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Common Buzzard, *Buteo buteo*, nest site selection pattern in relation to stands and their location factors in Central Lithuania, Central Eastern Europe

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Abstract

Environmental changes are expected in Europe due to ongoing timber harvesting in forests and changes in agriculture practices in cultivated areas. This study aimed to determine whether the nest site characteristics of the Common Buzzard *Buteo buteo* – a generalist raptor – have changed over time due to ongoing changes in forests and agricultural areas that are highly important for its breeding. A comparison of Common Buzzard nest sites occupied in 2002–2004 with nest sites occupied in 2017–2018 in commercially managed forests indicated certain changes. Common Buzzards preferred to nest in more mature stands with the higher proportion of deciduous trees in composition of the first tree layer. The location of stands in regard to agricultural areas did not shape habitat choice. The oak was most important nests tree. The nest sites of the Common Buzzard remained similar in terms of location within the landscape, however, age of stands used for nest significantly increased. In summary, these results suggest that Common Buzzard nest site selection pattern was driven by stand level decisions, but were not shaped by the landscape features. These findings indicate that behavioural plasticity typically assumed for this ubiquitous raptor may not necessarily act at the all levels of nest site selection process, which may further indicate species potential sensitivity to the changes in forest utilisation intensity.

Keywords: habitat selection, raptor, forestry impact

Introduction

Habitat is one of the most essential factors determining the distribution and abundance of organisms (Boyce et al. 2016, Benítez-López et al. 2017, Satyam and Thiruchitrambalam 2018). Raptors typically occupy and reproduce in the same territory for multiple seasons (Sergio and Newton 2003, Kochert and Steenhof 2012). Therefore, they should invest more effort in habitat selection since this process can strongly affect the survival and productivity of animal populations (Chalfoun and Schmidt 2012, Basille et al. 2013, Jedlikowski and Brambilla 2017). Since habitat loss is an important factor in population persistence, understanding habitat selection is a crucial task for species management and conservation (Pärt and Doligez 2003, Benítez-López et al. 2017, De Gabriel Hernando et al. 2021).

Human land use substantially affects forest structure, composition, and landscapes in many regions (Khanaposhtani et al. 2013 and references therein). This negative impact on forest ecosystems continues to grow worldwide (Brunet et al. 2010, Butchart et al. 2010). Timber harvesting in the temperate and boreal forests reduced the availability of key elements required by large stick-nesting birds (Lõhmus 2003a, Treinys et al. 2016). Large old trees, often with malformed canopies, are primary breeding habitat elements for forest-dwelling predatory birds (Lõhmus 2006, Treinys et al. 2011). A decline in the number of mature stands and broadleaved trees was observed in the forest landscape of Lithuania between 1995 and 2009 (Treinys et al. 2016). Moreover, the decline in old spruce forests around Common Buzzard *Buteo buteo* and Northern Goshawk *Accipiter gentilis* nest sites was documented in southern Finland during 1992–2010 (Björklund et al. 2015).

The subsidies aided by the Common Agricultural Policy have driven the intensification of agriculture operations and decreased permanent grasslands by ca. 12% in new Member States of the European Union (Pe'er et al. 2014). Changes also embrace the alteration of crop species composition (e.g. the growing popularity of oilseed rape *Brassica napus*) (Panek and Hušek 2014). These changes in farmland habitats throughout the EU began to threaten birds living or foraging in these sites (BirdLife International 2004, Mirski 2009, Grande et al. 2018), including bird species like the Lesser Kestrel *Falco naumani* (Donázar et al. 1993), Little Owl *Athene noctua* (Šálek and Schröpfer 2008) and predicted for the Montagu's Harrier *Circus pygargus* (Väli et al. 2017 and references therein). Lithuania accessed the EU in 2004; between 1990 and 2010, its arable lands increased by 27.7%, but at the same time, its grasslands and natural pastures declined by 59.4%. The latter was induced by a dramatic reduction in livestock numbers (Bogužas et al. 2013). Significant decrease in the Common Buzzard abundance due to reduction of hedgerows, woodlots and grasslands areas, as well as with the decrease in prey abundance was indicated in Western France (Butet et al. 2010). Recently, it was discovered that in forests of central Lithuania, Tawny Owls *Strix aluco* moved to nest deeper in the forest interior of since the 2000s, which was considered as a response to ongoing changes in agricultural areas (Grašytė et al. 2016). Notably, changes in the nest sites preferences could be expected in any raptor species because of ongoing habitat changes either in forests, agricultural areas or in both of them.

The Common Buzzard is a generalist predator and the most ubiquitous raptor species in Europe (ca. 814,000– 1,390,000 pairs: Birdlife 2020) and in Lithuania (Drobelis 2004). This species is characterised by a wide range of breeding habitats (Drobelis 2004, Zuberogoitia et al. 2006, Swan 2011, Gryz and Karuze-Gryz 2019); therefore, they can breed in various forest types ranging in size from continuous forests to small forest fragments surrounded by cultivated fields (Drobelis 2004, Zuberogoitia et al. 2006, Gryz and Karuze-Gryz 2019). Hodder and colleagues (1998) have referred that during the breeding season, Common Buzzards occupy territories within a < 1.1-km diameter; however, according to A. Lõhmus (2003b), they may forage within a 2-km radius of their nests. Meanwhile Väli (2017) has found that Common Buzzard home ranges cover 8.3 km^2 in Estonia. The most often Buzzard's prey item is *Microtus* voles (Selås 2001, Reif et al. 2004, Reif et al. 2009, Francksen et al. 2016). Open areas like meadows and fields are important food habitats for buzzards (Krüger 2002) because the majority of prey is hunted in these habitats (Goszczynski 1997, Wikar et al. 2008). Common Buzzards primarily utilise a sit-and-wait hunting strategy that could enable them to exploit uncropped field margins that are rich in rodents (Väli et al. 2017) as well as open areas in forests (e.g. recent clear-cuttings). Despite their exploitation of a wide variety of habitats, Common Buzzards usually build their nests in mature forests stands or on mature trees (Selås 1997, Drobelis 2004, Hakkareinen et al. 2004, Sergio et al. 2005, Bielański 2006, Lõhmus 2006, Gryz and Krauze-Gryz 2019, Kamarauskaitė et al. 2019).

The present study aimed to determine whether the nest site characteristics of Common Buzzards change over time, with the assumption of ongoing changes in forests and agricultural areas. We expected to observe certain differences in nest tree choice, nest site characteristics, and nest site locations in the landscape between territories currently occupied by Common Buzzard and those occupied by the same species nearly two decades (17 years) ago in central Lithuania.

Materials and methods

The study area (44,707 ha; 45% forest cover) is located in central Lithuania (municipalities of Kaišiadorys and Jonava) (Figure 1). The forest was dominated by the spruce *Picea abies* (30%) and birch *Betula pendula* (23%). The average stand age was 51.4-year-old within the study area and 78% of the forest area is attributed to commercial forest. The stands with the age of ≥ 45-year-old in 2002 comprised 26.4% of the study area, and after 15 years, the share of these stands within study area shrunken negligible to 25.1%. The mean age of these stands was 70 years and 78 years for the first and second period sampled, respectively. Meadows occupied only 4.2% of the study area in 2002 and their area dropped up to 2.9% recently. Agricultural areas covered ca. 35% of the studied region in 2017–2018, respectively. Common Buzzard nest occupancy data were collected in 2002–2004 and 2017–2018. The location of nests was determined by observing bird behaviour during the breeding season and by checking potential stands for

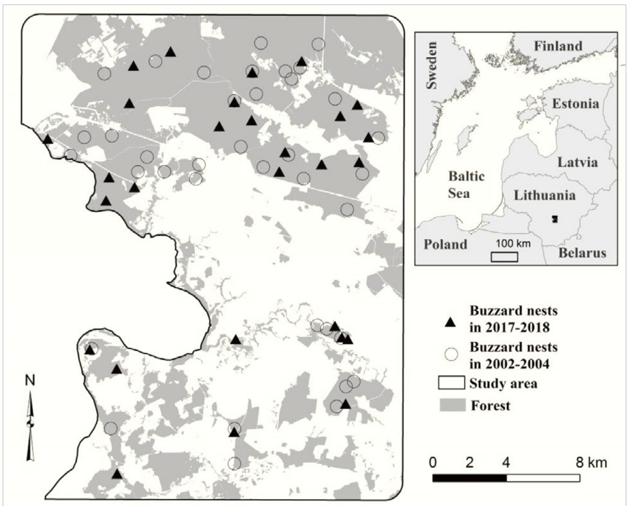

Figure 1. Location of the study area in the region and the distribution of Common Buzzard nests within the study area in 2002–2004 and 2017–2018

nests. We used a slow walking through the forest stands during the leafless season (autumn and winter). Nests were considered to be occupied by Common Buzzards if adult birds were observed at the nests from April to early July, or if Common Buzzard nestlings (or their remains) were present in/near the nests between late June and early August. A total of 37 nests were found to be occupied by Common Buzzards in 2002–2004, while 28 were found to be occupied in 2017–2018. Only one nest per breeding pair was included in the analyses for each period if several nests were occupied by the same pair in different years.

Four nesting habitat variables were used to describe Common Buzzard nest sites: 1) stand age, 2) proportion of deciduous trees in the first layer of stand (i.e. trees forming the overstorey of the stand), 3) distance to the nearest pasture, and 4) distance to the forest edge. The data on the age of forest stands were obtained from the State Forest Cadastre of the Republic of Lithuania (hereinafter referred to as the State Forest Cadastre) for the years 2003 and 2017. The CORINE databases for the years 2000 and 2018 and the State Forest Cadastre for the years 2003 and 2017 were used to measure the shortest distances from the nests to pastures and to forest edges, respectively. ArcGIS 10.2.2 software package was used for all spatial data processing (Esri 2014).

Data analysis

We randomly selected mature stands representing potential nesting habitat availability in both study periods. First, random points were generated (using the ArcGIS ArcMap 10.2.2 software tool "Create random points") only in forest stands, irrespective of their tree species composition. Only ≥45-year-old stands were selected for further analyses, according to the youngest stand with a Common Buzzard nest known in the study area. The shortest distance between the random points was limited to 500 m based on the shortest distance between the nests of two breeding Common Buzzard pairs identified in Lithuania (Kamarauskaitė et al. 2019). As a result, two sets of mature control stands were created: one for the years 2002–2004 ($n = 50$) and another for the years 2017–2018 ($n = 50$). Four characteristics of random mature stands were measured similar to the nest sites (see above).

To estimate habitat preferences, we compared the nest sites of Common Buzzards with the random mature stands using generalised linear models (*GLMs*; binomial error structure, logit link function). The site (nest or random) in the *GLMs* was included as a binary response variable (0 – random mature stand, 1 – nest site) and stand age, the proportion of deciduous trees in the nest stand, the distances to a forest edge, distance to pasture were included as explanatory variables. Candidate models with all possible combinations of the explanatory variables were constructed.

To check the source of possible variations, we constructed two groups of binomial *GLMs*. The first group included candidate models with the response variable 'nest sites' (0 – nest site in 2002, 1 – nest site in 2017), and the second group was the response variable 'mature random stand' (0 – random stand in 2002, 1 – random stand in 2017). The candidates models were constructed including stand age, proportion of deciduous trees in the first layer of stands, distance to the nearest pasture, and forest edge with all possible combination of these variables. The Akaike information criterion with a correction for small sample sizes (*AICc*) was used for model selection. All candidate models were ranked by $\Delta AICc = AICc_i - AICc_{\min}$, where $AICc_i$ is the value of candidate model, and $AICc_{\min}$ is the smallest value of the model in the set of candidate models. Only models with $\Delta AICc < 2$ were selected for further inference (Burnham and Anderson 2002). Software packages 'MuMIn' (Bartoń 2019) and 'sjPlot' (Lüdecke 2019) were used and all statistical calculations were performed using R software environment, version 3.6.0 (R Core Team 2019).

Results

Nest sites and its preferences

The most Common Buzzard nests were built in oaks (40%, $n = 65$ nest trees found in both periods), other tree species were used for nesting less frequently. Nevertheless, the average proportion of oak in nest stands was only 9% ($n = 65$ nest stands found in both periods). This four-fold more frequent use of oaks indicates a strong over-selection of this tree species.

The Common Buzzard nests were found in the mature stands (82 years ± 24 *SD*, $n = 65$) and no nests were found

Table 1. Descriptive characteristic for Common Buzzard nest sites and mature random stands in 2002–2004 and 2017–2018

Variable	2002–2004 (n = 37)		2017–2018 (n = 28)	
Common Buzzard				
	Mean ± *SD*	Range	Mean ± *SD*	Range
Stand age, years	77 ± 24	45–140	90 ± 21	55–145
Proportion of deciduous trees	0.65 ± 0.31	0–1	0.58 ± 0.33	0–1
Distance to forest edge, m	338 ± 230	25–1126	297 ± 263	43–1075
Distance to pasture, m	1573 ± 927	5–3849	1763 ± 1162	67–4532
Mature random stands				
Variable	2002–2004 (n = 50)		2017–2018 (n = 50)	
	Mean ± *SD*	Range	Mean ± *SD*	Range
Stand age, years	45 ± 27	45–160	82 ± 25	45–175
Proportion of deciduous trees	0.5 ± 0.38	0–1	0.38 ± 0.38	0–1
Distance to forest edge, m	344 ± 352	0.2–1554	295 ± 324	13–1366
Distance to pasture, m	1703 ± 1091	3–3821	1877 ± 1135	56–4533

in the stands younger than 45-year-old ones (Table 1). The proportion of deciduous tree species in the first layer of nests stands was 61% ± 32 *SD* (n = 65). The nests were located 300 metres on average (320 m ± 250 *SD*, n = 65) from the forest edges while meadows were well off the nest sites (1,650 m ± 1,050 *SD*, n = 65).

A comparison of Common Buzzard nest sites with the stands potentially suitable for nesting indicated a non-random occupation pattern. The differences between nest sites used by this raptor and potentially suitable stands within the study area were supported by the subset of three candidate models (i.e. $\Delta AICc < 2$; Table 2a). The best-ranked model including stand age and proportion of deciduous trees as the explanatory variables received similar support as the second model, which in addition to above-mentioned variables, included the distance to meadows. The distance to meadows from nests and potentially suitable stands had low importance according to model estimates (Table 3a). The third-ranked model included only stand age as the discriminator between nests and potentially suitable stands. In summary, Common Buzzard preferred significantly older stands and tends to select stands with the larger share of deciduous trees in the first forest layer compared to the availability of potentially suitable stands within the study area. The location of stands towards the agricultural areas, however, had no effect on nest site choice.

Table 2. Candidate models ranked according to *AICc* values describing differences between (a) random mature stands and Common Buzzard, (b) Common Buzzard nest sites occupied in 2002–2004 and 2017–2018, (c) random mature stands in 2002–2004 and 2017–2018. The models supported by the data (i.e. $\Delta AICc < 2$) are marked in bold

Model no.	Forest edge	Meadow	Stand age	Deciduous	*df*	*logLik*	*AICc*	Δ	Weight
(a) Random stands vs. Common Buzzard									
13			**0.33**	**0.62**	**3**	**–103.9**	**213.9**	**0.0**	**0.286**
15		**–0.20**	**0.33**	**0.65**	**4**	**–103.1**	**214.5**	**0.6**	**0.208**
9				**0.52**	**2**	**–105.7**	**215.4**	**1.5**	**0.133**
14	0.02		0.33	0.62	4	–103.9	216.0	2.1	0.101
11		–0.20		0.55	3	–104.9	216.0	2.2	0.097
16	0.09	–0.23	0.34	0.65	5	–103.0	216.4	2.5	0.082
10	0.00			0.52	3	–105.7	217.5	3.6	0.047
12	0.07	–0.22		0.55	4	–104.9	218.0	4.1	0.037
1(null)					1	–110.6	223.3	9.4	0.003
5			0.15		2	–110.2	224.4	10.5	0.001
3		–0.13			2	–110.3	224.7	10.8	0.001
2	0.00				2	–110.6	225.3	11.5	0.001
7		–0.12	0.15		3	–109.9	225.9	12.0	0.001
6	0.01		0.15		3	–110.2	226.5	12.6	0.001
4	0.05	–0.14			3	–110.3	226.7	12.8	0.000
8	0.06	–0.14	0.15		4	–109.8	227.9	14.0	0.000
(b) Common Buzzard 2002–2004 vs. 2017–2018									
5			**0.66**		**2**	**–41.7**	**87.6**	**0.0**	**0.269**
7		**0.30**	**0.71**		**3**	**–41.1**	**88.6**	**1.0**	**0.161**
6	**–0.18**		**0.66**		**3**	**–41.6**	**89.5**	**1.9**	**0.103**
13			**0.78**	**0.20**	**3**	**–41.6**	**89.5**	**1.9**	**0.103**
8	-0.31	0.37	0.71		4	–40.7	90.1	2.5	0.076
15		0.29	0.82	0.18	4	–41.0	90.7	3.1	0.058
1(null)					1	–44.4	90.9	3.3	0.051
14	–0.17		0.77	0.20	4	–41.4	91.5	3.9	0.038
9				–0.27	2	–44.0	92.2	4.6	0.027
16	–0.30	0.37	0.81	0.16	5	–40.6	92.3	4.7	0.026
3		0.19			2	–44.2	92.5	4.9	0.023
2	–0.21				2	–44.2	92.6	5.0	0.022
11		0.23		–0.30	3	–43.6	93.7	6.1	0.013
4	–0.32	0.27			3	–43.7	93.9	6.3	0.012
10	–0.22			–0.28	3	–43.8	93.9	6.3	0.011
12	–0.34	0.31		–0.32	4	–43.2	95.0	7.4	0.007
(c) Random stands 2002–2004 vs. 2017–2018									
9				**–0.33**	**2**	**–67.9**	**139.9**	**0.0**	**0.146**
1(null)					**1**	**–69.3**	**140.7**	**0.8**	**0.099**
13			**0.23**	**–0.31**	**3**	**–67.2**	**140.7**	**0.8**	**0.098**
11		**0.22**		**–0.37**	**3**	**–67.3**	**140.9**	**1.0**	**0.090**
5			**0.27**		**2**	**–68.4**	**140.9**	**1.0**	**0.089**
10	**–0.13**			**–0.33**	**3**	**–67.6**	**141.5**	**1.6**	**0.065**
12	**–0.24**	**0.31**		**–0.39**	**4**	**–66.6**	**141.7**	**1.8**	**0.060**
15		**0.21**	**0.22**	**–0.34**	**4**	**–66.7**	**141.8**	**1.9**	**0.056**
3		0.15			2	–69.0	142.1	2.2	0.048
2	–0.13				2	–69.1	142.2	2.3	0.045
14	–0.12		0.22	–0.31	4	–67.0	142.5	2.6	0.041
7		0.15	0.27		3	–68.1	142.5	2.6	0.040
6	–0.12		0.26		3	–68.2	142.6	2.7	0.038
16	–0.23	0.30	0.21	–0.36	5	–66.1	142.8	3.0	0.034
4	–0.21	0.23			3	–68.4	143.1	3.2	0.029
8	–0.20	0.22	0.25		4	–67.6	143.7	3.8	0.022

Table 3. Estimates of the most important candidate models describing differences between (a) random mature stands and Common Buzzard, (b) Common Buzzard nest sites occupied in 2002–2004 and 2017–2018, (c) random stands in 2002–2004 and 2017–2018. *CI* stands for confidence intervals. Significant estimates are marked in bold, tendency for significance is marked in bold italic

Predictors	Odds ratios	CI	*P*-level
(a) Random stands vs. Common Buzzard			
First ranked model			
(Intercept)	0.63	0.45–0.87	0.01
Stand age	1.39	0.98–1.97	***0.06***
Deciduous	1.86	1.30–2.65	**0.001**
Observations	165		
Tjur's R^2	0.08		
Second ranked model			
(Intercept)	0.63	0.45–0.87	0.01
Stand age	1.4	0.98–1.99	***0.06***
Decid. proportion	1.91	1.33–2.75	**< 0.001**
Nearest meadow	0.82	0.58–1.14	0.2
Observations	165		
Tjur's R^2	0.08		
Third ranked model			
(Intercept)	0.65	0.47–0.89	0.01
Stand age	1.17	0.85–1.59	0.3
Observations	165		
Tjur's R^2	0.01		
(b) Common Buzzard 2002–2004 vs. 2017–2018			
(Intercept)	0.71	0.42–1.18	0.18
Stand age	1.94	1.08–3.51	**0.03**
Observations	65		
Tjur's R^2	0.08		
(c) Random stands 2002–2004 vs. 2017–2018			
(Intercept)	0.93	0.62–1.40	0.74
Stand decid	0.72	0.49–1.06	0.10
Observations	100		
Tjur's R^2	0.03		

Temporal changes

The proportions of tree species used for Common Buzzard nest building in 2002 and 2017 varied, but the frequency of the most important nest tree species, oak, remained unchanged ($\chi^2 = 0.02$, $df = 1$, $p = 0.88$; Figure 2).

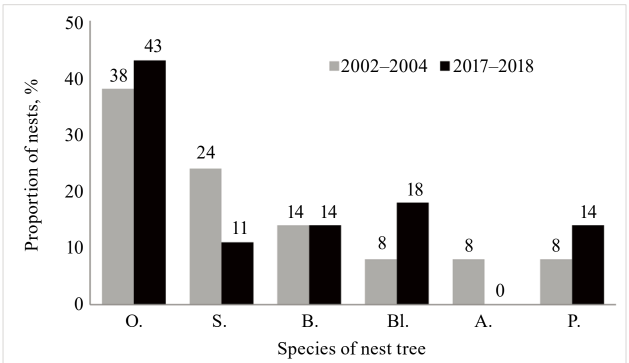

Figure 2. Common Buzzard nest tree species in 2002–2004 and 2017–2018

Abbreviations: O. – oak, B. – birch, A. – aspen, S. – spruce, Bl. – black alder, P. – pine

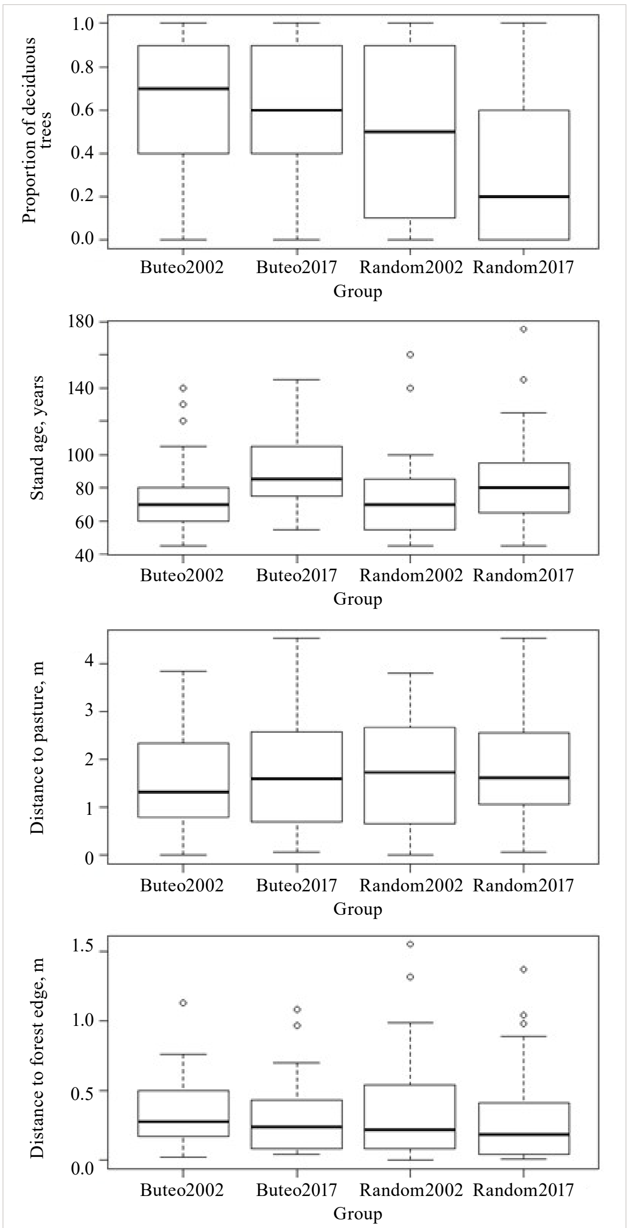

Figure 3. Variation of stand age, proportion of deciduous trees in the first layer of stand, distance to the nearest pasture and distance to the nearest forest edge between Common Buzzard nests and random mature stands in 2002 and 2017

The comparison of habitat characteristics between nest sites, occupied by the Common Buzzard in 2002 and in 2017 indicated the certain shift in characteristics. However, essentially, results indicated only the significant increase in the nest stand age (Table 2b and 3b, Figure 3). A similar comparison of random mature stands (available in the study area in 2002 and 2017) did not revealed the significant changes in forest stands, except for the tendency of decrease in the proportion of deciduous tree species in the first layer of stands (Tables 2c and 3c; Figure 3).

Discussion and conclusions

In commercially managed forests of central Lithuania, the comparison of Common Buzzard nest sites with the available potentially suitable stands has indicated the non-random habitat occupation pattern. Buzzards preferred to nest in the more mature stands with the higher share of deciduous trees in the composition of the first tree layer. The locations of stands in regard to agricultural areas, however, were estimated as unimportant determinants of nest site choice in this widespread avian predator. The oak was the most important nest tree species and was strongly over-selected compared to its availability in the nest stands. The comparison of several habitat metrics, possibly important to the Common Buzzards, indicated no evident changes between 2002–2004 and 2017–2018 within the study area. The nest sites of the Common Buzzard remained similar in terms of location within the landscape; however, the stand age used for the nest significantly increased. In summary, these results suggest that the Common Buzzards nest site selection pattern was driven by the stand-level decisions but was not shaped by the location of these stands in regard to agriculture areas.

The oak was the most common nest tree in both studied periods, with 40% of nests built in this tree species. This proportion markedly exceeds the proportion observed across Lithuania (20%; Drobelis 2004). In Poland, Common Buzzards built the majority of their nests in trees according to their availability in forests; for example, 73% of nests occupied by pairs of this raptor in oak-hornbeam forests were found in oaks (Bielański 2006). The mean proportion of oak in the nest stands described by us was 9%, while solitary oak trees were also available in stands dominated by other tree species. In Lithuanian forests, the oak comprised an even smaller proportion of the first tree layer in the stands (< 2%; Navasaitis et al. 2003). This implies that the oak is strongly over-selected as a nest tree by Common Buzzards in our study site and in Lithuania. This preference for oaks could be explained by the good support for nests provided by this hardwood tree due to its canopy structure and strong branches (Lõhmus and Sellis 2003, Lõhmus 2006). Despite the mature oak trees being scarce in Lithuanian forests, their availability has not decreased with the increase in the timber harvesting during recent decades (Treinys et al. 2016) and this could explain the unchanged frequency of oak nests in the current study. The oak is an important tree also for the Lesser Spotted Eagle *Clanga pomarina* and Black Stork *Ciconia nigra* in Lithuanian forests (Treinys and Mozgeris 2006, Treinys et al. 2016). This implies that the local populations of medium-sized raptors and Black Stork are strongly dependent on the availability of this scarce broadleaved tree species in the forest landscape. Moreover, different bird species might even compete for oaks, therefore, requiring preservation of oaks during the final felling as the retention trees for the future stands.

Other tree species were used differently between the two periods, with fewer nests built in spruce and aspen and more nests built in black alder in 2017–2018. Changes in the percentage distribution of Common Buzzard nest trees over a period of years (1982–2018) were identified in central Poland: the number of nests in pines decreased due to a decrease in the proportion of pines present in forests; consequently, the number of nests in larches *Larix decidua* increased (Gryz and Krauze-Gryz 2019). The changes in nest tree usage observed in our study are not likely related to the shift in suitable nest tree availability because the proportions of these tree species in the stands occupied by buzzards remained similar between the two periods. We suggest that non-preferred tree species may lack a clear advantage in terms of nest building. Hence the choice to build a nest might depend on individual tree characteristics, e.g. such as the presence of a trunk fork, where the majority of buzzard nests are built (77%; Kamarauskaitė et al. 2019).

The results indicate that Common Buzzard tend to occupy stands with the higher proportion of deciduous trees in the first layer of stands and this was in agreement with the findings made in other studies, where there were found that deciduous trees preponderate in the stands occupied by buzzards (Lõhmus 2006, Väli 2015). The Common Buzzards selected mature stands. In the first period, buzzards built their nests in the stands with a mean age of 77 years; in the more recent years, the mean stand age increased to average 90 years. Data collected on Common Buzzard nest stand age in Lithuania before 2000s revealed that the nest stands were 76 (Skuja and Budrys 1999) and 79 years old, on average (Drobelis 2004). This raptor species also nested in mature stands in southern Poland (mean age: 87 years in pine and 120 years in oak stands; Bielański 2006), central Poland (Gryz and Krauze-Gryz 2019), central Estonia (mean stand age: 79 years; Lõhmus 2006), southern Sweden (mean stand age: 99 years; Selås 1997), western Finland (Hakkarairen et al. 2004) or in mature trees in pre-Alpine forests in Italy (Sergio et al. 2005). Common Buzzards occupied nest stands that were similar in age to the nest stands used by the other sympatric, well-known mature forest-dwelling raptors such as the Lesser Spotted Eagle and Northern Goshawk *Accipiter gentilis* (Skuja and Budrys 1999, Bielański 2006, Lõhmus 2006, Kamarauskaitė et al. 2019). Geographic variation in the age of nest stands most likely relates to the different tree species composition (e.g. younger for softwood and larger for hardwood stands), soil, and climatic-influenced growing conditions for stands and local forestry practices. Overall, the result of our study and the data available in the current literature suggests that the Common Buzzard, despite its abundant distribution, may be considered a typical mature forest nesting raptor.

The availability of stands potentially suitable for the Common Buzzard to nests in terms of tree age was not reduced despite commercial forestry oriented for timber supply prevails in the forests of the study area. This finding is not surprising, because forestry in Lithuania is characterised by detailed planning, legal prescriptions, and scrupulous control to assure an even flow of timber in long run (Mozgeris et al. 2021). But why has the age of nest stands used by buzzards recently, despite no obvious changes in the mean age of stands available in the study area, significantly increased? First, necessary to mention that, this pattern is not unique. Tawny Owls have selected nest sites with higher availability of mature forests in another area of central Lithuania recently (Rumbutis et al. 2017) and older-age nest stands used by Black Storks have also been observed (Treinys et al. 2016). Nest sites differ in their qualities which results that birds occupying better nest sites may gain fitness benefits (Sergio and Newton 2003). One possible explanation for improvement of the buzzard nest stands might be decreased population density. We do not have data about local population dynamic in the study area, however, national population of Common Buzzard was estimated as decreasing between 2013 and 2018 (Eionet 2022). Decrease in population may relax intraspecific competition and thus broadening opportunity to select patches of higher quality in agreement to sequential habitat occupation hypothesis (Brown 1969). The nest site improvement in relation to the population decrease in Black Stork was suggested in Lithuania recently (Treinys et al. 2016). It has to be said that common raptors species, including Common Buzzard, is poorly covered in terms of monitoring at the European scale so far (Vrezec et al. 2012). Therefore, monitoring of forest nesting bird species, including widespread ones such as the Common Buzzard, may contribute to valuable information on the response of birds to ongoing environmental changes.

The Common Buzzard nest site occupation pattern was not significantly driven by agricultural areas, including meadows. This finding was unexpected because agricultural areas are the important feeding areas and especially pastures, which, due to their low vegetation structure, are regarded as optimal feeding habitats supporting a high density of voles and providing good prey accessibility for Common Buzzards (Wuczyński 2005, Schindler et al. 2012). A most plausible reason for that finding may be the complementary effect of meadow scarcity in the studied region and the availability of other feeding habitats such as arable lands and clear cuts. The potentially suitable stands as well as nests occupied by buzzards were located similarly on average ca. 0.32 km from agricultural areas. The freshly clear-cut areas (i.e. up to 5 years) were also close to the occupied nests, on average ca. 0.24 km (author's data). Considering that Common Buzzard is a generalist predator that can specialize in more profitable prey (Rooney and Montgomery 2013) and hunts for its prey within a 2-km radius (Lõhmus 2003b), we suggest that the current habitat structure of the studied area provides high availability of different types of feeding habitats in the close vicinity of mature stands. Therefore, most likely, that when buzzards establish their territories in the study area, they are not forced to be selective to realize their feeding requirements.

In conclusion, our study did not indicate deterioration in nest site quality or decrease in availabilities of potential stands during nearly two decades, because overall forestry in Lithuania is strictly regulated and regarded as non-intensive during that period (Mozgeris et al. 2021). However, modelling of nesting habitats of predatory birds under conservative and intensive forestry scenarios in Lithuania suggested a decrease in habitat availability in upcoming decades (Mozgeris et al. 2021, Mörtberg et al. 2021). Further, despite the Common Buzzard nest site preferences were not affected by agricultural areas, we cannot omit the possibility that the recently estimated population decline is related to the changes in the agriculture cultivation pattern. Therefore, monitoring this widespread raptor is important to track possible responses of the species to future changes in forests and open areas. .

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