

DIFFERENTIAL HABITAT UTILIZATION BY WINTERING ROUGH-LEGGED AND RED-TAILED HAWKS

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The winter ranges of the Rough-legged Hawk (*Buteo lagopus*) and the Red-tailed Hawk (*B. jamaicensis*) overlap to some extent across much of the United States (AOU Checklist 1957: 105-106, 110). These species are congeneric, similar in size and anatomy, and have roughly similar food habits. Thus, it is of interest to determine what behavioral and ecologic differences enable the two to partition the available and "suitable" living space at a given locality. Craighead and Craighead (1956) made an extensive study of winter raptors, including Rough-legged and Red-tailed Hawks, in a township in southern Michigan. Weller (1964) contributed observations on winter habits of rough-legs and red-tails in Iowa, noting some differences in habitat utilization. In this paper I will present additional quantitative data on differences in habitat utilization by the two species.

STUDY AREA AND METHODS

The study was conducted in a 43.1 square mile area located near the center of DeKalb County, Illinois, the major part of this area being in Afton Township (for map see Schnell 1967b). The study area varies from flat to gently rolling, as does the rest of the county. More than 90 per cent of the soil in the county is used agriculturally, and more than 80 per cent is in cropland. While prairie grasses once covered about 92 per cent of DeKalb County, they are virtually gone today (Kouba 1965: 36 and 61). Although all townships in the county have some upland timber soil, the land in my study area apparently has been without virgin timber since at least 1850, and only small patches of upland timber soil are present (Randall 1964:9).

I conducted a survey of the winter ground cover during March 1966. With the aid of 1964 aerial photographs and plat book maps, the vegetational cover type present on each field was recorded by driving along section roads. This survey showed that 47.3 per cent of the study area was covered by corn stubble fields, 28.6 per cent by grasslands, and 24.1 per cent by plowed fields. This is probably

an accurate estimate for the percentages of field types present during the 1964-65 winter as well. The "grassland" classification included not only pasture land, but also stubble fields of the cereal grains and soybeans. The land within the farmyards was not considered because of the relatively small acreages involved.

In addition to making general observations, I periodically censused birds along a 50-mile survey route in the study area from 14 November 1964 to 28 March 1965 and from 24 October 1965 to 15 March 1966 (Schnell 1967b). For each hawk I recorded the date and time the bird was first observed in addition to the following information: whether the bird was flying or standing; whether it was near or away from the road; the field type over which the bird was situated; the perching type used if the bird was perching; the height of perch trees; and the grouping of trees used.

RESULTS

ACTIVITY

I noted that 178 (33.3 per cent) of the 534 Rough-legged Hawks were flying when first observed, as were 10 (15.6 per cent) of 64 Red-tailed Hawks. The two samples were significantly different ($\chi^2 = 8.29$, $P < 0.005$, 1 *d.f.*), with the red-tails being somewhat more sedentary than the rough-legs. Elsewhere, I have analyzed further the activity of Rough-legged Hawks in relation to environmental variables (Schnell 1967a).

RELATION OF NUMBER OF BIRDS ALONG ROADWAYS TO SNOW COVER

Birds were recorded as being within or beyond 100 feet of a roadway when first sighted. I extracted data on the amount of snow on the ground at the time of each observation from records of the U.S. Weather Bureau, DeKalb Station (Earth Science Department, Northern Illinois University). The observations were grouped into the following categories: (1) no ground snow; (2) patches or under one inch; (3) one inch and under five inches; and (4) five inches and above.

	SNOW on GROUND				Total
	None	Patches, under 1"	1" and under 5"	5" and above	
Away From Road	191	44	20	87	342
Along Road	79	26	17	70	192
Total	270	70	37	157	534
Per Cent Along Road	29.3	37.1	45.9	44.6	

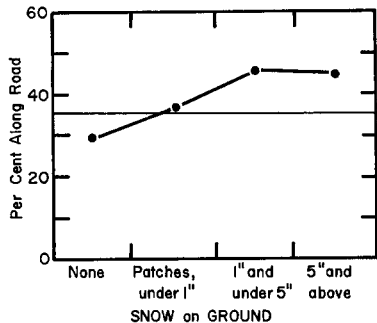


FIGURE 1. The numbers of Rough-legged Hawks found within or beyond 100 feet of the roadway under various conditions of ground snow. The straight line at 36 per cent represents the theoretical distribution expected from a random sample where the variables, snow cover and percentage of birds along the road, are independent.

The hypothesis that there was no significant difference in the number of Rough-legged Hawks along the road under different conditions of ground snow was rejected (see fig. 1; $\chi^2 = 12.03$, $P < 0.010$, 3 *d.f.*). The finding that Rough-legged Hawks tend to spend more time near roads when there is snow on the ground is further substantiated when one considers that rough-legs are more obvious to an observer against a background of snow. Therefore, if any birds away from the road were missed, it is likely that most such errors would have occurred during periods when there was no snow cover. No significant difference was found in the relative number of rough-legs along roads in the "one inch and under five inches" and "five inches and above" categories of snow cover.

The red-tails showed no tendency to move toward roads when there was snow on the ground. My sample of 20 red-tails (9 in snow cover class 2; 2 in class 3; and 9 in class 4) observed when there was snow on the ground was not sufficiently large to allow for subdivision into more specific categories. Of the 64 red-tails recorded, 25 per cent were present along the road. The proportion of red-tails along the road when there was no snow (11 of 44) was exactly the same as that when there was snow on the ground (5 of 20),

	Field Type			Total
	Corn Stubble	Grassland	Plowed	
Rough-legged Hawks, 1964-65	44 (59.7)	28 (37.3)	3 (4.0)	75
Rough-legged Hawks, 1965-66	23 (59.1)	123 (31.5)	37 (9.5)	391
Total	275	151	40	466
Red-tailed Hawks	26 (61.9)	15 (35.7)	1 (2.4)	42
Per Cent of Field Type in Study Area	47.3	28.6	24.1	

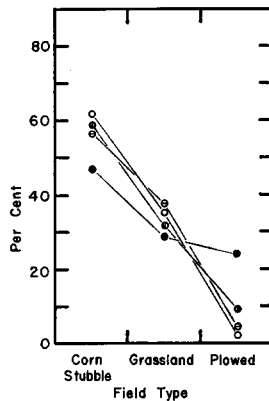


FIGURE 2. The field types utilized by Rough-legged and Red-tailed Hawks, and the percentage of crops in the various vegetation types in the study area for 1965-66. Tests for randomness indicated that there was a definite selection by the birds against plowed fields, but no detectable selection between grasslands and corn stubble fields. Percentages are given in parentheses.

proportions much different from those found for rough-legs.

FIELD TYPE

Fields were classified into three main categories: corn stubble; grasslands; and plowed fields (see description of study area for more details). The number of rough-legs found over the various field types for the two winters is given in figure 2. Comparing these values with the percentages of the various field types in the study area, I rejected the null hypothesis that rough-legs randomly selected fields to fly or perch over ($\chi^2 = 16.61$ for 1964-65, 47.34 for 1965-66; both $P < 0.005$, 2 *d.f.*). There was a much smaller percentage of rough-legs over plowed fields than would be expected by chance. Characteristically there are few small rodents present in plowed fields, and obviously the rough-legs were selecting fields that were more suitable for obtaining food.

Disregarding the land in plowed fields, 62.3 per cent of the area was in corn stubble and 37.7 per cent in grasslands. No statistical preference was indicated between the two

field types for rough-legs ($\chi^2 = 1.33$ for 1964–65, 0.100 for 1965–66; both $P > 0.100$, 1 *d.f.*).

Craighead and Craighead (1956:46) found almost all the Rough-legged Hawks observed were associated with "grassland, abandoned and cultivated fields," but they did not divide this category into more specific vegetation types.

The number of red-tails associated with the various field types yielded results almost identical to those obtained for rough-legs (see fig. 2). A comparison with the percentage of the various field types in the study area indicates that the Red-tailed Hawks also were avoiding plowed fields and not randomly selecting fields to fly or perch over ($\chi^2 = 10.82$, $P < 0.005$, 2 *d.f.*). The red-tails exhibited no statistical preference between corn stubble and grasslands ($\chi^2 = 0.03$, $P > 0.750$, 1 *d.f.*).

Because of the small number of both species found over plowed fields it was not possible to compare statistically the number of rough-legs and red-tails found over all field types. However, there was no significant difference between use of the other two field types by the two species ($\chi^2 = 0.02$, $P > 0.750$, 1 *d.f.*). Thus, concerning my broad groupings of field types, no difference was found in utilization by rough-legs and red-tails.

PERCH TYPE

I recorded the type of perch used by 359 standing rough-legs and 54 red-tails (fig. 3). A few birds were perched on wires close to utility poles and were included in the utility-pole category. There was a significant difference in the perching sites frequented by the two species ($\chi^2 = 18.42$, $P > 0.005$, 2 *d.f.*). It is obvious that red-tails do spend some time on the ground, but they show a greater preference for higher perches than do rough-legs. When comparing just two of the categories, utility poles and trees, a significant difference was noted between the two species ($\chi^2 = 7.17$, $P < 0.010$, 1 *d.f.*), with red-tails showing a greater preference for trees than do the rough-legs.

HEIGHT OF PERCH TREES

The height of perch trees was noted and classified according to the following groups: (1) 0 to 14 feet; (2) 15 to 29 feet; (3) 30 to 44 feet; and (4) 45 feet and above. For the 173 Rough-legged Hawks that were perched in trees, the following number were in each of the above-mentioned classes: (1) 7, 4.0 per cent; (2) 22, 12.7 per cent; (3) 45, 26.0 per cent; and (4) 99, 57.3 per cent.

Of the 42 Red-tailed Hawks observed in

	PERCHING SITE			Total
	Ground or Fence Post	Utility Pole	Tree	
Rough-legged Hawk	67(18.7)	119(33.1)	173(48.2)	359
Red-tailed Hawk	1(1.8)	11(20.4)	42(77.8)	54
Total	68	130	215	413

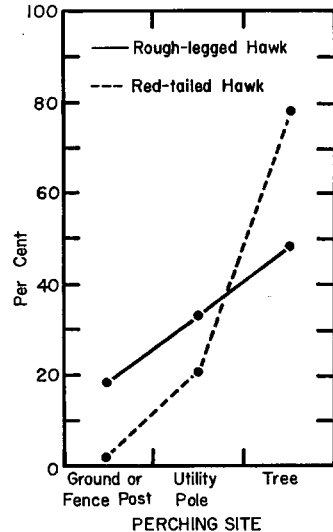


FIGURE 3. The number of Rough-legged and Red-tailed Hawks found on different types of perches. The "ground" and "fence post" observations (33 and 34, respectively, for rough-legs; 0 and 1 for red-tails) were combined for statistical analysis. Percentages are given in parentheses.

trees, none were in trees of classes (1) and (2), with 16 (38.1 per cent) in (3) and 26 (61.9 per cent) in (4). Since 29 (16.7 per cent) of the 173 rough-legs seen in trees were in those of the two lower-height classes, there was an obvious difference in selection of tree size, with the red-tails showing a greater preference for higher trees.

GROUPING OF TREES

The trees used for perching were recorded as being lone trees, a group of trees, or a grove of trees. The "group of trees" class included those locations where two or more trees were within 100 feet of each other, and the few small woodlots in the study area were considered as groves. I found 106 (61.3 per cent) of the 173 rough-legs in lone trees, 64 (37.0 per cent) in groups of trees, and 3 (1.7 per cent) in groves. Of the 42 red-tails, 11 (26.2 per cent) were in lone trees, 27 (64.3 per cent) in groups of trees, and 4 (9.5 per cent) in groves. For analysis the latter two classes were combined, placing 106

rough-legs and 11 red-tails in lone trees, and 67 rough-legs and 31 red-tails in groups of trees or groves. The difference between the two species proved highly significant ($\chi^2 = 16.88$, $P < 0.005$, 1 *d.f.*), indicating that rough-legs were more likely to be found in lone trees and red-tails in groups of trees or groves.

DISCUSSION

This series of comparisons indicates significant differences and similarities between the two species. Considering these, it would be of interest to get some indication as to whether the two species eat the same things when in the same general area in winter. While I obtained information on the food habits of Rough-legged Hawks in DeKalb County (Schnell 1967b), no data were collected for red-tails. However, Craighead and Craighead (1956:133-134) analyzed regurgitated pellets of rough-legs (66 pellets) and red-tails (126) taken in Superior Township, Washtenaw County, Michigan, during the winter of 1942-43. Both species relied almost entirely on small rodents, particularly meadow mice (*Microtus pennsylvanicus*), for food. *Microtus* represented 83.7 per cent and 89.0 per cent of the prey items identified from pellets of rough-legs and red-tails, respectively. The data indicate that the rough-legs may have been taking a slightly higher percentage of shrews, but this difference could also reflect a spotty distribution of these prey species or some other factor, considering the number of hawk individuals (six rough-legs and three red-tails) represented by each pellet sample. This information shows little or no difference in the prey species taken by rough-legs and red-tails wintering in the same area. General compilations, such as that by May (1935), also indicate that similar prey are taken by the two species. This being so, and considering that rough-legs and red-tails showed almost identical field-type preferences, it would seem advantageous to have some mechanism(s) that would reduce competition when and where the ranges of the two species overlap.

Interspecific competition in birds may be reduced as a result of: morphological diversity; partitioning of the environment by means of specialization and habitat selection; and staggered nesting seasons (Ricklefs 1966:235). I have not considered the first possibility here, and the third does not apply in this particular case. There were only a few periods during my study when relatively high numbers of both species were present in the study area (for census data see Schnell 1967b). How-

ever, on occasion this situation did occur, and regular contact would have been inevitable if it were not for several differences in the behavior of rough-legs and red-tails, including habitat selection, that tended to minimize contact.

The fact that red-tails were more sedentary than rough-legs indirectly indicates that red-tails spend more time watching for prey from a perch than do the more active rough-legs. This in itself, because of relatively few and scattered perching sites available, would tend to differentiate between areas (of the same general locality) over which the two species would hunt for food and, thereby, partition to some extent the prey populations utilized by the two predator species.

Also, the rough-legs apparently took advantage of open areas by spending more time along the roads to hunt for food when snow covered the ground, while the red-tails did not show this tendency. The limited number of "suitable" perches coupled with the sedentary habits of red-tails may have been responsible in part for the lack of plasticity of red-tails in this regard. Apparently, many of the red-tails reacted to increased snow cover and (or) generally colder weather conditions by leaving the area (see Schnell 1967b), whereas the rough-legs remained and adjusted their behavior accordingly.

There were several other differences that would tend to minimize contact between Rough-legged and Red-tailed Hawks. One could expect to find more rough-legs than red-tails on lower perches or on the ground. The more frequent use of lower perches by Rough-legged Hawks may represent a partial continuation of behavioral activities on the breeding grounds, where few of the higher perches are available. Not only did the Red-tailed Hawks generally select higher perches, but they also showed a greater preference for trees rather than utility poles, when compared with the Rough-legged Hawks. I found a higher percentage of the total rough-legs than red-tails in lone trees rather than in groups of trees or groves, and this would partially differentiate subareas "suitable" for rough-legs and red-tails. This partial subdivision of the available living space would result in a further partitioning of the populations of each prey species utilized by the two species of hawks. In this way the individual prey animal most vulnerable to capture by red-tails rarely would be taken by a rough-leg, and the converse would be true as well.

Craighead and Craighead (1956:48, 52)

recorded a higher percentage of rough-legs than red-tails flying, but found the perching height most frequently used by the two species to be about the same (40 feet). They recorded perching height while I recorded the tree size and perch type utilized. It may be that rough-legs stand closer to the top of perch trees than do red-tails. Craighead and Craighead (*op. cit.*, p. 46) also found a somewhat higher percentage of red-tails than rough-legs associated with woodlots, and this indicates, as do my data, the preference of red-tails for groups of trees or groves whereas rough-legs prefer lone trees. Weller (1964: 58) surmised from his studies in Iowa that wintering red-tails preferred the open woods of stream bottoms, while rough-legs favored open areas. However, he found red-tails conspicuous in open areas during migration periods, a situation not apparent in my rather uniform study area.

There is definite overlap in the habitats frequented by Rough-legged and Red-tailed Hawks. However, there are at the same time very distinct differences in use of available space by the two species, thus allowing them to be present in the same general area with a minimum of contact and competition.

SUMMARY

Quantitative differences in habitat utilization between Rough-legged and Red-tailed Hawks were studied in northern Illinois during the winters of 1964-65 and 1965-66. Rough-legged Hawks were more active than Red-tailed Hawks. Rough-legged Hawks spent more time along roads when there was snow on the ground, while Red-tailed Hawks did not show this tendency.

There was no significant difference in field type preference between the two species, and a smaller percentage of both species frequented plowed fields than would be expected by chance. Considering the various types of perches used, red-tails showed a greater preference for trees than did rough-legs, as well as a greater preference for higher trees. The Red-tailed Hawks also had a definite preference for groups of trees or groves, whereas the Rough-legged Hawks were found more often in lone trees.

The data of Craighead and Craighead (1956) indicate that the two species feed essentially on the same prey when the hawks occur in the same locality. The ways in which the above-mentioned differences between Rough-legged and Red-tailed Hawks reduce interspecific competition are discussed.

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