EFFECTS OF LANDSCAPE SPATIAL STRUCTURE AND COMPOSITION ON THE SETTLEMENT OF THE EAGLE OWL *BUBO BUBO* IN A MEDITERRANEAN HABITAT

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We analysed the breeding density of a Mediterranean Eagle Owl *Bubo bubo* population and the characteristics of the landscape surrounding the nest, in an attempt to identify the determinants of habitat preferences within a radius of 1000 m around each nest. A total of 59 nest site were identified (15.3 nest sites 100 km^2; mean nearest neighbour distance 1770 m). Eleven variables were correlated with the presence of an Eagle Owl nest: three variables describing the patch composition of the landscape, three variables of landscape heterogeneity, and five variables for minimum distance from landscape components. The comparison between the landscape features surrounding the nest sites and the control plots (defining the whole landscape structure) showed a significant difference. Openlands and landscape heterogeneity around the nest are a key determinant for the settlement of the Eagle Owl.

Key word: *Bubo bubo* - habitat heterogeneity - habitat preference at landscape-level - Mediterranean landscape

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INTRODUCTION

Studies on habitat preferences indicate that nesting birds select portions of the available natural environment which suit their primary living requirements best (Hilden 1965; Morse 1980; Cody 1985). The selection of a specific nesting habitat provides presumably more secure prospect for survival and reproduction than a random choice. However, the scale at which an individual select its nesting habitat and the relative contributions of certain habitat features to the choice remain important questions. Habitat preferences are related to the morphology of birds, their behaviour and their ability to successfully obtain food and shelter in their habitat (Morse 1985). A bird species can exhibit different patterns of habitat correlation at different spatial scales, from micro- to macro-habitat levels (Wiens & Rotenberry 1981). Landscape analyses of bird habitat preferences, especially raptors, are generally scarce (e.g., Ceballos & Donázar 1989; Schmutz 1989; Løfaldli *et al.* 1992; Storch 1993). Many studies of Eagle Owl *Bubo bubo* focused on diet and reproduction, and nest-site preferences were generally described at the nest-level (nest hole and nest cliff; Frey 1973; Blondel & Badan 1976; Olsson 1979; Mysterud & Dunker 1982; Gorner 1983; Scherzinger 1987; Bergerhausen *et al.* 1989; Donazar *et al.* 1989; Simeonov & Milchev 1990;

Papageorgiou *et al.* 1993; Sascor & Maistri 1996), without considering the possible effects of the landscape structure on Eagle Owl distribution. Few studies attempt to quantitatively determine the factors which are involved in nest site selection at the landscape level (Bergerhausen *et al.* 1989; Donazar 1988; Martinez *et al.* 1992).

The Eagle Owl is known as an eclectic species in terms of nest choice (Willgohs 1974; Mikkola 1983; Cugnasse 1983; Penteriani 1996), but it appears to be sensitive to the structure of the landscape around the nest, which influences hunting success (Blondel & Badan 1976; Olsson 1979; Donazar 1988). This paper presents an analysis of the breeding density of an Eagle Owl population on a Mediterranean mountain, and the features of the landscape surrounding the nest, with an attempt to identify the elements that determine the settlement of this species and its distribution.

STUDY AREA

A population of Eagle Owls was investigated from 1995 to 1998 in a Mediterranean mountain of southern France (Luberon, Provence; Gallardo *et al.* 1987). The elevation of the area ranges from 160 m (Durance River valley) to 1125 m (Grand Luberon ridge). The study covered a 1200 km^2 surface area with a mosaic structure, consisting of calcareous rocks, overhanging garrigues (Kermes Oak *Quercus coccifera*, Garden Thyme *Thymus vulgaris* and Rosemary *Rosmarinus officinalis*), Mediterranean forests (Evergreen Oak *Quercus ilex*, Downy Oak *Q. pubescens* and Aleppo Pine *Pinus halepensis*), croplands, pastures and fallow lands. In the Luberon mountain, we identified two altitudinal levels, on the basis of morphology, landscape structure, and land use patterns: the *lowland level*, corresponding to the mountain borders (the lower slopes of the massif) and to the Durance river valley (160 - 300 m altitude), and the *upland level*, characterised by parallel valleys perpendicular to the main river valley and the ridge of the mountain (300 - 700 m altitude).

METHODS

Censuses of Eagle Owl nest sites

The Eagle Owl nest sites were identified from a combination of methods, including topographic mapping of the overall rocky areas (1:25 000) and walking searches of cliffs whose size was too limited to be shown in topographic maps, walking visits (October-February, May-July) in the rocky areas in order to detect records of the species (nests, pellets, plucking sites), sunrise and sunset passive auditory surveys from October to February, the period when the adult Eagle Owl's vocal activity is the most intense (Bergerhausen and Willelms 1988; Penteriani & Pinchera 1991ab) and passive auditory surveys of the young calls, from two weeks prior to nest leaving to the following month (May-June in the study area). The listening sessions of young calls were during day (Penteriani *et al.* 2000) and night. The night sessions commenced one hour before sunset and stopped three hours later, i.e. during one of the periods of day with peak vocal activity (Kranz 1971; Mysterud & Dunker 1982; Mikkola 1983). Adult and young listening sessions were also held in valleys without cliffs, because some nests were found in rockless areas of Provence (Blondel & Badan 1976; M. Gallardo, unpubl. data). Occasionally, nests were found during direct observations of adults and of their activity in rocky areas or in the nest (e.g. copulation, feeding of young). A site that seemed to be a priori favourable to the species was considered as unoccupied only after a complete walking search and three negative adult listening sessions (Bergerhausen & Willelms 1988; Penteriani & Pinchera 1991ab). A site was considered as a possible nesting territory when Eagle Owls were observed, but without further signs of reproduction. For density computation, the nearest neighbour distance method (NND, Newton *et al.* 1977) was applied. Regularity in nest spacing was analysed by means of the *G*-statistic (Brown & Rothery 1978), calculated as the ratio between the geometric mean and the arithmetic mean of the squared nearest neighbour distances. This index ranged from 0 - 1: values close to 1 (> 0.65) indicate a uniform distribution of nests.

Analysis of the landscape-level habitat preferences

The landscape-level analysis of habitat preference only considered those Eagle Owl nest sites inside the area covered by aerial photographs (300 km^2), and where nests occupied by a reproductive pair were detected (n = 26). The analysis of the landscape features was based on circular plots centred on the occupied nest and extending within a radius of 1000 m around it. The choice of this scale, although arbitrary, arose from the idea that Eagle Owls prefer to nest near favourite hunting grounds (Frey 1973; Olsson 1979; Donazar 1988; Donazar *et al.* 1989; Cochet 1991; Leditznig 1992), and that their breeding success is also influenced by the flight distance between the nest and the hunting areas (Leditznig 1996).

The landscape was analysed via the IDRISI program (Geographical Information System, GIS), using a landcover layer and a Digital Elevation Model (DEM) layer with an horizontal resolution of 50 m (Fig.1). We classified a 1996 Landsat 4 scene using an unsupervised classification procedure with 25 classes. The classes were identified from vegetation maps and field surveys. We aggregated the initial classes into five land cover elements defined by both the density of vegetation cover and the nature of the woody vegetation (Table 1). The resulting landscape elements represent more the structure of the vegetation than the nature of the dominant species. The five landscape elements are: sparse vegetation, low vegetation, shrublands, coppices and forest. Altitudes

Table 1. Description of the land cover types used by describe the Eagle Owl nesting habitat at a landscape level.

Land cover type	Description	Typical plant species
Woodlands	Areas continuously, covered by trees, mean height above 4 m	Aleppo Pine *Pinus halepensis* Downy Oak *Quercus pubescens* Evergreen Oak *Quercus ilex* Scots Pine *Pinus silvestris* Atlas Cedar *Cedrus atlantica*
Coppices	Areas continuously covered by coppiced trees (2-4 m)	Evergreen Oak *Quercus ilex* Downy Oak *Quercus pubescens*
Shrublands	Areas covered by shrubs, some scattered trees (1-2 m)	Kermes Oak *Quercus coccifera* Rosemary *Rosmarinus officinalis* Box *Buxus sempervirens* Snowy Mespil *Amelanchier ovalis* Jasmine-box *Phyllirea angustifolia*
Low vegetation	Areas covered by small shrubs and herbaceous plants, some bare ground (0-80 cm)	Kermes Oak *Quercus coccifera* Rosemary *Rosmarinus officinalis* White-leaf Rockrose *Cistus albidus* Stemmy False-brome grass *Brachypodium retusum* Sheep's-fescue *Festuca ovina*
Sparse vegetation	Mixed class of bare ground, cultivated areas (ploughed lands, crops, vineyards) (0-2 m)	*complex natural and cultivated plants*

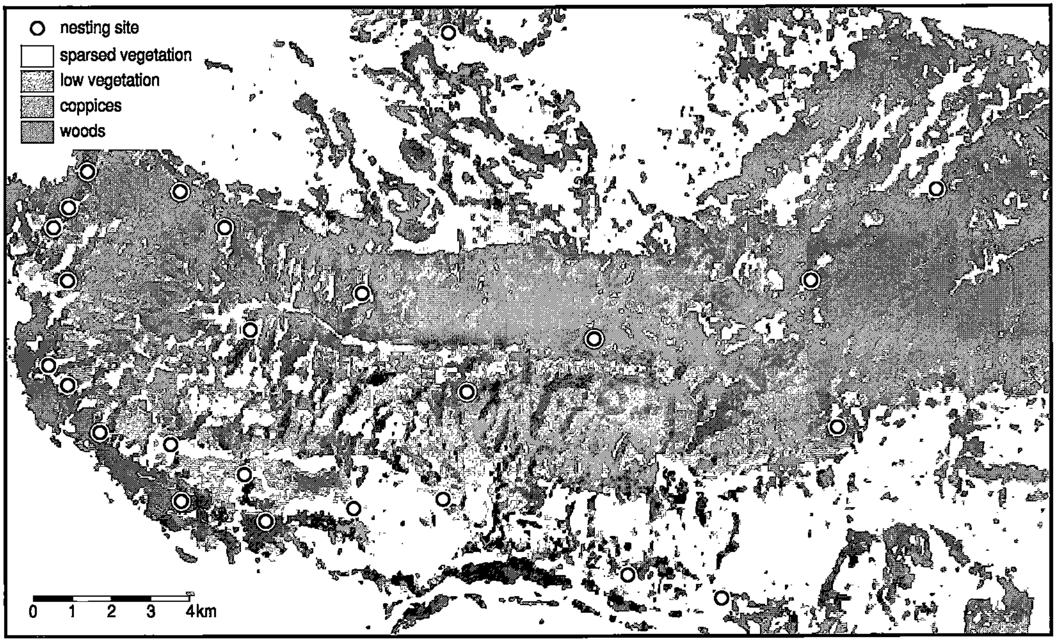

Fig. 1. Map of the study area with the main landscape elements. The open white circles indicate the location of the Eagle Owl nesting sites used in the landscape analysis.

and slope gradients were determined with the DEM.

Each landscape structure of a nest site was characterised by using a set of 17 variables: slope (SLO), exposure (ASP), 5 variables describing patch composition of the landscape [percentages of sparse vegetation (SPV), low vegetation (LVE), shrublands (SHR), coppices (COP), forests (WOO)], 4 IDRISI common index of landscape heterogeneity [Complexity index (COM = ecotone number calculated on a 90 m-side window -3 pixels-), Shape index (SHI = surface / perimeter of landscape patches)], Proximity index (PRX = mean distance of the plot centre from open patches, including sparse vegetation, low vegetation and shrublands patches), and Shannon index (HSh)], maximum difference in elevation (ALT), and 5 variables for minimum distance of the nest from the surrounding landscape components [patches of sparse vegetation (DSV), low vegetation (DLV), shrublands (DSH), forest (DWO) and open patches (DOP)]. In order to compare the landscape surrounding the nest sites with that occurring in the overall landscape, we produced a neutral sample of 66 plots, thereafter called control plots. That sample was created using a regular mesh of 2500 m layered over the whole studied area. We did not keep the samples containing nest sites. For each control plot, we used the sampling protocol as for the nest site. That neutral sample allowed to define the whole landscape structure without reference to the nest sites that are supposed to be chosen by the Eagle Owl, as well as if the Eagle Owl chose a subset of the landscape structure or if the nest sites occur all over the landscape structure. A second analysis was performed, using only control plots that included cliff areas.

Statistical analysis

The landscape features of the nest sites and of the control plots were compared by using two methods. First, we used a Principal Component Analysis (PCA), in order to analyse the landscape structure, on the landscape data of both the nest sites and the control plots. This procedure allowed to establish whether Eagle Owls select its nest site at the landscape level and which parameters guide such selection. In case of landscape structure selection, the nest sites points occupy a subset of the PCA space. Since the ratio between the number of samples and the number of variables, we did not use a discriminant analysis in order to identify discriminant landscape variables between landscape nest sites and control plots (Sokal & Rohlf 1995). We used the analysis of variance to compare the factorial scores and the variables of the nest sites and the control plots, in order to identify parameters that significantly separate the two sets. The bottom-up decrease of density and the nest exposures were tested by χ^2 test.

RESULTS

Nest-sites density

A total of 59 certain and nine possible Eagle Owl nesting territories were identified, with an overall density of 15.3 nest sites 100 km^{-2}, and an overall nearest neighbour distance (NND) of 1770 ± 971 m (range 700 - 4300 m). The value of the *G*-statistic (0.74) indicated a relatively regular distribution of nest sites inside the study area. In the two sectors of the massif, a progressive and significant bottom-up decrease of Eagle Owl density was observed (χ^2_1 = 138.6, P = 0.001): the mountain borders and the Durance valley (31.6 nest sites 100 km^{-2}), were characterised by an average NND of 1353 ± 828 m (range 700 - 3000 m), and the value of the *G*-statistic (0.75) showed their uniform dispersion; the upland area (19.6 nest sites 100 km^{-2}), was characterised by an average NND of 1808 ± 961 m (range 800 - 3500 m), and the value of *G*-statistic (0.77) showed a uniform dispersion of the sites.

Landscape level habitat preference

From the landscape scale of 1000 m around the nest, axes 1 and 3 significantly separated the nest sites from the control plots (Table 2). The factorial spaces bounded by the PCA axes 1 and 2 identified the nest sites and the variables characterising them (Fig.2A): axes 1 explained 39.4% of the variance, axis 2 and 3 explained 15.3 and 10.4% of the variance, respectively. According to the absolute contributions of the variables to the two significant axis, 11 variables played an important role in the nesting site location at the landscape level. The variables for the first axis were: SPV (< around the Eagle Owl nests), COM (> around the Eagle Owl nests), SHI (> around the Eagle Owl nests), DLV (< around the Eagle Owl nests), DSH (< around the Eagle Owl nests) and DWO (< around the Eagle Owl nests); for the third axis, they were: LVE (> around the Eagle Owl nests), WOO (> around the Eagle Owl nests), SHI (> around the Eagle Owl nests), Hsh (> around the Eagle Owl nests), DSV (> around the Eagle Owl nests) and DOP (< around the Eagle

Table 2. Results of the ANOVA on the factorial scores between nest sites (n = 26) and control plots (n = 66) and absolute contribution of the variables to the PCA axes (values in bold represent the variables contributing to the Eagle Owl landscape choice). The abbreviations follow those indicated in the methods chapter.

	Fac 1	Fac 2	Fac 3	Fac 4
F_{obs}	15.66	0.008	10.21	2.343
P	0.0002	0.927	0.002	0.1252
SPV	**1159**	177	0	734
LVE	349	40	**1865**	520
SHR	619	52	96	66
COP	390	108	504	2917
WOO	89	432	**1392**	415
ALT	668	642	23	418
SLO	353	650	234	83
COM	**1175**	90	550	5
SHI	**1060**	251	**732**	0
HSh	654	7	**755**	557
PRX	677	1933	115	1
DSV	188	881	**1409**	1794
DLV	**760**	1638	144	0
DSH	**732**	1377	394	75
DWO	**930**	497	459	154
DOP	190	1188	**1320**	1718
ASP	0	29	1	534

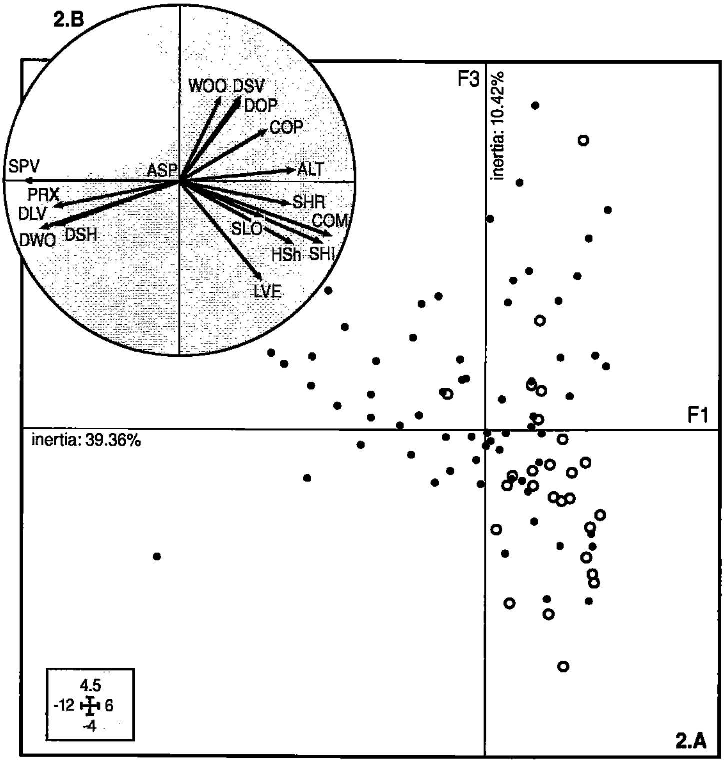

Fig. 2. Scatter diagram of PCA axes 1 and 3 of the landscape variables for the nesting and control sites on the 1000 m scale. 2A, the scatter plot of the sites; the open circles refer to the nesting sites, the black dots indicates the control sites. 2B, correlation circle of variables. SPV = sparse vegetation, LVE = low vegetation, SHR = shrublands, COP = coppices, WOO = woodlands, COM = Complexity index, SHI = Shape index, PRX = Proximity index, Hsh = Shannon index, ALT = maximum difference in elevation, SLO = Relief index, DSV = distance to sparse vegetation, DLV = distance to low vegetation, DSH = distance to shrublands, DWO = distance to forests, DOP = distance to open areas, Asp = nest exposure.

Owl nests). That can be summarised as an heterogeneous landscape with a dominance of low vegetation and at proximity of both openlands (with low vegetation) and woodlands. If we consider the variables individually, the nest site plots and the control plots showed a significant difference for 11 parameters: SPV, LVE, COP (> around the Eagle Owl nests), ALT (> around the Eagle Owl nests), SLO (> around the Eagle Owl nests), COM, SHI, Hsh, PRX (< around the Eagle Owl nests), DLV and DWO (Table 3). The main difference with the previous analysis is the presence of altitude and slope as discriminant factors, and the removal of DSV, DSH and DOP.

The comparison between the nest site plots and the control plots with cliff areas suggested that there was a significant difference for 5 variables (Table 4): SLO, COM, SHI, DLV and DWO. The analysis of nest exposure (n = 34) shows that in 23.8% (n =10) of the nests the exposure was SW (χ^2_7 = 16.29, P = 0.05), in 21.4% (n = 9) E, in 16.7% (n = 7) S and SE, in 9.5% (n = 4) W, in 7.1% (n = 3) NW, and in 2.4% (n = 1) N and NE.

Table 3. Landscape analysis on the 1000-m scale: mean values and standard deviations (SD) of landscape variables for nest site plots ($n = 26$) and control plots ($n = 66$). The F and P values refer to the ANOVA, P values in bold are significant at the 5% level. The abbreviations follow those indicated in the methods chapter.

	Nest Sites		Control sites		ANOVA	
	Range	Mean ± SD	Range	Mean ± SD	F	P
SPV	1.3-54.2	15.38 ± 11.9	0.2-100	35.55 ± 29.17	11.41	**0.001**
LVE	2-43.8	15.12 ± 11.11	0-27.9	6.12 ± 6.56	22.45	**0.000**
SHR	9.7-53	30.13 ± 13.55	0-59.5	26.68 ± 16.63	0.86	0.357
COP	9.3-69.7	38.25 ± 16.45	0-84.6	29.32 ± 20.34	3.90	**0.049**
WOO	0-15.4	0.9 ± 2.94	0-7.7	0.62 ± 1.41	0.36	0.554
ALT	86.5-469.27	290.33 ± 97.47	9.88-645.58	216.86 ± 133.89	6.34	**0.013**
SLO	0-15.8	5.22 ± 3.74	0-13.7	1.93 ± 2.86	20.15	**0.000**
COM	9-15.9	13.43 ± 1.71	0.39-15.84	9.33 ± 4.49	20.02	**0.000**
SHI	0.14-0.39	0.27 ± 0.05	0.05-0.38	0.19 ± 0.08	21.86	**0.000**
HSh	1.34-1.98	1.71 ± 0.18	0-2.04	1.45 ± 0.46	8.08	**0.005**
PRX	22.75-159.7	67.49 ± 36.66	19.18-2268.33	208.97 ± 337.74	4.44	**0.036**
DSV	0-237.88	49.04 ± 60.56	0-689.93	79.74 ± 140.29	1.13	0.290
DLV	0-266.44	76.3 ± 63.66	0-3512.39	328.99 ± 550.41	5.33	**0.022**
DSH	0-201.8	77.11 ± 61.19	0-3292.61	218.18 ± 488.81	2.10	0.146
DWO	0-263.57	61.7 ± 72.3	0-2089.48	254.31 ± 352.84	7.46	**0.007**
DOP	0-159.78	29.97 ± 40.1	0-438.86	49.32 ± 95.82	0.97	0.328
ASP	2-343	199.69 ± 89.28	0-354	203.95 ± 105.45	0.03	0.852

Table 4. Landscape analysis on the 1000-m scale: mean values and standard deviations (SD) of landscape variables for nest site plots ($n = 26$) and control ones with cliff areas ($n = 53$). The F and p values refer to the ANOVA, p values in bold are significant at the 5% level. The abbreviations follow those indicated in the methods chapter.

Variables	Nest Sites		Control Sites		ANOVA	
	Range	Mean ± SD	Range	Mean ± SD	F	P
SPV	1.3-54.2	15.38 ± 11.9	0.20 - 100.00	20.96 ± 22.53	1.370	0.245
LVE	2-43.8	15.12 ± 11.11	0.00 - 42.00	10.37 ± 9.93	3.590	0.059
SHR	9.7-53	30.13 ± 13.55	0.00 - 59.50	31.78 ± 16.27	0.190	0.665
COP	9.3-69.7	38.25 ± 16.45	0.00 - 80.20	35.52 ± 17.86	0.420	0.528
WOO	0-15.4	0.9 ± 2.94	0.00 - 7.70	0.80 ± 1.53	0.030	0.845
ALT	86.5-469.27	290.33 ± 97.47	97.00 - 645.58	285.88 ± 118.03	0.030	0.865
SLO	0-15.8	5.22 ± 3.74	0.10 - 13.70	3.47 ± 3.27	4.510	**0.035**
COM	9-15.9	13.43 ± 1.71	0.39 - 16.15	11.57 ± 3.90	5.250	**0.023**
SHI	0.14-0.39	0.27 ± 0.05	0.06 - 0.38	0.23 ± 0.07	4.870	**0.029**
HSh	1.34-1.98	1.71 ± 0.18	0.00 - 2.04	1.57 ± 0.40	3.180	0.075
PRX	22.75-159.7	67.49 ± 36.66	19.18 - 513.30	130.05 ± 117.57	6.850	0.104
DSV	0-237.88	49.04 ± 60.56	0.00 - 689.93	101.02 ± 157.37	2.580	0.108
DLV	0-266.44	76.3 ± 63.66	0.00 - 1132.76	186.58 ± 226.61	5.780	**0.018**
DSH	0-201.8	77.11 ± 61.19	0.00 - 407.14	102.55 ± 99.21	1.400	0.238
DWO	0-263.57	61.7 ± 72.3	0.00 - 855.49	156.53 ± 181.19	6.440	**0.013**
DOP	0-159.78	29.97 ± 40.1	0.00 - 438.86	62.49 ± 108.66	2.130	0.145
ASP	2-343	199.69 ± 89.28	12.00 - 354.00	198.68 ± 111.61	0.001	0.967

DISCUSSION

Even if the density of the Eagle Owl in the study area decreases from the mountain borders and the Durance valley to the upland area, it is one of the highest in Europe, approaching values reported for other Mediterranean areas of France (16.2 pairs 100 km^{-2}, Cheylan 1979; 16 pairs 100 km^{-2}, Bergier & Badan 1991). The decreasing nesting density from low-altitude to higher areas can be explained mostly by the changing landscape structure. Nest sites in the lower border level of the mountain (Durance valley) are located in an open agricultural landscape, whereas the nest sites in the interior upland areas frequently lie in patches within a wooded landscape, relatively far from open spaces. Densely forested areas are considered to limit density and young productivity (Frey 1973; Donazar 1988; Cochet 1991; Leditznig 1996), and in the most forested areas of the mountain, the productivity of Eagle Owl pairs does not appear to be constant (M. Gallardo and V. Penteriani, unpubl. data). Moreover, the nest site distribution in our study area is also characterised by shorter distances from open areas and a more heterogeneous landscape (Fig. 2, Tables 3 and 4).

The landscape analysis suggests that the Eagle Owl does not select its nest site landscape at random, as testified by the PCA analysis, as well as by the significant differences between the nest site and control plot variables (Tables 3 and 4). The Eagle Owl is an area-sensitive species that requires nesting sites in a heterogeneous landscape (as shown by higher values of the Complexity, Shape and Shannon indices), with a preference for open patches (as shown by landscape features around nest sites). The preference for openlands was also reported by Donazar (1988) and Martinez *et al.* (1992). The showed shorter distances from wooded areas, as well as the higher percentages of coppices and forests around the nests, are not surprising if we consider that wooded patches might introduce a higher heterogeneity in the overall landscape surrounding an Eagle Owl nest. The preference for areas with cliffs, also mentioned by Donazar *et al.* (1989) and Martinez *et al.* (1992), is probably due to the fact that Eagle Owls usually use rocky areas as elective sites for nesting, as well as for perching, calling and plucking. The presence of cliffs might explain the significantly higher values of slope and maximum difference in elevation that characterised the landscape occupied by breeding pairs of Eagle Owls. Nest exposure probably depends on local factors, such as temperature, duration of sunlight, dominant wind direction, snow fall (e.g., Rockenbauch 1978; Olsson 1979; Mysterud & Dunker 1982; Gorner 1983). The tendency to predominantly use of south-exposed cliffs may be due to the same factors: protection from low temperatures and wind (the prevalent direction of the *mistral*, a high speed wind up to 100 km h^{-1}, is N-NW).

If the Eagle Owl is known for its eclectism in nest choice, the landscape structure and composition are very similar between the different study (Blondel & Badan 1976, Bergerhausen *et al.* 1989; Donazar 1988; Martinez *et al.* 1992). Our results demonstrate the influence of landscape structure and composition on the distribution of the Eagle Owl: the presence of openlands and their distance from cliffs are key determinants for the settlement of this species in a given territory. The dependence of the Eagle Owl on open areas and on habitat heterogeneity may be a problem for conservation of the species in Mediterranean landscapes. In southern France, as in other countries and regions of the Mediterranean basin, the general trend is toward disruption of the dynamic agro-pastoral equilibrium maintained by man, that has contributed to the biological diversity and productivity of these seminatural landscapes (Naveh & Liebermann 1994). The decreasing grazing pressure, especially in inland areas, combined with depopulation and abandonment of agricultural uplands, favors the development of Mediterranean forests (e.g. *Quercus ilex*) with a very closed structure and a rapid reduction of open areas and landscape diversity. In such a situation, the landscape preferences of Eagle Owls might limit the expansion of the species in the Mediterranean range, and benefit the smaller owls living in the more forested areas. Our results indicate that quantitative analysis of nest site preferences at the landscape level must be considered for adequate management of raptor populations (Mosher *et al.* 1987), particularly of such species as the Eagle Owl, in which signs of regression were found in some European regions (Tucker & Heath 1994; Penteriani 1996).

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SAMENVATTING

De habitatpreferenties van een populatie Oehoes *Bubo bubo* werd onderzocht in een mediterraan berggebied in het zuiden van Frankrijk (Luberon, Provence). Hiertoe werd het landschap gekarakteriseerd binnen een straal van 1000 meter rond elk nest. Vervolgens werd dit vergeleken met het 'aanbod' van verschillende landschapstypen in de hele regio op basis van controlegebieden. In totaal werden 59 nesten gelokaliseerd (15,3 nesten per 100 km^2). De gemiddelde afstand van ieder nest tot het dichtstbijgelegen volgende nest bedroeg 1770 meter. Elf variabelen werden in verband gebracht met de aan- of afwezigheid van Oehoenesten. Drie variabelen beschreven de structuur van de nestplaats, drie de heterogeniteit van het omringende landschap en vijf de minimale afstand tot bepaalde componenten van het landschap. De landschapskarakteristieken rondom elk nest week significant af van controlegebieden. De voornaamste factoren voor Oehoes bleken een open en zeer gevarieerd landschap te zijn. (CJC)

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