Influence of forest stand structure on the occurrence of bird community in Skalná Alpa National Nature Reserve in the Veľká Fatra Mts. (West Carpathians)

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ABSTRACT: The study deals with the influence of the structure, texture and dynamics of a spruce-beech primeval forest on the bird community in Skalná Alpa National Nature Reserve in the Veľká Fatra Mts. (West Carpathians, Slovakia) in the years 1982–2002. The abundance of Norway spruce (*Picea excelsa* LAM.) was highest both in the optimum and decomposition stage. In the growth stage the number of Norway spruce (*Picea excelsa* LAM.) trees was quite low. The texture of spruce-beech virgin forest was very variable. Percentage ratios of individual stages on the area of 42.16 ha were as follows: growth stage 38.3%, optimum stage 20.1% and decomposition stage 41.6%. Altogether 46 bird species were represented in the bird community during the spring season. Mean total density was 85.8 ind/10 ha. The bird community consisted of 52 species in the summer season, 45 in the autumn migration season, 34 in the winter season, and of 47 in the spring migration season. The highest density was found in the bird community during the autumn migration season (109.8 ind/10 ha), the lowest in the winter season (24.6 ind/10 ha). During the spring migration season, both the spectrum of bird species and total density of bird community increased by the number of migratory species that came back from winter habitats.

Keywords: primeval forest; texture; diameter structure; dead wood; bird community

The understanding of the development and innate natural lows of the life cycle of a primeval forest provides important information not only for forest managers who apply new findings to management of various types of forests in terms of their functions. These findings are also relevant for the people who manage forest protection from the aspect of diversity.

Both the structure of a primeval forest and the dynamics of its changes are determined by climax species that have established at the given locality at the end of phylogenetic evolution. Dynamics of changes in the stand structure as well as growth processes are controlled by the species composition and site conditions in the stand (Korpeľ 1989). Leibundgut (1993), Vyskot (1981), Průša (1975), and Saniga (1999a,b) were also of the same opinion.

The structure of a primeval forest, its species composition and the site conditions are also determinant factors for the composition of bird communities (e.g. Blana 1978; Tomiałojć et al. 1984; Scherzinger 1985; Mosimann et al. 1987; Schaffner 1990; Saniga 1994a,b, 1995a,b; Kropil 1996). The former studies of breeding bird communities in primeval forest reserves in the West Carpathians (Krištín 1991, 1993; Saniga 1994a,b, 1995a,b; Kropil 1996) were focussed only on the species composition, abundance and biomass without taking in consideration the linkage of individual species to the structure of these virgin forests.

Our paper is aimed at the relation of the structure of a primeval forest in the National Nature Reserve (NNR) Skalná Alpa in the Veľká Fatra Mts. (West Carpathians, Slovakia) comprised in the frame of its bulk texture to the occurrence of bird communities.

MATERIAL AND METHODS

Study area

Skalná Alpa NNR is situated in the Veľká Fatra Mts. (18°50´–19°18´E; 48°47´–49°09´N, West Carpathians, Slovakia) on a south-southwest slope, from 1,200 to 1,400 m above sea level. The mean annual temperature

Supported by Grants No. 2/2001/22 and No. 2/3006/23 of the Grant Agency VEGA of the Slovak Academy of Sciences.

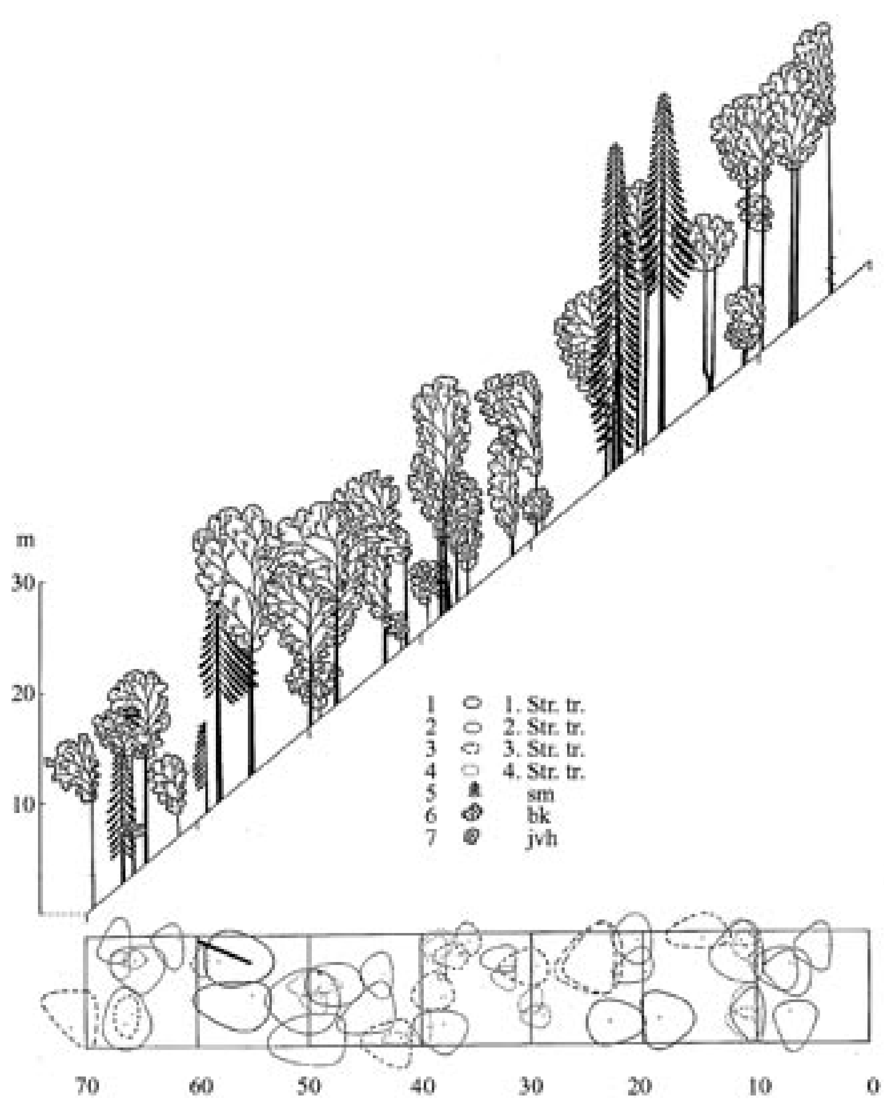

Fig. 1. Stand profile of primeval forest on PRP 1 in Skalná Alpa NNR in the stage of growth; 1,150–1,200 m a.s.l.; Veľká Fatra Mts. – West Carpathians, Slovakia (for Fig. 1–3: Str. tr. – classes of trees; sm – Norway spruce; bk – beech; jvh – sycamore)

is 4°C, the mean annual precipitation ranges between 1,000–1,200 mm, out of which 400–450 mm falls in the vegetation period. The number of summer days with the temperature equal to or exceeding 25°C is 20 and the mean number of days with frost is 170. The parent rock is limestone, the soil type is brown rendzina with a sufficient water supply.

In the spruce-beech-fir forest vegetation zone Skalná Alpa NNR represents natural spruce-beech forest with admixed sycamore (*Acer pseudoplatanus* L.). The following species are dominant in the herbal synusia: *Mercurialis perennis*, *Adenostyles alliarie, Mulgedium alpinum, Doronicum austriacum, Homogyne alpina* and *Cortusa matthiolii.* The forest site type group is prevailingly *Fageto-Aceretum.*

In Skalná Alpa NNR three permanent research plots (PRP) were established and surveyed in 1982. The classification was repeated in 1992 and 2002. To cover the whole life cycle of spruce-beech virgin forest, the plots were localised and stabilised in such a manner as to represent all three developmental stages of virgin forests (KORPEĽ 1989).

PRP 1 is in the stage of growth at present. The plot covers an area of 0.5 ha (70 × 71.5 m) extending from 1,150 m to 1,200 m a.s.l, and it contains a transect 70 × 10 m in size. The gradient of south-west slope is 38°. The stand profile of the plot is illustrated in Fig. 1.

PRP 2 represents the stage of optimum. The area, size and transect are the same as in plot 1. The plot exposure is south-southeast, slope gradient 36°, altitude from 1,150 to 1,200 m a.s.l. (Fig. 2).

PRP 3 represents the beginning of the stage of decomposition. The area and transect are the same as in plot 1 (83.3 × 60 m in size). The plot exposure is south-southeast, slope gradient 36°, altitude from 1,150 to 1,200 m a.s.l. (Fig. 3).

Field investigations

The stands on permanent research plots were surveyed in 1982, 1992 and 2002. Tree heights and diameters 1.3 m above the ground were measured. The trees growing on transects were examined in greater detail, they were stabilised in the system of *x, y* co-ordinates; and their re-

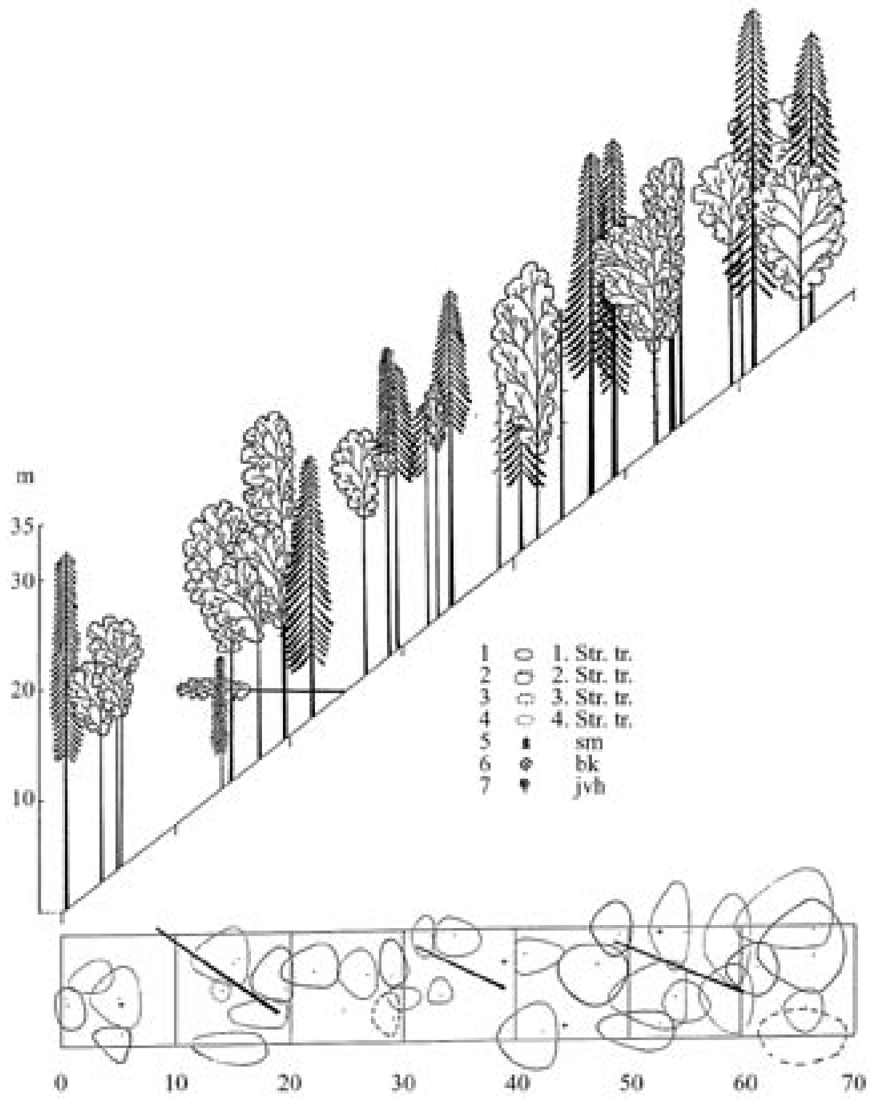

Fig. 2. Stand profile of primeval forest on PRP 2 in Skalná Alpa NNR in the stage of optimum; 1,150–1,200 m a.s.l.; Veľká Fatra Mts. – West Carpathians, Slovakia

generation was registered. Other biometric data were also determined in these trees: (i) height of crown setting using a height gauge, to the nearest 0.5 m; (ii) crown projection to the nearest 10 cm.

In addition to the determination of stand diameter structure, these biometric variables were used for plotting the stand structure of transects. The occurrence of dead wood, an important component of forest ecosystems enabling the breeding and sleeping of certain bird species, was assessed and evaluated as follows: (i) standing dry trees were measured to obtain diameter at breast height (dbh) and stem height; (ii) lying trees were measured to obtain stem length and diameter in the half of the length.

According to the decomposition stage, fallen trunks were classified into three classes: (i) freshly fallen stems, without rot, it is possible to identify the wood species; (ii) rotting stems, maintaining the shape and coherence, the wood species is still possible to be classified; (iii) considerably decomposed stems, moderate physical stress is responded by destruction, it is difficult to identify the species. The assessment of dead wood was performed according to the woody plant species.

Besides the detailed measurements of biometric characteristics, an evaluation of the area texture of the primeval forest covering 42.19 ha was performed in 1992. The term area texture is taken to mean area differentiation between the individual development stages of a virgin forest. The primeval forest texture was analysed in stands 528, 530 and 531 (Working Plan Area Rakytov), where the PRPs are situated.

Bird community was investigated in five seasons: (i) spring migration season (March–April); (ii) spring season (May–June); (iii) summer season (July–August); (iv) autumn migration season (September–October); and (v) winter season (November–February). Censuses of birds were carried out in the years 1990–1995 using the strip transect method (VERNER 1985). Field checks were carried out at different intervals during 24 hours to cover all the bird species occurring in the area under study. During the spring and summer seasons the birds were counted mainly twice a day (early in the morning from 03.00 to 09.00 CET and later in the evening from 17.00 to 20.00 CET). In the other seasons, birds were observed in the morning after sunrise and in the afternoon before sunset.

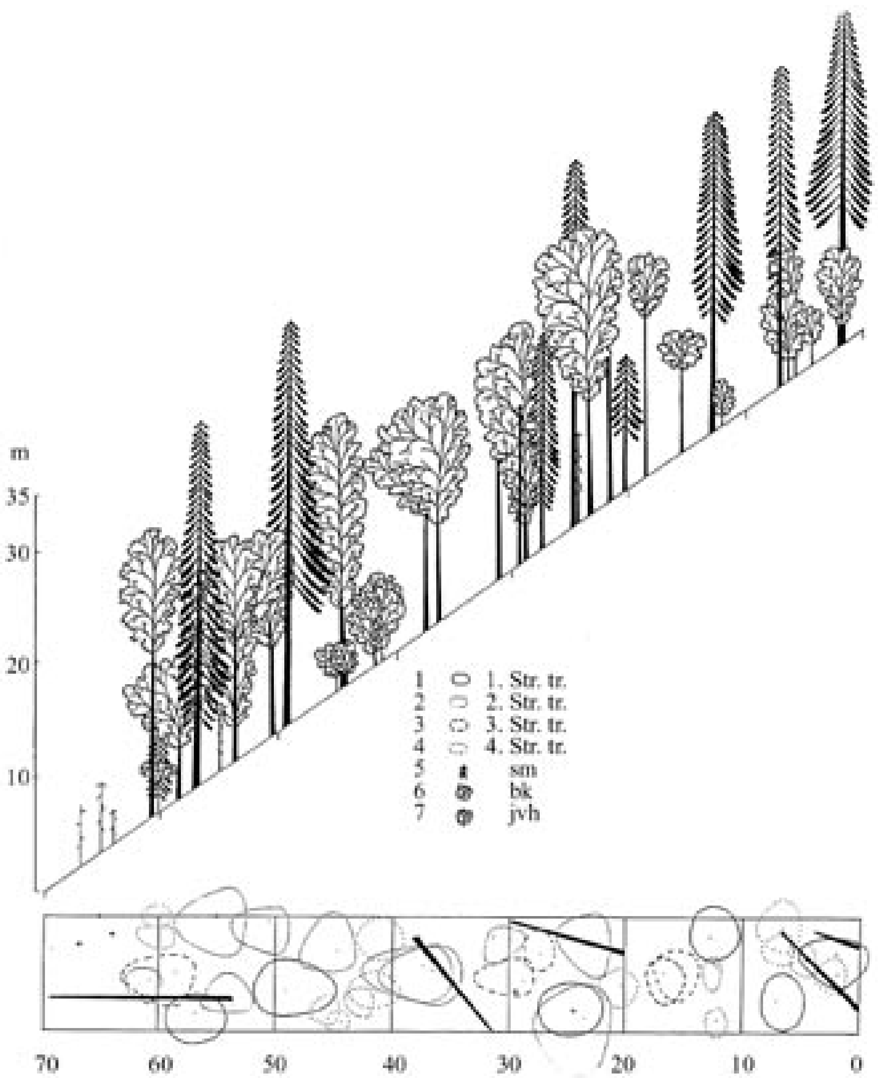

Fig. 3. Stand profile of primeval forest on PRP 3 in Skalná Alpa NNR in the stage of decomposition; 1,150–1,200 m a.s.l.; Veľká Fatra Mts. – West Carpathians, Slovakia

All the checks were carried out in satisfactory weather conditions. Census speed was about 0.75–1.50 km per hour. Bird species with nocturnal activity (order Strigiformes, *Caprimulgus europaeus, Tetrao urogallus*) were monitored during the night. The breadth of the census belt was 50 m and the length of the transect was 2.0 km. Minimally five field checks were conducted in each season and every year in the period 1990–1995. The density of the species with relatively large nesting territories (Falconiformes, Strigiformes) was not ascertained (in Tables they are marked by „x“).

The obtained results were used to calculate the following population features: (i) abundance (A); (ii) dominance of individuals (D); (iii) biomass (B) – the average biomass of birds was determined according to HUDEC and ČERNÝ (1977) and HUDEC (1983); and (iv) dominance of biomass (DB). Shannon-Weaver's diversity (H') and equitability indices (E) of the bird community were also calculated (SHANNON, WEAVER 1949; SHELDON 1969).

With regard to foraging strategy of bird species on the study plot, ten guilds were distinguished. The foraging substrate was divided into 4 categories: (i) ground (ground surface, herb layer, dead lying wood); (ii) bark (bark of tree stems); (iii) leaves (leaves and twigs); and (iv) air space. With regard to the diet, birds were divided into three categories: (i) herbivores; (ii) insectivores; and (iii) vertebratophages. Classification into foraging guilds was made according to our own observations and using data available from regional literary data (HUDEC, ČERNÝ 1977; HUDEC 1983; KRIŠTÍN 1990; KROPIL 1996).

Four basic nesting guilds were established in respect to the location of nests: (i) ground nesters (ground surface, herb layer, dead lying wood); (ii) shrub nesters (shrubs and ground tree branches); (iii) hole and crown nesters. Breeding status was determined by direct investigations on the study plot or data from other study plots with typologically akin forests were used.

Bird species were proportionally classified into foraging (some birds are partially insectivores and partially herbivores and also take food from different substrates) and nesting guilds (some species nest at different places).

RESULTS AND DISCUSSION

Diameter structure of virgin forest

Data on the diameter structure of individual tree species in dependence on the development stage of primeval for-

Table 1. Structure of diameter frequency in tree species on PRP 1 (calculation per 1 ha) in Skalná Alpa NNR (Veľká Fatra Mts., West Carpathians, Slovakia, 1982–2002)

Diameter class	1982				1992				2002			
	Beech	Sycamore	Spruce	Sum	Beech	Sycamore	Spruce	Sum	Beech	Sycamore	Spruce	Sum
10	31	2	1	34	20	1	–	21	36	2	–	38
14	29	7	2	38	11	5	–	16	36	10	2	48
18	31	10	1	42	13	4	–	17	56	6	–	62
22	30	12	1	43	13	6	2	21	40	18	4	62
26	30	4	–	34	21	9	–	30	56	10	–	66
30	23	–	–	23	5	2	–	7	40	2	–	42
34	25	1	2	28	12	1	–	13	34	–	–	34
38	10	1	2	13	12	1	1	14	36	2	2	40
42	15	–	3	18	11	–	1	12	30	–	2	32
46	6	–	2	8	6	–	1	7	18	–	–	18
50	2	–	1	2	2	–	1	3	6	–	2	8
54	3	–	2	5	3	–	2	5	4	–	2	6
58	–	–	1	1	1	–	2	3	4	–	–	4
62	–	–	3	3	–	–	–	–	–	–	2	2
66	–	–	–	–	–	–	–	–	–	–	–	–
70	–	–	–	–	–	–	–	–	–	–	–	–
74	–	–	–	–	–	–	1	1	–	–	2	2
Sum	235	37	21	292	130	29	11	170	396	50	18	464

Table 2. Structure of diameter frequency in tree species on PRP 2 (calculation per 1 ha) in Skalná Alpa NNR (Veľká Fatra Mts., West Carpathians, Slovakia, 1982–2002)

Diameter class	1982				1992				2002			
	Beech	Sycamore	Spruce	Sum	Beech	Sycamore	Spruce	Sum	Beech	Sycamore	Spruce	Sum
10	7	–	–	7	6	–	–	6	10	–	–	10
14	1	2	1	4	8	–	2	10	6	–	2	8
18	6	6	2	14	7	4	–	11	4	6	4	14
22	22	3	1	26	16	2	2	20	20	6	6	32
26	21	8	2	31	21	7	2	30	22	12	2	36
30	17	2	11	30	19	5	6	30	32	6	12	50
34	15	3	8	26	14	6	8	28	36	4	4	44
38	18	–	4	22	14	–	5	19	8	4	4	16
42	6	–	2	8	6	–	4	10	12	–	6	18
46	6	–	10	16	6	–	8	14	6	–	2	8
50	4	–	16	20	1	–	10	11	6	–	10	16
54	2	–	9	11	3	–	8	11	4	–	18	22
58	–	–	7	7	2	–	5	7	4	–	8	12
62	–	–	3	3	–	–	4	4	–	–	8	8
66	–	–	4	4	–	–	7	7	–	–	–	–
70	–	–	1	1	–	–	2	2	–	–	2	2
74	–	–	–	–	–	–	1	1	–	–	–	–
Sum	125	24	81	230	123	24	74	221	170	38	88	296

Table 3. Structure of diameter frequency in tree species on PRP 3 (calculation per 1 ha) in Skalná Alpa NNR (Veľká Fatra Mts., West Carpathians, Slovakia, 1982–2002)

Diameter class	1982				1992				2002			
	Beech	Sycamore	Spruce	Sum	Beech	Sycamore	Spruce	Sum	Beech	Sycamore	Spruce	Sum
10	17	–	2	19	27	2	2	31	28	–	–	28
14	12	2	4	18	13	1	2	16	16	2	6	24
18	12	1	2	15	7	–	1	8	14	2	4	20
22	7	2	1	10	9	3	1	13	18	2	2	22
26	13	9	5	27	14	6	7	27	16	12	10	38
30	16	8	2	26	16	6	2	24	20	12	–	32
34	17	2	–	19	12	7	1	20	30	8	4	42
38	16	1	4	21	14	1	1	16	20	2	4	26
42	11	–	14	25	10	1	9	20	12	2	4	18
46	6	–	6	12	5	–	9	14	12	–	6	18
50	2	–	10	12	4	–	6	10	16	–	10	26
54	2	–	2	4	–	–	2	2	4	–	10	14
58	–	–	3	3	–	–	5	5	4	–	2	6
62	–	–	3	3	–	–	3	3	–	–	6	6
66	–	–	4	4	–	–	4	4	–	–	4	4
70	–	–	2	2	–	–	4	4	–	–	6	6
74	–	–	–	–	–	–	–	–	–	–	6	6
78	–	–	1	1	–	–	2	2	–	–	–	–
82	–	–	–	–	–	–	1	1	–	–	4	4
Sum	131	25	65	221	131	27	62	220	210	42	88	340

Table 4. Necromass volume on PRP 1, 2 (calculation per 1 ha) in Skalná Alpa NNR (Veľká Fatra Mts., West Carpathians, Slovakia, 1992–2002)

PRP	Tree species		Lying snags – decay stage				Standing snags	Sum
			(i)	(ii)	(iii)	sum		
1	1992							
	Spruce	m^3	19.00	21.00	–	–	12.31	–
		%	48.30	53.70	–	–	35.10	–
	Beech	m^3	20.31	18.10	–	–	15.12	–
		%	51.70	46.30	–	–	43.20	–
	Sycamore	m^3	–	–	–	–	7.60	–
		%	–	–	–	–	21.70	–
	Sum	m^3	39.31	39.10	27.30	105.71	35.03	140.74
		%	37.20	37.00	25.80	75.10	24.90	100.00
	2002							
	Spruce	m^3	–	7.50	–	–	41.28	–
		%	–	31.30	–	–	69.60	–
	Beech	m^3	4.92	16.34	–	–	18.06	–
		%	79.40	68.30	–	–	30.40	–
	Sycamore	m^3	1.28	0.10	–	–	–	–
		%	20.60	0.40	–	–	–	–
	Sum	m^3	6.20	23.94	21.36	51.50	59.34	110.84
		%	12.00	46.50	41.50	46.50	53.50	100.00
2	1992							
	Spruce	m^3	–	16.10	–	–	8.53	–
		%	–	52.60	–	–	38.10	–
	Beech	m^3	16.40	11.00	–	–	13.86	–
		%	100.00	36.00	–	–	61.90	–
	Sycamore	m^3	–	3.50	–	–	–	–
		%	–	11.40	–	–	–	–
	Sum	m^3	16.40	30.60	27.30	74.30	22.39	96.69
		%	22.10	41.20	36.70	76.80	23.20	100.00
	2002							
	Spruce	m^3	29.16	24.22	–	–	66.50	–
		%	85.60	75.40	–	–	92.80	–
	Beech	m^3	3.14	7.90	–	–	5.16	–
		%	9.20	24.60	–	–	7.20	–
	Sycamore	m^3	1.76	–	–	–	–	–
		%	5.20	–	–	–	–	–
	Sum	m^3	34.06	32.12	42.24	108.42	71.66	180.08
		%	31.40	29.60	39.00	60.20	39.80	100.00

est are summarised in Tables 1–3. Evaluation of the species diameter structure on PRP 1, representing the stage of growth, revealed a considerable difference in tree number per hectare between the years 1982 (292 trees per ha) and 1992 (170 trees per ha) (Table 1). The number of trees per hectare observed in 2002 was 464. This considerable variability followed from the natural decline of trees of the former generation (phase of over-maturation) and the auto-reduction of trees in diameter classes 10–18 cm in connection with unfavourable environmental conditions and with damage by wind-throws of Norway spruce and partially also beech trees – each with a volume between

6–10 m^3. The measurements performed in 2002 recorded the highest numbers of trees per hectare (464) in this development stage.

The tree number on PRP 2, representing the advanced optimum stage of virgin forest development, was relatively uniform until 1992 (Table 2). The frequency polygon for the diameter classes is asymmetric – shifted to the right. The abrupt change in 2002 is a result of a wind disaster that afflicted the right upper quadrant of the plot, which was reflected in an increase in windbreaks of beech trees belonging to the diameter classes 10 to 14 cm.

On PRP 3, representing the initial stage of decay, besides a similar polygon the dynamics of changes in the tree frequency according to their diameter is also characterised by rather a low number of trees per hectare (Table 3). A comparison of the tree composition in the particular development stages indicated that the number of Norway spruce trees per hectare was highest in the stages of optimum and decomposition. In the growth stage the number of Norway spruce (*Picea excelsa* LAM.) trees was quite low. The cause is that whereas the physical age of beech (*Fagus sylvatica* L.), a dominant tree species in this virgin forest, ranges between 210 and 230 years, Norway spruce can reach up to 300 years. As a result, beech trees of large diameters can begin to die in the stage of decay, Norway spruce trees quit the community in the stage of growth. This alternation or overlapping of the two species through two developmental stages of virgin forest coupled with the virgin forest texture provides highly variable biotopes for bird populations.

Texture of virgin forest

In 1992, we assessed the stability and area alternation of individual stages of virgin forest on an area of 42.19 ha. We determined the proportions corresponding to the particular development stages. The proportion corresponding to the stage of growth, without differentiation between the beginning and advanced period, ranged between 2,000–2,800 m^2. The optimum stage covered the smallest area: 1,600–2,000 m^2. The greatest area with the highest diversity belonged to the stage of decomposition: 2,400 to 3,000 m^2. In percent, the particular stages accounted for: 38.3% growth, 20.1% optimum and 41.6% decomposition stage.

The analysis of area texture showed that the size of the area in the stage of decomposition was influenced by the presence of spruce trees, highly sensitive, mainly in the last ten years, to an important abiotic factor – wind.

The frequency of high-speed winds (exceeding 100 km per hour) has continually increased during the last decade. The localities with abundant Norway spruce (25–35%) show more progressive stages of decomposition. On the other hand, the stage of decomposition observed at localities with the proportion of Norway spruce trees lower than 20% was significantly lower.

Table 5. Necromass volume on PRP 3 (calculation per 1 ha) in Skalná Alpa NNR (Veľká Fatra Mts., West Carpathians, Slovakia, 1992–2002)

Tree species		Lying snags – decay stage				Standing snags	Sum
		(i)	(ii)	(iii)	sum		
1992							
Spruce	m^3	10.80	33.70	–	–	12.57	–
	%	100.00	66.90	–	–	34.20	–
Beech	m^3	–	16.70	–	–	24.23	–
	%	–	33.10	–	–	65.80	–
Sycamore	m^3	–	–	–	–	–	–
	%	–	–	–	–	–	–
Sum	m^3	10.80	50.40	52.80	114.00	36.80	150.80
	%	9.50	44.20	46.30	75.60	24.40	100.00
2002							
Spruce	m^3	0.92	24.22	–	–	36.42	–
	%	17.40	82.20	–	–	72.60	–
Beech	m^3	4.38	5.24	–	–	13.72	–
	%	82.60	17.80	–	–	27.40	–
Sycamore	m^3	–	–	–	–	–	–
	%	–	–	–	–	–	–
Sum	m^3	5.30	29.46	36.40	71.16	50.14	121.30
	%	7.40	41.40	51.20	58.70	41.30	100.00

Table 6. The structure of bird community in Skalná Alpa NNR (Veľká Fatra Mts., West Carpathians, Slovakia, 1990–1995)

Species	SMS		SGS		SRS		AMS		WRS	
	A	D	A	D	A	D	A	D	A	D
Fringilla coelebs L.	**11.0**	**14.9**	**14.8**	**17.2**	**12.9**	**13.3**	**32.6**	**29.7**	0.5	2.0
Parus ater L.	**9.4**	**12.7**	**9.0**	**10.5**	**9.8**	**10.1**	**8.0**	**7.3**	**3.6**	**14.6**
Erithacus rubecula (L.)	**4.2**	**5.7**	**8.1**	**9.4**	**7.2**	**7.4**	**6.2**	**5.6**		
Regulus regulus (L.)	**5.2**	**7.0**	**5.2**	**6.1**	**5.0**	**5.1**	4.2	3.6	**2.0**	**8.2**
Sylvia atricapilla (L.)	1.2	1.6	**5.0**	**5.8**	4.2	4.3	1.2	1.1		
Prunella modularis (L.)	1.2	1.6	3.9	4.5	3.8	3.9	3.5	3.2		
Turdus torquatus L.	2.6	3.5	3.6	4.2	3.2	3.3	2.2	2.0	0.5	2.0
Troglodytes troglodytes (L.)	3.6	4.9	3.6	4.2	3.9	4.0	3.0	2.7	**2.8**	**11.4**
Certhia familiaris L.	**3.8**	**5.1**	3.6	4.2	3.9	4.0	2.8	2.6	**2.8**	**11.4**
Turdus philomelos Brehm	2.0	2.7	3.0	3.5	2.8	2.9	2.0	1.8	0.1	0.4
Turdus viscivorus L.	2.0	2.7	2.0	2.4	1.8	1.9	1.6	1.5	0.1	0.4
Pyrrhula pyrrhula (L.)	2.2	3.0	2.0	2.4	1.8	1.9	1.4	1.3	1.0	4.1
Sitta europaea L.	2.0	2.7	2.0	2.4	2.1	2.2	1.9	1.7	**1.9**	**7.7**
Phylloscopus sibilatrix (Viell.)			2.0	2.4	1.6	1.6				
Phylloscopus collybita (Viell.)	0.4	0.5	1.8	2.1	1.9	2.0	1.6	1.5		
Turdus merula L.	1.2	1.6	1.8	2.1	2.5	2.6	1.2	1.1	0.1	0.4
Parus montanus Baldenst.	1.4	1.9	1.4	1.6	1.8	1.9	1.6	1.5	**1.5**	**6.1**
Phylloscopus trochilus (L.)	0.2	0.3	1.2	1.4	1.6	1.6	0.4	0.4		
Columba palumbus L.	1.0	1.4	1.0	1.2	1.0	1.0	0.4	0.4		
Phoenicurus phoenicurus L.	0.1	0.1	1.0	1.2	0.8	0.8				
Parus cristatus L.	1.0	1.4	1.0	1.2	2.8	2.9	1.3	1.2	**1.3**	**5.3**
Parus palustris L.	1.2	1.6	1.0	1.2	2.6	2.7	1.3	1.2	0.9	3.7
Ficedula albicollis (Temm.)			0.8	0.9	1.2	1.2				
Carduelis spinus (L.)	0.7	1.0	0.7	0.8	2.0	2.1	0.6	0.5	0.2	0.8
Dendrocopos leucotos Bechst.	0.7	1.0	0.7	0.8	1.4	1.4	0.8	0.7	0.7	2.9
Glaucidium passerinum (L.)	0.6	0.8	0.6	0.7	0.6	0.6	0.6	0.5	0.6	2.5
Ficedula parva (Bechst.)			0.5	0.6	0.8	0.8				
Muscicapa striata (Pall.)			0.5	0.6	0.5	0.5				
Picoides tridactylus (L.)	0.5	0.7	0.5	0.6	0.6	0.6	0.6	0.5	0.5	2.0
Loxia curvirostra (L.)	0.5	0.7	0.5	0.6	3.8	3.9	2.1	1.9	0.8	3.3
Bonasa bonasia (L.)	0.5	0.7	0.5	0.6	0.9	0.9	0.7	0.6	0.5	2.0
Scolopax rusticola L.	0.1	0.1	0.4	0.5	0.3	0.3	0.2	0.2		
Anthus trivialis (L.)	0.1	0.1	0.2	0.2	0.6	0.6	0.2	0.2		
Dryocopus martius (L.)	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.8
Garrulus glandarius (L.)	0.2	0.3	0.2	0.2	0.4	0.4	0.4	0.4	0.1	0.4
Nucifraga caryocatactes (L.)	0.2	0.3	0.2	0.2	0.5	0.5	0.6	0.5	0.1	0.4
Cuculus canorus L.	0.1	0.1	0.2	0.2	0.2	0.2				
Picus canus Gmel.	0.2	0.3	0.2	0.2	0.3	0.3	0.1	0.1	0.1	0.4
Aegolius funereus (L.)	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.8
Tetrao urogallus L.	0.2	0.3	0.2	0.2	0.7	0.7	0.5	0.5	0.3	1.2
Columba oenas L.	0.1	0.1	0.2	0.2	0.4	0.4				
Dendrocops major (L.)	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.4
Strix aluco L.	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.4
Coccothraustes coccothraustes (L.)	0.1	0.1	0.1	0.1	0.4	0.4	0.6	0.5		
Fringilla montifringilla L.	**7.8**	**10.6**					**18.2**	**16.6**	0.2	0.8
Turdus iliacus L.	2.2	3.0					2.9	2.6		

Table 6 to be continued

Species	SMS		SGS		SRS		AMS		WRS	
	A	D	A	D	A	D	A	D	A	D
Accipiter nisus (L.)	x		x		x		x		x	
Strix uralensis Pall.	x		x		x		x		x	
Parus caeruleus L.	0.2	0.3			0.5	0.5	0.6	0.5	0.4	1.6
Regulus ignicapillus (Temm.)					0.4	0.4				
Parus major L.	0.3	0.4			0.4	0.4	0.3	0.3	0.2	0.8
Aegithalos caudatus (L.)	1.0	1.4			0.4	0.4	0.5	0.5	0.2	0.8
Anthus spinoletta (L.)					0.2	0.2	0.2	0.2		
Sylvia borin (Bodd.)					0.1	0.1				
Total	73.8	100.0	85.8	100.0	97.4	100.0	109.8	100.0	24.6	100.0
Total species	47.0		46.0		52.0		45.0		34.0	

SMS – spring migration season (March–April), SGS – spring season (May–June), SRS – summer season (July–August)
AMS – autumn migration season (September–October), WRS – winter season (November–February), A – abundance in individuals per 10 ha
D – dominance in %, x – population density was not estimated, bold types are dominants (more than 5% of the community density)

Dead wood structure

Data illustrating the dynamics of changes in dead wood structure during the last 10 years are summarised in Tables 4 and 5. The necromass volume on PRP 1 representing the growth stage by its structure decreased from 140.74 m^3/ha to 110.84 m^3/ha in the last 10 years. For the lying dead wood in the first and the second decay stage (year 1992) the proportions of beech and Norway spruce were very similar. In the case of standing dry trees there was a slight dominance of beech trees. In the assessment performed in 2002 we observed a higher proportion of lying beech trees in the stages of decay (i) and (ii). On the other hand, Norway spruce had the significantly highest proportion of standing dry trees.

The necromass in decay stage (iii), when it is not possible to distinguish between the tree species, was by 6 m^3/ha higher in 1992 compared with the amount observed in 2002.

The necromass volume in the stand representing the optimum stage (PRP 2) was 180.08 m^3/ha in 2002, which was significantly more than in 1992. It was caused by rather a high increase in the number of wind-thrown (3) or by bark beetle (*Ips typographus* L.) attacked Norway spruce trees of relatively high age and large diameter. Only 4 trees were attacked by the bark beetle; nevertheless, thanks to the volume (on average 16–17 m^3 per tree) of their wood, the increase in necromass in the stand was significant.

The dynamics of necromass formation on PRP 3 (advanced stage of decay) was lowered. The necromass amount on this plot in 1992 was 150.80 m^3/ha, out of which dry standing trees accounted for 36.80 m^3/ha (with a higher proportion of beech). In spite of the fact that there were several new dry standing Norway spruce trees (36.42 m^3/ha), the proportion of lying trees in 2002 was significantly lower, thanks to a high rate of decomposition process.

Summarising the assessment of all the development stages we can conclude that considering the maximum physical age of two main species, beech and Norway spruce, the amount of necromass will be equalised in all three stages, with a moderate decrease in the optimum stage.

Structure of the bird community in the spring season

Altogether 46 bird species represented the bird community during the spring season. Mean total density was 85.8 ind/10 ha. Populations of the species chaffinch (*Fringilla coelebs*), coal tit (*Parus ater*), robin (*Erithacus rubecula*), gold crest (*Regulus regulus*) and black cap (*Sylvia atricapilla*) were present as dominants species (Table 6). The total biomass of the bird community had the value 4,113 g per 10 ha. The highest proportion was registered in the species capercaillie (*Tetrao urogallus*) (Table 7).

Altogether 72.4% of the bird species within the study plot fed on invertebrates at least partly (Table 8). 13.3% of the species were herbivores, 11.4% were vertebratophages. Some bird species foraged also partly or completely outside the interior of the forest (3 species, 2.9%). Mean density of the insectivores was 73.6 ind/10 ha (85.9%). Crown insectivores accounted for 35.2% and ground insectivores for 28.2% of total density. Shrub insectivores were present in the community with abundance 13.1%. The proportions of bark and air insectivores were the lowest (6.7% and 2.7%, respectively). Vertebratophages, represented by 6 species, had very low density (0.9% of total density). Herbivorous birds accounted for more than 10% of total density.

As for the biomass, 55.2% of the species belonged to insectivores, 35.2% to herbivores, 6.3% species foraged outside the forest interior, and 3.3% were vertebratophages. Ground insectivores accounted for 39.2% and ground herbivores for 24.8% of total biomass.

Table 7. The biomass of bird community in Skalná Alpa NNR (Veľká Fatra Mts., West Carpathians, Slovakia, 1990–1995)

Species	SMS		SGS		SRS		AMS		WRS	
	B	DB	B	DB	B	DB	B	DB	B	DB
Fringilla coelebs L.	**253**	**6.8**	**340**	**8.3**	297	4.5	**750**	**13.4**	12	0.6
Parus ater L.	85	2.3	81	2.0	88	1.3	72	1.3	32	1.6
Erithacus rubecula (L.)	71	1.9	138	3.4	122	1.9	105	1.9		
Regulus regulus (L.)	31	0.8	31	0.8	30	0.5	25	0.5	12	0.6
Sylvia atricapilla (L.)	22	0.6	90	2.2	76	1.2	22	0.4		
Prunella modularis (L.)	22	0.6	70	1.7	68	1.0	63	1.1		
Turdus torquatus L.	**265**	**7.1**	**367**	**8.9**	326	5.0	224	4.0	51	2.5
Troglodytes troglodytes (L.)	32	0.8	32	0.8	35	0.5	27	0.5	25	1.3
Certhia familiaris L.	30	0.8	29	0.7	31	0.5	22	0.4	22	1.1
Turdus philomelos Brehm	140	3.8	**210**	**5.1**	196	3.0	140	2.5	7	0.4
Turdus viscivorus L.	**226**	**6.1**	**226**	**5.5**	203	3.1	181	3.2	11	0.6
Pyrrhula pyrrhula (L.)	75	2.0	68	1.7	61	0.9	48	0.9	34	1.7
Sitta europaea L.	46	1.2	46	1.1	48	0.7	44	0.8	44	2.2
Phylloscopus sibilatrix (Viell.)			20	0.5	16	0.2				
Phylloscopus collybita (Viell.)	3	0.1	14	0.3	15	0.2	13	0.2		
Turdus merula L.	120	3.2	180	4.4	250	3.8	120	2.2	10	0.5
Parus montanus Baldenst.	14	0.4	14	0.3	18	0.3	16	0.3	15	0.7
Phylloscopus trochilus (L.)	2	0.1	11	0.3	14	0.2	4	0.1		
Columba palumbus L.	**450**	**12.2**	**450**	**10.9**	**450**	**6.9**	180	3.2		
Phoenicurus phoenicurus L.	2	0.1	15	0.4	12	0.2				
Parus cristatus L.	11	0.3	11	0.3	31	0.5	14	0.3	14	0.7
Parus palustris L.	11	0.3	9	0.2	23	0.3	12	0.2	8	0.4
Ficedula albicollis (Temm.)			12	0.3	18	0.3				
Carduelis spinus (L.)	9	0.2	9	0.2	26	0.4	8	0.2	3	0.1
Dendrocopos leucotos Bechst.	75	2.0	75	1.8	150	2.3	86	1.6	75	3.7
Glaucidium passerinum (L.)	40	1.1	40	1.0	40	0.6	40	0.7	40	2.0
Ficedula parva (Bechst.)			5	0.1	7	0.1				
Muscicapa striata (Pall.)			8	0.2	8	0.1				
Picoides tridactylus (L.)	33	0.9	33	0.8	39	0.6	39	0.7	33	1.6
Loxia curvirostra (L.)	20	0.5	20	0.5	152	2.3	84	1.5	32	1.6
Bonasa bonasia (L.)	**200**	**5.4**	200	4.9	**360**	**5.5**	280	5.0	**200**	**9.9**
Scolopax rusticola L.	33	0.9	133	3.2	100	1.5	67	1.2		
Anthus trivialis (L.)	2	0.1	46	1.1	14	0.2	5	0.1		
Dryocopus martius (L.)	50	1.4	50	1.2	50	0.8	50	0.9	50	2.5
Garrulus glandarius (L.)	36	1.0	36	0.9	72	1.1	72	1.3	18	0.9
Nucifraga caryocatactes (L.)	36	1.0	36	0.9	89	1.4	107	1.9	18	0.9
Cuculus canorus L.	13	0.3	26	2.6	26	0.4				
Picus canus Gmel.	26	0.7	26	0.6	39	0.6	13	0.2	13	0.6
Aegolius funereus (L.)	30	0.8	30	0.7	30	0.5	30	0.5	30	1.5
Tetrao urogallus L.	**750**	**20.3**	**750**	**18.2**	**2,625**	**40.1**	**1,875**	**33.6**	**1,125**	**55.8**
Columba oenas L.	27	0.7	54	1.3	106	1.6				
Dendrocops major (L.)	8	0.2	8	0.2	16	0.2	16	0.3	8	0.4
Strix aluco L.	58	1.6	58	1.4	115	1.8	58	1	58	2.9
Coccothraustes coccothraustes (L.)	6	0.2	6	0.1	23	0.3	35	0.6		
Fringilla montifringilla L.	**187**	**5.1**					**437**	**7.8**	5	0.2
Turdus iliacus L.	132	3.6					174	3.1		

Table 7 to be continued

Species	SMS		SGS		SRS		AMS		WRS	
	B	DB	B	DB	B	DB	B	DB	B	DB
Accipiter nisus (L.)	x		x		x		x		x	
Strix uralensis Pall.	x		x		x		x		x	
Parus caeruleus L.	2	0.1			5	0.1	6	0.1	4	0.2
Regulus ignicapillus (Temm.)					2	0.1				
Parus major L.	6	0.2			8	0.1	6	0.1	4	0.2
Aegithalos caudatus (L.)	9	0.2			4	0.1	5	0.1	2	0.1
Anthus spinoletta (L.)					5	0.1	5	0.1		
Sylvia borin (Bodd.)					2	0.1				
Total	3,699	100	4,113	100	6,541	100	5,580	100	2,015	100

B – biomass in g per 10 ha, DB – dominance of biomass. Bold types are dominants (more than 5% of the community) biomass. Other abbreviations see Table 6

The structure and texture of primeval forest affected the location of bird's nests. Almost half of the species (43.1%) belonged to hole nesters. This fact was due to the variable structure and texture of primeval forest with numerous old, partly or wholly dead standing trees (snags) with numerous cavities and semi-cavities. As for the density, crown nesters accounted for 31.4%, hole nesters for 27.7%, ground nesters for 23.4%, and shrub nesters for 17.5% of total density. As for the biomass, species nesting on the ground predominated (32.6%) while the proportion of shrub nesters was the lowest (13.4%). This was due to the occurrence of capercaillie (*Tetrao urogallus*) and hazel grouse (*Bonasa bonasia*).

Bird species belonging to atypical hole nesters (*Erithacus rubecula, Prunella modularis, Turdus merula, Turdus philomelos, Turdus torquatus, Turdus viscivorus,* and *Troglodytes troglodytes*) used especially semi-cavities in the snags. Predation pressure on the hole nesters was much lower than on the other nesting guilds on the study plot (SANIGA submitted). These bird species used the strategy that their nests in semi-cavities were more protected not only from predators but also from weather (heavy rains

Table 8. Foraging and nesting guilds of bird community during the spring season (May–June) in Skalná Alpa NNR (Veľká Fatra Mts., West Carpathians, Slovakia, 1990–1995)

Foraging guilds	N	(%)	A	(%)	B	(%)
Air insectivores	4	7.2	2.3	2.7	32	0.8
Bark insectivores	7	13.6	5.7	6.7	206	5.0
Crown insectivores	15	23.0	30.2	35.2	295	7.2
Ground insectivores	21	23.9	24.2	28.2	1,611	39.2
Shrub insectivores	10	4.7	11.2	13.1	122	3.0
Total insectivores	57	72.4	73.6	85.9	2,266	55.2
Crown herbivores	5	4.8	4.7	5.5	363	8.8
Ground herbivores	8	7.8	5.7	6.6	1,019	24.8
Shrub herbivores	1	0.7	0.2	0.2	67	1.6
Total herbivores	14	13.3	10.6	12.3	1,449	35.2
Vertebratophages	6	11.4	0.9	1.0	137	3.3
Foraging outside forest interior	3	2.9	0.7	0.8	261	6.3
Total foraging guilds	80	100.0	85.8	100.0	4,113	100.0
Nesting guilds						
Crown nesters	15	28.9	26.9	31.4	1,255	30.5
Ground nesters	10	19.1	20.1	23.4	1,342	32.6
Hole nesters	22	43.1	23.8	27.7	965	23.5
Shrub nesters	7	8.9	15.0	17.5	551	13.4
Total nesting guilds	54	100.0	85.8	100.0	4,113	100.0

N – number of species, A – abundance in individuals per 10 ha, B – biomass in g per 10 ha and snow-storms were not unusual on the study plot also during spring season).

Some bird species (*Erithacus rubecula, Prunella modularis, Turdus merula, Turdus philomelos, Turdus torquatus, Troglodytes troglodytes,* and *Parus ater*) utilised also roots of uprooted trees and dead wood – characteristic features of a primeval forest – for the location of their nests. Such nests also showed lower losses both of the clutches and juveniles in comparison with the location in crowns or on the ground (SANIGA submitted).

SCHERZINGER (1985) ascertained the bird community in a spruce-beech-fir primeval forest in the Bavarian Forest consisting of 31 species with total density of 34 ind/10 ha. GŁOWACIŃSKI (1990, 1991) found 34 species with total density of 75.0 pairs/10 ha in a beech-fir-spruce forest in the Polish part of the Carpathians. The density of some species was very much alike. KROPIL (1996), who studied the bird community in the fir-spruce-beech Dobroč primeval forest using a combined mapping method, found 44 species with total density 62.6 pairs per 10 ha.

Dominant species accounted for 49% of total density in the Skalná Alpa primeval forest. It is the lowest value in comparison with previously reported results. In the fir-spruce-beech Dobroč primeval forest, dominant species accounted for 54% (KROPIL 1996). In the temperate primeval forest of Białowieźa in Poland (TOMIAŁOJĆ, WESEŁOWSKI 1994), the cumulative sum of dominants was higher in oak-lime-hornbeam stands (55.8%) and even higher in coniferous stands (64.5%). The high diversity and evenness of bird community during the spring season in Skalná Alpa NNR were also confirmed by the high values of diversity ($H' = 4.37$) and equitability ($E = 0.80$).

Structure of the bird community in other seasons

The bird community consisted of 52 species in the summer season, 45 in the autumn migration season, 34 in the winter season, and of 47 in the spring migration season. The highest density of bird community was found during the autumn migration season (109.8 ind/10 ha), the lowest in the winter season (24.6 ind/10 ha). During the spring migration season, both the spectrum of bird species and total density of bird community increased by the number of migratory species which came back from winter habitats. The values for population density were not much different in the majority of sedentary species during the winter and spring (breeding) seasons. These values were different in some species, which could be caused by the fact that not all the individuals of the residents were present permanently on the study plot during the winter period.

Chaffinch (*Fringilla coelebs*), coal tit (*Parus ater*) and robin (*Erithacus rubecula*) were classified as dominant species during the spring migration season, summer and autumn migration seasons. Brambling (*Fringilla montifringilla*) joined these species in the spring and autumn migration seasons (10.6% and 16.6%, respectively). In the winter season, the populations of coal tit (*Parus ater*), goldcrest (*Regulus regulus*), wren (*Troglodytes troglodytes*), tree-creeper (*Certhia familiaris*), willow tit (*Parus montanus*) and crested tit (*Parus cristatus*) were present as dominants.

SCHERZINGER (1985) recorded 15 bird species with total density of 11 ind/10 ha in the spruce-beech-fir primeval stands of the Bavarian Forest during the winter season. The composition of dominant species was very similar on our study plot (*Parus ater, Regulus regulus,* and *Certhia familiaris*). The very low total biomass (427 g/10 ha) of bird community in the Bavarian Forest was obviously caused by the absence of the capercaillie (*Tetrao urogallus*) and hazel grouse (*Bonasa bonasia*), which had a high proportion in the biomass of bird community in Skalná Alpa NNR (65.7%).

Acknowledgement

We are very grateful to Dr. DAGMAR KÚDELOVÁ for helping us to translate the text into English.

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Received for publication December 20, 2003
Accepted after corrections January 21, 2004

Vplyv porastovej štruktúry na výskyt ornitocenóz v Národnej prírodnej rezervácii Skalná Alpa vo Veľkej Fatre (Západné Karpaty)

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ABSTRAKT: Práca zhodnocuje meranie štruktúry, textúry, dynamiky priebehu vzniku a dekompozície mŕtveho dreva vo vzťahu k variabilite a abundancii ornitocenózy v Národnej prírodnej rezervácii Skalná Alpa vo Veľkej Fatre (Západné Karpaty, Slovensko) v rokoch 1982–2002. Pokiaľ sa týka hrúbkovej štruktúry a zastúpenia jednotlivých drevín v pralese, bolo zistené, že početnosť smreka obyčajného (*Picea excelsa* LAM.) je najvyššia v štádiu optima a rozpadu. V štádiu dorastania je podiel tejto dreviny veľmi nízky a súvisí s jeho fyzickým vekom. Textúra pralesa bola veľmi variabilná, pričom plošný podiel jednotlivých štádií na ploche 42,16 ha bol zistený v nasledovných hodnotách: štádium dorastania 38,3 %, štádium optima 20,1 %, štádium rozpadu 41,6 %. Podiel nekromasy a jej drevinová štruktúra závisela od vývojových štádií životného cyklu pralesa. Vtáčie spoločenstvo bukovo-smrekového pralesa v jarnom období (máj–jún) tvorilo 46 druhov s denzitou 85,8 jedincov na 10 ha. V letnom období (júl–august) tvorilo vtáčiu zložku skúmaného pralesa 52 druhov, v jesennom migračnom období (september–október) 45 druhov, v zimnej perióde (november–február) 34 druhov a počas jarnej migračnej periódy (marec–apríl) 47 druhov. Najvyššiu abundanciu dosahovalo vtáčie spoločenstvo skúmaného pralesa počas jesennej migračnej periódy (109,8 jedincov na 10 ha) a najnižšiu v zimnom období (24,6 jedincov na 10 ha).

Kľúčové slová: prales; textúra; hrúbková štruktúra; mŕtve drevo; vtáčie spoločenstvo

Práca analyzuje vzťah medzi štruktúrou smrekovo-bukového pralesa v Národnej prírodnej rezervácii Skalná Alpa vo Veľkej Fatre (18°50´–19°18´ východná dĺžka, 48°47´– 49°09´ severná šírka, Západné Karpaty, Slovensko), nachádzajúcom sa na rozhraní 6. a 7. lesného vegetačného stupňa, a výskytom ornitocenózy v tomto lesnom ekosystéme v rokoch 1982–2002. Základnou drevinou, ktorá rozhoduje o štruktúre pralesa ako aj o plošnej textúre jeho jednotlivých vývojových štádií, je buk lesný (*Fagus sylvatica* L.). Zastúpenie drevín v počte ako aj v hrúbkovej štruktúre sa na ploche pralesa menilo hlavne pokiaľ sa týkalo zastúpenia smreka obyčajného (*Picea excelsa* LAM.). Najvyšší podiel tejto dreviny v štádiu optima a rozpadu súvisel s jej fyzickým vekom, ktorý sa pohybuje v rozpätí 300–350 rokov. Uvedený fakt znamená, že táto drevina prechádza do druhého vývojového cyklu pralesa a odumiera v štádiu dorastania. Takéto striedanie, resp. prelínanie dreviny cez dva vývojové cykly pralesa spolu s textúrou vytvára veľmi variabilné podmienky biotopu pre vtáčie populácie.

Textúra pralesa v Národnej prírodnej rezervácii Skalná Alpa je pomerne variabilná. Veľkosť plôch, ktoré boli charakterizované ako štádium dorastania, sa pohybovala v rozpätí 2 000–2 800 m^2.V štádiu optima bola táto plocha najmenšia (1 600–2 000 m^2). Najväčšia plocha bola zistená v štádiu rozpadu (2 400–3 000 m^2). Plošná textúra zisťovaná na ploche 42,16 ha bola nasledovná: štádium dorastania predstavovalo plošný podiel 38,4 %, štádium optima 20,1 % a štádium rozpadu 41,6 %.

Štruktúra nekromasy s ohľadom na rozdielny fyzický vek smreka obyčajného a buka lesného mala vyrovnaný priebeh s miernym poklesom v štádiu optima.

Kvalitatívno-kvantitatívne zloženie vtáčieho spoločenstva sme skúmali počas celého roka, ktorý sme rozdelili na päť období (jarné obdobie: máj–jún; letné: júl–august; jesenné migračné obdobie: september–október; zimné: november–február; jarné migračné obdobie: marec–apríl). Kvalitatívno-kvantitatívne zloženie vtáčieho spoločenstva sme skúmali použitím pásovej metódy (VERNER 1985). Šírka sčítacieho pásu bola 50 m a dĺžka tranzektu bola 2.0 km. Minimálne päť výskumných exkurzií bolo uskutočnených v každej sezóne v období rokov 1990–1995.

Vtáčie spoločenstvo bukovo-smrekového pralesa v jarnom období (máj–jún) tvorilo 46 druhov s denzitou 85,8 jedincov na 10 ha. Dominantne sa vo vtáčom spoločenstve uplatňovali druhy *Fringilla coelebs*, *Parus ater*, *Erithacus rubecula*, *Regulus regulus* a *Sylvia atricapilla*. Celková biomasa predstavovala hodnotu 4 113 g na 10 ha. Najvyšší podiel na biomase vykazovala populácia druhu *Tetrao urogallus* (18,2 %).

Celkovo 72,4 % vtáčích druhov patrilo do skupiny invertebratofágov. Druhy živiace sa semenami stromov a bylín tvorili 13,3 % a 11,4 % predstavovali vertebratofágy. Tri druhy vyhľadávali potravu mimo lesného interiéru (2,9 %). Denzita hmyzožravcov predstavovala hodnotu 73,6 jedincov na 10 ha (85,9 %). Hmyzožravce živiace sa v korunách stromov vykazovali podiel na denzite 35,2 %. Hmyzožravce hľadajúce potravu na zemi tvorili 28,2 %. Hmyzožravce kŕmiace sa v podrastovej etáži sa podieľali na celkovej abundancii hodnotou 13,1 %.

Tak štruktúra, ako aj textúra pralesa ovplyvňovala lokalizáciu hniezd viacerých vtáčích druhov. Takmer polovica druhov (43,1 %) hniezdila v dutinách, resp. v polodutinách stromov. Tento fakt súvisel s rozmanitou štruktúrou a textúrou pralesa a s početnými starými, čiastočne alebo celkom odumretými stojacimi stromami (suchármi) s množstvom dutín a polodutín. Pokiaľ sa jednalo o denzitu, korunové hniezdiče tvorili 31,4 %, dutinové 27,7 %, druhy hniezdiace na zemi 23,4 % a v podrastovej etáži 17,5 %.

Druhy patriace k atypickým dutinovým hniezdičom (*Erithacus rubecula, Prunella modularis, Turdus merula, Turdus philomelos, Turdus torquatus, Turdus viscivorus* a *Troglodytes troglodytes*) uprednostňovali v skúmanom pralese hniezdenie v polodutinách suchárov. Predačný tlak na vtáky hniezdiace v dutinách a polodutinách bol podstatne nižší ako na druhy hniezdiace v korunách stromov, resp. na zemi. Hniezda týchto vtáčích druhov boli bezpečnejšie nielen pred predátormi, ale aj pred nepriaznivými poveternostnými podmienkami (búrky ako aj snehové prehánky neboli ničím nezvyčajným aj počas hniezdneho obdobia).

Niektoré vtáčie druhy (*Erithacus rubecula, Prunella modularis, Turdus merula, Turdus philomelos, Turdus torquatus, Troglodytes troglodytes* a *Parus ater*) využívali tiež koreňové koláče vyvrátených stromov, ktoré sú charakteristické pre porasty s charakterom pralesa, na lokalizáciu svojich hniezd. Tieto hniezda vykazovali rovnako menšie straty tak na znáškach, ako aj na mláďatách v porovnaní s hniezdami týchto druhov, ktoré boli umiestnené v korunách stromov a krov, resp. na zemi.

V letnom období (júl–august) tvorilo vtáčiu zložku skúmaného pralesa 52 druhov, v jesennom migračnom období (september–október) 45 druhov, v zimnej perióde (november–február) 34 druhov a počas jarnej migračnej periódy (marec–apríl) 47 druhov. Najvyššiu abundanciu dosahovalo vtáčie spoločenstvo skúmaného pralesa počas jesennej migračnej periódy (109,8 jedincov na 10 ha) a najnižšiu v zimnom období (24,6 jedincov na 10 ha). Tak spektrum vtáčích druhov, ako aj denzita vtáčieho spoločenstva sa počas jarného migračného obdobia (marec–apríl) zvyšovali, keďže do skúmaných lesných porastov sa navracali migranti zo zimovísk.

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