

NEST SITES AND HABITATS OF SYMPATRIC HAWKS (*BUTEO* SPP.) IN WASHINGTON

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Abstract.—Nest sites and nest habitats used by Red-tailed (*Buteo jamaicensis*), Ferruginous (*B. regalis*), and Swainson's (*B. swainsoni*) hawks in Washington state were quantitatively described. Discriminant function analysis showed that each species used specific nesting areas with significant variation among species in the distance to water, distance to human disturbance, nest tree diameter, nest height, nest exposure, type of nest structure, and percentages of grass, shrub, and juniper habitats surrounding nests. Red-tailed Hawks nested closest to water, in the tallest and oldest trees, and in areas with large amounts of shrub and grassland habitat. Ferruginous Hawks nested at lower elevations in locations that were farthest from water and at heights of less than 10 m. Swainson's Hawk nests were closest to roads and human structures and nearly half were in areas where the surrounding habitat was dominated by wheat fields.

HABITAT Y LUGAR DE ANIDAMIENTO DE HALCONES SIMPÁTRICOS EN WASHINGTON

Sinopsis.—Se describe cuantitativamente el habitat y lugar de anidamiento de tres especies de halcones (*Buteo jamaicensis*, *B. regalis* y *B. swainsoni*) que viven en simpatria en el estado de Washington. El análisis de funciones discriminativas mostró que cada especie utiliza un área de anidamiento particular. Se encontró una variación significativa en la distancia del nido a un cuerpo de agua, distancia a perturbaciones de humanos, diámetro del árbol, altura del nido, exposición del nido, tipo de estructura del nido, y porcentaje de yerbas, arbustos y juníferos alrededor del nido. *Buteo jamaicensis* anida cerca de agua, en los árboles mas altos y viejos, y en areas con una buena cantidad de arbustos y yerbas. *B. regalis* anida a menor elevación, en localidades lejos del agua y a alturas menores a los 10 m. *B. swainsoni* anida en lugares cercanos a carreteras y a estructuras humanas; virtualmente la mitad de los nidos se encontraron en habitat dominados por campos de trigo.

Red-tailed (*Buteo jamaicensis*), Ferruginous (*B. regalis*), and Swainson's (*B. swainsoni*) hawks nest in shrub-steppe and grassland habitats

throughout western North America. All three species have similar nest sites, food habits, and hunting methods (Bechard 1980, 1982; Fitzner et al. 1977; Fitzner 1980; Janes 1984; Lokemoen and Duebbert 1976; Smith and Murphy 1973; Thurow et al. 1980; Wakeley 1978; Woffinden and Murphy 1977), yet frequently nest within 0.5 km of each other (Smith and Murphy 1973, Thurow and White 1983). Use of specific nesting areas may enable members of this triad to obtain some degree of spatial isolation that minimizes interspecific contacts and permits such close coexistence (Cottrell 1981, Rothfels and Lein 1983, Schmutz et al. 1980, Thiollay 1981). However, no quantitative documentation exists for any species' specific characteristics of nest sites or nest habitats of these hawks. We undertook this study to describe and compare characteristics of nest sites and nest habitats used by the three buteos in Washington in an attempt to identify key features of each species' nesting habitat.

METHODS

Nest-site and nest-habitat features were measured in four areas of southeastern Washington: Esquatzel Coulee (56 km long), the juniper area (117 km²) in Franklin county, the U.S. Department of Energy Hanford Site in Benton and Franklin counties (1476 km²), and the Palouse Prairie located in Whitman and Garfield counties (4000 km²). All four areas have been described in detail elsewhere (Bechard 1980, Fitzner 1980, Knight and Smith 1982).

Each area was systematically searched for occupied hawk nests beginning in April and continuing through the remainder of the nesting season. After fledging, eight nest-site and 12 nest-habitat variables were measured (Table 1). Heights of nests and nest structures were measured to the nearest 0.5 m by climbing to each nest. Diameter at breast height (DBH) of nest trees was measured to the nearest 0.5 cm using a DBH tape. Orientations of nests were recorded as N, NE, E, SE, S, SW, W, or NW using a compass. Nest-site elevations and distances from roads, human structures, and other raptor nests were obtained from U.S.G.S. 7.5-min maps. Land use was measured by visually estimating the percentages of wheatland, grassland, sage shrubland, and juniper (*Juniperus occidentalis*) forest within a 3.0 km radius of nests. Water types were designated based on the names of lakes, rivers, creeks, and other information provided on topographic maps.

Chi-square analysis was used to compare nest site and nest habitat characteristics with respect to nominal scale data such as nest structure, nest exposure, and nearest permanent water body. Mean compass direction and angular dispersions of exposures were determined using circular distribution statistics (Zar 1974).

Full model discriminant and stepwise discriminant analyses were used to test differences in parameters among the three species. Normality of each nest variable was evaluated separately for each species using graphical methods (Zar 1974). Variables that were not normally distributed were log transformed and retested. Only those variables that fitted a

TABLE 1. Nest-site and nest-habitat meristic variables analyzed at *Buteo* nests in southern Washington. Units of measurement in parentheses.

Nest-site variables	
1.	Nest-site exposure (degrees)
2.	Nest-structure exposure (N, NE, E, SE, S, SW, W, NW)
3.	Condition of nest tree (alive or dead)
4.	DBH of nest tree (cm)
5.	Nest height (dm)
6.	Nest structure (cliff, man-made, tree)
7.	Nest-site elevation (m)
8.	Height of nest above ground (m)
Nest-habitat variables	
1.	Distance to permanent water (m)
2.	Type of water (brook, river, pond, lake, marsh, spring, water tank, waste water pond, canal)
3.	Distance to primary road (paved road and interstate highways) (m)
4.	Distance to secondary road (unpaved access road) (m)
5.	Distance to human habitation (m)
6.	Type of human habitation (farm, town park, house, ranch, reactor, power plant, rest stop, airport)
7.	Distance to nearest occupied raptor nest (m)
8.	Nearest raptor species (American Kestrel, Swainson's Hawk, Ferruginous Hawk, Red-tailed Hawk, Great Horned Owl, Long-eared Owl, Short-eared Owl, Prairie Falcon, Burrowing Owl, Common Raven)
9.	% of surrounding habitat consisting of wheatland ^a
10.	% of surrounding habitat consisting of native grassland ^a
11.	% of surrounding habitat consisting of shrub vegetation ^a
12.	% of surrounding habitat consisting of juniper forest ^a

^a % of area within a 3.0 km radius of the nest.

normal distribution were included in subsequent analyses. Because highly correlated variables measured similar aspects of habitat, we eliminated one of each pair of variables when $r > 0.7$ and retained the most ecologically-meaningful variable. The number of variables was further reduced through ANOVA and Kruskal-Wallis tests, and only variables significant at $P < 0.01$ were included in further analyses.

Full model and stepwise discriminant analyses results were displayed in a territorial map and in classification tables. All statistical analyses used followed SPSSX routines (SPSS, Inc. 1986). Default criteria were used throughout and Mahalanobis was the method selected for stepwise discriminant analysis.

RESULTS

We measured variables at 57 Red-tailed, 29 Ferruginous, and 67 Swainson's hawk nests between 1975 and 1980. Red-tailed and Ferruginous hawk nests occurred in all four sites. Swainson's Hawk nests occurred most commonly in the Hanford Site and not at all in the Esquatzel Coulee site.

TABLE 2. Types of nest structures used by three *Buteo* species in Washington.^a Percentages in parentheses.

	Cliff	Man-made structure	Tree ^b	Totals
Red-tailed Hawk (RTH)	19 (33.4)	11 ^c (19.1)	27 (47.5)	57
Ferruginous Hawk (FH)	18 (62.1)	1 ^d (3.5)	10 (34.4)	29
Swainson's Hawk (SH)	0	0	67 (100.0)	67
Totals	37	12	104	153

^a Chi-square of 3×3 matrix = 69.35, $df = 4$, $P < 0.001$; Chi-square of 2×3 matrices, (RTH \times FH) = 7.89, $df = 2$, $P < 0.02$; (RTH \times SH) = 46.51, $df = 2$, $P < 0.001$; (FH \times SH) = 54.73, $df = 2$, $P < 0.001$. Chi-square tested against random placement of nests (RTH) = 6.74, $df = 2$, $P < 0.05$; (FH) = 15.3, $df = 2$; $P < 0.01$; (SH) = 67.0, $df = 2$, $P < 0.001$.

^b Cottonwood, black locust, box elder, juniper, willow, aspen.

^c All on transmission towers.

^d Constructed on a windmill.

Nest-site descriptions.—Chi-square analysis showed significant differences in nest sites with respect to nest structure. All Swainson's Hawk nests were in trees including black locust (*Robinia pseudoacacia*), box elder (*Acer negundo*), willow (*Salix* spp.), Ponderosa pine (*Pinus ponderosa*), and juniper (Table 2), while Red-tailed Hawks nested on cliffs, transmission towers, and in cottonwoods (*Populus trichocarpa*), aspens (*Populus tremuloides*), and black locusts. Ferruginous Hawks nested mainly on basalt rock outcrops and in juniper trees. Partitioning of nest-site exposures into a 3×3 contingency table showed significant differences with respect to nest exposure ($\chi^2 = 2.84$, $df = 4$, $P < 0.05$). Red-tailed and Swainson's hawks selected primarily northerly (N, NE, E) exposures whereas the Ferruginous Hawks selected southern and western exposures (Table 3). Ferruginous Hawk nests also showed less variation in angular dispersion ($s = 74.9^\circ$) than Red-tailed Hawks ($s = 122.6^\circ$), which in turn showed less variation than Swainson's Hawks ($s = 221.4^\circ$) although none of the three species exhibited a significant mean direction of nest structure exposure (Rayleigh's tests).

Diameters of nest trees varied significantly among the three species, as did height of the nest above ground, the elevation of the nest and the type of nest structure (Table 4). Red-tailed Hawk nests were in older, taller trees and were constructed higher in the tree itself. Over 53% of Red-

TABLE 3. Nest structure exposure of three *Buteo* species in Washington.

	N	NE	E	SE	S	SW	W	NW	Totals
Red-tailed Hawk	15	10	10	6	4	2	7	3	57
Ferruginous Hawk	1	0	3	1	7	8	3	6	29
Swainson's Hawk	19	8	11	0	14	8	4	3	67
Totals	35	18	24	7	25	18	14	12	153

TABLE 4. Means, standard deviations, and ranges of meristic variables (in parentheses) of nest-sites and nest-habitats of three *Buteo* species in Washington. *F* statistics obtained through one-way ANOVA. For variables with percentage measurements, Kruskal-Wallis tests were used to obtain *H* statistics.

Variable	Red-tailed Hawk (<i>n</i> = 57)	Ferruginous Hawk (<i>n</i> = 29)	Swainson's Hawk (<i>n</i> = 67)	<i>F</i> and <i>H</i> statistics
Nest site				
Nest-site exposure	159.1 ± 16.2 (0-360)	208.5 ± 15.1 (20-300)	168.5 ± 14.4 (0-350)	10.89**
DBH of nest tree	68.5 ± 6.2 (27-145)	26.2 ± 1.0 (23-35)	49.5 ± 4.4 (10-200)	32.22**
Nest height	17.6 ± 1.3 (3-48)	8.7 ± 1.8 (2-56)	8.7 ± 0.5 (3-27)	23.04**
Nest-site elevation	333.1 ± 22.1 (124-791)	275.7 ± 12.2 (201-556)	471.7 ± 31.2 (111-834)	12.79**
Nest habitat				
Height of nest above ground	21.6 ± 1.5 (7-50)	11.6 ± 2.4 (2-61)	11.6 ± 0.6 (4-33)	21.11**
Distance to permanent water	1431 ± 287 (0-7700)	3756 ± 889 (0-13,000)	2421 ± 418 (0-19,200)	4.77*
Distance to primary road	2356 ± 541 (18-18,000)	3967 ± 656 (22-12,800)	2206 ± 775 (69-33,000)	1.63
Distance to secondary road	963 ± 279 (12-6400)	1595 ± 427 (64-6000)	928 ± 226 (91-6200)	1.16
Distance to human habitation	2234 ± 309 (9-9000)	4806 ± 713 (1200-19,200)	2524 ± 383 (16-11,500)	8.08**
Distance to nearest occupied raptor nest	1687 ± 249 (70-6400)	1312 ± 203 (229-5000)	2222 ± 350 (15-6400)	0.63
% of surrounding habitat consisting of wheatland ^a	20.1 ± 4.3 (0-100)	6.7 ± 3.1 (0-50)	50.4 ± 5.4 (0-100)	27.68**
% of surrounding habitat consisting of native grassland ^a	14.5 ± 3.5 (0-100)	41.4 ± 7.0 (0-100)	25.2 ± 4.8 (0-100)	11.65*
% of surrounding habitat consisting of shrub vegetation ^a	57.5 ± 6.4 (0-100)	31.1 ± 7.4 (0-100)	17.2 ± 4.5 (0-100)	24.74**
% of surrounding habitat consisting of juniper forest ^a	0	28.3 ± 8.6 (0-100)	0	37.15**

* = $P < 0.01$, ** = $P < 0.001$.

^a % of area within a 3.0 km radius of the nest.

tailed Hawk nests were higher than 10 m, whereas 86% of Ferruginous and 63% of Swainson's Hawk nests were lower than 10 m. Nest-site elevation of Red-tailed and Swainson's hawks ranged between 124-791 and 111-834 m, respectively, although a higher percentage (35%) of

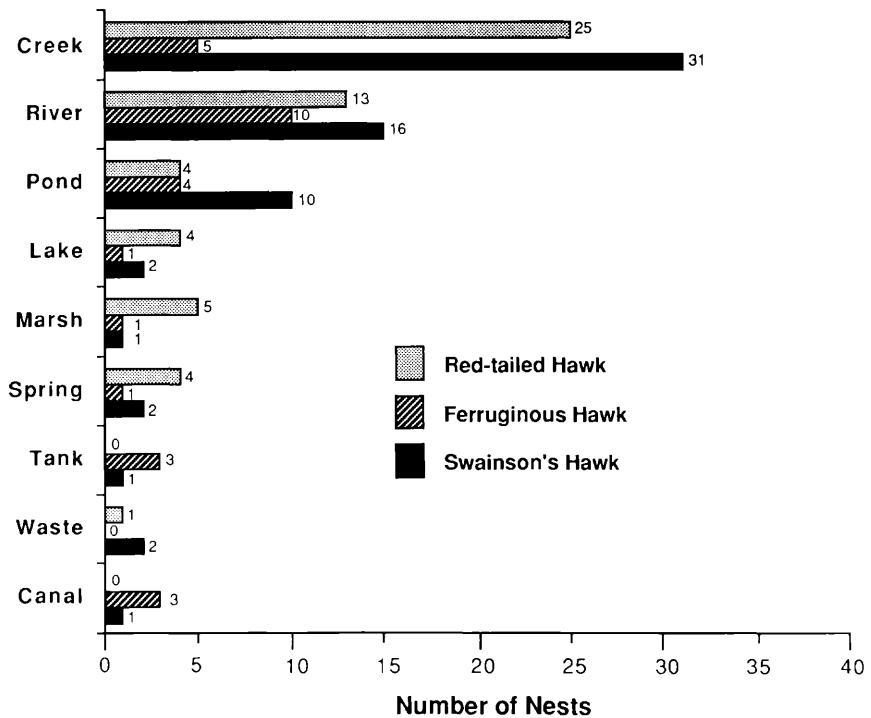


FIGURE 1. Nearest permanent bodies of water to nests of three *Buteo* species in Washington.

Swainson's Hawk nests were at elevations greater than 660 m. Ferruginous Hawks nested primarily at lower elevations with 83% of their nests occurring at 200–300 m and none higher than 556 m.

Nest-habitat descriptions.—Although each species nested adjacent to creeks and rivers, Ferruginous Hawks nested farthest from water with 31% of their nests greater than 5.0 km from permanent water (Table 4). Red-tailed and Swainson's hawk nests were closer to permanent water (66% and 42.2% within 1000 m, respectively) and only 10.7% and 4.2% were greater than 5.0 km away. To compare water types nearest nests, we used nine water categories (Fig. 1). Although there was considerable variation in the nearest water type, nests of all three species most commonly occurred nearest to creeks with rivers and ponds, the second and third most frequent nearest bodies of water.

Swainson's Hawk nests were nearest to roads and human structures (Table 4). Forty-two percent of these nests were within 1.0 km of a building, whereas 72.8% of Ferruginous Hawk nests were at distances greater than 2.0 km. Ranches and farms were the nearest human structures for at least 60% of all nests; however, Swainson's Hawks nested nearest such structures as power plants, airports, highway rest stops, nuclear reactors, and towns.

Nest habitat also differed with respect to the dominant form of surrounding land use. Almost half of the Swainson's Hawk nests were in areas where at least 50% of the surrounding habitat was undergoing wheat cultivation and 36% of these were in areas where 100% of the land within a 3.0 km radius of the nest was wheatland. A few nesting areas of Red-tailed and Ferruginous hawks were in areas with 100% and 50% wheatland, respectively, but most occurred in areas devoid of wheatland and had higher percentages of grassland, shrubland, and juniper forest.

Nearest-neighbor nests.—A total of 10 species of raptors nested in the study areas. They included Prairie Falcons (*Falco mexicanus*), American Kestrels (*F. sparverius*), Great Horned Owls (*Bubo virginianus*), Long-eared Owls (*Asio otus*), Short-eared Owls (*A. flammeus*), Burrowing Owls (*Athene cunicularia*), Common Barn-Owls (*Tyto alba*), and Common Ravens (*Corvus corax*). Raptors nesting nearest Red-tailed Hawk nests were most frequently conspecifics (39.6% of nests) and Swainson's Hawks (32.1%) (Table 5). Other nearest-neighbor species included Great Horned Owls (9%), Ferruginous Hawks (7.5%), Burrowing Owls (6%), and, infrequently, Common Ravens, Prairie Falcons, and American Kestrels. Distances between nearest-neighbor Red-tailed and Swainson's hawk nests were similar, averaging 2.1 ± 1.8 km and 2.18 ± 1.8 km, respectively whereas average distances between Red-tailed and Ferruginous hawk nests varied from 0.97–1.7 km. Red-tailed Hawks nested much closer to Burrowing Owls (0.05 km, $n = 3$) and an American Kestrel (0.18 km).

Nearest neighbors of Ferruginous Hawks were Red-tailed (30.8% of nests), Ferruginous (28.2%), and Swainson's hawks (20.5%), Common Ravens (10.3%), and Great Horned Owls (5.1%). Ferruginous Hawks nested nearer to Swainson's Hawks (1.1 ± 0.6 km) compared to Red-tailed Hawks (1.7 ± 1.3 km) and other Ferruginous Hawk nests. Other raptor species nesting near Ferruginous Hawks were Burrowing Owls (0.02 km) and Prairie Falcons (0.2 km).

Swainson's Hawk nests were usually located nearest each other (53.1% of nests) followed by nests of Red-tailed Hawks (29.7%), Ferruginous Hawks (4.7%), American Kestrels (4.7%), and Long-eared Owls (3.1%). Distances between Swainson's Hawk nests averaged 2.36 ± 1.31 km (range 0.8–4.8 km). Two Common Raven nests averaged a distance of only 0.02 km whereas a Great Horned Owl nest was at a distance of 0.15 km and an American Kestrel was 0.12 km from an active Swainson's Hawk nest.

Discriminant function analysis.—Twelve of 17 variables determined significant by ANOVA and Kruskal-Wallis tests were initially considered for discriminant function analysis, but two were eliminated due to high correlations with other variables. All 10 remaining variables were subsequently standardized to a mean of zero and a standard deviation of one prior to entry into full model and stepwise discriminant analyses. Stepwise discriminant analysis selected a subset of nine variables including distances to water, human habitation and nest tree, nest height, nest-site elevation, nest structure, and the percentages of grassland, shrubland, and juniper

TABLE 5. Matrix of nearest-neighbor distances between active nests of Red-tailed, Ferruginous, and Swainson's hawk nests. Nearest active raptor nests often differed between adjacent nests, necessitating a full matrix. Values are $\bar{x} \pm$ SD, sample size and range in parentheses.^a

	Red-tailed Hawk	Ferruginous Hawk	Swainson's Hawk
Red-tailed Hawk	2.1 \pm 1.82 ($n = 21$) (0.55-6.4)	0.97 \pm 0.43 ($n = 4$) (0.46-1.43)	2.18 \pm 1.82 ($n = 17$) (0.18-6.4)
Ferruginous Hawk	1.7 \pm 1.3 ($n = 12$) (0.31-2.9)	1.6 \pm 0.62 ($n = 11$) (0.8-2.9)	1.1 \pm 0.6 ($n = 8$) (0.23-1.9)
Swainson's Hawk	1.98 \pm 1.31 ($n = 9$) (0.18-6.4)	1.7 \pm 1.5 ($n = 3$) (0.23-3.2)	2.36 \pm 1.31 ($n = 34$) (0.8-4.8)

^a Distances to other nearest-nesting raptor species and the Common Raven by *Buteo* species: Red-tailed Hawk nests: Common Raven 1.2 km ($n = 2$), Great Horned Owls 1.1 km (5), American Kestrel 0.18 km (1), Burrowing Owls 0.05 km (3). Ferruginous Hawk nests: Common Raven 1.1 km ($n = 4$), Great Horned Owls 1.4 km (2), Prairie Falcon 0.2 km (1), Burrowing Owls 0.02 km (1). Swainson's Hawk nests: Long-eared Owls 0.25 km ($n = 2$), Great Horned Owls 0.15 km (1), American Kestrel 0.12 km (3), Common Raven 0.02 km (2).

forest in surrounding habitats (Table 6). The relatively large number of variables selected again suggested that the three species of hawks responded to many habitat variables rather than focusing on a few. The first discriminant function of full model discriminant analysis had an eigenvalue of 2.07 and an associated variance of 67%. Both of these values were similar to the eigenvalue of 2.04 and associated variance of 67.3% obtained through stepwise discriminant analyses. Eigenvalues of 1.02 and 0.99 and associated variances of 33% and 32.7% for the second discriminant function were also similar to those obtained by stepwise analysis.

Although there was overlap in nest-site utilization, both analyses showed nearly complete separation along discriminant function one and considerable overlap along discriminant function two for all three species (Fig. 2). The percentages of surrounding habitat consisting of juniper forest and grassland showed high positive loadings and the diameter of the nest tree showed high negative loading on discriminant function one illustrating that habitat utilization and heights of nest structures used by the three species differed significantly. Only one variable, distance to permanent water, had a high positive loading for both analyses. Conversely, variables nest tree height and type of nest structure had high negative loadings illustrating the tendency of Ferruginous Hawks to build their nests on lower structures and in juniper trees.

Data were subsequently split into two samples using a random sort procedure. The first sample gave coefficients of classification whereas the second gave a measure of the error rate of classification and provided a cross-validation model. Overall classification rate was 87% with an error classification of 84.9%, suggesting that the discriminating variables were very reliable for identifying the nest sites of the three species of hawk (Table 7). Both subsamples correctly classified 84.2% of the Red-tailed

TABLE 6. Summary of FMDA and SWDA discriminant analysis of *Buteo* nest-site and nest-habitat variables.

	Discriminant function			
	I		II	
	FMDA	SWDA	FMDA	SWDA
Eigenvalue	2.0683	2.0439	1.0176	0.9949
Relative percentage of Eigenvalue associated with the function	67.02	67.26	32.98	32.74
Canonical correlation	0.82103	0.81944	0.71019	0.70620
Chi-square statistic (df)	264.34*	263.35*	101.78*	100.83*
	22	18	10	8
Nest site				
DBH of nest tree	-1.03347	-1.06697	0.37826	0.39166
Nest height	0.12747	0.12290	-0.48878	-0.49745
Height of nest above ground	-0.17569	-0.15703	-0.47081	-0.44458
Nest-site elevation	0.26418	0.24843	0.19874	0.24592
Nest habitat				
Distance to permanent water	-0.20111	-0.19474	0.47513	0.46276
Distance to primary road	0.13285		0.02059	
Distance to human habitation	0.15911	0.18110	0.21458	0.19890
% of surrounding habitat consisting of wheatland ^a	0.04810		0.23297	
% of surrounding habitat consisting of native grassland ^a	0.77399	0.76009	0.20867	0.14910
% of surrounding habitat consisting of shrub vegetation ^a	-0.05268	-0.05880	-0.32054	-0.46318
% of surrounding habitat consisting of juniper forest ^a	1.11442	1.13097	0.03698	0.00051

* $P < 0.001$.^a % of area within a 3.0 km radius of the nest.

Hawk nests, but the coefficient subsample misclassified them as Swainson's Hawk nests and the error subsample equally mistook them for Ferruginous and Swainson's hawk nests. The model correctly classified all Ferruginous Hawk and 84% of Swainson's Hawk nests with most of the latter misclassified as Red-tailed Hawks.

DISCUSSION

There were significant differences among nest sites and nest habitats of the three species of *Buteo* found in the shrub-steppe region of southern Washington. Notable differences in nest sites were associated with ele-

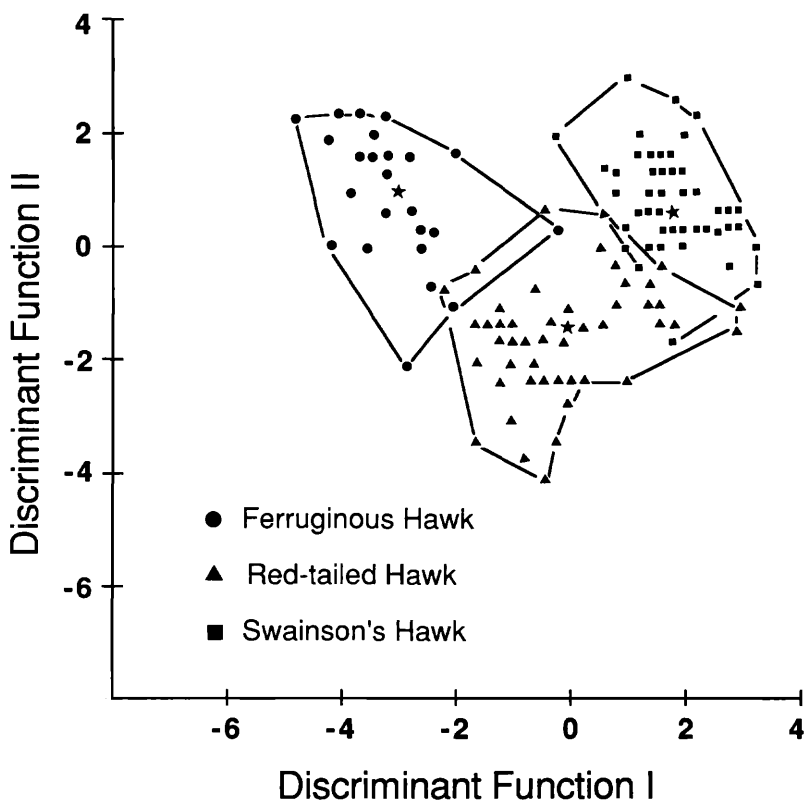


FIGURE 2. Discriminant function analysis of nest site and nest habitat among Red-tailed, Ferruginous, and Swainson's hawks in Washington. Star represents centroid for each species.

TABLE 7. Classification of nests of three *Buteo* species in Washington based on discriminant function analysis. For estimates of error rate of classification, the sample was split using a random number generator of Trunc 2.5.

	Coefficient estimation predicted			Unbiased error estimation predicted				
	<i>n</i>	Red-tailed Hawk	Ferruginous Hawk	Swainson's Hawk	<i>n</i>	Red-tailed Hawk	Ferruginous Hawk	Swainson's Hawk
Red-tailed Hawk	19	16 (84.2) ^a	0	3 (15.8)	38	32 (84.2)	3 (7.9)	3 (7.9)
Ferruginous Hawk	10	0	10 (100)	0	19	3 (15.8)	15 (78.9)	1 (5.3)
Swainson's Hawk	25	4 (16.0)	0	21 (84.0)	42	4 (9.5)	1 (2.4)	37 (88.1)

^a Classification percentage in parentheses.

vation, distance from water, and the type, size, height, and exposure of nest structures. Ferruginous Hawk nests occurred at lowest elevations and farthest from water. At times they were built in trees near water but, more frequently, they were on low, basalt outcroppings more than 5.0 km from the nearest body of permanent water. The Swainson's Hawk used intermediate nest heights and distances to permanent water, but its nests occurred at the highest elevations. Like the Ferruginous Hawk, it used trees that were intermediate in height and grew either as isolated individuals or at the edges of small woodlots on hillsides. Red-tailed Hawk nests were both the highest and closest to water. At times, its nests occurred on high basalt cliffs and outcroppings but, more frequently, they were in tall trees that grew at elevations between 124 and 791 m and less than 1.5 km from a creek or river.

Our findings are consistent with the results of studies on other groups of sympatric buteos. In midwestern and Appalachian woodlands, Red-tailed, Red-shouldered (*B. lineatus*), and Broad-winged (*B. platypterus*) hawks showed similar differences among nest structures and their distances from water (Bednarz and Dinsmore 1982, Titus and Mosher 1981). Similarly, in grassland habitats of the northern Great Plains, the same species we studied used trees of differing ages, heights, and distances from water (Schmutz et al. 1980). Unlike the northern Great Plains, however, Ferruginous and Red-tailed hawks switched from trees to the use of basalt cliffs in the arid, treeless regions of Washington's Columbia Basin.

Habitat dimensions are more important than temporal dimensions in partitioning habitat use among groups of ecologically similar animals (Schoener 1974), possibly because the degree of temporal isolation is limited by the number of members in the group (Jaksic 1982). The three species of *Buteo* nesting in southern Washington illustrated this concept. They stagger their nesting seasons with Red-tailed, Ferruginous, and Swainson's hawks completing clutches by 25 March ($n = 25$), 10 April ($n = 25$), and 15 May ($n = 25$), respectively (unpublished data for fresh egg clutches in Western Foundation of Vertebrate Zoology). Craighead and Craighead (1956) and Olendorff (1973) suggested no two species of hawk selected nest sites simultaneously by staggering their nesting seasons. Due to variability in nesting dates, however, late-breeding Red-tailed Hawks often occupied nests when both Ferruginous and Swainson's hawks arrived on nesting grounds (Fitzner 1980, Olendorff 1973, Smith and Murphy 1973, and this study) indicating that, when three species are involved, the degree of temporal isolation gained by staggering nesting dates was relatively ineffective in reducing the amount of overlap in nest-site use.

We suggest that species-specific habitat use is the key to the coexistence of these three species. Because nests act as loci around which resource use is centered during the breeding season, each species develops some degree of spatial isolation through the use of specific nest sites. This isolation effectively partitions resource use within the group minimizing any possible interspecific competition in such an ecologically similar group.

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