

SWAINSON'S HAWK NESTING ECOLOGY IN NORTH DAKOTA

DAVID S. GILMER

AND

ROBERT E. STEWART

ABSTRACT.—Swainson's Hawks (*Buteo swainsoni*) were studied at 270 occupied nest sites in south-central North Dakota on a 1,259-km² intensive study block and on a surrounding study area (16,519 km²) during three breeding seasons. On the intensive study block the number of occupied nests ranged from 46 in 1977 to 100 in 1979. Average nest densities were highest on ground moraine (0.119 nest/km²) and on eolian sand deposit (0.102 nest/km²) landforms. Pasture and haylands made up 75% of the land-use within 1.0 km of a sample of 27 nests. Some pairs nested successfully in sites characterized by intensive agriculture and human activity; about 75% of all nests were in sites attributable to human activities. The most common nesting sites (43%) were in shelterbelts. Cottonwoods (*Populus deltoides*) were the most frequently used (44%) nest trees. At least 50% of the pairs constructed new nests each year. Mean nest success was 64% and mean number of young fledged per occupied nest was 1.5. Wind and hail caused over 30% of the nest failures each of the three years. Northern pocket gophers (*Thomomys talpoides*) were the most frequent prey, accounting for 44% of all animal remains found at nests. Man-made changes in central North Dakota during the last century have provided many nesting sites in areas previously sparsely populated by Swainson's Hawks.

Swainson's Hawks (*Buteo swainsoni*) are a major component of the raptor fauna within their breeding range in the semiarid region of North America (Brown and Amadon 1968). Despite their wide distribution, few studies of their breeding ecology in the northern prairie region have been published. Major studies have been conducted in Colorado (Olendorff 1973), Wyoming (Dunkle 1977), Washington (Bechard 1980, Fitzner 1980), Saskatchewan (Schmutz et al. 1980), and California (Bloom 1981). Briefer but noteworthy studies include those of Cameron (1913), Bowles and Decker (1934), Bent (1937), Craighead and Craighead (1956), Platt (1971), Smith and Murphy (1973), Keir (1976), and Tyler (1981).

Land use in North Dakota is changing, with increased emphasis being placed on intensive agriculture (Stewart 1975) and energy development (D. L. Evans, unpubl. rep., U.S. Fish and Wildlife Service, Jamestown, North Dakota, 1980). The effect of this trend on birds of prey breeding in the region is unknown. We studied the Swainson's Hawk in North Dakota in order to provide a basis for evaluating the future status of this species in the region. Our objectives were to evaluate population density, productivity, habitat, nest-site selection, and food habits of Swainson's Hawks in North Dakota. Our study was conducted from spring through the summers of 1977-1979.

STUDY AREA

The 16,519-km² study area consists of Stutsman, Kidder, Logan, and Burleigh counties in south-central North Dakota. The area contains three biotic subregions (Stewart 1975): Drift Plain, 21%; Missouri Coteau, 62%; and Coteau Slope, 17% (Fig. 1). The Drift Plain is mostly gently rolling ground moraine and end moraine. The Missouri Coteau is mostly high-relief dead-ice moraine and gently rolling glacial outwash. The Drift Plain and Missouri Coteau are characterized by the eastern mixed-grass climax community. Glacial action only moderately affected the topography of the Coteau Slope subregion where principal landforms include sheet moraine and shallow ground moraine deposits. The climax vegetation is the western mixed-grass community. Major land uses in the Missouri Coteau and Coteau Slope subregions are haylands and pasture areas (mostly native prairie); croplands (mostly wheat and sunflower) dominate the Drift Plain (North Dakota Crop and Livestock Reporting Service 1980).

Small stands of deciduous trees occur throughout the study area on river bluffs, on east- and north-facing slopes of high moraines, along margins of many permanent and semi-permanent fresh-water lakes, in shelterbelts, and in groves associated with nearly all farmsteads.

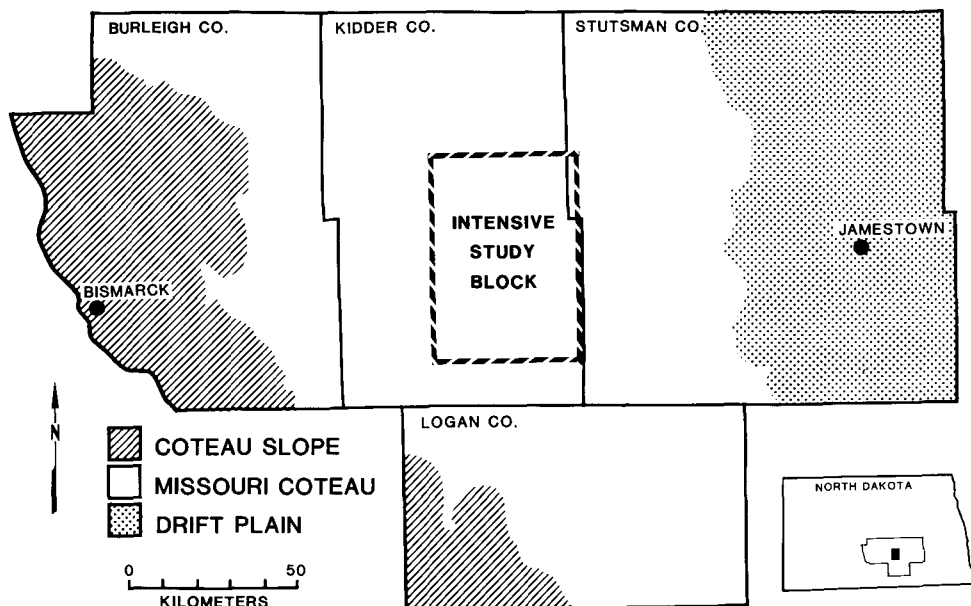


FIGURE 1. Relation of the 16,519-km² study area and the 1,259-km² intensive study block to the biotic subregions of North Dakota.

A 1,259-km² intensive study block (ISB) was established in the Missouri Coteau, in the central portion of the study area (Fig. 1), where densities of raptors were believed to be highest (Stewart 1975). The ISB was used to collect data about nesting density and habitat.

METHODS

We conducted field work from mid-April to about 30 August each year. Effort was made to locate all Swainson's Hawk nests in the study area. These nests provided the basis for ascertaining breeding density, nest success, and assessing characteristics of nest locations. To estimate Swainson's Hawk breeding density and assess land-use patterns in the entire study area, we selected a random sample of 5.18-km² plots (two adjacent sections) in each of the three subregions. The number of sample plots was based on subregion size and expected relative abundance of breeding hawks (Stewart 1975). There were 148 sample plots distributed as follows: Drift Plain, 26; Missouri Coteau, 95; and Coteau Slope, 27. A simple random sampling design produced optimum results in a survey of 11 raptor species in west-central North Dakota (Postovit 1979). Because we had well-defined subregions in our study area we developed a design based on stratified random sampling.

We conducted a complete nest search of the 1,259-km² ISB and the 148 sample plots each spring from vehicles and aircraft, and on foot. Binoculars and spotting scopes were used to find nests and soaring birds. After completing

these searches, we covered the rest of the study area, primarily from vehicles and aircraft. During late June we walked to all occupied nests.

At least two visits were made to most nests during a breeding season. The first was to locate a nest and determine if it was occupied. This visit was usually during early incubation. Subsequent visits were to determine hatching success and to collect data about nest site characteristics, surrounding habitat, and food habits. All three-week or older young were banded with U.S. Fish and Wildlife Service lock-on bands. Guidelines described by Fyfe and Olen-dorff (1976) were followed to prevent nest abandonment and injury to young and eggs.

Terminology similar to that proposed by Postupalsky (1974) was used to describe nest status. A nest was classified as "occupied" only if an adult was seen in the nest, or if it contained eggs or young. If an unoccupied nest appeared to be recently repaired or if a hawk was seen nearby we returned to the site within a few days to assess the nest status. A "successful" nest was an occupied nest from which at least one young was fledged or raised to banding age.

To ascertain food habits, only fresh prey found at the nest were collected and identified. Importance of prey was calculated by means of an index of relative importance (IRI) described by Pinkas et al. (1971). We used this method because it provided a single value for each prey species, which included total number, biomass, and frequency of occurrence.

TABLE 1. Occupied Swainson's Hawk nests observed in 148 sample plots and the estimated total nests in the 16,519-km² study area in central North Dakota, 1977-1979.

| | Nests observed in sample plots | | | Estimated total nests | | |
|------|--------------------------------------|-----------------------------------|----------------------------------|-----------------------|------|----------------------|
| | Missouri Coteau (n = 95 plots) | Coteau Slope (n = 27 plots) | Drift Plain (n = 26 plots) | n | SD | Nest/km ² |
| | | | | | | |
| 1977 | 3 | 0 | 1 | 89 | 43.1 | 0.005 |
| 1978 | 3 | 0 | 2 | 115 | 49.7 | 0.007 |
| 1979 | 5 | 0 | 2 | 156 | 56.7 | 0.009 |

Pellets were periodically collected and analyzed to determine if any major items were not found as fresh prey.

A 259-km² (100-mi²) area in the central portion of the ISB was mapped in August 1977 with an aerial photo system described by Woodcock (1976). Occupied nests on the photographed area were plotted on a photo mosaic, and habitats within a 1.0-km radius of each nest were classified into four land-use categories. Results were checked from the ground.

Nest locations were plotted on North Dakota highway department county road maps (scale 1:126,720). Landform maps (Colton et al. 1963) were used to evaluate the distribution of nests according to prominent geological features (e.g., glacial outwash, dead-ice moraine, end moraine). Nest locations were recorded in state plane coordinates.

RESULTS

POPULATION DENSITIES

Numbers of occupied nests on the ISB ranged from 46 (0.036 nest/km²) in 1977 to 100 (0.079 nest/km²) in 1979. Between 1978 and 1979 the population increased by 113%. The average density for all years combined was 0.051 occupied nest/km². Mean distances between adjacent Swainson's Hawk nests varied between 2.8 km in 1977 and 1.8 km in 1979, and averaged 2.3 ± 0.3 ($\bar{x} \pm SD$) km for all years. The ISB contained higher nest densities than did any other portion of the study area.

Nest densities estimated for the entire study area provided a better indication of conditions in central North Dakota than did the densities derived from the relatively small ISB because regional habitat conditions were more accurately represented in the study area. For instance, glacial outwash made up 55.5% of the ISB, whereas, this landform was 18.3% of the study area as a whole. On the study area, nest densities estimated from sample plots were highest in 1979 (Table 1). The average density for all years was 0.007 nest/km². Sample plots in the Missouri Coteau contained the highest proportion of occupied nests of the three

TABLE 2. Sites used by Swainson's Hawks for nesting in the study area in central North Dakota, 1977-1979.

| Site description | No. nests* | Percent of nests |
|----------------------------|------------|------------------|
| Shelterbelt | 117 | 43 |
| Wetland border | 60 | 22 |
| Abandoned farmstead | 30 | 11 |
| Rights-of-way ^b | 21 | 8 |
| Isolated tree | 18 | 7 |
| Tree claim ^c | 11 | 4 |
| Coulee | 7 | 3 |
| Active farmstead | 6 | 2 |
| TOTAL | 270 | 100 |

* Occupied nests in each site were counted each year, regardless of whether they were counted the previous year.

^b Along railroad tracks and roads.

^c Trees in clumps other than single- or double-row shelterbelts.

subregions. None of the sample plots in the Coteau Slope contained nests. High variability precluded detection of changes of breeding density on the entire study area; however, trends in the data suggested an increase had occurred between 1977 and 1979.

NEST SITE CHARACTERISTICS

We identified eight types of tree sites used for nesting by Swainson's Hawks (Table 2). Nests in shelterbelts and in trees adjacent to wetlands accounted for about 65% of all sites. Wetland borders and coulees were the only sites used that were not influenced in some way by human activity. Approximately 75% of all nest sites used by Swainson's Hawks in the study area were directly or indirectly produced by man.

At 234 nest sites, eastern cottonwood (*Populus deltoides*) was the most common tree species (45%) used. Other species included Chinese elm (*Ulmus parvifolia*), 22%; peachleaf willow (*Salix amygdaloides*), 13%; boxelder maple (*Acer negundo*), 12%; green ash (*Fraxinus pennsylvanica*), 7%; with American elm (*U. americana*) and Russian olive (*Elaeagnus angustifolia*) accounting for the remaining 1%. Except for cottonwood and peachleaf willow, which grew naturally around wetlands and along drainages, the other trees had been planted.

Average diameter of 222 nests was $67.3 \pm SD$ of 6.0 cm, and average depth was 37.0 ± 2.0 cm. The highest nest we recorded, situated in a cottonwood, was 17.8 m above the ground; the lowest nest, in a peachleaf willow, was 2.1 m above the ground. Mean height of 245 nests was 7.1 ± 3.3 m. Nest materials were twigs and sticks. Cottonwood leaves and branches were the most commonly used materials, found in 68% of the nests even though only 45% of the nests were in cottonwood trees. The second most frequently used item in nest construction

TABLE 3. Land-use (%) within 100 m and 1.0 km of 27 occupied Swainson's Hawk nests in a 259-km² portion of the intensive study block compared with land-use within the study area in North Dakota, 1977-1979.

| Land-use category | Within 100 m of nests | Within 1.0 km of nests | Within the study area |
|-------------------------------|-----------------------|------------------------|-----------------------|
| Pasture ^a | 33.2 | 37.0 | 36.1 |
| Hayland/alfalfa | 37.9 | 38.4 | 21.6 |
| Cultivated crops ^b | 17.5 | 17.7 | 36.7 |
| Other ^c | 11.4 | 6.9 | 5.6 |

^a Includes native mixed-grass prairie and tame grasslands.
^b Includes fallow areas.
^c Includes shelterbelts and tree claims, wetlands, road rights-of-way, farm/town.

was the common Russian thistle (*Salsola kali*), found in 59% of the nests.

On the basis of 90 breeding areas monitored from year to year, we estimated that about 50% of the pairs in 1978 and about 59% in 1979 constructed new nests. Of the old nests reused in 1978 and 1979, 77% and 42%, respectively, had been occupied by Swainson's Hawks the year before. Also used were nests occupied the year before by Ferruginous Hawks (*Buteo regalis*), Red-tailed Hawks (*B. jamaicensis*), and Great Horned Owls (*Bubo virginianus*).

HABITAT PREFERENCE

Swainson's Hawks have been found breeding throughout North Dakota except for the extreme eastern portion (Stewart 1975). This distribution suggested that breeding pairs can adapt to a wide range of habitat conditions. On the basis of sample plots within the Drift Plain we estimated that about 82% of the land in that portion of the study area was under cultivation in 1977. Despite the intensive agriculture, 10 occupied nests were found in the Drift Plain. Only four Swainson's Hawk nests were found in the Coteau Slope; all other nests (94.8%) were found in the Missouri Coteau.

Land uses within 100 m and 1.0 km of a sample of 27 occupied nests within the ISB

TABLE 5. Swainson's Hawk nest success and productivity in the study area in central North Dakota, 1977-1979.

| | 1977 | 1978 | 1979 | Overall |
|--|------|------|------|---------|
| Occupied nests | 64 | 60 | 146 | 270 |
| Percent nest success | 54 | 63 | 69 | 64 |
| Total young fledged | 74 | 82 | 259 | 415 |
| Young fledged/occupied nest ^a | 1.17 | 1.37 | 1.77 | 1.55 |

^a Last nest visit usually within one week of fledging date for most nestlings.

were classified as pasture, haylands, cultivated crops, or other (wetlands, roads, farmsteads, and shelterbelts) (Table 3). The 1.0-km radius was chosen because it was about half the mean distance (2.3 km) between adjacent Swainson's Hawk nests in the ISB. Pasture and haylands were the dominant (75%) land use within 1.0 km of nests. However, some pairs showed a noticeable tolerance to agricultural disturbance. Two pairs used nest sites where the total cropland area within a 1.0-km radius exceeded 60%, and two other pairs nested in sites surrounded by 100 m of cultivated crops; for most pairs, however, this degree of habitat disturbance appeared to be unacceptable.

Nest densities were calculated for the five geological landforms found on the ISB (Table 4). The highest mean nest densities were on ground moraine and eolian sand deposits, but differences between number of nests expected based on area in each landform type, and the number of nests observed was not significant ($P > 0.05$).

NEST SUCCESS

The percentage of successful nests on the study area ranged from 54% in 1977 to 69% in 1979 (Table 5). Concomitant with increased nest success was a significant ($P < 0.01$, one-way ANOVA) increase in the average number of young fledged per occupied nest. Of 100 suc-

TABLE 4. Density of occupied Swainson's Hawk nests on glacial landforms found in the 1,259-km² intensive study block in North Dakota, 1977-1979.

| Landform | Percent of area | Number of nests and density | | | | | | Mean density |
|------------------|-----------------|-----------------------------|-----------------------|------|-----------------------|------|-----------------------|--------------|
| | | 1977 | | 1978 | | 1979 | | |
| | | n | Nests/km ² | n | Nests/km ² | n | Nests/km ² | |
| Glacial outwash | 55.5 | 32 | 0.046 | 31 | 0.044 | 61 | 0.087 | 0.059 |
| Dead-ice moraine | 19.4 | 3 | 0.012 | 3 | 0.012 | 8 | 0.033 | 0.019 |
| End moraine | 14.9 | 5 | 0.027 | 7 | 0.037 | 17 | 0.091 | 0.052 |
| Eolian sand | 4.1 | 4 | 0.077 | 4 | 0.077 | 8 | 0.154 | 0.102 |
| Ground moraine | 2.2 | 2 | 0.071 | 2 | 0.071 | 6 | 0.214 | 0.119 |
| Permanent water | 3.9 | | 0 | | 0 | | 0 | 0 |
| TOTAL | 100 | 46 | 0.036 | 47 | 0.037 | 100 | 0.079 | 0.051 |

cessful nests in 1979, 19 produced four fledging-age young while only one of 38 nests in 1978 and two of 34 nests in 1977 fledged four young.

Failure of nests due to unknown causes accounted for 44% of the 97 unsuccessful nests. Loss of nests due to wind and hail damage varied from 30 to 43% of the total loss each year ($\bar{x} = 34\%$) and was the second major cause of nest failure. Nests were typically flimsy and many were unable to withstand summer windstorms, common in the region. Other causes of nest failure on our study area were predation (19%) and human disturbance (3%).

To determine if human activity might be a factor in nesting success we compared the success of 49 pairs of Swainson's Hawks nesting within 500 m of a farmhouse (z -test, Dixon and Massey 1969:249) to that of other pairs ($n = 221$). Success was similar between groups ($\bar{x} = 61.2\%$ vs. 67.7% , $z = 0.85$, $P > 0.05$).

FOOD HABITS

Swainson's Hawks in the study area preyed primarily on northern pocket gophers (*Thomomys talpoides*). Index-of-relative-importance (IRI) values each year were much higher for this species than for other prey (Table 6).

Consistently, the second most important food item was the Richardson's ground squirrel (*Spermophilus richardsonii*). The meadow vole (*Microtus pennsylvanicus*) was the third-ranked prey followed by the thirteen-lined ground squirrel (*S. tridecemlineatus*). Although not noted as prey in 1977, voles accounted for 26.1% of all prey items by 1979. Other mammals found less often in the diet of Swainson's Hawks on the study area included deer mouse (*Peromyscus maniculatus*), Wyoming pocket mouse (*Perognathus fasciatus*), and long-tailed weasel (*Mustela frenata*).

No avian prey was found at nests in 1977 but in 1978 and in 1979 birds accounted for 2.3% and 8.3% of all prey items we examined (Table 6). Prey species included the Western Meadowlark (*Sturnella neglecta*), Chestnut-collared Longspur (*Calcarius ornatus*), Sharp-tailed Grouse (*Tympanuchus phasianellus*), Short-eared Owl (*Asio flammeus*), American Kestrel (*Falco sparverius*), Blue Jay (*Cyanocitta cristata*), and Rock Dove (*Columba livia*). Except for the kestrel, jay, and dove, all were fledglings. Cannibalism was noted in 1979 in one nest where young fed on a dead nest-mate.

Reptiles and amphibians, although abundant on the study area, were not noted as prey. We did not observe insects as prey, possibly because our technique (examination of fresh prey remains) favored larger prey items (Snyder and Wiley 1976). However, insect parts

TABLE 6. Prey species at occupied nests of Swainson's Hawks in the study area in central North Dakota, June through August 1977-1979.

| Species | Percent of total prey | Percent of total prey biomass ^a | Percent frequency ^b | IRI ^c |
|--------------------------------|-----------------------|--|--------------------------------|------------------|
| 1977 ($n = 39$) | | | | |
| Northern pocket gopher | 53.8 | 36.2 | 48.5 | 4,365 |
| Richardson's ground squirrel | 33.3 | 54.1 | 36.4 | 3,181 |
| Meadow vole | 0 | 0 | 0 | 0 |
| Thirteen-lined ground squirrel | 10.3 | 9.4 | 12.1 | 238 |
| Other mammals | 2.6 | 0.3 | 3.0 | 9 |
| Birds | 0 | 0 | 0 | 0 |
| 1978 ($n = 44$) | | | | |
| Northern pocket gopher | 54.5 | 45.9 | 44.2 | 4,438 |
| Richardson's ground squirrel | 20.5 | 41.5 | 26.5 | 1,643 |
| Meadow vole | 13.6 | 1.8 | 14.7 | 226 |
| Thirteen-lined ground squirrel | 6.8 | 7.8 | 8.8 | 128 |
| Other mammals | 2.3 | 0.4 | 2.9 | 8 |
| Birds | 2.3 | 2.6 | 2.9 | 14 |
| 1979 ($n = 96$) | | | | |
| Northern pocket gopher | 35.4 | 31.7 | 33.8 | 2,268 |
| Richardson's ground squirrel | 20.8 | 45.1 | 22.1 | 1,456 |
| Meadow vole | 26.1 | 3.7 | 17.6 | 524 |
| Thirteen-lined ground squirrel | 7.3 | 8.9 | 10.3 | 167 |
| Other mammals | 2.1 | 0.3 | 4.4 | 11 |
| Birds | 8.3 | 10.3 | 11.8 | 219 |
| All years ($n = 179$) | | | | |
| Northern pocket gopher | 44.0 | 36.3 | 40.0 | 3,216 |
| Richardson's ground squirrel | 23.4 | 46.6 | 26.6 | 1,865 |
| Meadow vole | 17.5 | 2.3 | 12.6 | 247 |
| Thirteen-lined ground squirrel | 7.8 | 8.8 | 10.4 | 173 |
| Other mammals | 2.2 | 0.3 | 3.7 | 9 |
| Birds | 5.1 | 5.7 | 6.7 | 72 |

^a Weights of mammals taken from Gunderson and Beer (1953).

^b Percentage of visits prey observed.

^c IRI (Index of Relative Importance) = (% number of prey + % total prey biomass) × (% frequency observed) (after Pinkas et al. 1971).

were not found in pellets we examined; these invertebrates probably provided little food for Swainson's Hawks in central North Dakota.

DISCUSSION

POPULATIONS AND PRODUCTIVITY

Nesting densities of Swainson's Hawks in central North Dakota were similar to those reported for other studies. In southwestern Wyoming, Dunkle (1977) reported 49 nests on a 1,554-km² area (0.032 nest/km²). On a 4,000-km² study area in Washington, Bechard (1980) located 35 nests (0.009 nest/km²).

The average nest success for this study was 64% and 1.55 young fledged per nest. The re-

productive performance of Swainson's Hawks was highest in southeastern Washington (Bechard 1980) where nest success was about 89% and young fledged per occupied nest was 2.26. Reproduction reported from Colorado (Olendorff 1973), Wyoming (Dunkle 1977), and Washington (Fitzner 1980) ranged from 43 to 86% for nest success and from 1.1 to 1.9 young fledged per occupied nest.

We feel that the increased nesting density in 1979 lends credence to Galushin's (1974) contention that certain raptor populations consist of constant numbers of individuals who may shift within a large area in response to food availability. Nevertheless, other factors such as increased survival and recruitment may have also contributed to the increase in nesting densities we observed.

We attributed nest failures mostly to unknown causes but wind and hail accounted for 34%. Nest success in central North Dakota was greatly influenced by the severity and frequency of wind and hailstorms. Storm damage in one year accounted for the loss of about 33% of all Swainson's Hawk nests in northeastern Colorado (Olendorff 1973).

INFLUENCE OF MAN

On our study area, Swainson's Hawks used only trees or shrubs for nesting sites. In Wyoming (Dunkle 1977) and in Saskatchewan (Munro 1935), Swainson's Hawks nested on utility poles, but this may have been because trees were scarce. Ferruginous Hawks and Red-tailed Hawks commonly nested on power line towers in central North Dakota (Gilmer and Wiehe 1977).

Human activities in North Dakota during the past century have greatly increased the availability of nest sites for the Swainson's Hawk. The planting of trees as a soil conservation measure, for shelter, and esthetics has provided numerous nest sites in grassland areas that probably supported sparse populations previously. Olendorff (1973) speculated that similar developments have influenced populations in northeastern Colorado where 40% of the Swainson's Hawks nested in man-created situations, mostly in trees at abandoned farmsteads.

HABITAT REQUIREMENTS

Some Swainson's Hawk pairs nested in intensively cultivated areas typical of the Drift Plain; however, most pairs selected nesting habitat dominated by grasslands. Ferruginous Hawks on our study area were highly dependent on extensive grasslands (Gilmer and Stewart 1983). Of the large raptors breeding in northern Colorado, only the Swainson's Hawk regu-

larly nested near cultivated lands (Olendorff 1973). The reason for the sparsity of nests on the Coteau Slope was unclear but was probably related to low prey availability. Swainson's Hawks often nested near (<500 m) farmhouses and the productivity of such pairs was similar to that of pairs in other sites. Call (1978) reported that this species often constructed nests near human activity.

Northern pocket gophers were the most important prey of Swainson's Hawks in our study as in southeastern Washington (Bechard 1980). The fossorial habit of the gophers apparently did not protect them from hawks. Gopher mounds were conspicuous in pastures and haylands and may have enabled hawks to concentrate their hunting efforts on these sites. Gophers were the secondary prey of Ferruginous Hawks in the study area (Gilmer and Stewart 1983). The most important prey of Swainson's Hawks in Saskatchewan was Richardson's ground squirrels (Schmutz et al. 1980). Use of meadow voles increased each year of our study and coincided with a noticeable increase in vole populations between 1978 and 1979 on small mammal survey plots 50 km north of our ISB (T. Gatz, pers. comm.). This species may have been used more frequently by Swainson's Hawks early in the season, prior to our prey sampling effort. Our sampling methods may have slightly under-represented the importance of small prey including gophers, voles and mice in the Swainson's Hawk diet.

Nesting densities in the ISB were relatively high, probably resulting from a combination of favorable habitat conditions and apparently plentiful prey. Although nesting sites are abundant, expansion of intensive agricultural practices in central North Dakota may reduce the attractiveness of the region to Swainson's Hawks.

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Northern Prairie Wildlife Research Center, U.S. Fish and Wildlife Service, Jamestown, North Dakota 58401. Present address of first author: Wildlife Research Field Station, U.S. Fish and Wildlife Service, 6924 Tremont Road, Dixon, California 95620. Received 2 July 1982. Final acceptance 28 May 1983.