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Nest-site Preferences of Common Buzzard, *Buteo buteo* (Linnaeus, 1758), from Eastern Romania

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Abstract: The common buzzard is one of the most common birds of prey on the Balkans. Although it is a widespread species, its population and ecology are poorly studied in this region. During the 2012 breeding season we studied, for the first time in Eastern Romania, nest occupancy and fledging rate of Buteo buteo. We found that common buzzards used mature oak (30%), beech (30%) and lime trees (25%) in which they build their nests at heights always greater than 8 m. The data on nest sites did not show any pattern related to altitude for this hilly region. Buzzards built their nests in areas with low slopes, without selecting specific environments. Areas, which were close to the forest edge (less than 1 km) and more than 1 km away from human settlements were more suitable for nesting sites. We found a relatively high fledging rate (2 ± 0.12), outlining this eastern part of Romania as an important area for sustaining the species population.

Key words: birds of prey, breeding ecology, habitat selection, fledging rate

Introduction

Birds of prey are top predators with a firm place in the upper layers of trophic pyramids related to the habitat where they are found. Their density can represent a valuable indicator for environment health (Voos 1994), biodiversity (Sergio *et al.* 2005) and for understanding the effect of environmental changes on biodiversity (Nikolov *et al.* 2006). In order to use them as bioindicators, we have to understand the factors influencing their distribution. Beside prey and climatic variables, their abundance could be influenced by habitat structure and by nest-site availability (Swann & Etheridge 1995; Goszczyński *et al.* 2005; Sim *et al.* 2010; Demerdzhiev *et al.* 2014). Understanding these variables is the first step in the area-suitability evaluation process.

The common buzzard, *Buteo buteo* (Linnaeus, 1758) is one of the most common medium-sized raptors (Cramp & Simmons 1980) throughout Europe and Asia (Ferguson-Lees & Christie 2007; Birdlife International 2012). Its global population is increasing in almost its entire range; only some local populations are declining (Lehikoinen *et al.* 2009). Factors currently limiting the species population are the low availability of food and nest sites, direct persecution, poisoning and road collisions (Newton *et al.* 1982; Graham *et al.* 1995; Kalpakis *et al.* 2009; Kambourova-Ivanova *et al.* 2012).

On the Balkan Peninsula, the common buzzard population is poorly known. There are only a few studies that focus on the species' breeding (Spasov *et al.* 2012; Baltag *et al.* 2013a), migration (Michev *et al.* 2011; Panuccio *et al.* 2013; Oppel *et al.* 2014) and wintering densities (Baltag *et al.* 2013b; Nikolov *et al.* 2006), distribution and climatic influences. Prior to this study and for this area, little data exist on common buzzard nest occupancy or breeding ecol-

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ogy. In order to better understand the species ecology in Eastern Europe, the present study is aiming to identify the nest-site preference, fledging rate and influence of northern goshawks on common buzzards in Eastern Romania.

Materials and Methods

The study area covers Iasi County (5476 sq. km, 47.25°N, 27.31°E), which is situated in Eastern Romania (Fig. 1), at the border with the Republic of Moldova. Being a hilly region, the elevation in our study area fluctuates between 40 m to 587 m a.s.l. (Dealul Mare – Hârlău), with a mean altitude of 180 m a.s.l. The habitat structure is a mosaic of agriculture, pastures, wetlands and forests (Baltag *et al.* 2013b). The highest percent (53%) is covered by agriculture. An important part of the study area is covered by forest (17.52%) and grasslands area (16.4%), which together represent one third of the habitat structure.

The study was conducted during one breeding season (March – June 2012), although the nests were identified in the previous winter (November 2011 – February 2012). During this period, it was easier to see the nests after the autumn leaves had fallen and before the spring leaves had emerged. We conducted 30 transects, each 7 km long. On the first visits, we recorded the nests' geographical coordinates, the tree species present and the height of the nest. Transects for searching the nests were randomly selected in areas with forests and woodlands greater than 30 ha. In the study area, the small woodlands (less than 30 ha) were very rarely used by nesting birds of prey, according to a previous research conducted in 2005-2010 (except falcons, see Baltag *et al.* 2013a). This was probably due to disturbance from humans or because the areas were composed mainly of thin trees, which are not suitable for breeding such as black locust (*Robinia pseudoacacia*).

During April, the nests were checked for the first time in order to identify the species that were using them for nesting. The second survey was conducted in June – July to record the number of fledglings. The nests were surveyed from a vantage point up a slope opposite the nest with a 10 X 42 binoculars or a 20 X 60 spotting scope in order to record the fledging rate (fledging chicks/successful nests). For each identified nest (occupied or not), we measured the altitude, slope, aspect, distance to the forest edge and the distance to the nearest settlement using ESRI ArcGIS software and the specific vector and raster layers. The differences between nests occupied by the common buzzard and unoccupied nests were tested for these features using Mann-Whitney U test. For all occupied nests, the nearest-neighbour distances were calculated in ESRI ArcGIS software.

We tested for spatial autocorrelation using Global Moran's I values (Moran 1950) with the spa-

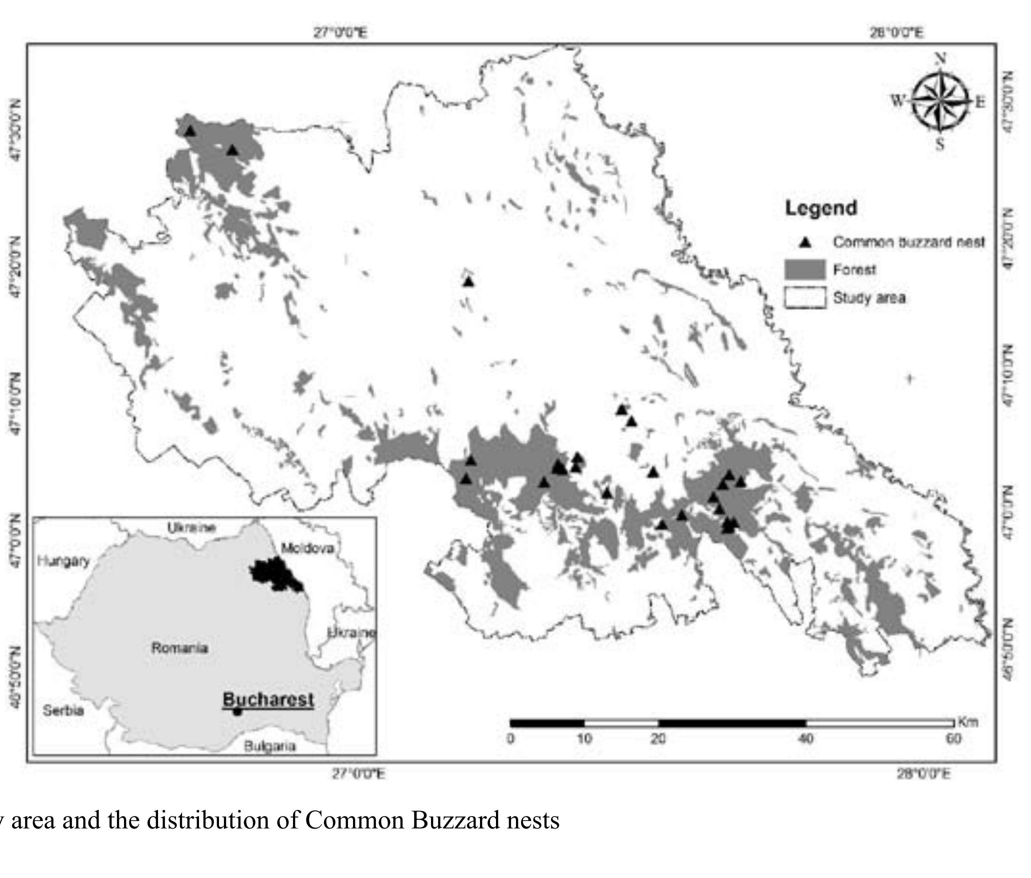

Fig. 1. Study area and the distribution of Common Buzzard nests

tial statistics tool in ArcMap (ESRI 2011). The statistical significance of Moran's I ($P < 0.05$) is based on distances by randomisation, using a Monte Carlo procedure with 200 permutations (Sfougaris *et al*. 2014). Spatial autocorrelation for the identified nests was not present; Moran's Index (Moran's Index = 0.003, $Z_{score} = 0.974$, $p = 0.329$) showed a random distribution of the identified nest with respect to the position of the transects for nest searching.

Results

During our survey we identified 93 large tree nests (Table 1). From the total number of nests, 28 were occupied by common buzzards, nine by northern goshawks (*Accipiter gentilis*) and three by ravens (*Corvus corax*). The other 53 nests were not occupied during the 2012 breeding season. Most of these were very close to those occupied, representing secondary nests of the breeding birds of prey pairs (86 %). The highest number of large tree nests identified in a common buzzard territory was four nests, with a mean of three nests per breeding pair. Analysing the neighbour distance between the nests of *B. buteo* we found a minimum value of 371.88 m and a maximum of 6266.92 m (mean = 1839.28 m). However, we identified a clustered pattern for the common buzzard nests (Moran's Index = 0.032, $Z_{score} = 2.18$, $p = 0.029$), even if the transects were randomly distributed.

Most of the nests (occupied and unoccupied, n = 93) were recorded in oak trees (29.03%), beech trees (22.6%) and lime trees (18.3%). The common buzzards generally nested in the same three tree species, with nests found in oak and beech (each with 30.0% occupancy), and 25% were found in lime trees. They were also at the same height range as all identified nests, between eight and 29.2 m (Table 2).

The altitude at which *B. buteo* were nesting varied considerably, reaching up to 440 m a.s.l.. They mostly used areas with only a little slope, building their nest on the lower third of the slope. The highest proportion of common buzzard nests were placed on the north-eastern (23.1%) and south-eastern, southern and south-western slopes (16.3 % for each). However, we did not find a significant selection for a specific slope.

The nests were placed close to the forest edge, most of them at a distance of less than 1 km. For the distance to the nearest human settlement we recorded an opposite pattern; all common buzzard nests were found more than 1 km from the nearest town or village. Comparing the nests of *B. buteo* with the nests which were not occupied, we did not find a significant difference between them (all $P < 0.05$, Table 2).

Table 1. The species structure of the large tree nests occupied during the 2012 breeding season in Iași County. Means are given ± SE.

Common name	Scientific name	Number of nests	Mean number of fledglings (± SE)
Common Buzzard	*Buteo buteo*	28	2 ± 0.12
Northern Goshawk	*Accipiter gentilis*	9	2.38 ± 0.18
Raven	*Corvus corax*	3	-
Unused		53	-
Total		93	-

Table 2. Range and mean values of variables used in the description of the nest sites of the Common Buzzard from Iași County, Romania. For each variable the Mann-Whitney U test results are presented, comparing between nests occupied by Common Buzzards and those that are unoccupied. Min – minimum value, max – maximum value, SD – Standard Deviation.

Variable	Occupied nests				Unoccupied nests				Mann-Whitney U test	
	min	max	mean	SD	min	Max	mean	SD	U values	P values
Altitude (m)	120	440	158.08	79.5	98	378	243.7	73.3	7655.8	0.762
Slope (°)	1.27	18.67	8.09	3.9	0.8	13.9	7.8	3.1	7656.1	0.784
Distance to the forest edge (m)	27	2539	773.44	631.0	134.8	8001.5	2399.9	1933.5	7656.3	0.155
Distance to the nearest settlement (m)	906.2	5402.5	2718.0	1337.9	833.8	3976.6	2036.1	843.4	7656.25	0.067

The fledging rate for the breeding pairs of common buzzard identified in Iaşi County during the 2012 breeding season was 2.0 (± 0.12). The largest number of fledglings was 3, but the broods with this high number represented only 15.0% of the total breeding pairs.

Discussion

The large number of unoccupied nests is explained by the species breeding behaviour – they build a number of nests and do not always use the same one every year (Beneharo *et al.* 2010). Common buzzards typically refurbish many alternate nests each year before selecting the one which they would eventually use (Cramp & Simmons 1980). They have an average of three nests in their territory (Sergio *et al.* 2002), a value which was also confirmed by this study.

Most of the nests were built in oak, beech and lime trees at a mean height of 17.8 m. Their preferences are connected with the tree species (in particular their height) and the forestry management (through tree age and species composition). The absence of previous nest-site data for Romania and the Republic of Moldova concerning the same trees species and almost the same forestry management makes a comparison with other studies difficult. However, in Italy Sergio *et al.* (2002) recorded a lower mean height (15 m) and in Poland Goszczyński *et al.* (2005) recorded a higher value (19.2 m). These differences could be explained by the higher percent of the old growth forest in former communist countries (Dudley 1993).

Buteo buteo is common at altitudes of up to 1000 m a.s.l. (Cramp & Simmons 1980). Therefore, it is unsurprising that the altitude of the nest sites covered almost the entire elevation range of the study area, except the lowest areas, which were mainly covered by wetlands.

In the studied area, the nests were placed in the lower part of the slope, with a low gradient and without a significant selection for the slope orientation. Although there were more nests on the north-eastern to south-western slopes, this orientation was not significant. These data differ for instance from data from the Canary Island population of common buzzards which nest on the steep slopes of the island with a north-western and south-eastern orientation (Beneharo *et al.* 2010).

Buteo buteo hunts in open areas (Cramp & Simmons 1980; Ferguson-Lees & Christie 2007) and the proximity to the forest edge could represent an advantage due to low energy consumption to fly to the hunting grounds. Most of the nests were located within 1 km from the forest edge, even for large forests (larger than 12000 ha). However, if a town or village was present the nest was further away. In contrast to the nests of common buzzards, all the northern goshawk nests were close to the human settlements. The northern goshawk is the main species which could negatively influence the population of *B. buteo* (Kostrzewa 1991; Goszczyński *et al.* 2005; Krüger 2002, 2004; Chakarov & Krüger 2010; Mueller *et al.* 2016) as it frequently hunts in settlements, catching domestic and feral pigeon. This negative influencemay lead to an active avoidance by the common buzzards to nest closer to the settlements. Northern goshawk was also found negatively influence the honey buzzard (Gamauf *et al.* 2013). Another cause of the large distance between *B. buteo* nests and settlements could be disturbance by humans and/or persecution (Sergio *et al.* 2002; Kalpakis *et al.* 2009; Beneharo *et al.* 2010). These factors also apply to the goshawk.

The nearest-neighbour distance varied across the study area, although this parameter was poorly covered in the present study due to large areas which were not surveyed for large tree nests. Referring only to the minimum neighbour distance, we recorded values close to the common buzzard population from northern Great Britain (Swann & Etheridge 1995). However, this parameter is difficult to be analysed for the entire study area because forest bodies are separated by large agricultural fields, grasslands or settlements, creating a discontinuous area where buzzards may breed.

The fledging rate of *B. buteo* is positively correlated with the prey abundance (Sim *et al.* 2010; Rooney & Montgomery 2013; Jonker *et al.* 2014) but we cannot compare our data with prey density due to the unavailability of this type of information for the study area. Additionally, because this is the first study on common buzzard breeding ecology in this region of Romania, a comparison of the fledging rate with other areas from this region (Romania or the Republic of Moldova) is impossible. However, the fledging rate was similar with the one of the common buzzard population from Scotland (Swann & Etheridge 1995) and the north-east of Ireland (Rooney & Montgomery 2013). It was higher than that found in Wales (Sim *et al.* 2010) and Italy (Sergio *et al.* 2002). This relatively high fledging rate indicates that the study area is suitable for *B. buteo* to successfully breed.

This study presents the first data on common buzzard nest sites and fledging success from Romania, contributing to the species knowledge across Eastern Europe.

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