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NEST-SITE HABITAT SELECTED BY COMMON BUZZARD (*Buteo buteo*) IN SOUTHWESTERN FRANCE

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ABSTRACT.—I studied the habitat characteristics associated with nest sites of Common Buzzards (*Buteo buteo*) in southwestern France during three years. Nineteen nest sites were compared to 60 random points in buzzard nesting habitat using 21 quantitative habitat variables. Most nests were in large pines or oaks and in the upper ⅔ of the tree at a mean height of 13.4 m. It appeared that buzzards selected nest sites in mature wooded areas with easy access, rather high in the tree, and close to woodland edges.

Selección de sitios de nidificación por *Buteo buteo* en el suroeste de Francia

RESUMEN.—Estudié las caracteristicas del hábitat asociado a los sitios de nidificación de *Buteo buteo* en el suroeste de Francia durante tres años. Se compararon 19 sitios de nidificación con 60 puntos escogidos al azar en el hábitat de esta especie; se usaron 21 variables cuantificables del hábitat. La mayoría de los nidos se encontraron en grandes pinos o robles y sobre el tercio superior del árbol, a una altura media de 13.4 m. Al parecer esta especie selecciona sitios de nidificación en áreas de árboles maduros, de fácil acceso a la cima del árbol y cercanos a áreas abiertas.

[Traducción de Ivan Lazo]

Although many nest-site preferences have been described for the Common Buzzard, few studies have attempted to determine the decisive factors involved in its nest-site selection. These studies have concluded that tree nests simply need to be adequate in size and shape. No previous studies attempted to describe nest-site habitat of the buzzard quantitatively.

MATERIALS AND METHODS

Study Area. I conducted my study in the forest of Bouconne (2300 ha) located near Toulouse (southwestern France) which is surrounded by cultivation and villages, and lies between 200 and 300 m elevation. Dominant overstory trees are oaks, including *Quercus pedonculata,* but also *Q. sessiliflora* and *Q. lanaginosa,* and introduced pines (*Pinus sylvestris* and *P. pinaster*). The understory is mixed with hornbeam (*Carpinus betulus*), chestnut (*Castanea sativa*), ash (*Fraxinus excelsior*), maple (*Acer campestre*), lime (*Tilia platyphyllos*) and wild service tree (*Sorbus aria*). Undergrowth is composed of hawthorn (*Crataegus* spp.), blackthorn (*Prunus spinoza*), broom (*Sarothamnus scoparius*), heath (*Erica* spp.), holly (*Ilex aquilifolium*) and bramble (*Rubus fruticosus*). The forest is subject to logging: oaks are cut when 160 years old and pines when 80 years old. Because of logging, the forest is divided into numbered sections delimited by large pathways.

Nesting Habitat Description. Buzzard nests were located in the winters of 1989, 1990, and 1991 through systematic foot searches of ⅔ of the forest. Frequent visits were made to each nest to see if buzzards were attending or defending nest sites, and later in the spring in order to see if there were brooding buzzards or nestlings.

All nest sites were plotted on a 1:25 000 topographic map. A nest site was defined as the nest tree plus a 0.04-ha circular plot (11.3 m radius) centered on the nest tree (Titus and Mosher 1981). Within the nest site, all woody plants over 1.65 m were tallied according to species, diameter at breast height (dbh) and whether the predominant foliage was part of the overstory or understory. Separate size categories were created for understory plants and overstory trees. In such a way, 21 quantitative habitat variables (Table 1) were either measured directly or created by aggregation. Height measurements were made using a clinometer. Distances were measured directly on the field when short (<50 m), or measured from the map. Percentage of vegetation cover was simply visually estimated.

If the plot fell at the edge of a field or other forest opening, no corrections were made, this opening being considered as part of the plot. Altitude was not considered here because of the flatness of the forest, nor was the exposure.

Available Nesting Habitat. Random sampling was used to estimate available nesting habitat. A numbered grid (grid squares of 250 × 250 m) of 226 points was overlaid on the forest. Sixty points were drawn at random (Titus and Mosher 1981). Each random point was plotted on the map. Once the approximate site was located in the woods, the nearest tree was made the center of the random plot A tree was used to remain consistent with a nest-site sample plot. Except for the nest-tree specific variables, the

Table 1. Sample means and standard deviation of nest site and random plots and significant differences between random and nest-site plots (ANOVA (F) and Mann-Whitney (U, z) values are given).

VARIABLES	NEST SITE ($N = 19$) (RANGES)	RANDOM ($N = 57$) (RANGES)	TEST P VALUES
Canopy height (m)	20.6 ± 0.83 (12.5–23.4)	16.98 ± 0.6**[a] (10–25.4)	$P = 0.002$ $F(1,75) = 9.95$
Distance to nearest open water (m)	901 ± 162 (20–2425)	805 ± 46.2 (20–1750)	$P = 0.43$ $F(1,75) = 0.61$
Distance to nearest woodland edge (m)	211 ± 46.1 (14–887)	480 ± 40.8** (0–1000)	$P = 0.0007$ $F(1,75) = 12.6$
Distance to pathways (m)	67.4 ± 7.5 (16–137)	54.2 ± 5.8 (0–162)	$P = 0.13$ $U = 418$, $z = -1.5$
% of canopy cover	35.3 ± 3.4 (15–60)	37.37 ± 2.1 (10–75)	$P = 0.617$ $F(1,75) = 0.25$
% of understory cover	34.5 ± 3.6 (20–60)	32.8 ± 1.7 (20–60)	$P = 0.94$ $U = 536$, $z = -0.06$
% of ground cover	54.7 ± 6.2 (10–95)	40.79 ± 3.3 (10–100)	$P = 0.059$ $U = 385$, $z = -1.88$
Number of species of overstory	1.42 ± 0.12 (1–2)	1.56 ± 0.07 (1–2)	$P = 0.27$ $U = 461$, $z = -0.96$
Number of species of understory cover	2.68 ± 0.32 (1–5)	3.05 ± 0.14 (2–6)	$P = 0.22$ $F(1,75) = 1.54$
Number of ground species	4.58 ± 0.40 (2–8)	4.61 ± 0.24 (2–8)	$P = 0.94$ $F(1,75) = 0.005$
Number of overstory trees	17.2 ± 2.01 (1–35)	27.47 ± 1.90** (1–68)	$P = 0,004$ $U = 308$, $z = -2.80$
Number of overstory trees <25 cm dbh	10.7 ± 2.36 (1–35)	23.63 ± 2.21* (1–68)	$P = 0.002$ $U = 288$, $z = -3.03$
Number of overstory trees 26–50 cm dbh	5.42 ± 1.02 (1–18)	3.54 ± 0.52 (1–11)	$P = 0.035$ $U = 367$, $z = -2.09$
Number of overstory trees >50 cm dbh	1.05 ± 0.24 (1–3)	0.3 ± 0.07*** (1–3)	$P = 0.0003$ $U = 288$, $z = -3.6$
Number of understory stems 1–4 cm dbh	18.21 ± 6.33 (0–124)	40 ± 13.9* (1–800)	$P = 0.01$ $U = 338$, $z = -2.4$
Number of understory trees 5–8 cm dbh	16.05 ± 2.32 (4–39)	14.65 ± 1.75 (1–72)	$P = 0.36$ $U = 465$, $z = -0.91$
Number of understory trees >9 cm dbh	15.74 ± 1.95 (5–32)	11.25 ± 7.71 (1–38)	$P = 0.04$ $U = 373$, $z = -2.0$
DBH of the nest tree	52.85 ± 2.76 (33–73)		
Height of the nest tree (m)	20.6 ± 0.83 (12–23.4)		
Height of the nest (m)	13.39 ± 1.02 (4.1 ± 23.2)		

[a] * = $P < 0.01$; ** = $P < 0.001$; *** = $P < 0.005$.

sampling variables were the same as that of the nest site. The criterion for accepting a random plot was that the plot must be within a forested area with a canopy height greater than or equal to 10 m. This excluded some habitats in which buzzards do not nest (young plantation areas) but included some areas where nesting was unlikely (copsewoods, partly cut areas of timber woods). This scheme generally allowed the sampling of the total forest area without preselecting "representative" or "typical" areas (Green 1979 in Titus and Mosher 1981).

Statistical Methods. Parametric and nonparametric statistics were used where appropriate. Univariate ANOVA was conducted on the two groups (buzzard nest site and random samples) for 6 of the 17 variables which had

Table 2. Proportion of oaks and pines in the forest of Bouconne (from 57 random plots).

TREE SPECIES	% OVERSTORY TREES <25 cm dbh	% OVERSTORY TREES >26 cm dbh	% TOTAL OVERSTORY TREES
Pine	2	56	9
Oak	98	44	91

a distribution close to the Gauss curve. For the 10 other variables (showing nonnormal distributions), Mann-Whitney tests were conducted.

RESULTS AND DISCUSSION

I found a total of 33 nests of which 23 nests were occupied at least once by a buzzard pair during the three years. One nest was occupied twice by a pair of European Sparrowhawk (*Accipiter nisus*), one nest by a pair of Booted Eagle (*Hieraaetus pennatus*), and one nest by a pair of Goshawks (*Accipiter gentilis*). The other nests showed no evidence of occupation or defence by any species. Four actively defended buzzard nest trees were cut down by foresters. Hence only 19 buzzard nest sites were characterized quantitatively.

No nests were found in areas with canopy heights below 14 m (Table 1). The mean height of nests was 13.4 m. Most nests (52%) were in the upper ⅔ of the tree, with 80% in the upper half. Buzzards nested in mature trees more than expected, based on the fact that most nests (89%) were in trees over 40 cm dbh (Table 1). The marked preference to nest in mature plots could be due to the fact that mature trees allowed high nest placement, shelter from predators, and also gave a safe base to the nest (Solonen 1982). Most of the nests were at the same height as understory trees which gave additional protection after the appearance of the foliage (Morris et al. 1982). Moreover, a low density of overstory trees around the nest site facilitated accessibility and vigilance.

All species of overstory trees were used as nest trees, but nests occurred slightly more often in pines (11) than in oaks (8). This trend depended on the proportion of pines and oaks counted in the random plots (Table 2). Whatever the diameter, pines represented only 10% of the total overstory trees of the random plots. A chi-square test showed no differences between the proportion of large oaks and large pines (over 26 cm dbh) as determined from the random sampling versus the proportion of nest trees used ($N = 57$, $Z = 1.318$, $P = 0.19$). Numerous studies on buzzards show a preference for a tree species. Oak is generally selected in France (Roche 1977, Nore 1979). In Finland, 66% of buzzard nests are in spruce *Picea* sp. (Solonen 1982). In Germany, 70% of the nests are in beech *Fagus* sp. (Rockenbauch 1975 in Bayle and de Ruffray 1980). In the United Kingdom, pines are sometimes used (Dare 1961, Picozzi and Weir 1974) but rock sites are also selected (Brown 1976, Dare 1989). In this study, the selection of nest-tree species simply reflected the availability of large specimens of available species.

Buzzards also nested significantly nearer to edges of woodlands than expected (Table 1). Although one nest was 800 m away from an edge, 50% of the nests were less than 200 m from an edge. The importance of woodland edges has already been mentioned for buzzards (Joenson 1968, Nore 1979, Kostrzewa 1987), and is explained by the fact that buzzards hunt mainly at the woodland edge or on the surrounding land (Joenson 1968). Thiollay (1972) emphasized that buzzard density is correlated with the length of contact between woods and open land: 600–900 m of edge per pair. The association between buzzards and forest openings could be even stronger when buzzards nest on hedgerows (Roche 1977) or on pylons (Melde 1983). Moreover, closeness to woodland edges facilitates nest accessibility (Roche 1977).

Buzzards did not select nest sites in relation to open water; the distance to pathways did not influence the buzzard in its nest-site selection. Neither percentage cover (whatever the story) nor the number of species (whatever the story) influenced selection of the nest-site (Table 1).

Based on these results, I concluded that Common Buzzard selected mature wooded areas with an easy access, rather high in the tree itself, and close to the woodland edge. It could be interesting to compare nest-site habitat of the Common Buzzard with the ecologically similar Red-tailed Hawk (*Buteo jamaicensis*; Cramp and Simmons 1977): nest-site requirements of both species appear to be rather similar (Orians and Kuhlman 1956, Titus and Mosher 1981, Bechard et al. 1990).

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