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Bird communities in the natural spruce-beech forests in the Veľká Fatra Mts, Western Carpathians

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Abstract

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The qualitative-quantitative composition of bird communities in the natural spruce-beech forests in the Veľká Fatra mountains (Slovakia) was studied during the spring season (April–June) in 2008–2010, using the strip transect method on three study plots. The bird assemblage of the investigated spruce-beech forests comprised 49 bird species at a density of 58.4 ind. per 10 ha. Bird community in the natural spruce-beech forest Skalná alpa was the richest (49 species at a density of 62.5 ind./10 ha). At the locality Suchý vrch were found 48 species at a density of 57.8 ind./10 ha, on the study plot Čierny kameň were identified 45 species at a density of 55.4 ind./10 ha.

Key words

beech, bird community, natural forest, spruce, Veľká Fatra Mts, Western Carpathians

Introduction

At present, forest biocoenoses are more and more stressed by air pollution, acid rain, and global warming, the long-term effect of which results in changes to the species composition and to the structure of the vegetation components, thus having a secondary impact on animals, too.

It is therefore of fundamental importance to determine in detail the structure of all animal assemblages (including bird communities) in primeval and relatively undamaged forest ecosystems – in order to be able, in the future, to compare the structure of these communities in damaged biocoenoses with those in the natural forests. Primeval forests represent the unique ecosystems and are identified as areas of high nature conservation value from the landscape ecology aspect.

Problems of the relationship between bird communities and the vegetation cover have been studied by many authors (e.g. Ferry, 1960; Short, 1979; Kocian, 1981; Wiens, 1981; Verner and Larson, 1989; Krištín, 1990, 1991, 1993; Saniga, 1995; Kropil, 1996a, b; Adamík et al., 2003; Korňan, 2004).

In the spruce vegetation tier of the Veľká Fatra Mts, fragments of non-affected primeval forests have been conserved at some less accessible sites up to now. I focused my attention on the bird communities of these fragments during the years 2008–2010. The Veľká Fatra Mts has already been the subject of a number of ornithological studies (e.g. Topercer, 1989; Saniga, 1994a, b, 1995). The aims of this study are as follows:

1. Analysis of the qualitative-quantitative structure of the breeding bird communities
2. Analysis of the population abundance, dominance and species diversity
3. New data supplementing the previous bird censuses in this area.

Material and methods

Bird communities were investigated over the spring seasons (from the beginning of April to late June) 2008–2010. Bird censuses were carried out using the strip transect method (Verner, 1985). A singing male, pair of birds, family, feeding bird, and a bird defending nest area were considered as a pair (2 individuals) during the spring season. One bird seen or heard was considered as one individual in this period (Blondel et al., 1970).

Lengths of transects are as follows: locality Suchý vrch (1,000 m), Skalná alpa (1,200 m), and Čierny kameň (1,000 m). A total of 30 field checks were made (10 evening investigations).

Birds were generally counted twice per day (early in the morning from 03.00 to 09.00 CET and later in the evening from 17.00 to 20.00 CET). All checks were made under satisfactory weather conditions. Species with nocturnal activity (order Strigiformes, species *Caprimulgus europaeus* L.) were observed during night. Individuals outside the survey belt were also recorded, yet without the quantitative indices („x" in Table 2).

The results obtained were used for calculating the following population characteristics: density (D); relative abundance (A %), Shannon-Weaver´s (1949) equation was used for calculating the diversity index (H´); and index of equitability (E) was calculated according to Sheldon (1969).

Breeding status was determined by direct evidence found on or near the study sites (nests, fledglings, feeding birds) or data from previous observations in the same habitats.

I concentrated on the bird communities in the primeval spruce-beech forests (altitude ranging from 1,100 to 1,300 m a.s.l.) in the Veľká Fatra Mts (E = 18°50`–19°18`; N = 48°47`–49°19`). The main habitat features of three census sites are given in Table 1. The geobiocoenology nomenclature of the groups of forest types is used according to Randuška et al. (1986). The characteristics of the study plots are given according to the Forest management plans made in the years 1998 and 2008 by Lesoprojekt.

Table 1. Features of the examined localities

Locality	Group of forest types	Tree composition	
Suchý vrch	Fageto-Aceretum	*Picea abies*	5%
(Veľká Fatra Mts)	140-year-old	*Fagus sylvatica*	95%
Skalná alpa	Fageto-Aceretum	*Fagus sylvatica*	60%
(Veľká Fatra Mts)	200-year-old	*Picea abies*	25%
		Acer pseudoplatanus	10%
		Abies alba	5%
Čierny kameň	Fageto-Aceretum	*Fagus sylvatica*	90%
(Veľká Fatra Mts)	150-year-old	*Acer pseudoplatanus*	5%
		Picea abies	5%

Table 2. The density (D – ind./10 ha), relative abundance (A%), diversity index (H`), and equitability index (E) for bird communities in natural spruce-beech forests in the Veľká Fatra Mts, Slovakia in 2008–2010 (x – occurrence outside the strip belt)

Locality / Species	Suchý vrch		Skalná alpa		Čierny kameň		Total	
	D	A	D	A	D	A	D	A
Parus montanus Bald.	1.2	2.1	1.2	1.9	1.0	1.8	1.2	2.0
Regulus regulus (L.)	1.1	1.9	1.1	1.8	1.1	2.0	1.1	1.9
Fringilla coelebs L.	9.0	15.6	12.4	19.8	10.0	18.1	10.5	18.0
Erithacus rubecula (L.)	5.0	8.6	6.0	9.6	5.2	9.4	5.4	9.2
Turdus torquatus L.	3.0	5.2	3.8	6.1	4.0	7.2	3.6	6.2
Prunella modularis L.	3.0	5.2	3.2	5.1	2.8	5.0	3.0	5.1
Troglodytes troglodytes (L.)	3.0	5.2	3.0	4.8	2.8	5.0	2.9	5.0
Certhia familiaris L.	2.6	4.5	2.8	4.5	2.8	5.0	2.7	4.6
Ficedula albicollis (Temm.)	2.6	4.5	2.8	4.5	2.8	5.0	2.7	4.6
Sitta europaea L.	2.4	4.2	2.6	4.2	2.2	4.0	2.4	4.1
Phylloscopus collybita (Viell.)	2.0	3.5	2.0	3.2	1.8	3.2	1.9	3.2
Phylloscopus trochilus (L.)	2.0	3.5	1.8	2.9	1.6	2.9	1.8	3.1
Phylloscopus sibilatrix (Bechst.)	2.0	3.5	1.8	2.9	1.6	2.9	1.8	3.1
Phoenicurus phoenicurus (L.)	2.0	3.5	1.8	2.9	1.4	2.5	1.7	2.9
Sylvia atricapilla (L.)	1.6	2.8	1.8	2.9	1.4	2.5	1.6	2.7

Table 2. Continued

Locality / Species	Suchý vrch		Skalná alpa		Čierny kameň		Total	
	D	A	D	A	D	A	D	A
Turdus philomelos Brehm	1.6	2.8	1.8	2.9	1.4	2.5	1.6	2.7
Pyrrhula pyrrhula (L.)	1.4	2.4	1.4	2.2	1.2	2.2	1.3	2.2
Turdus viscivorus L.	1.4	2.4	1.4	2.2	1.2	2.2	1.3	2.2
Turdus merula L.	1.4	2.4	1.4	2.2	1.2	2.2	1.3	2.2
Tetrastes bonasia (L.)	1.1	1.9	1.1	1.8	1.1	2.0	1.1	1.9
Dendrocopos leucotos (Bechst.)	1.0	1.7	0.8	1.3	0.8	1.5	0.9	1.5
Dendrocopos major (L.)	1.0	1.7	0.8	1.3	0.8	1.5	0.9	1.5
Parus ater L.	1.0	1.7	0.8	1.3	0.8	1.5	0.9	1.5
Parus cristatus L.	0.8	1.4	0.6	1.0	0.4	0.7	0.6	1.0
Columba palumbus L.	0.6	1.0	0.5	0.8	0.4	0.7	0.5	0.9
Glaucidium passerinum (L.)	0.5	0.8	0.5	0.8	0.5	0.9	0.5	0.9
Loxia curvirostra L.	0.4	0.6	0.4	0.5	0.4	0.7	0.4	0.7
Parus palustris L.	0.4	0.6	0.4	0.5	0.4	0.7	0.4	0.7
Parus caeruleus L.	0.4	0.6	0.4	0.5	0.4	0.7	0.4	0.7
Aegithalos caudatus (L.)	0.4	0.6	0.4	0.5	0.4	0.7	0.4	0.7
Muscicapa striata (Pall.)	0.4	0.6	0.4	0.5	0.4	0.7	0.4	0.7
Regulus ignicapillus (Temm.)	0.2	0.4	0.1	0.2	0.2	0.4	0.2	0.3
Carduelis spinus (L.)	0.2	0.4	0.2	0.2	0.1	0.2	0.2	0.3
Scolopax rusticola L.	0.2	0.4	0.1	0.2	0.1	0.2	0.1	0.2
Picoides tridactylus (L.)	0.2	0.4	0.1	0.2	0.1	0.2	0.1	0.2
Dryocopus martius (L.)	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.2
Nucifraga caryocatactes (L.)	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.2
Anthus trivialis (L.)	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.2
Aegolius funereus (L.)	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.2
Coccothraustes coccothraustes (L.)	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.2
Tetrao urogallus L.	0.1	0.2	0.1	0.2			0.03	0.1
Cuculus canorus L.	0.1	0.2	0.1	0.2			0.03	0.1
Sylvia curuca (L.)			0.1	0.2	0.1	0.2	0.03	0.1
Accipiter nisus (L.)	x		x		x		x	
Garrulus glandarius (L.)	x		x		x		x	
Accipiter gentilis (L.)	x		x				x	
Strix uralensis Pall.	x		x		x		x	
Strix aluco L.	x		x		x		x	
Caprimulgus europaeus L.	x		x				x	
Total	57.8	100.0	62.5	100.0	55.4	100.0	58.4	100.0
Total species	48		49		45		49	
Diversity index (H`)	4.00		4.10		3.78		4.20	
Equitability index (E)	0.75		0.77		0.72		0.78	

Results

During the spring season, 49 species at a total density of 58.4 ind./10 ha formed the bird community in the natural spruce-beech forests. *Fringilla coelebs* L. (18.0%) was eudominant, with *Erithacus rubecula* (L.) (9.2%), *Turdus torquatus* L. (6.2%), and *Prunella modularis* (L.) (5.1%) being dominant. The diversity index H´ was 4.20 and the value of the equitability index E was 0.78.

In total, 46 species were considered to nest in the primeval spruce-beech forests. Individulas of

Accipiter nisus (L.), *Sylvia curruca* (L.), and *Coccothraustes coccothraustes* (L.) were observed several times in this type of habitat, but breeding was not apparent.

The highest species richness was found in the bird assemblage of the spruce-beech forest Fageto-Aceretum at the locality Skalná alpa (49 species at a total density 62.5 ind./10 ha). *Fringilla coelebs* L. (19.8%) was eudominant, with *Erithacus rubecula* (L.) (9.6%), *Turdus torquatus* L. (6.1), and *Prunella modularis* (L.) (5.1%) being dominant.

Bird community of the natural spruce-beech forest of the group of forest types Fageto-Aceretum at the locality Suchý vrch formed 48 species at a total density of 57.8 ind./10 ha. *Fringilla coelebs* L. (15.6%) was eudominant, with *Erithacus rubecula* (L.) (8.6%), *Turdus torquatus* L. (5.2%), *Prunella modularis* (L.) (8.5%), and *Troglodytes troglodytes* (L.) (5.2%) being dominant.

Fourty-five species at a total density of 55.4 ind./10 ha formed the bird community in the natural spruce-beech forest of the group of forest types Fageto-Aceretum at the locality Čierny kameň. *Fringilla coelebs* L. (18.1%) was eudominant, with *Erithacus rubecula* (L.) (9.4%), and *Turdus torquatus* L. (7.2%) being dominant.

Based on the results obtained by dividing bird species into guilds and from the results of previous studies carried out in the natural spruce-beech forests in the Veľká Fatra Mts, it may be concluded that bird species of the understudied vegetation tiers displayed their optimum vertical occurrence patterns. The species structure and relative abundance of the bird assemblage showed a high temporal stability.

Bird communities on the study plots situated in the natural spruce-beech-fir forests of the Veľká Fatra Mts did not differ a great deal in the number of species. Differences among the compared bird communities have been discovered both in the species composition in respect to their dominance and in the number of individuals in the populations.

Discussion

Klíma (1959) used the strip transect method in studying the bird community of the primeval spruce-beech-fir forests of the nature reserve Boubín, within altitude from 922 to 1,100 m a.s.l. and recorded altogether 40 bird populations with a total density of 290.3 ind./10 ha. Populations of species *Fringilla coelebs* L., *Phylloscopus sibilatrix* (Bechst.), *Certhia familiaris* L., *Parus ater* L., *Regulus regulus* (L.), and *Troglodytes troglodytes* (L.) exhibited dominant occurrence in this bird community.

In the mountain area of the West Tatras, Kocian (1981) found 31 bird species from which 13 were breeders.

In the spruce-beech-fir biocoenoses of the Bavarian forest (altitude 900–1,200 m a.s.l.) Scherzinger (1985) ascertained a bird community consisting of 31 species with a total density of 34 ind./10 ha. Individuals of the species *Fringilla coelebs* L., *Regulus regulus* (L.), *Phylloscopus sibilatrix* (Bechst.), *Regulus ignicapillus* (Temm.), *Erithacus rubecula* (L.), and *Certhia familiaris* L. occurred with a dominance higher than 5.1%.

Mosimann et al. (1987), studying a bird community in fir-beech biocoenoses at altitudes ranging from 900–1,300 m a.s.l. in Switzerland, recorded 49 populations of birds with the most frequent *Fringilla coelebs* L., *Parus ater* L., *Regulus ignicapillus* (Temm.), *Turdus philomelos* Brehm and *Erithacus rubecula* (L.).

Adamík et al. (2003), who investigated a bird assemblage of an old-growth beech-fir forest in the Šrámková National Nature Reserve in the Malá Fatra Mts, recorded 23 bird species.

Ceľuch and Kropil (2004) found out 37 bird species with an abundance of 63.3 breeding pairs per 10 ha in a primeval fir-beech forest in the Latiborská hoľa National Nature Reserve (National Park Nízke Tatry). The diversity index H´ was 4.03 and the value of the equitability index E was 0.82, which are the values very similar to my results. The high density of *Fringilla coelebs* L., *Erithacus rubecula* (L.), *Troglodytes troglodytes* (L.), *Parus ater* L. and *Regulus regulus* was typical for that study plot, which was in accordance also with the Veľká Fatra Mts. Higher density of the bird species in comparison with this study resulted from using different census method – combined version of the mapping method.

Korňan (2004) studied a breeding bird assemblage of a primeval beech-fir forest in the Šrámková National Nature Reserve (the Malá Fatra Mts), using an improved version of the mapping method. He found 57 bird species (52 breeders). Among these, 48 species reached a mean density of 58.17 breeding pairs per 10 ha. The Shannon diversity index (H´) varied between 4.10–4.36 bites. The evenness index (J`) reached values between 0.78–0.82. In summary, seven bird species were characterized as dominant: *Fringilla coelebs* L., *Erithacus rubecula* (L.), *Sylvia atricapilla* (L.), *Parus ater* L., *Phylloscopus collybita* (Viell.), *Regulus regulus* (L.), and *Prunella modularis* L. Dominance of the most abundant species, Shannon diversity and evenness indices are very similar to the results from the Veľká Fatra Mts, even though this study was carried out by the mapping method.

Comparing the results of the present paper with the data mentioned above, it is obvious that there exists similarity in the species composition of the compared bird communities. The differences are distinct in the density of the compared communities and in the substitution of the dominant species. Such differences may result both from the distinctions in the character of the forest biocoenoses (composition of the tree species, vertical

stratification of the vegetation), and from the different years when investigations were carried out.

By comparing the data of this study with the investigations carried out on these study plots in years 1989–91 (Saniga, 1994a, b; Saniga, 1995), there have not been found significant differences in the qualitative-quantitative structure of the bird communities. Altogether 59 bird species populations formed a bird community of the spruce-beech-fir forest biocoenoses at a density 60.2 ind./10 ha in the years 1989–91, which are values very similar to these from the years 2008–2010 (49 species with abundance 58.4 ind./10 ha). This shows that the bird communities in the fragments of original forests, relatively unspoilt by human activities, are very stable in comparison to the managed forests.

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Vtáčie spoločenstvá v prírodných smrekovo-bukových lesoch vo Veľkej Fatre, Západné Karpaty

Súhrn

V prírodných smrekových lesoch vo Veľkej Fatre (Slovensko) boli skúmané kvalitatívno-kvantitatívne zloženie vtáčích spoločenstiev v hniezdnom období (apríl–jún) v rokoch 2008–2010. Na troch výskumných plochách sa vyšetrovali vtáčie spoločenstvá použitím pásovej transektovej metódy. Vtáčia zložka všetkých troch skúmaných lokalít pozostávala zo 49 druhov s priemernou hustotou 58,4 jedincov na 10 ha. *Fringilla coelebs* L. (18,0 %) bol eudominantný. *Erithacus rubecula* (L.) (9,2 %) a *Turdus torquatus* L. (6,2 %) a *Prunella modularis* (L.) (5.1 %) boli prítomné dominantne. Index druhovej diverzity tohto vtáčieho spoločenstva mal hodnotu 4,20 a index druhovej vyrovnanosti 0,78. Najrozmanitejšie vtáčie spoločenstvo bolo zistené v prírodnom bukovom lese skupiny lesných typov Fageto-Aceretum na lokalite Skalná alpa (49 druhov s denzitou 62,5 jedincov na 10 ha). Na lokalite Suchý vrch pozostávalo vtáčie spoločenstvo prírodného bukového lesa skupiny lesných typov Fageto-Aceretum zo 48 druhov s hustotou 57,8 jedincov na 10 ha. Druhovo i početne najchudobnejšie vtáčie spločenstvo prírodného bukového lesa bolo zistené na lokalite Čierny kameň v skupine lesných typov Fageto-Aceretum (45 druhov s denzitou 55,4 jedincov na 10 ha). Pri porovnaní výsledkov výskumu vtáčích spoločenstiev z týchto výskumných plôch uskutočnených v rokoch 1989-91 s údajmi prezentovanými v tejto práci neboli zistené rozdiely v ich kvalitatívno-kvantitatívnej štruktúre. Tento fakt svedčí o tom, že vtáčie spoločenstvá vo fragmentoch pralesov, ktoré sú minimálne atakované ľudskou činnosťou, sú veľmi stabilné v porovnaní so spoločenstvami vtákov v hospodárskych lesoch.

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