

Technical Report No. 26
DIURNAL RAPTORS ON THE PAWNEE SITE

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INTRODUCTION

The hawks, eagles, and falcons are important consumers on the Pawnee Site, preying on a variety of primary and secondary consumers ranging from insects to birds, rodents and other small mammals. These diurnal raptors have been censused during routine bird counts described in a separate report by Giezentanner but also by means of special, more extensive counts designed specifically to take into consideration these raptors' rather large home ranges and relatively low population densities. Marti is reporting elsewhere on the more nocturnal birds of prey.

OBJECTIVES

The objectives were:

1. To determine the numbers and biomass of diurnal raptors frequenting the Pawnee Site;
2. To compare data from the Pawnee Site with those collected in similar areas elsewhere; and, eventually,
3. To determine the food habits and energy demands of these birds in the grassland ecosystem.

METHODS AND MATERIALS

Counts of hawks, eagles, and falcons have been mainly of two types:

1. Area count:

An attempt has been made to get a *total* count on an area 7 x 8 miles in extent (see Fig. 1). The area has been surveyed by one observer and usually an assistant, who traversed the area in a vehicle traveling from 10 to 20 mph. The transect followed crosses the study area five times with approximately two miles between each transect. Raptors

are spotted with the naked eye and 7 x 35 binoculars. Then, with the vehicle stopped, they are observed and identified with a 20-power spotting scope. The location of the raptor, its direction of flight, time and other pertinent information are recorded on a map and special data form. Counts are made from about 8 AM until 1 PM. Usually four to five hours are required to drive the 45-mile route through the 56 sq miles.

2. Roadside count:

Birds of prey are routinely observed on the standard, 24 1/2-mile-long, 50-stop roadside count described by Giezentanner. Since birds are recorded within a one-quarter-mile radius of each stop, the roadside counts census 50 circular plots, each of approximately 125 acres or 6,250 acres total area. These counts have been conducted weekly during the breeding season (April to August) and every two weeks the rest of the year. The counts are commenced at sunrise, and approximately four hours are required to cover the route.

In addition to the above, a special roadside route of more than 100 miles was covered outside of the above areas nine times from August 6 to September 17, 1969, in an effort to trap hawks for weights, banding, and marking. All sightings of birds of prey along this trapping route were recorded as in the area count.

RESULTS

The 56-sq-mile study area has been counted 12 times in 1969 (see Table 1), with from seven to 27 diurnal raptors being observed on individual days. The golden eagle (*Aquila chrysaetos*) was the most frequently observed species (32.6% of all observations); the rough-legged hawk (*Buteo lagopus*) and the marsh hawk

(*Circus cyaneus*) each accounted for about 20% of the observations. Lesser numbers of red-tailed hawks (*Buteo jamaicensis*), Swainson's hawks (*Buteo swainsoni*), ferruginous hawks (*Buteo regalis*), prairie falcons (*Falco mexicanus*), and sparrow hawks (*Falco sparverius*) also were noted.

Standing crop biomass was calculated from these counts, using average weights given by Brown and Amadon (1968). Golden eagles, being the heaviest individually as well as the most numerous of the species observed, made up the bulk of the standing crop biomass, particularly in the winter months (see Table 2).

Raptor-days of use on the 56-sq-mile study area were also calculated from these 12 counts (see Table 3). When more specific data on food habits and food demands per day are available, the energy demands for a year will be calculated from these "raptor-days-use" data.

Considerably different species composition was noted on the Weld County hawk-trapping route (Table 4) compared to the 56-sq-mile study area. Sparrow hawks accounted for almost half, and Swainson's hawks for more than a fourth of the 566 observations on the hawk-trapping route. No rough-legged hawks were noted, as the route was covered before the rough-legs had migrated into the area. Swainson's hawks and sparrow hawks do not regularly winter on the 56-sq-mile area but often migrate through Weld County in large flocks. Wills (1968) reported 100 to 150 Swainson's hawks in one area on the Pawnee National Grassland in September 1968, while Hurley *et al.* (1968) saw more than 450 Swainson's hawks in a one-day count in the same general area two days earlier.

Results from the 24 1/2-mile roadside count (which was covered 50 times from July 2, 1968, to December 12, 1969) were more similar to counts of the 56-sq-mile study area both in population indices and species composition (Table 5). More variety, however, was noted on the roadside count, where species not observed on the study area were seen, namely pigeon hawks (*Falco columbarius*) and one peregrine falcon (*Falco peregrinus*).

Population indices expressed in total numbers of raptors observed per 100 miles of census route indicate that the Pawnee Site has a greater population of raptors than reported in similar studies in Colorado (Enderson, 1965), Nebraska (Mathisen and Mathisen, 1968), and Texas (Allan and Sime, 1943), but that the Pawnee populations *average* somewhat less than counts observed in the Fort Collins area by Ray (1967) and along the hawk-trapping route in the peak of the fall hawk migration (see Table 5).

Most of the golden eagles using the 56-sq-mile study area are believed to nest to the north in the Chalk Bluffs along the Colorado-Wyoming border but, at least in 1969, one pair (site 54A) of the eagles nested in a cottonwood tree eight miles east of the IBP laboratory. They successfully fledged one young. In all, six eaglets were known to have fledged from four active nests within 10 miles of the 56-sq-mile study area (see Table 6). Two eagles were found dead (apparently electrocuted by a pump) two miles northeast of the study area during the summer of 1969 (Dale Wills, personal communication). Eagles using the area in the winter may come from more distant nesting sites. One eagle banded as a nestling near Livermore, Colorado, on May 27, 1967, was found dead in the 56-sq-mile study area December 20, 1967 (Boeker, 1969).

In addition to the Falconiformes so far discussed, two raptorial Passeriformes, the loggerhead shrike (*Lanius ludovicianus*) and the northern shrike (*Lanius excubitor*) frequent the Pawnee Site. The loggerhead, a summer resident, is more abundant (168 loggerheads were seen on 29 roadside counts made when it was resident compared to only nine northern shrikes seen during the course of 10 counts made when it was resident). The northern shrike is a winter resident and probably feeds on larger prey, mainly small birds and mice. The loggerhead nests on the site and feeds heavily on insects. Six loggerhead shrike pairs nested in one 20-sq-mile

area on the Central Plains Experimental Range, which would indicate a breeding density of 0.05 pairs per 100 acres. In general, loggerheads experienced a better hatching success than most ground-nesting passerines (see Table 7). A total of 69 shrikes were banded (44 also color-marked) during the summer of 1969 (see Table 8). A technical paper on the nesting and growth of young of the species is being prepared by J. B. Giezentanner.

ACKNOWLEDGMENTS

Many students have taken part in the various raptor counts which resulted in the data reported on herein. Particularly helpful have been David Cobb, Lester Flake, Brent Giezentanner, Wayne Marion, Carl Marti, Chet McCord, Robert Minor, Richard Olendorff, Thomas Ray, and Thomas Rutter. Thomas Ray provided considerable data which he gathered concerning the golden eagle while he was employed by the Denver Research Center, U. S. Bureau of Sport Fisheries and Wildlife. Dale Wills, biologist with the U. S. Forest Service, also has generously provided data concerning raptors on the Pawnee National Grasslands. Leslie Brown, noted authority on eagles from Nairobi, Kenya, and senior author of *Eagles, Hawks and Falcons of the World*, spent one day on the area and assisted in one of our regular semi-monthly counts.

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Table 1. Hawks and eagles observed on the Pawnee Site study area (56 sq miles), Weld County, Colorado in 1969.

Species	Jan. 25	Feb. 8	Feb. 14	Mar. 8	July 18	Aug. 26	Oct. 4	Oct. 25	Nov. 8	Nov. 15	Nov. 29	Dec. 11
Red-tailed hawk	-	-	-	-	-	-	-	1	-	-	-	-
Swainsons's hawk	-	-	-	-	2	3	-	-	-	-	-	-
Rough-legged hawk	10	3	5	7	-	-	-	4	2	1	2	2
Ferruginous hawk	3	1	1	2	-	2	1	4	-	2	1	1
Golden eagle	9	1	9	3	1	6	4	1	5	5	11	2
Marsh hawk	2	4	3	-	4	11	4	-	1	1	3	2
Prairie falcon	-	-	1	-	-	2	2	1	1	1	-	-
Sparrow hawk	-	-	-	-	1	1	-	-	-	-	-	-
Unidentified	1	-	1	-	-	2	4	1	3	-	1	-
Total - Hawks and Eagles	25	9	20	12	8	27	15	12	12	10	18	7
Raptor/100 miles ^{1/}	56	20	44	27	18	60	33	27	27	22	40	16
Raptor/100 miles ²	45	16	36	21	14	48	27	21	21	18	32	13

^{1/} Based on 45-mile route through 56-sq-mile study area.

Table 2. Standing crop biomass^{1/} of major diurnal raptors expressed in kilograms in 56-sq-mile study area.

Species	Jan. 25	Feb. 8	Feb. 14	Mar. 8	July 18	Aug. 26	Oct. 4	Oct. 25	Nov. 8	Nov. 15	Nov. 29	Dec. 11
Red-tailed hawk	-	-	-	-	-	-	-	1.1	-	-	-	-
Swainson's hawk	-	-	-	-	2.0	3.0	-	-	-	-	-	-
Rough-legged hawk	9.5	2.9	4.8	6.7	-	-	-	3.8	1.9	1.0	1.9	1.9
Ferruginous hawk	3.3	1.1	1.1	2.2	-	2.2	1.1	4.4	-	2.2	1.1	1.1
Golden eagle	38.8	4.3	38.8	12.9	4.3	25.8	17.2	4.3	21.5	21.5	47.4	4.3
Marsh hawk	0.8	1.7	1.3	-	1.7	4.6	1.7	-	0.4	0.4	1.3	0.8
Prairie falcon	-	-	0.9	-	-	1.8	0.9	0.9	0.9	0.9	-	-
Sparrow hawk	-	-	-	-	0.1	0.1	-	-	-	-	-	-
Totals	52.4	10.0	46.9	21.8	8.1	37.5	20.9	14.5	24.7	26.0	51.7	8.1

^{1/} Computed from weights given by Brown and Amadon (1968).

Table 3. Calculated use of the 56-sq-mile study area by the four most frequently observed raptors, expressed in raptor-days-use, 1969.^{1/}

Species	Jan. 25- Feb. 8	Feb. 8- Feb. 14	Feb. 14- March 8	July 18- Aug. 26	Oct. 4- Oct. 25	Oct. 25- Nov. 8	Nov. 8- Nov. 15	Nov. 15- Nov. 29	Nov. 29- Dec. 11
Golden eagle	70	35	138	140	53	42	35	112	78
Rough-legged hawk	91	56	138	-	42	42	11	21	24
Ferruginous hawk	28	7	36	40	53	28	7	21	12
Marsh hawk	42	25	36	300	42	7	7	28	30

^{1/} One golden eagle using the area 10 days would be 10 eagle-days use.

Table 4. Summary of raptors observed along trapping route, Weld County, Colorado, 1969.

Species	Aug. 6	Aug. 13	Aug. 20	Aug. 27	Aug. 29	Sep. 3	Sep. 10	Sep. 17	Total	% of Totals
Sparrow hawk	13	7	17	32	43	66	70	23	271	47.8
Swainson's hawk	8	7	14	12	17	34	35	24	151	26.7
Marsh hawk	2	4	9	4	9	11	6	5	50	8.8
Ferruginous hawk	-	2	3	1	1	3	3	5	18	3.2
Red-tailed hawk	2	1	2	4	2	3	3	1	18	3.2
Prairie falcon	-	2	2	-	3	4	2	1	14	2.5
Golden eagle	-	1	1	1	2	1	-	-	6	1.1
Sharp-shinned hawk	-	-	-	-	-	1	-	-	1	0.2
Unidentified hawk	1	1	3	3	17 ^{1/}	2	3	7	37	6.5
Totals	13	25	51	57	94	125	122	66	566	100.0
Miles covered	153	203	152	133	121	114	114	114	1,104	-
Raptor/100 miles	8.5	12.5	33.6	42.8	77.6	109.7	107.1	57.8	51.3	-

^{1/} The increase in unidentified hawks reflects the lack of a spotting scope, which was used in making identifications on other days.

Table 5. Raptor counts reported in various studies in the Great Plains.

Characteristic or Statistic	Places							
	Pawnee Site		Colorado					
	56-sq-mile study area	24 1/2- mile Roadside Route	Hawk-Trapping Route, Weld County, Colorado	Ft. Collins Area, Colorado	Ft. Collins to Colorado Spgs., Colorado	Panhandle of Nebraska	Panhandle of Texas	
Year(s) of study Reference	1969 This Study	1968-69 This Study	1969 This Study	1967 Ray (1967)	1962-64 Enderson (1965)	1957-59 Mathisen and Mathisen (1968)	1938-42 Allan and Sime (1943)	
Total miles covered	540	1,225	1,104	275	1,675	53,347	26,768	
Number of censuses	12	50	9	4	12	?	?	-12-
Total raptor observations	175	382	566	275	426	2,564	6,175	
Raptors/100 miles (avg)	32.2	31.2	51.3	43.4	25.4	4.7	23.3	
Min.-Max. of above	16-60	12-110	9-110	38-47	?	?	?	
Percent rough-legged hawk	20.6	15.2	1/	60.6	42.0	19.4	0.8	
Percent golden eagle	32.6	12.3	1.1	16.4	7.5	5.3	0.5	
Percent marsh hawk	20.0	26.2	8.8	13.2	17.8	25.4	22.3	
Percent sparrow hawk	1.1	10.5	47.8	0.8	7.5	29.8	7.0	
Percent Swainson's hawk	2.9	11.8	26.7	2/	1.7 ^{3/}	6.7	41.7	
Percent prairie falcon	4.6	6.3	2.5	0.8	14.8	0.2	1.2	
Percent ferruginous hawk	10.3	13.9	3.2	-	3.5	0.3	6.7	
Percent red-tailed hawk	0.5	2.4	3.2	0.8	0.9	3.2	1.6	

1/ August 6 - September 17 before rough-legged hawks arrive but during the peak of the Swainson's and sparrow hawk migrations.

2/ Ray's counts were all in winter, *after* most Swainson's had migrated out of his area.

3/ Enderson's counts were mainly *after* most Swainson's had migrated out of his area.

Table 6. Golden eagles fledged on the Pawnee Site (Rockport to Hereford) 1964-1969 (Data courtesy of Tom Ray).

Year	Nest Sites (F. & W. S. Numbers)						Total
	53	54	54A	55	56	57	
1964	?	-	?	?	2	1	3
1965	0	-	?	2	1	0	3
1966	1	-	?	1	-	2	4
1967	2	A	?	-	-	1	3
1968	-	A	?	2	-	-	2
1969	-	1	1	2	-	2	6

? = No data available.

- = Nest checked, but was inactive.

0 = Eagles nested but failed to fledge any young.

A = Nest active but fate unknown.

Table 7. Fate of nests of loggerhead shrikes followed on the Pawnee Site in 1969 (Data compiled by J. B. Giezantanner).

Characteristic	Number
Number of nests	16
Eggs, when found	78
Young, when found	18
Eggs hatched	65
Hatching, percent	83.3%
Eggs, not hatched	12
Eggs predated	1
Eggs abandoned	0
Young predated	24
Predation, percent	36.9%
Young abandoned	0
Fledglings	41
Fledging, percent	63.7%

Table 8. Loggerhead shrikes banded on the Pawnee Site in 1969.

Age Class	Total Banded	Number Color Banded
Adults	5	5
Nestlings	52	27
Fledgling	12	12
Total	69	44

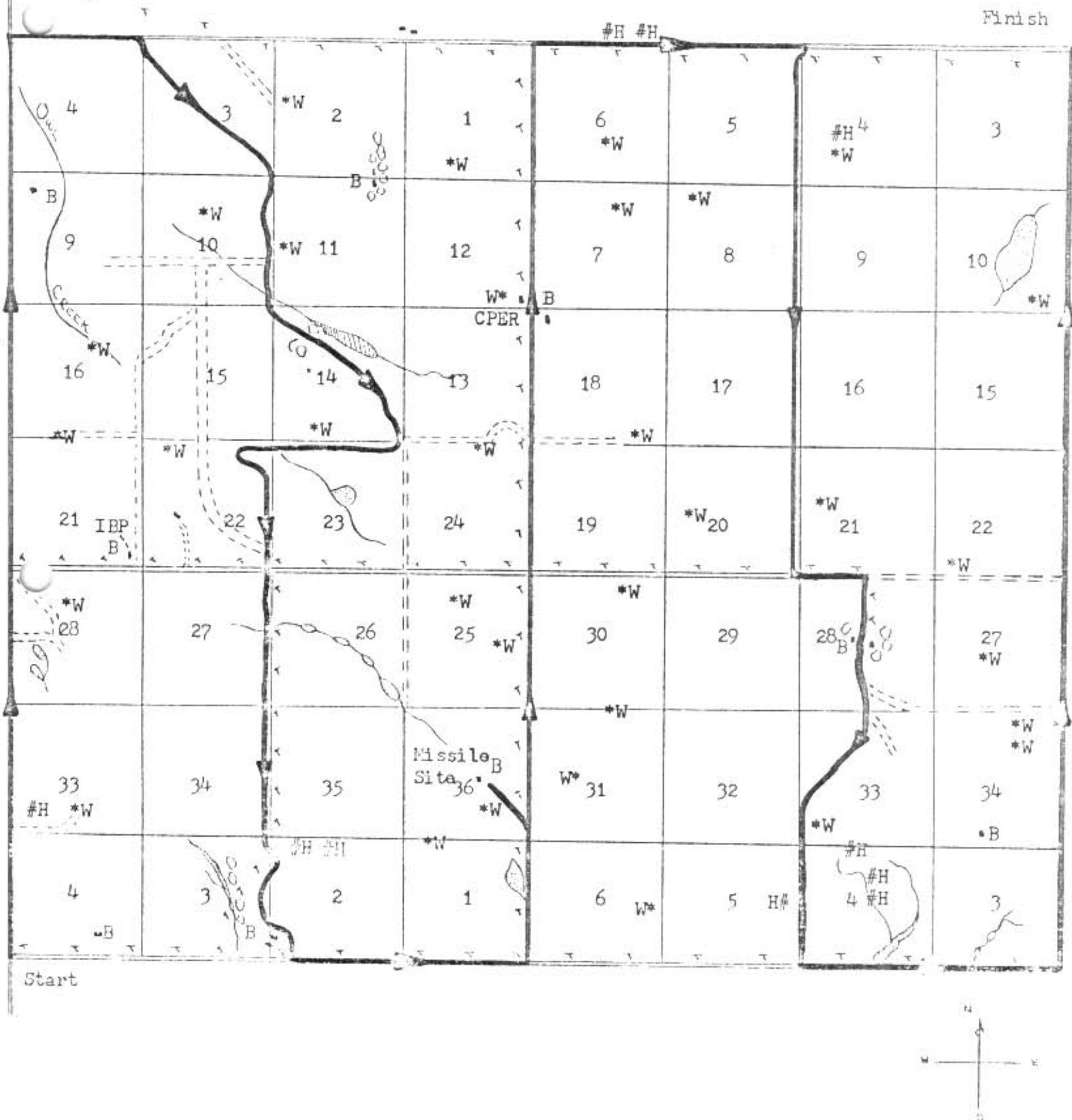


Fig. 1. Fifty-six-sq-mile raptor study area showing route followed in counting.