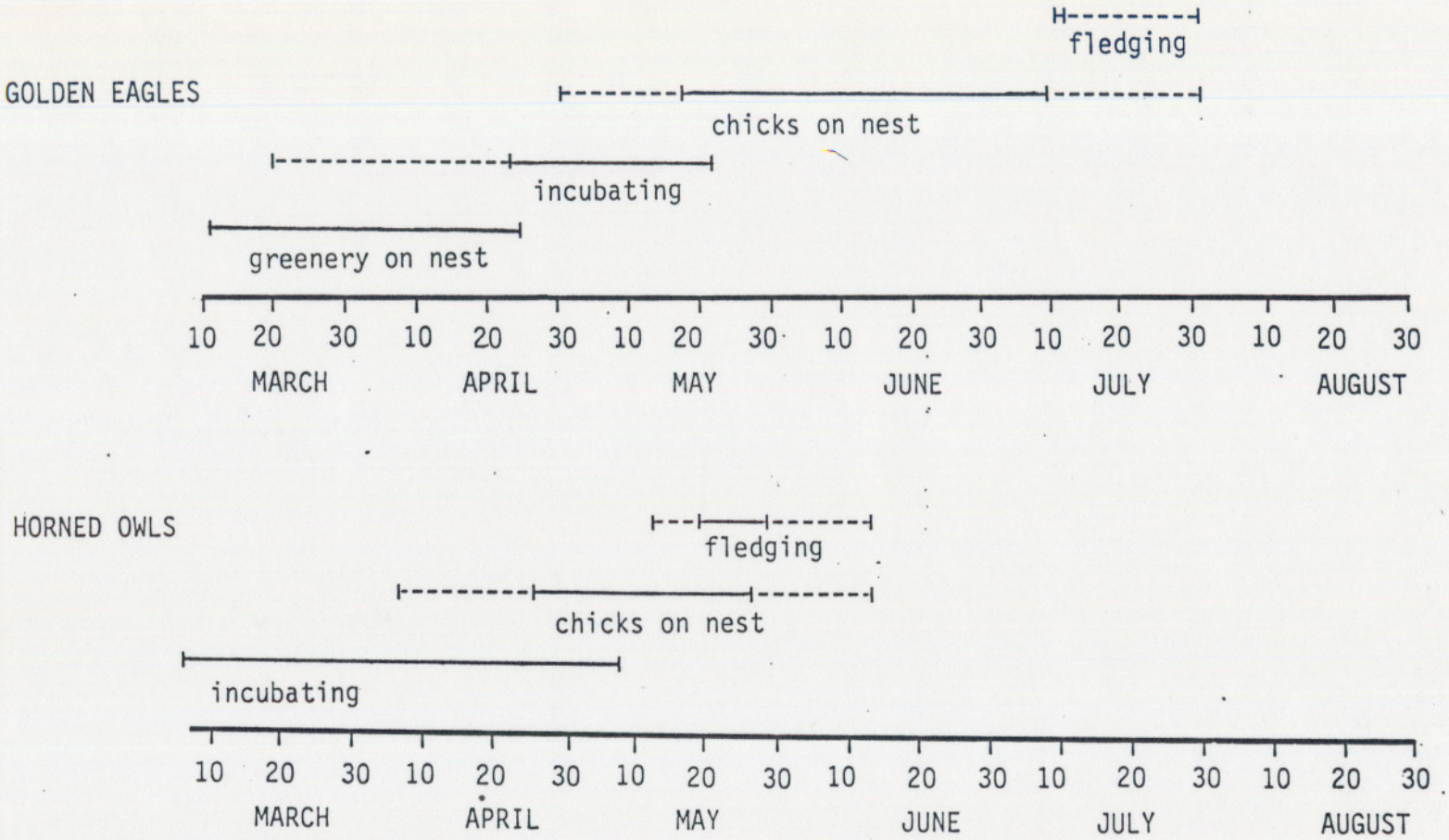
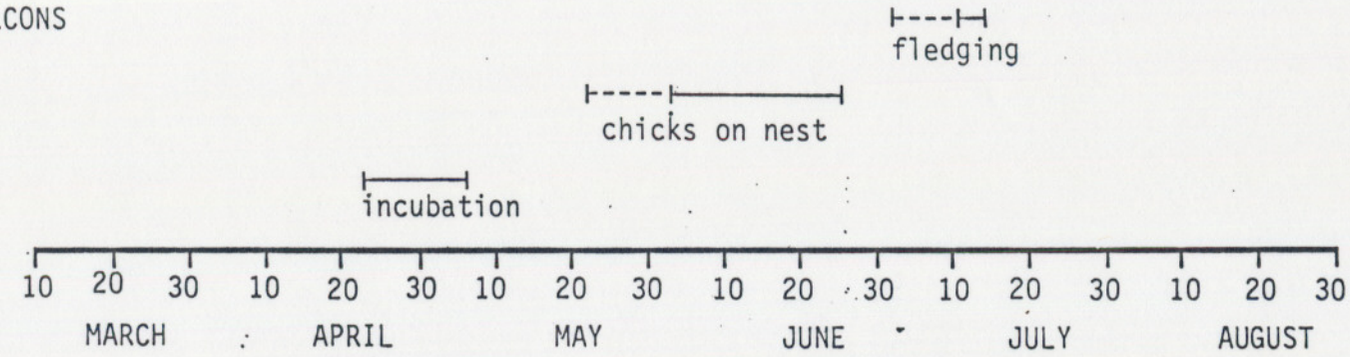


Figure 10. Breeding chronology of nesting raptors in western North Dakota.

—— observed

---- estimated (Bent 1938, Snow 1974)

PRAIRIE FALCONS



FERRUGINOUS HAWKS

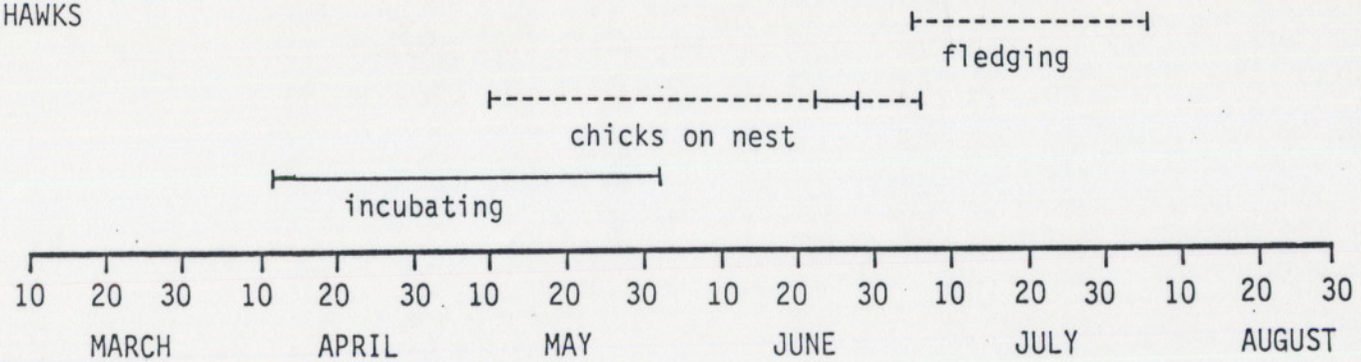


Figure 10. (continued)

—— observed

---- estimated (Bent 1938, Snow 1974)

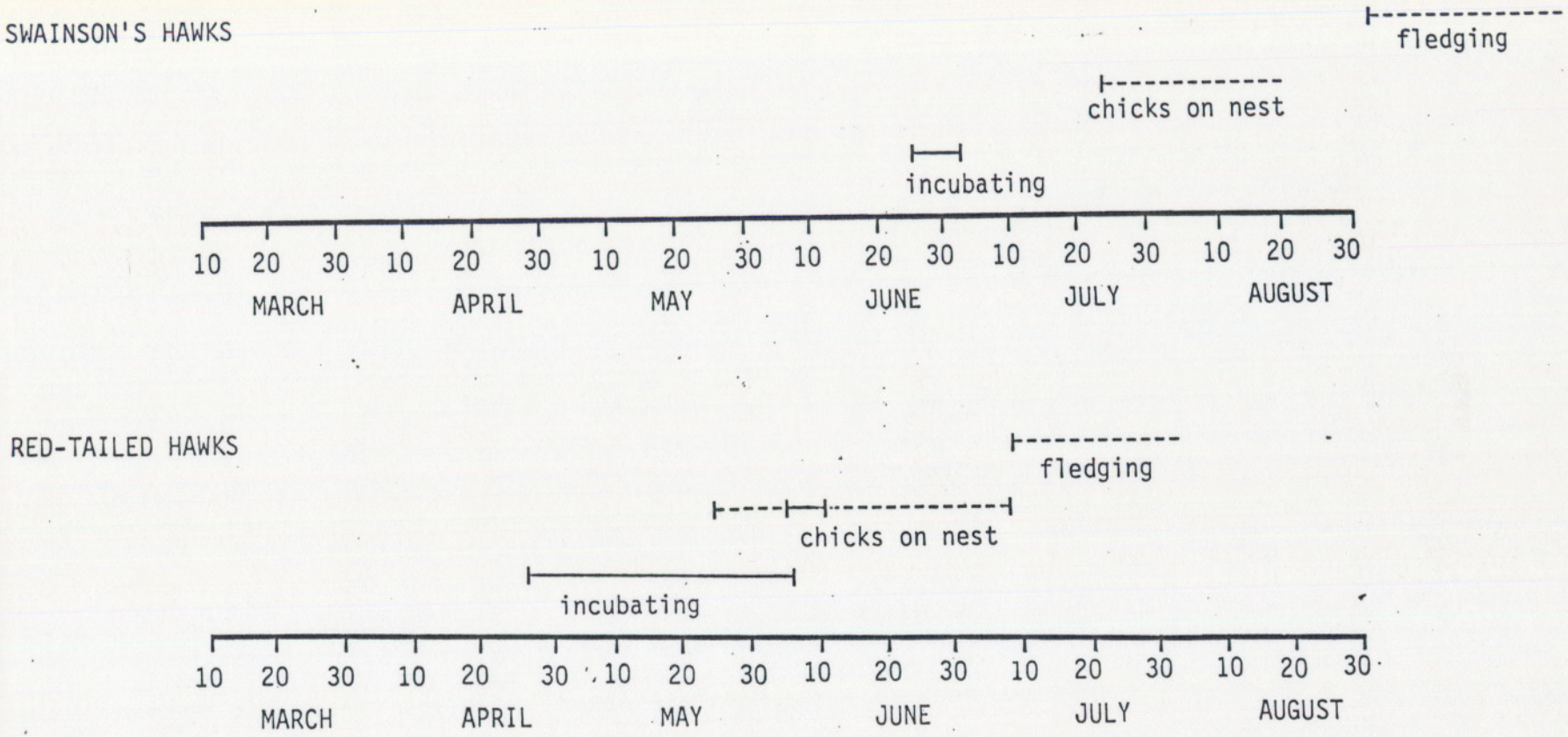


Figure 10. (continued)

—— observed

---- estimated (Bent 1938, Snow 1974)

the nests from 27 May until 16 July. Stewart (1975) had no data for prairie falcons. Red-tailed hawks had eggs from 19 April through 11 June and chicks from 23 June to 22 July.

Other researchers have listed nesting dates for raptors in other western states and Canada. Snow (1973) states that time of courtship for golden eagles varies with altitude and latitude. Bent (1938) lists 5 records for egg laying dates for golden eagles in the Arctic ranging from 27 May to 29 June. In northeastern Wyoming, eagles started incubating eggs in late February with hatching in early April (Phillips and Beske 1982).

Ferruginous hawks began egg laying about 1 month after golden eagles. Many researchers (in Snow 1974) list incubation starting in April, usually after the 1st week. Eggs would then be hatching by May and the young fledging by early July. Based on our data, ferruginous hawks on the study area would not be fledging until early August.

Bent (1938) lists 14 records for nesting prairie falcons in Montana and Wyoming; eggs were usually in nests from 25 April to 10 June. Enderson (1964) observed that clutch completion occurred on the average around 25 April in southern Wyoming and northern Colorado, but variation was large.

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Appendix A. Geographic planning unit designation.

SURVEY UNIT	USGS QUADRANGLES WHICH COMPRISE SURVEY UNIT
McKenzie-Williams	Brush Lake (North Dakota), Grenora, Hanks, Zahl, Appam, Brush Mountain (North Dakota), West Bonetraill, Bonetraill, Blacktail Lake, Twin Lakes, Epping NW, Epping NE, Ray NW, Temple, Tioga, Bull Butte (North Dakota), Bonetraill SW, Bonetraill SE, Ottertail Creek, Marmon SE, Spring Brook, Epping, Ray, Ray SE, Tioga SW, Tioga SE (Williams Co.), Red Bank Creek (North Dakota), Trenton NW, Trenton NE, Williston West, Williston East, Stockyard Creek, Gamache Creek, Cussicks Spring, Red Mike Hill, Charlson NW, Charlson NE (Williams Co.), Bainville SE (North Dakota), Trenton SW, Trenton, Williston SW, Williston SE, Lake Jessie, Chris Creek, Banks, Tobacco Garden Bay, Charlson SW, Charlson, Dore (T152N in North Dakota), Buford (T152N), Cartwright NE (152N), Camp Creek West (T152N), Camp Creek East (152N), Watford City NW, Watford City NE, Timber Prong Creek, Demicks Lake, Keene, Blue Buttes, Schafer SE, Johnsons Corner, Blue Butte SE. Total Area = 7,138 km^2 (2,753 mi^2).
Bennie Pierre	Sather Lake, Moline School, Bear Butte. Total Area = 392 km^2 (151 mi^2).
Little Missouri River Breaks	Redwing Creek, Sperati Point, Long X Divide, Lone Butte, Lone Butte SE, North Killdeer Mtn. Lost Bridge, Mandaree SE, Saddle Butte SW, Hay Flatt, Petes Creek, Killdeer Mountains, Dunn Center NW (north half), Halliday NW (north half), Lone Butte NE, Croff, Figure 4_2Ranch. Total Area = 2,224 km^2 (858 mi^2).

Appendix A. (continued)

SURVEY UNIT	USGS QUADRANGLES WHICH COMPRISE SURVEY UNIT
Dickinson Addition	Grassy Butte, Oakdale, Dunn Center NW (south half), Dunn Center NE, Halliday NW (south half), Grassy Butte SW, Grassy Butte SE, Fayette, Killdeer, Fairfield, Hungry Man Butte, Manning NW, Manning, Rattlesnake Butte, Fairfield SE, New Hradec North, Manning SE, Belfield, Belfield NE, New Hradec South, Dickinson North, Belfield SW, Belfield SE, South Heart, Dickinson South, Lehigh, Gladstone, Bratburg Butte, Daglum (north half), New England NW, Schefield, Lefor NW, Lefor, White Butte NW. Total Area = 4,447 km^2 (1,715 mi^2).
Southwest	Daglum (south half), New England SW, New England, Lefor SW, Stony Butte, White Butte West, White Butte East (T135N), Clark Butte SW (T135N), Clark Butte (T135N), Lake Tschida West (T135N), Lake Tschida East (T135N), Crow Butte Creek West (T135N), Amidon, White Lake, West Rainy Butte, East Rainy Butte, Jung Lake, Havelock, Regent, Mott NW, Mott North, Burt NW, North Star Butte, New Leipzig North, Elgin, Heil, Stewart Lake, Amidon SE, Mineral Springs, Warnke Hill, Cedar Lake, Enterprise School, Liens Dams, Abbey Hill, Mott SW, Mott South, Burt, Bentley, New Leipzig South, Sheep Creek Dam (omit T132N east of sections 8 and 17), Leith (omit T132N), Bowman, Talbot Butte, Scranton, Scranton NE, Whetstone Buttes, Wolf Butte, Ehler Lake, Taylor Butte, Pearl Butte NW, Long Butte, Plum Butte, Plum Butte NE, Coffin Buttes, Pretty Rock Butte (west half). Omit T129N in the following quadrangles; Scranton SW, Gascoyne, Reeder, Bucyrus, Hettinger North, Taylor Butte SE, Pearl Butte, Barth Butte, Cedar Butte, Mason Hill, Round Top, and Pretty Rock Butte SE (west half north of T129N). Total Area = 8,073 km^2 (3,113 mi^2).

NEST NO. SP. UTME UTMN T N R W SEC 1/16 1/4 COUNTY

SUBSTRATE SURFACE OWNERSHIP MINERAL OWNERSHIP MAP NAME

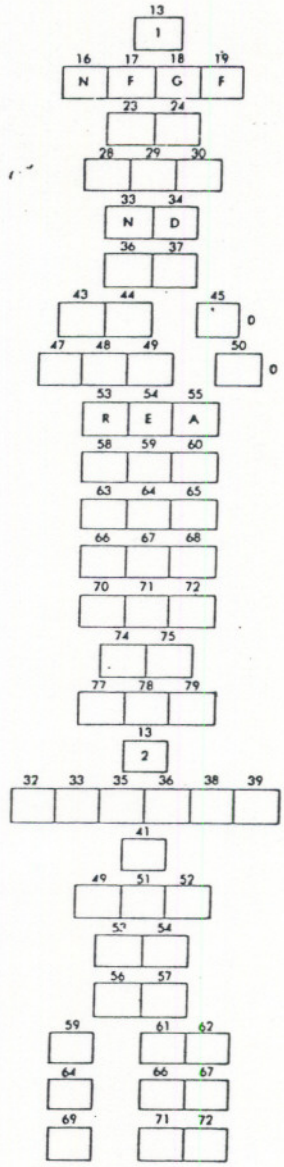
DESCRIPTION

HISTORY & OBSERVATIONS

Appendix B. Data record card used for compiling information on North Dakota raptors.

N D RAPTOR NEST RECORD

FOR OFFICE USE ONLY



OBSERVER: _____

ADDRESS & PHONE NO: _____

RAPTOR SPECIES: _____

Date: Month _____ Day _____ Year 19 _____

COUNTY: _____

Legal Description:
T___N, R___W, Sec.___. ¼ Sec._____

or miles and direction to nearest landmark, town, farm, etc.

_____

_____

HABITAT/LAND:

Briefly describe the habitat within ½-mile radius of nest:

_____

_____

Topography: _____
1) Flat, 2) Rolling, 3) Steep Hill,
4) Coulee, 5) Badlands 6) Other

NEST DESCRIPTION:
Nest/Substrate Type: _____
1) Tree 2) Ground 3) Haystack
4) Tower 5) Cliff 6) Burrow in ground
7) Other

Photos taken? Yes _____ No _____

METHOD OF OBSERVATION: _____
Naked eye, Binocs, From car, etc.

RETURN VISIT TO NEST:

Date: Month _____ Day _____ Year 19 _____

Was nest successful: Yes ___ No ___

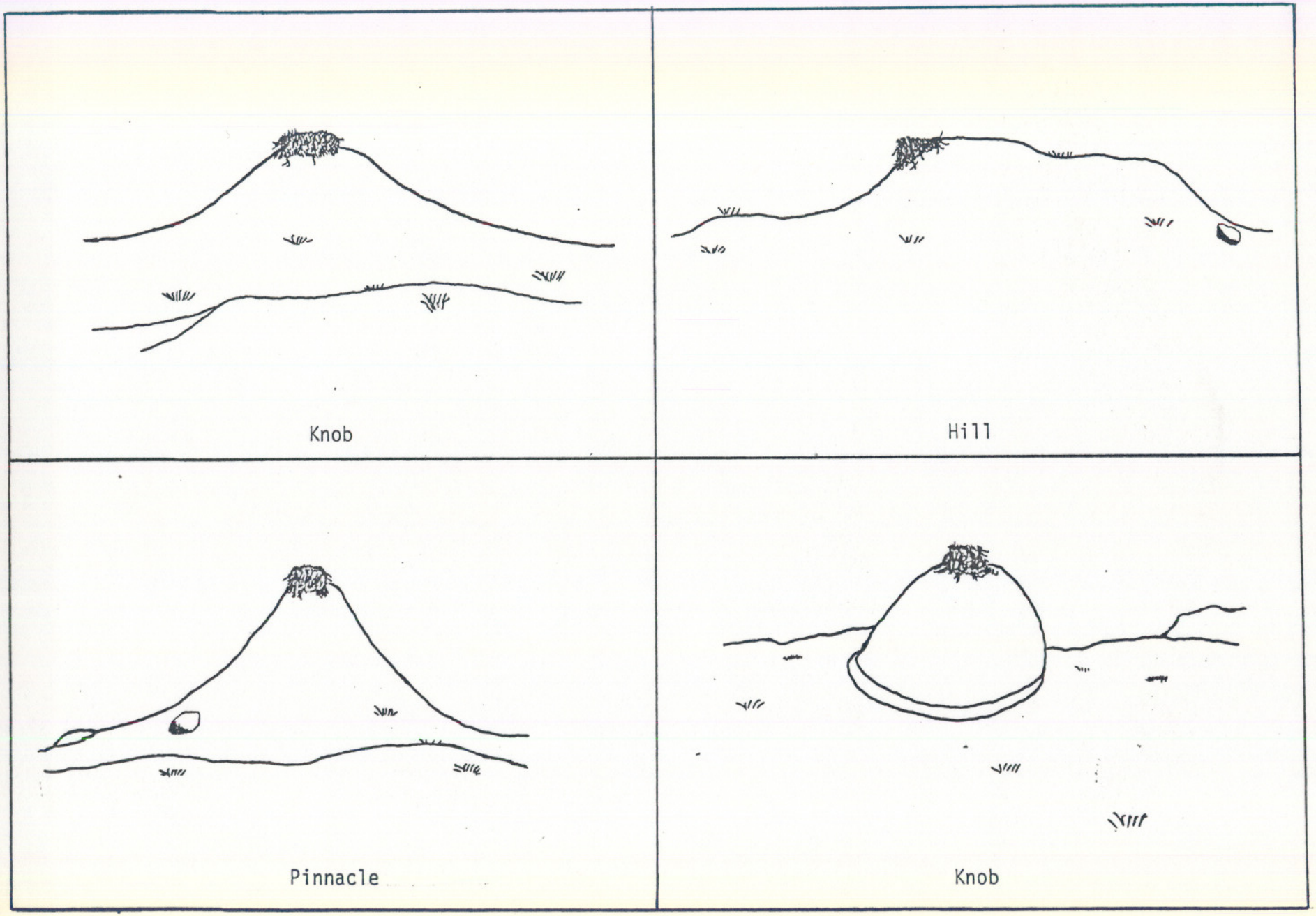
Number and size of young:
Already fledged ½ - ¾ grown, well feathered
¾ grown, about to leave nest ½ grown, small downy
just hatched

COMMENTS: _____

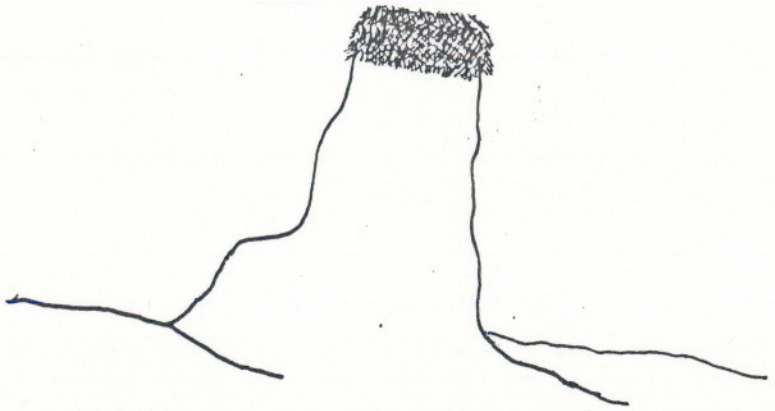
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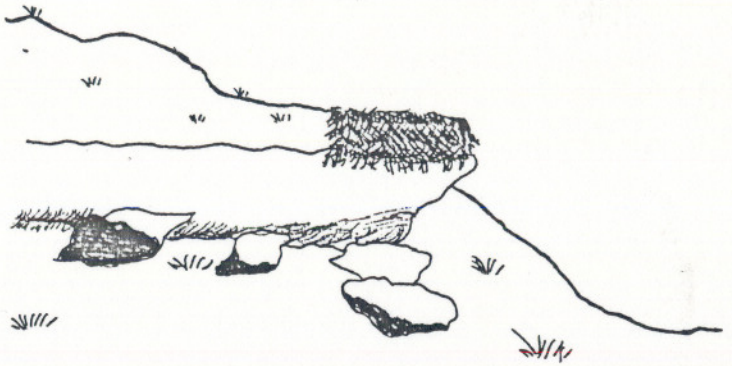
Appendix B. (continued).



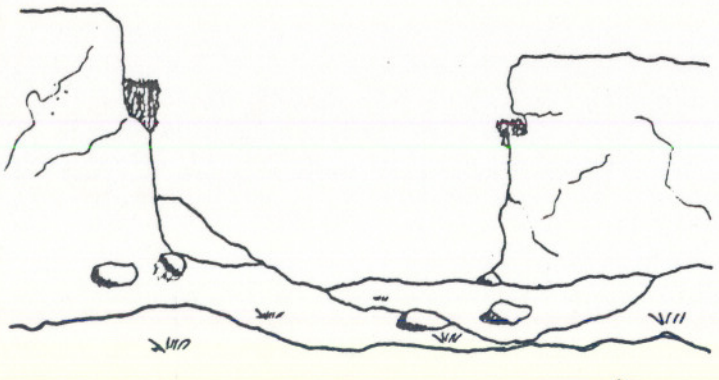
Appendix C. Some typical nest site locations for golden eagles and ferruginous hawks in western North Dakota.



Rock Column



Rock Outcrop



Cliffs



Cliff Top

Appendix C. (continued)

Appendix D. Black-tailed prairie dog towns and burrowing owl occurrences within the raptor inventory area.

USGS QUADRANGLE	LOCATION	OWNERSHIP	ACREAGE 1971	1973	1976	1977	1979	1980	1981	1982	HABITAT	STATUS
Sather Lake	T149N,R103W,C4	Federal						4[a]	12[a]	0[a]	Mixed-grass prairie	Poisoned: no burrowing owls
Sather Lake	T149N,R103W,9	Federal		1[c]						0[a]	Mixed-grass prairie	No town: no burrowing owls
Sather Lake	T149N,R103W,SWNW10	Federal			5[b]			6[a]	28[a]	0[a]	Mixed-grass prairie	Poisoned: 2 burrowing owls
Sather Lake	T149N,R103W,NESE10	Federal			7		2[e]			0[a]	Mixed-grass prairie	Poisoned: 1 burrowing owl
Sather Lake	T149N,R103W,N12	Federal						2[a]		9[a]	Mixed-grass prairie	Active: 4 burrowing owls
Sather Lake	T149N,R103W,SW21	Federal			1					0	Mixed-grass prairie	No town: no burrowing owls
Sather Lake	T148N,R103W,24	Federal			?		2[e]			0	Mixed-grass prairie	Active
Sather Lake	T149N,R103W,NE26+NW25	Federal			10[c]		40[e]			0[a]	Mixed-grass prairie	Poisoned 1980: 3 burrowing owls
Sather Lake	T149N,R103W,27	Federal	30[f]							0[a]	Mixed-grass prairie	Town never existed
Moline School	T149N,R101W,NE7	?			?					0	Cultivated/grassland	No town: no burrowing owls
Moline School	T148N,R103W,24	?			?					0[a]	Mixed-grass prairie	No town: no burrowing owls
Red Wing Creek	T148N,R101W,21	Private			21					90.2	Mixed-grass prairie	Active: 8 burrowing owls
Red Wing Creek	T147N,R100W,C5	TRNP[d]						2[a]		0[a]	Badlands grassland	Did not visit
Red Wing Creek	T147N,R101W,SWNE4	Federal						0.3[a]		0	Mixed-grass prairie	No town: no burrowing owls

Appendix D. (continued)

USGS QUADRANGLE	LOCATION	OWNERSHIP	ACREAGE 1971	1973	1976	1977	1979	1980	1981	1982	HABITAT	STATUS
Sperati Point	T147N,R101W,NWNW1	Federal						0.3[a]		0	Mixed-grass prairie	No town: no burrowing owls
Sperati Point	T147N,R101W,C16	TRNP[d]			25			28[a]		61.6[k]	Badlands grasslands	Active: no burrowing owls
Sperati Point	T147N,R100W,SW16	TRNP[d]			25[c]					0	Badlands grassland	No town: no burrowing owls
Sperati Point	T148N,R100W,30	Private			?						Mixed-grass prairie	Could not locate
Sperati Point	T147N,R100W,SWNW33	Federal			9		15[c]		16[a]	16[a]	Badlands grassland	Active: no burrowing owls
Sperati Point	T147N,R100W,SW34	Private			5[g]						Badlands grassland	Did not visit
Sperati Point	T147N,R100W,NENW35	Private						2[a]		2	Badlands grassland	Active: 3 burrowing owls
Sperati Point	T147N,R101W,NENW36	State			7		15[c]			11[c]	Badlands grassland	Active
Long X Divide	T147N,R99W,SENE11	Federal						.3[a]		1[k]	Badlands grassland	Active: 1 burrowing owl
Long X Divide	T148N,R99W,W19	TRNP[d]			22			62[a]		125.1	Badlands grassland	Active: no burrowing owls
Long X Divide	T147N,R99W,21	Private			20[c]					0[a]	Badlands grassland	Poisoned: no burrowing owls
Long X Divide	T148N,R99W,SE29+SW28	TRNP[d]			41			10[a]		190.4	Badlands grassland	Active: 2 burrowing owls
Long X Divide	T147N,R99W,30	?			?[f]						Badlands grassland	Did not visit
Long X Divide	T147N,R99W,31	Private			?[f]					0[a]	Badlands grassland	No town: no burrowing owls
Lone Butte	T147N,R99W,W12	Private			2						Badlands grassland	Could not locate

Appendix D. (continued)

USGS QUADRANGLE	LOCATION	OWNERSHIP	ACREAGE 1971	1973	1976	1977	1979	1980	1981	1982	HABITAT	STATUS
Lone Butte SE	T147N,R97W,2	?						?[a]			Badlands grassland	Could not locate
Lone Butte SE	T147N,R97W,NWSE7	Private			25				80[c]	45.1	Badlands grassland	Active: no burrowing owls
Lone Butte SE	T147N,R97W,SW18	Private			70				20[c]	18.1	Badlands grassland	Active: no burrowing owls
Lone Butte SE	T148N,R97W,SE22,SW23, W26,NE35	Private							160[c]	191.4	Badlands grassland	Active: encompasses the next 3 towns, no burrowing owls
Lone Butte SE	T148N,R97W,26	Private		15[c]	40						Badlands grassland	
Lone Butte SE	T148N,R97W,NE27	Private			5						Badlands grassland	
Lone Butte SE	T148N,R97W,35	Private		20	25						Badlands grassland	
N Killdeer Mtn	T147N,R97W,SW12	Federal						?[a]				Did not visit
Lost Bridge	T147N,R95W,NENE3,NWNW2	Private		40[c]	40					36.8	Badlands grassland	Active: hunted, no burrowing owls
Lost Bridge	T148N,R95W,NE34	FBIR[g]		1[e]						0	Badlands grassland	Does not exist: no burrowing owls
Mandaree SW	T148N,R95W,SW36	FBIR[g]		20	40					113.2	Badlands grassland	Active: 9 burrowing owls
Mandaree SW	T147N,R94W,6	FBIR[g]		?[c]						0	Badlands grassland	No town: no burrowing owls
Mandaree SW	T147N,R95W,SE2NE11	Private			30					59.8	Badlands grassland	Active: 1 burrowing owl
Mandaree SW	T147N,R95W,23	Private	100[f]							0	Badlands grassland	Does not exist: no burrowing owls, gassed (CO) 6 yrs ago

Appendix D. (continued)

USGS QUADRANGLE	LOCATION	OWNERSHIP	ACREAGE 1971	1973	1976	1977	1979	1980	1981	1982	HABITAT	STATUS
Fairfield	T142N,R98W,SW6	Federal						5[a]			Mixed-grass prairie	Active: no burrowing owls
Fairfield	T143N,R99W,NE20	?									Mixed-grass prairie	Did not visit
Rattlesnake Butte	T141N,R99W,NE1	Private						10[c]				Did not visit
Belfield	T140N,R99W,SE15	?			?							Did not visit
Belfield	T140N,R99W,NW7	Private						20[c]				Did not visit
Belfield	T140N,R99W,SW14	Private						30[a]				Did not visit
Belfield	T141N,R99W,SE29	Private			200			69[e]		0[c]	Mixed-grass prairie	Inactive
Belfield NE	T140N,R99W,SE12	Private	10[f]		10			1[h]		100.3	Mixed-grass prairie	Inactive: mounds still present, no burrowing owls
Belfield NE	T140N,R98W,NW33	Private			?			60[h]		0	Agriculture	No town: no burrowing owls
Belfield SW	T139N,R99W,7	Private						5[c]		0	Agriculture	No town: no burrowing owls
Belfield SE	T138N,R99W,13	Private						13[c]		0		Not visited
New England NW	T138N,R97W,SW31	?			20[c]							Not visited
Schefield	T137N,R96W,NE30	Private			?					0	Agriculture	No town: no burrowing owls
Schefield	T138N,R97W,SW36	Private			20[c]					42.3	Mixed-grass prairie	Active: poisoned for several years, 2 burrowing owls

Appendix D. (continued)

USGS QUADRANGLE	LOCATION	OWNERSHIP	ACREAGE 1971	1973	1976	1977	1979	1980	1981	1982	HABITAT	STATUS
Schefield	T137N,R97W,NWNW1	Private								15.6	Mixed-grass prairie	Active: poisoned for several years, 2 burrowing owls
Schefield	T137N,R97W,SE36	Private			25					0	Mixed grass prairie	No town: no burrowing owls
Lefor NW	T137N,R95W,S3	Private			?					0	Mixed-grass prairie	No town: no burrowing owls
Lefor NW	T137N,R95W,SE11	Private			?					0	Mixed-grass prairie	No town: no burrowing owls
Lefor NW	T137N,R96W,SW25	Private			?					0	Agriculture	No town: no burrowing owls
Lefor NW	T137N,R96W,NW25	Private			?					0	Agriculture	No town: no burrowing owls
Lefor	T137N,R95W,NE13	Private			?					0	Agriculture	No town: no burrowing owls
Lefor	T137N,R94W,NE16	Private			?					0	Agriculture	No town: no burrowing owls
Lefor	T137N,R96W,NW30	Private					?[c]			0	Mixed-grass prairie	No town: no burrowing owls
White Butte	T137N,R94W,NE36	Private			?					0	Mixed-grass prairie	No town: no burrowing owls
Daglum	T137N,R99W,NWSW14	Private						3[c]		6.4	Mixed-grass prairie	Active: 9 burrowing owls
Daglum	T137N,R99W,SW17	Private			?					0	Agriculture	No town: no burrowing owls
Daglum	T137N,R98W,NE18	Private			?					0	Agriculture	No town: no burrowing owls
Daglum	T137N,R99W,19	Private			200						Mixed-grass prairie	Active: town combined with Sec.30, 6 burrowing owls

Appendix D. (continued)

USGS QUADRANGLE	LOCATION	OWNERSHIP	ACREAGE 1971	1973	1976	1977	1979	1980	1981	1982	HABITAT	STATUS
Daglum	T137N,R99W,NE30SE19	Private		60[c]	60			316[i]		339.2	Mixed-grass prairie	Active: 2 additional burrowing owls
Daglum	T137N,R99W,SW20	Private			10-15			12[e]		0	Agriculture/mixed-grass	No town: no burrowing owls
Daglum	T137N,R99W,NW23	Private	50[f]		50					0	Agriculture	No town: no burrowing owls
Daglum	T136N,R100W,26+27	Private		?[f]						0	Agriculture	No town: no burrowing owls
Daglum	T136N,R99W,N6	Private						70[e]		121.6	Mixed-grass prairie	Active: 3 burrowing owls
Daglum	T137N,R100W,NE36	State			130[c]			130[e]		192.0	Mixed-grass prairie	Active: 5 burrowing owls
New England SW	T135N,R98W,9	Private			5[f]					0	Agricultue/mixed-grass	No town: no burrowing owls
New England SW	T136N,R98W,SE3	Private			?							Did not yisit
Reagent	T135N,R95W,SE33	Private			?					0	Agriculture/mixed-grass	No town: no burrowing owls
Stewart Lake	T132N,R102W,SE18	Private			?					0	Mixed-grass prairie	No town: no burrowing owls
Stewart Lake	T133N,R102W,SW22	Private						10[c]		0	Mixed-grass prairie	No town: no burrowing owls
Stewart Lake	T133N,R101W,SE29	Private						5[c]		0	Agriculture/mixed-grass	No town: no burrowing owls
Amidon SE	T133N,R101W,SE25	Private			?					0	Agriculture	No evidence of town: 1 burrowing owl on fence post
Sheep Creek Dam	T132N,R89W,SENE17	Private			15					20.2	Agriculture/mixed-grass	Active: 6 burrowing owls

Appendix D. (continued)

USGS QUADRANGLE	LOCATION	OWNERSHIP	ACREAGE 1971	1973	1976	1977	1979	1980	1981	1982	HABITAT	STATUS
Sheep Creek Dam	T132N,R89W,NWSE18	Private								4 burrows	Mixed-grass prairie	Active: 4 mounds, 1 burrowing owl
Bowman	T131N,R102W,NE5	?			?							Did not visit
Bowman	T132N,R102W,SC26	?				?[j]						Did not visit
Bowman	T132N,R102W,NE30	Private			10						Mixed-grass prairie	Did not visit
Bowman	T132N,R102W,35	Private			25							Did not visit
Talbot Butte	T131N,R101W,NW36	?			?							Did not visit
Whetstone	T131N,R98W,NW8	Private			?					0	Agriculture	No town: no burrowing owls
Whetstone	T132N,R98W,30	?			?							Did not visit
Ehler Butte	T131N,R96W,8	?			?							Did not visit
Ehler Butte	T131N,R96W,SE27	?			?							Did not visit
Ehler Butte	T132N,R96W,S30	?			?							Did not visit
Ehler Butte	T132N,R96W,33	State/Pvt			60[f]							Did not visit
Taylor Butte	T132N,R95W,NW22	?			?							Did not visit
Pearl Butte	T131N,R94W,C29	?			?							Did not visit
Long Butte	T131N,R93W,18	State/Pvt			100[c]							Did not visit
Reeder	T129N,R98W,NE1	?			?							Did not visit

Appendix D. (continued)

USGS QUADRANGLE	LOCATION	OWNERSHIP	ACREAGE 1971	1973	1976	1977	1979	1980	1981	1982	HABITAT	STATUS
Hettinger North	T130N,R96W,NWNW5	Private			20					0	Agriculture/mixed-grass	No town: 2 burrowing owls in badger den
Taylor Butte SE	T130N,R95W,SE18	?			?					0	Mixed-grass prairie	No town: no burrowing owls
Taylor Butte SE	T130N,R95W,SW21	?			?					0	Mixed-grass prairie	No town: no burrowing owls
Taylor Butte	T130N,R95W,28+29	Private			5[c]					0	Mixed-grass prairie	No town: no burrowing owls
Cedar Butte	T130N,R92W,1	?			?					0	Mixed-grass priaire	No town: no burrowing owls
Cedar Butte	T129N,R92W,NW14	?			?					0	Mixed-grass prairie	No town: no burrowing owls

[a] Brian Stotts, USDA Forest Service, McKenzie Ranger District, Watford City, North Dakota

[b] All 1976 data is from REAP (North Dakota Regional Environmental Assessment Program) unless otherwise noted

[c] North Dakota Game and Fish Department

[d] Theodore Roosevelt National Park - North Unit

[e] USDA Forest Service

[f] US Fish and Wildlife Service (USFWS)

[g] Fort Berthold Indian Reservation

[h] Bureau of Land Management, Dickinson, North Dakota

[i] Combined acreage from Sections 19, 20, 29, 30

[j] NDGFD, 1978

[k] Aerial estimate

Appendix E. Summary of burrowing owl observations within the study area.

NEST NO.	USGS QUADRANGLE	LOCATION	NO. OF OWLS	HABITAT	COMMENTS
	Sather Lake	T149N,R103W,SWNW10	2[a]	Mixed-grass prairie	Inactive: poisoned prairie dog town
	Sather Lake	T149N,R103W,NESE10	1[a]	Mixed-grass prairie	Inactive: poisoned prairie dog town
	Sather Lake	T149N,R103W,NE26+ NW25	3[a]	Mixed-grass prairie	Inactive: poisoned prairie dog town
	Sather Lake	T149N,R103W,N12	4[a]	Mixed-grass prairie	Active prairie dog town
3,4	Red Wing Creek	T148N,R101W,NWSE21	8	Mixed-grass prairie	Active prairie dog town
	Sperati Point	T147N,R100W,NENW35	3[a]	Badlands grassland	Active prairie dog town
	Long X Divide	T147N,R99W,SENE11	1[a]	Badlands grassland	Active prairie dog town
5	Long X Divide	T148N,R99W,SWSW28	2	Badlands grassland	Active prairie dog town
8	Mandaree SW	T147N,R95W,SESW36	9	Badlands grassland	Active prairie dog town
7	Mandaree SW	T147N,R95W,SENE11	1	Badlands grassland	Active prairie dog town
9	Schefield	T137N,R97W,SWSW1	2	Mixed-grass prairie	Poisoned: but active prairie dog town
10	Schefield	T138N,R97W,NWSW36	2	Mixed-grass prairie	Poisoned: but active prairie dog town
11,12	Daglum	T137N,R99W,NWSW14	9	Mixed-grass prairie	Active prairie dog town
13	Daglum	T137N,R99W,SWSE19	6	Mixed-grass prairie	Active prairie dog town

Appendix E. (continued)

NEST NO.	USGS QUADRANGLE	LOCATION	NO. OF OWLS	HABITAT	COMMENTS
14	Daglum	T137N,R99W,NENE30	2	Mixed-grass prairie	Active prairie dog town
	Daglum	T137N,R99W	1	Mixed-grass prairie	No prairie dog town: owl sighted on fence post
1,2	Daglum	T137N,R100W,NWNE36, NENE36	5	Mixed-grass prairie	Active prairie dog town
15	Daglum	T136N,R99W,NENE6	3	Mixed-grass prairie	Active prairie dog town
	East Rainy Butte	T135N,R98W,32	1	Mixed-grass prairie	Owl sighted on telephone wire
	East Rainy Butte	T135N,R98W,35	1	Agriculture	Owl sighted on fence post
	Amidon	T133N,R101W,SE25	1	Agriculture	Owl sighted on fence post
16	Sheep Creek Dam	T132N,R89W,NWSE18	1	Mixed-grass prairie	A few active prairie dog burrows
17	Sheep Creek Dam	T132N,R89W,NWSE17	6	Agriculture/mixed-grass	Active prairie dog town
6	Havelock	T134N,R96W,NWNE27	1	Agriculture/mixed-grass	Owl sighted on badger hole
18	Hettinger North	T130N,R96W,NWNW5	2	Agriculture/mixed-grass	Owl sighted on badger hole

[a]Brian Stotts, USDA Forest Service, McKenzie Ranger District, Watford City, North Dakota.