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CARPATHIAN BEECH SPECIES COMPOSITION OF THE BIESZCZADY NATIONAL PARK IN THE PERIOD FROM 1993 TO 2003

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Abstract. The paper presents results of the research carried out in beech stands of the Carpathian beech fertile complex (*Dentario glandulosae-Fagetum*) in the lower subalpine zone in the Bieszczady National Park. The objective of the presented study was to analyse changes of species composition in all developmental stand of the lowers stands in the period from 1993 to 2003/04. The obtained results are proof of high levels of stability of the stands in focus, which was confirmed by absence, at the beginning and at the end of the control period, of statistically significant changes in species composition of the old trees layer, undergrowth and natural seeding. Enduringly, the Carpathian beech stands are build by three specific forest-forming species to the Eastern Carpathian Mts.: beech, fir and sycamore.

Key words: The Bieszczady National Park, *Dentario glandulosae-Fagetum*, beech, fir, sycamore

INTRODUCTION

A characteristic feature of the Bieszczady National Park is that its forest cover is made up, primarily, of extensive complexes of well-preserved beech forests [Przybylska and Kucharczyk 1999]. From among 16 categories of species composition distinguished in the Park [Wdrożenie... 1996], pure beech forests, i.e., stands with at least 80% proportion of European beech trees, al-together occupy 14 729.75 ha, i.e. 65.8% of its total forest area [Przybylska and Kucharczyk 1999]. In the lower subalpine forest zone, domination of single-species beech stands becomes even more conspicuous.

According to Przybylska and Banaś [1997], the Bieszczady Mts. range possesses exceptionally favourable conditions for the development of rich multispecies and multigenerational forests. This can be attributed to the appropriate climate, fertile mountain soils as well as the location of the region within the range of natural occurrence of beech, fir and spruce – main forest tree species found in the Carpathian Mts. but also of

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ash, maple and witch elm – valuable admixture woody species of considerable biocenotic and economic importance.

In the present times, when the natural environment is under continuous strong human pressure, foresters all over the world draw our attention to conspicuous changes taking place in forest ecosystems. In recent decades, under the influence of dynamically changing environmental conditions associated, primarily, with increasing concentrations of carbon dioxide and nitrogen in the atmospheric air, we can observe currently, among others, a phenomenon of retreat of species within limits of their natural occurrence [Fabijanowski and Jaworski 1996].

Systematic monitoring of changes in forest resources resulting from the direct or indirect human impact on nature makes it possible to form accurate conclusions with respect to forest protection and silviculture. Since 1993, a continuous forest monitoring process has been under way in the Bieszczady National Park on permanent circular test surfaces [Wdrożenie... 1996]. This made it possible to compare consecutive measurements and draw conclusions about the dynamics of changes in stand construction and structure taking place in these forests.

The objective of the presented study was to analyse species composition in lower subalpine forest zone stands of the Carpathian beech fertile complex (*Dentario glandulosae-Fagetum*) in the period from 1993 to 2003/2004. It was assumed that stands of this association were characterised by the highest stability from among all categories of species composition distinguished in the Bieszczady National Park.

MATERIAL AND METHODS

The object of investigations comprised pure stands of the Carpathian beech growing on the montane forest site in the lower subalpine zone of the Bieszczady National Park. The following constituted the database for the presented study:

- Results of measurements taken in 1993 by employees of the Office of Forest Management and Forest Geodesy, Przemyśl Branch (BULiGL O/Przemyśl) on monitoring stand surfaces in the Bieszczady National Park within the framework of a statistical-mathematical system of inventory and control of forest resources [Wdrożenie... 1996]. The data were made available by the Park Management.
- Results of repeated measurements taken in July-August 2003 and in June-July 2004 on the total of 100 research surfaces of a statistical-mathematical system of inventory and control of the Bieszczady National Park forests. These surfaces were selected randomly from a network of 362 permanent circular test plots situated in the lower subalpine forest zone in single-species beech stands of a typical fertile Carpathian beech forest sub-association *Dentario glandulosae-Fagetum typicum* growing on the montane forest site (Fig. 1). The test plots are located in the area of 5 forest divisions: Suche Rzeki (34 test plots), Caryńskie (9), Ustrzyki Górne (13), Moczarne (29) and Wołosate (15).

The period between the first measurement (1993) and the repeated one (years 2003/2004) is referred to as a 10-year control period.

The selected research plots represented four developmental forest phases in the classification system of the Bieszczady National Park stands used in the Protection Plan [Wdrożenie... 1996]: optimal maturing phase (O1 – 22 test plots), optimal matured

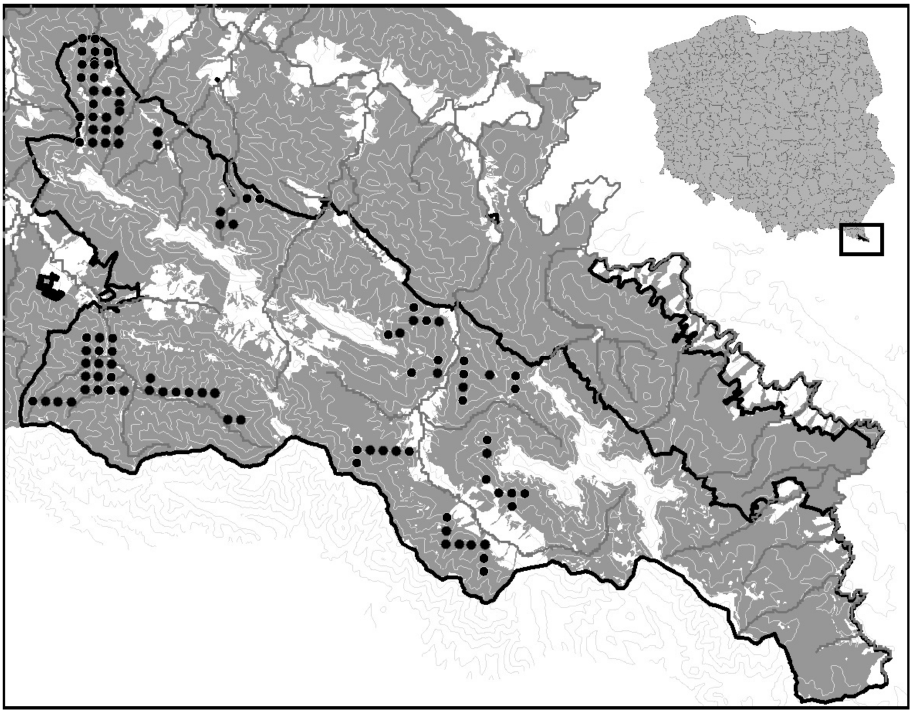

Fig. 1. Location of test plots in the Bieszczady National Park
Rys. 1. Lokalizacja powierzchni badawczych na terenie Bieszczadzkiego Parku Narodowego

phase (O2 – 27 test plots), terminal phase of low degree of under-canopy regeneration (T1 – 26 test plots), terminal phase with intensive natural regeneration (T2 – 25 test plots).

During each developmental forest phase, the analysis of stand species structure was carried out and the following three layers were distinguished: trees, undergrowth and natural seeding.

The tree layer comprised all trees with the diameter at breast height of at least 7 cm. Measurements of this layer included the inventory of the number of living trees (with division into species) growing on circular surfaces of 0.04 ha area.

The layer of the undergrowth comprised all trees exceeding the height of 0.5 m and thickness below the threshold of the breast height diameter measurement, while that of the natural seeding – all individuals whose height did not exceed 0.5 m. Studies of the young generation included:

- determination of the number of undergrowths (with division into species) on a concentric circular surface of 0.01 ha area
- determination of the number of natural seedings (with division into species) on a concentric circular surface of 0.004 ha area and estimation of the percentage surface coverage on a concentric circular surface of 0.01 ha area.

The results of measurements obtained from test plots were recalculated into 1 hectare.

In order to investigate the significance of differences during the control period in species composition in individual stand layers, the analysis of variance was carried out with the level of significance of α = 0.05 [Zieliński and Zieliński 1990].

RESULTS

On the basis of the experiments carried out in 2003/2004, the numerical proportion of beech trees in the species composition of the tree layer was determined at 88.6%. In the admixture, fir (5.7%) and maple (3.8%) were found dominant, whereas the proportion of the remaining species (spruce, sallow, aspen, witch elm, rowan and ash) did not exceed 2% in total (Fig. 2). It should be emphasised here that, in general, maple occurred numerously only in young stands which were found to be in their optimal maturing phase (O1) – their proportion reaching more than 10% (Table 1). The proportion of this species in older developmental phases did not exceed 2% and was replaced either by spruce (2.0% in the optimal mature phase – O2) or by sallow (1.8% in terminal younger phase – T1). On the other hand, fir occurred most numerously in the oldest stands (the proportion in the terminal older phase – T2 – amounted to 13.4%) and outside phase O1 (proportion only 1.5%) it was the main admixture species in the examined beech forests.

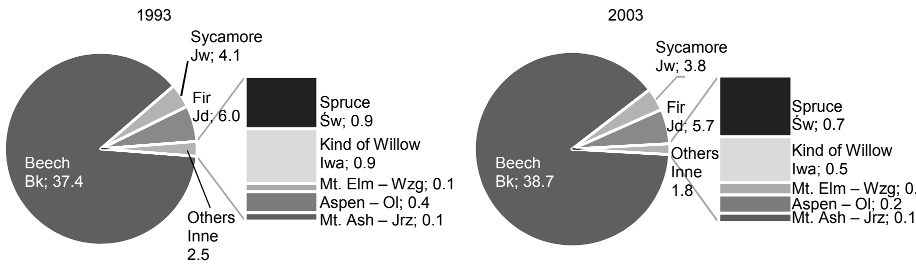

Fig. 2. Species structure of the trees layer at the beginning (1993) and at the end (2003) of the control period, %

Rys. 2. Struktura gatunkowa warstwy drzew na początku (1993 r.) i na końcu (2003 r.) okresu kontrolnego, %

In comparison with the data gathered 10 years earlier (1993), the species composition of the examined beech forests did not undergo significant changes: beech – 87.4%, fir – 6.0% maple – 4.1%. The proportion of beech increased by 1.3%, while proportions of fir and maple trees decreased slightly (by 0.3%) and in the case of the former – the decline in numbers concerned exclusively older stands (T1 and T2 phases), while of the latter – younger stands (O1 phase). The absence of differences of significance in this regard was confirmed by the results of the analysis of variance (Table 2).

The species composition of the natural regeneration, basically, corresponded to the composition of the parent stand (Fig. 3, Table 3). In the undergrowth layer, beech was found dominant (91.5% in the year of measurements), whereas the proportion of fir, on average, amounted to 8.0%. Almost a complete lack of maple (0.3%) deserves attention. What made it surprising was the fact that, in the natural seeding layer (Fig. 4, Table 4),

Table 1. Share of trees species in development phases of forest at the beginning (1993) and at the end (2003) of the control period – the tree layer, %
Tabela 1. Udział gatunków drzew w fazach rozwojowych lasu na początku (1993 r.) i na końcu (2003 r.) okresu kontrolnego – warstwa drzew

Year Rok	Species – Gatunki								
	Beech Bk	Sycamore Jw	Fir Id	Spruce Św	Kind of Willow Iwa	Mt. Elm Wzg	Aspen Os	Mt. Ash Jrz	Ash Js
Phase O1 – Faza O1									
1993	86.6	10.6	1.3	0.9	0.3	0.2	–	–	–
2003	87.4	10.2	1.5	0.8	0.0	0.1	–	–	–
Phase O2 – Faza O2									
1993	88.7	1.2	6.8	2.5	0.3	0.0	0.2	0.2	–
2003	89.2	1.2	7.0	2.0	0.3	0.0	0.2	–	–
Phase T1 – Faza T1									
1993	92.8	0.5	3.3	0.0	2.9	0.0	–	0.5	0.2
2003	94.2	0.5	3.1	0.0	1.8	0.0	–	0.4	–
Phase T2 – Faza T2									
1993	81.0	1.9	14.8	0.2	0.2	0.3	1.5	–	–
2003	83.2	1.9	13.4	0.2	0.0	0.5	0.9	–	–
In all – Ogółem									
1993	87.4	4.1	6.0	0.9	1.0	0.1	0.4	0.1	0.0
2003	88.6	3.8	5.7	0.7	0.6	0.1	0.3	0.1	–

Phase O1, O2, T1, T2 – explanation in text.
Faza rozwojowa O1, O2, T1, T2 – objaśnienie w tekście.

Table 2. Results of variance analysis of species composition of the tree layer
Tabela 2. Wyniki analizy wariancji składu gatunkowego warstwy drzew

Source of variance Źródło wariancji	*SS*	*df*	*MS*	F_o	*p*	F_k	$F_o > F_k$
1	2	3	4	5	6	7	8
Beech – Bk	3.10	1	3.10	0.14	0.72	5.99	×
Sycamore – Jw	0.02	1	0.02	0.00	0.97	5.99	×
Fir – Jd	0.20	1	0.20	0.01	0.94	5.99	×
Spruce – Św	0.06	1	0.06	0.05	0.83	5.99	×
Kind of Willow – Iwa	0.30	1	0.30	0.25	0.64	5.99	×
Mt. Elm – Wzg	0.00	1	0.00	0.02	0.90	5.99	×
Aspen – Os	0.06	1	0.06	0.16	0.70	5.99	×

Table 2 cont. – Tabela 2 cd.

1	2	3	4	5	6	7	8
Mt. Ash – Jrz	0.00	1	0.00	0.07	0.79	5.99	×
Ash – Js	0.00	1	0.00	1.00	0.36	5.99	×

SS – sum squares, *MS* – mean squares, F_o – empirical value of the F statistic, F_k – critical value of the F statistic, *p* – probability level, $F_o > F_k$: "×" difference insignificant or "+" difference significant.
SS – suma kwadratów, *MS* – średnie kwadraty, F_o – wartość empiryczna statystyki F, F_k – wartość krytyczna statystyki F, *p* – poziom prawdopodobieństwa, $F_o > F_k$: „×" różnice nieistotne lub „+" różnice istotne.

Table 3. Share of trees species in development phases of forest at the beginning (1993) and at the end (2003) of the control period – the layer of the undergrowth, %
Tabela 3. Udział gatunków drzew w fazach rozwojowych lasu na początku (1993 r.) i na końcu (2003 r.) okresu kontrolnego – warstwa podrostu

Year Rok	Species – Gatunki						
	Beech Bk	Fir Jd	Sycamore Jw	Spruce Św	Kind of Willow Iwa	Alder Ol	Mt. Ash Irz
			Phase O1 – Faza O1				
1993	90.7	9.3	–	–	–	–	–
2003	83.2	15.3	0.4	–	–	1.1	–
			Phase O2 – Faza O2				
1993	86.3	10.2	1.4	1.9	0.2	–	–
2003	93.0	6.7	–	0.3	–	–	0.1
			Phase T1 – Faza T1				
1993	91.3	8.7	–	–	–	–	–
2003	92.3	7.7	–	–	–	–	–
			Phase T2 – Faza T2				
1993	90.4	8.2	1.3	–	–	–	–
2003	91.5	7.8	0.8	–	–	–	–
			In all – Ogółem				
1993	89.5	9.0	1.0	0.5	0.1	–	–
2003	91.5	8.0	0.3	0.1	–	0.1	0.0

Phase O1, O2, T1, T2 – explanation in text.
Faza rozwojowa O1, O2, T1, T2 – objaśnienie w tekście.

this species was found to occur quite numerously (on average – 18.7%, with its maximum in phase O1 – 34.5%). Simultaneously, in comparison with older stand layers, a slightly lower proportion of beech (on average – about 70%) was characteristic; only 53.6% in phase O1.

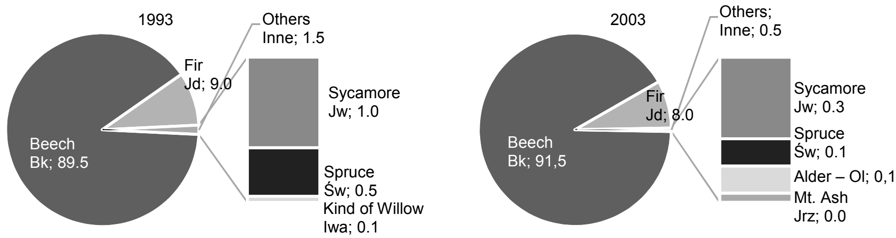

Fig. 3. Species structure of the layer of the undergrowth at the beginning (1993) and at the end (2003) of the control period, %
Rys. 3. Struktura gatunkowa warstwy podrostu na początku (1993 r.) i na końcu (2003 r.) okresu kontrolnego, %

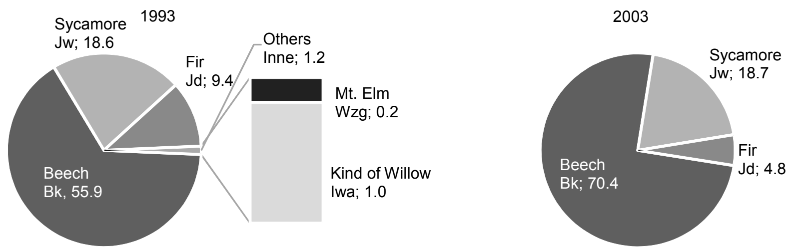

Fig. 4. Species structure of the layer of the natural seeding at the beginning (1993) and at the end (2003) of the control period, %
Rys. 4. Struktura gatunkowa warstwy nalotu na początku (1993 r.) i na końcu (2003 r.) okresu kontrolnego, %

Table 4. Share of trees species in development phases of forest at the beginning (1993) and at the end (2003) of the control period – the layer of the natural seeding, %
Tabela 4. Udział gatunków drzew w fazach rozwojowych lasu na początku (1993 r.) i na końcu (2003 r.) okresu kontrolnego – warstwa nalotu

Year Rok	Species – Gatunki				
	Beech Bk	Sycamore Jw	Fir Jd	Kind of Willow Iwa	Mt. Elm Wzg
1	2	3	4	5	6
Phase O1 – Faza O1					
1993	40.5	39.5	10.9	–	–
2003	53.6	34.5	2.7	–	–
Phase O2 – Faza O2					
1993	65.2	14.4	13.0	–	–
2003	74.1	16.7	1.9	–	–
Phase T1 – Faza T1					
1993	54.6	12.3	6.2	3.8	–
2003	78.8	13.1	8.1	–	–

Table 4 cont. – Tabela 4 cd.

1	2	3	4	5	6
		Phase T2 – Faza T2			
1993	63.2	8.0	7.6	–	0.8
2003	75.2	10.4	6.4	–	–
		In all – Ogółem			
1993	55.9	18.6	9.4	1.0	0.2
2003	70.4	18.7	4.8	–	–

Phase O1, O2, T1, T2 – explanation in text.
Faza rozwojowa O1, O2, T1, T2 – objaśnienie w tekście.

Table 5. Results of variance analysis of species composition of the layer of the undergrowth
Tabela 5. Wyniki analizy wariancji składu gatunkowego warstwy podrostu

Source of variance Źródło wariancji	*SS*	*df*	*MS*	F_o	*p*	F_k	$F_o > F_k$
Beech – Bk	0.18	1	0.18	0.01	0.91	5.99	×
Fir – Jd	0.14	1	0.14	0.02	0.90	5.99	×
Sycamore – Jw	0.33	1	0.33	0.86	0.39	5.99	×
Spruce – Św	0.33	1	0.33	0.73	0.43	5.99	×
Kind of Willow – Iwa	0.01	1	0.01	1.00	0.36	5.99	×
Mt. Ash – Jrz	0.00	1	0.00	1.00	0.36	5.99	×
Aspen – Ol	0.16	1	0.16	1.00	0.36	5.99	×

SS – sum squares, *MS* – mean squares, F_o – empirical value of the F statistic, F_k – critical value of the F statistic, *p* – probability level, $F_o > F_k$: "×" difference insignificant or "+" difference significant.
SS – suma kwadratów, *MS* – średnie kwadraty, F_o – wartość empiryczna statystyki F, F_k – wartość krytyczna statystyki F, *p* – poziom prawdopodobieństwa, $F_o > F_k$: „×" różnice nieistotne lub „+" różnice istotne.

Table 6. Results of variance analysis of species composition of the layer of the natural seeding
Tabela 6. Wyniki analizy wariancji składu gatunkowego warstwy odnowienia naturalnego

Source of variance Źródło wariancji	*SS*	*df*	*MS*	F_o	*p*	F_k	$F_o > F_k$
Beech – Bk	424.88	1	424.88	3.32	0.12	5.99	×
Fir – Jd	43.10	1	43.10	4.70	0.07	5.99	×
Sycamore – Jw	0.02	1	0.02	0.00	0.99	5.99	×
Kind of Willow – Iwa	1.81	1	1.81	1.00	0.36	5.99	×
Mt. Elm – Wzg	0.08	1	0.08	1.00	0.36	5.99	×

SS – sum squares, *MS* – mean squares, F_o – empirical value of the F statistic, F_k – critical value of the F statistic, *p* – probability level, $F_o > F_k$: "×" difference insignificant or "+" difference significant.
SS – suma kwadratów, *MS* – średnie kwadraty, F_o – wartość empiryczna statystyki F, F_k – wartość krytyczna statystyki F, *p* – poziom prawdopodobieństwa, $F_o > F_k$: „×" różnice nieistotne lub „+" różnice istotne.

During the control period, both in the undergrowth, as well as in the natural seeding layers, a more distinct – in comparison with the tree layer – mean increase in the numerical proportion of beech was observed (respectively: by 2.0 and 14.5%). On the other hand, proportions of fir declined, on average, by 1.0% in the undergrowth and by 4.6% – in the natural seeding layer. In turn, in the case of maple, its numbers in the older regeneration dropped and were recorded at the level of 0.7%, while in the younger stand – a slight increase was observed (by 0.1%). However, it is evident from the results of the analysis of variance (Tables 5 and 6) that also in layers of the younger generation no statistical justification was found to claim that during the 10-year long control period significant changes in the species structure of the examined beech forests occurred, although it cannot be denied that these differences were greater than in the layer of the mature stand.

DISCUSSION

According to experiments conducted by Jaworski and co-workers, the composition of lower subalpine forest stands of primeval nature in the *Dentario glandulosae-Fagetum* association, in general, is restricted to three species: in Western Carpathian Mts. (Babia Góra, Gorce) – to beech, fir and spruce [Jaworski and Karczmarski 1990a, 1990b, Jaworski and Skrzyszewski 1995], while in Eastern Carpathian Mts. (Bieszczady Mts.) – to beech, fir and maple [Jaworski et al. 1991, 1995, 2000]. This is further corroborated by the results presented in this study. However, what is characteristic is the fact that beech domination, in the Bieszczady Mts., is far greater in comparison with the Bieskidy Mts. The minimal numerical proportion of this species in the composition of the tree layer reported by Jaworski et al. [1995] amounted to 78.7% in the area of Babia Skała I in the Bieszczady National Park, while the maximal – 97.1% in the area of Tarnicki [Jaworski et al. 2000]. On the other hand, stands of primeval nature situated in Western Carpathian Mts., in general, are characterised by beech proportions at the level of 50% and, in some places, this species is even replaced by other tree species, e.g. in Łopuszna II area in the Gorczański National Park [Jaworski and Skrzyszewski 1995] spruce was found to be a dominant species (62.2%, at beech proportion amounting only to 21.8%). A synthetic review of long-term studies conducted by Korpel as well as by Jaworski and co-workers on lower subalpine Carpathian natural stands can be found in a paper published by Skrzydłowski [1998]. It is evident from his comparisons that mean numerical beech proportions in Eastern Carpathian Mts. amount to 74.4%, whereas in Western Carpathians – to 54.5%.

On the basis of analyses of majority of Carpathian lower subalpine stands Jaworski and co-workers found that their species diversity became impoverished as a result of replacement of fir by beech because proportions of fir within the limits of its natural range declined steadily. In 1976-1986, proportions of fir in the area of Babia Góra decreased by 4-9% [Jaworski and Karczmarski 1990a], while in years 1975-1987, in the Pieniny Mts. – by 8-14% [Jaworski and Karczmarski 1991]. Similar changes, albeit slightly smaller, were also observed in the Łopuszna reserve in Gorce (1981-1991) where the decline in fir proportions ranged from 0-3.2% [Jaworski and Skrzyszewski 1995], as well as in Łabowiec reserve in the Sądecki Beskid Mts. (years 1980-1990) – from 2 to 15% [Jaworski et al. 1994]. At the same time, beech was found to increase its domination by: 2-21% – on Babia Góra, 7-15% – in the Pieniny Mts., 2-15% – in Łabowiec and by 3-8% – in Łopuszna. The above observations are also corroborated by studies carried out by Korpel [1989] in Carpathian forests. He found that the phenomenon of declining fir proportions clearly increased during the last 15-25 years and has been accompanied by increasing proportions of beech and this process has recently become characteristic for the entire region of the Carpathian Mountains.

The results of experiments obtained by the authors of this study indicate that, in the course of the 10-year long control period (1993-2003), no significant changes in the species composition of the examined beech forests were observed. Nevertheless, certain trends were noticed which coincide with the remarks of the above-mentioned researchers. It can be noticed that in all developmental phases beech proportions in the species composition of the tree layer numerically increased slightly (in total by 1.2%), while the total fir proportions declined by 0.3%. However, these changes were statistically so insignificant that it was difficult, on their basis, to draw far-reaching conclusions; the more so, as the decline in fir proportions referred exclusively to the oldest stands (in the terminal phase) which should rather be associated with the process of natural dying-off of individuals at considerably advanced age. In the young generation layers, these changes were slightly more conspicuous but their weight also failed to find support in statistical tests.

Also in neighbouring stands in the Carpathian Nature Park in Ukraine, no distinct signs of fir withdrawal process were observed [Karczmarski and Loryś 1993]. Therefore, it appears that, although in the Carpathian Mountains as a whole the share of beech has increased in recent decades, the phenomenon does not apply to stands in which the frequency of this species exceeds 80%. On the other hand, the presence of fir is reduced to the role of a stable admixture.

In the case of stands of Eastern Carpathian Mts., alongside fir, also maple plays an important role as an admixture species and its natural regeneration is characterised by a fairly specific regularity – its numerously appearing natural seeding fades away before reaching the height of 0.5 m. This phenomenon can probably be attributed to unfavourable, for this species, lighting conditions occurring under the dense canopy of old beech forest. A similar trend was also observed by Jaworski and co-workers [1995] during their experiments in Bieszczady stands with beech and maple trees in Moczarne forest complex, as well as near Rabia Skała. This was also mentioned by Skrzydłowski [1998] in the synthesis of his research results concerning regenerations in natural lower subalpine stands occurring in the region of the Carpathian Mts. On the other hand, according to Zachara [1993] fir seedlings can easily survive even when the supply of full light does not exceed 5% and they can pass into the phase of older natural seeding when the supply of light is only at the level of 8%. This explains far greater proportions of fir in the undergrowth of the examined beech forests in comparison with maple, even though these proportions in the natural seeding were reverse. In addition, in the youngest forest layer, alongside numerously occurring maple trees, also a slightly smaller share of beech (on average – about 79%) was also observed, while in the stands of phase O1 – only slightly above 55%. However, this phenomenon is fairly typical for Carpathian beech forests. According to Skrzydłowski [1998], in natural forests with beech prevalence, regenerations of this species amount to 53.2% of all natural seedings in the class of up to 20 cm in height and to 67.4% – in the class over 20 cm.

CONCLUSIONS

Species composition of pure Carpathian beech stands in the area of Bieszczady National Park showed structure typical for the Eastern Carpathian Mts. forests. Stands were made up, primarily, of beech whose share fluctuated at about 88% accompanied by significant admixtures of fir (about 6%) and maple (about 4%).

Species composition of the young generation corresponds, basically, to the structure of parental stand and a slightly lower share of beech in the natural seeding layer and fading away of maple trees before they reach the height of 0.5 m is a phenomenon characteristic for many beech stands of the lower subalpine zone, as well as Carpathian maple forests.

Absence, during the entire control period, of statistically significant changes in species composition of all developmental phases of the examined Carpathian pure beech stands can indicate high levels of their stability.

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SKŁAD GATUNKOWY BUCZYNY KARPACKIEJ BIESZCZADZKIEGO PARKU NARODOWEGO W OKRESIE 1993-2003

Streszczenie. Praca prezentuje wyniki badań prowadzonych w drzewostanach bukowych należących do zespołu żyznej buczyny karpackiej *Dentario glandulosae-Fagetum* strefy regla dolnego Bieszczadzkiego Parku Narodowego. Celem badań była analiza zmian składu gatunkowego wszystkich warstw rozwojowych lasu w okresie 1993-2003/04. Otrzymane wyniki dowodzą dużej stabilności badanych drzewostanów, czego potwierdzeniem był brak statystycznie istotnych różnic w budowie warstwy drzew, podrostu i nalotu na początku i na końcu okresu kontrolnego. Niezmiennie buczynę karpacką tworzą trzy charakterystyczne dla Karpat Wschodnich gatunki lasotwórcze: buk, jodła i jawor.

Słowa kluczowe: Bieszczadzki Park Narodowy, *Dentario glandulosae-Fagetum*, buk, jodła, jawor

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