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DYNAMICS OF THE GROWTH AND DEVELOPMENT PROCESS OF LOWER SUBALPINE CARPATHIAN BEECH STANDS OF THE BIESZCZADY NATIONAL PARK

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Abstract. This paper presents results of analysis of the dynamics of growth and development of beech stands in the lower subalpine zone in the Bieszczady National Park from the point of view of size-volume interrelationships of the following three main forest-forming processes: thickness increment, the process of trees dying off in stands and growing of young trees to reach the layer of the manure stand. The obtained results confirmed that the examined beech forests exhibit similarity with multigenerational, complex forests of primeval character. An argument in favour of this includes in particular: high stand volume, good forest health condition and a positive relationship between the process of tree survival (volume increment and ingrowth) and the decrement process. The wide peak distance of culminations of two traits is characteristic too: the number of trees in the lowest diameter subclass and the volume in the diameter subclass several intervals higher.

Key words: Carpathian beech stands, The Bieszczady National Park, loss, ingrowth, increment, dry-wood

INTRODUCTION

Continuous increase of dimensions of trees (thickness and height increments) in the course of forest development cycle results in their gradual shift towards ever higher diameter groups. Simultaneously, together with growth, trees continue to grow from the undergrowth layer to the first diameter group (ingrowth) and a process of natural dying off of trees from the stand (loss) takes place (Fig. 1). Persistence and stability of forests depends, to a considerable extent, on relationships between these three phenomena which, in natural forest ecosystems, occur with differing intensity [Poznański 1996a, 1996b, Poznański and Banaś 2001]. According to Poznański [1997], current volume increment in a given period can be treated as a measure of increment intensity of trees, whereas their volume in the same time interval is their measure of intensity of ingrowth and loss.

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The development of forests of varying structure is characterised by the fact that, in general, current increments are distinguished by the highest intensity, the process of natural deaths of trees in stands is marked by lower intensity, whereas the lowest intensity can be observed in the course of tree maturation process, i.e. when they reach the threshold of diameter breast height measurement [Dziewolski and Rutkowski 1987, 1991, Poznański and Banaś 2001, Jaworski and Kołodziej 2002].

The aim of this study was to analyse the dynamics of growth and development of beech stands of the lower subalpine zone in Bieszczady National Park from the point of view of size-volume interrelationships of the following three main forest-forming processes: thickness increment, the process of trees dying off in stands and growing of young trees to reach the layer of the manure stand.

MATERIAL AND METHODS

The object of investigations comprised pure stands of Carpathian beech growing on the montane forest site in the lower subalpine zone of Bieszczady National Park. Measurements and observations were carried out in years 1993-2003/04 (control period) on 100 research surfaces of the statistical-mathematical system of the Park forest inventory and control [Wdrożenie... 1996]. The first measurements were taken in 1993 by the Office of Forest Management and Forest Geodesy (BUL&GL), Przemyśl Branch (data were made available by the Management of the Park), whereas measurements in 2003 and 2004 were taken by the authors of this paper.

The selected research plots represented four developmental forest phases in the classification system of Bieszczady National Park stands used in the Protection Plan [Wdrożenie... 1996]:

- optimal maturing phase (O1) – 22 research plots – stands of up to 70 years of age, characterised by a large number of trees per unit area, relatively low volume and by a high dynamics of growth processes
- optimal matured phase (O2) – 27 research plots – stands of 70-140 years of age, characterised by a slightly smaller number of trees per unit area, higher volume and by a reduced dynamics of growth processes resulting from trees entering the age of seed bearing
- terminal phase of low degree of under-canopy regeneration (T1) – 26 research surfaces – stands of about and over 140 years of age, characterised by high volume and low increment in which the process of dying and regeneration of trees is beginning, with natural regenerations covering less than 50% of the area
- terminal phase with intensive natural regeneration (T2) – 25 research plots – stands of over 140 years of age characterised by high but decreasing volume as well as low increment in which intensive natural regenerations covered more than 50% of the area.

The dynamics analysis of the stand growth and development process was performed on the basis of size and volume structure of trees grouped according to 4 cm diameter subclasses of the following mean values: 9, 13, 17 cm etc. In accordance with the assumptions of Gournaud-Biolley's classical method of control [Biolley 1920, Grochowski 1951, Przybylska 1993], the performed analysis employed the following three measures of the forest growth and development known as: loss, ingrowth and increment. Loss is understood as the result of a natural process of dying off of trees in a stand. Ingrowth refers to trees which, during the control period, shifted from the undergrowth to the layer of mature stand (it was assumed that the boundary between these layers would be designated by a 7 cm threshold of diameter breast height measurement). Finally, increment refers to the overall result of natural tree growth expressed in cubic meters.

In addition, the intensity of the above-mentioned measures was determined as a percentage indicator in relation to the initial volume of the examined forests evaluated in 1993. It was adopted, after Poznański [1997], that the measure of loss and ingrowth intensity was their volume in the control period, while the measure of increment intensity – current periodical volume interment which was calculated on the basis of the following formula [Grochowski 1973]:

$$Z_v = (V_k - V_p) + U - D$$

where:

V_k – large timber volume at the end of the control period (2003/04),
V_p – large timber volume from the beginning of the control period (1993),
U – the sum of volume of losses during the control period,
D – sum of ingrowth volume during the control period.

Total stand volume was estimated on the basis of Czuraj's [1991] tables of volumes on the basis of equalised heights in diameter subclasses using the method of the least squares according to Näslund's curve [Näslund 1936].

Stand health condition was assessed on the basis of the amount (pcs./ha) and the size (m^3/ha) of dry-wood occurrence, i.e. dry standing trees with dead crowns.

RESULTS

The total number of the examined beech trees in the lower subalpine zone of the Bieszczady National Park amounted to nearly 700 pieces/ha and underwent relative slight changes in the course of 10 years (1993 – 696 pcs./ha, 2003 – 684 pcs./ha; Fig. 2). It is worth mentioning here that in the optimal maturing phase (O_1) and terminal older phase (T_2), predominance of the dying off of trees from the stand (loss of, respectively, 82 and 31 pcs./ha/year) over the phenomenon of undergrowth reaching the 7 cm threshold of diameter breast height measurement (25 and 26 pcs./ha/year) was observed. On the other hand, in the case of stands in the phase of optimal maturity (O_2) and younger terminal phase (T_1), a positive balance in the number of trees (by several pcs./ha) was recorded. Spatial variability in this regard was determined at a fairly high level as confirmed by the value of the coefficient of variation which amounted to about 50% (Table 1).

At relatively negligible changes in numbers, the examined beech forests were characterised by a considerable current annual volume increment which, during the period of control, amounted to 12.21 m^3/ha/year (Table 2) and corresponded to 519.45 m^3/ha volume in 2003 (Fig. 3). It is worth emphasising that the above value was strongly influenced by the presence of fir (Fig. 4); it was almost two times higher (9.5% in the year of measurement) than the share of this species in the number of trees. A similar regularity was also observed in the case of spruce and sycamore, albeit on a considerably smaller scale.

Table 1. Statistical characteristics of experiential data (number of trees on trial plots and volume of single trees)
Tabela 1. Charakterystyka statystyczna materiału empirycznego z powierzchni badawczych (liczba drzew na powierzchniach próbnych i miąższość pojedynczych drzew)

Development phase Faza rozwojowa	Average Średnia	Minimum Minimum	Maximum Maksimum	Variance Wariancja	Standard deviation Odchylenie standardowe	Coefficient of variance, % Współczynnik zmienności, %
			Number of trees, in 0.04 ha – Liczba drzew, szt./0,04 ha			
O_1	39.91	10.00	80.00	418.28	20.45	51
O_2	24.89	8.00	52.00	135.79	11.65	47
T_1	28.46	7.00	90.00	417.06	20.42	72
T_2	24.60	9.00	60.00	140.42	11.85	48
Total Ogółem	29.46	8.00	90.00	277.89	16.09	55
			Volume, m^3 – Miąższość, m^3			
O_1	0.40	0.01	5.21	0.49	0.70	174
O_2	0.51	0.01	10.98	1.28	1.13	221
T_1	0.86	0.01	14.63	4.71	2.17	253
T_2	0.61	0.01	7.61	1.61	1.27	208
Total Ogółem	0.59	0.01	14.63	2.02	1.32	214

Table 2. Volume increment, loss and ingrowth of trees and their intensity in 1993-2003
Tabela 2. Przyrost miąższości, ubytek i dorost oraz ich intensywność w okresie 1993-2003

Development phase Faza rozwojowa	Increment Przyrost	Loss Ubytek	Ingrowth Dorost	Increment Przyrost	Loss Ubytek	Ingrowth Dorost
	m^3/ha/year (trees/ha/year) m^3/ha/rok (szt./ha/rok)			%/year %/rok		
O_1	13.79	0.79 (8.2)	0.03 (2.5)	3.77	0.22	0.008
O_2	10.94	0.32 (2.0)	0.03 (2.2)	3.78	0.11	0.010
T_1	12.73	1.99 (4.5)	0.06 (4.9)	2.32	0.36	0.011
T_2	11.68	0.83 (3.1)	0.05 (2.6)	2.86	0.20	0.012
Total Ogółem	12.21	0.99 (4.1)	0.04 (3.1)	3.03	0.25	0.010

In the year of measurement, stands of the terminal phase were characterised by a distinctly higher volume which ranged from 521 (phase T_1) to 660 m^3/ha (phase T_2) as compared to 500 m^3/ha in optimal phases (Fig. 3). However, the current volume increment was high in all analysed stages of development of the examined forests and

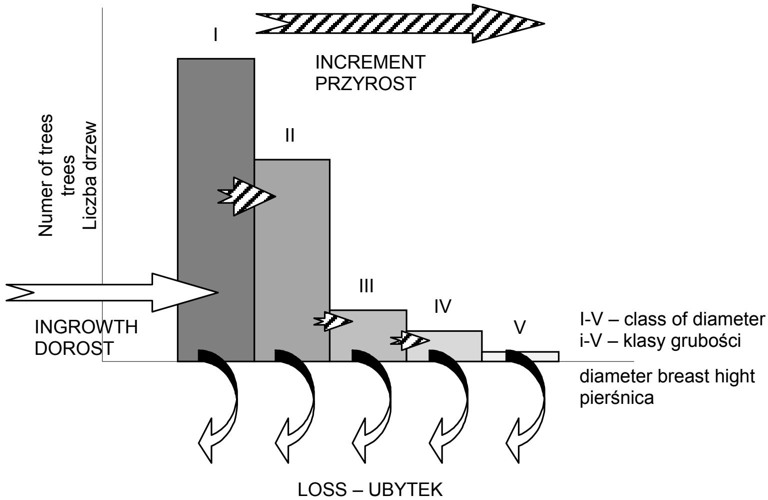


Fig. 1. Impact of volume increment, ingrowth and loss of trees on tree distribution in diameter subclasses in a growth and development of stands process [prepared according to Dziewolski and Rutkowski 1987]

Rys. 1. Oddziaływanie przyrostu, dorostu i ubytku na rozkład drzew w klasach grubości w procesie wzrostu i rozwoju drzewostanów [opracowano na podstawie Dziewolski i Rutkowski 1987]

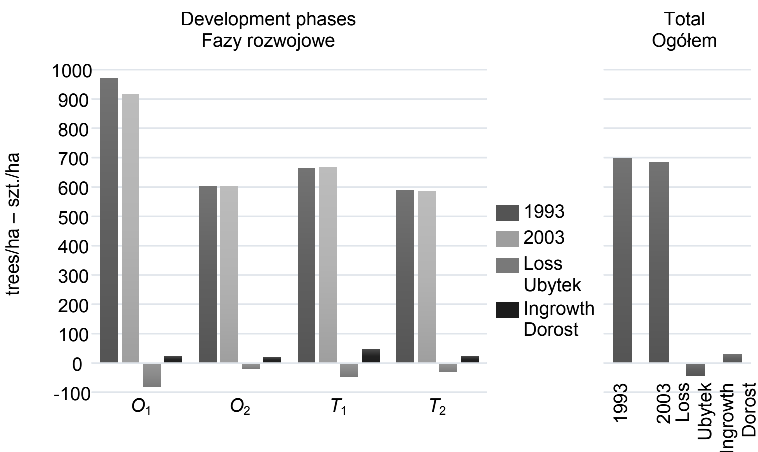


Fig. 2. Number of trees in Carpathian beech stands and its revision in the control period (1993-2003) in development phases separately and in all

Rys. 2. Liczba drzew w drzewostanach buczyny karpackiej oraz jej zmiana w okresie kontrolnym (1993-2003) w fazach rozwojowych i ogółem

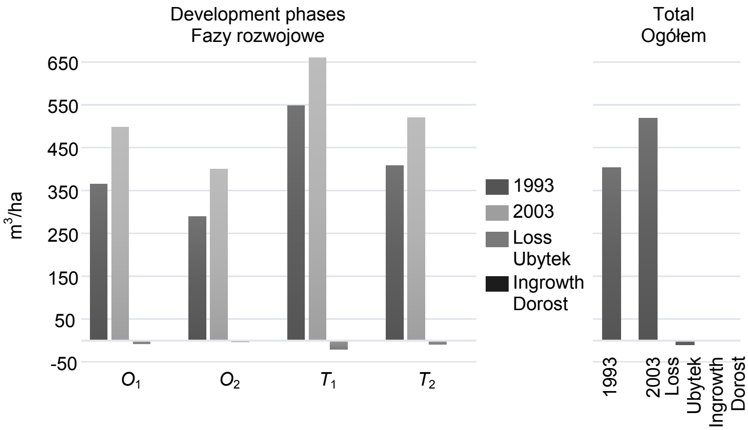


Fig. 3. Volume of Carpathian beech stands and its revision in the control period (1993-2003) in development phases separately and in all
Rys. 3. Zasobność drzewostanów buczyny karpackiej oraz jej zmiana w okresie kontrolnym (1993-2003) w fazach rozwojowych i ogółem

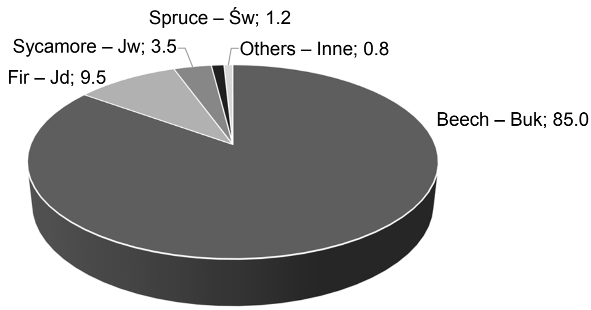


Fig. 4. Share of trees species in total stand volume in 2003, %
Rys. 4. Udział gatunków drzew w ogólnej zasobności drzewostanów w 2003 roku, %

every time reached values of over 10 m^3/ha/year (Table 2). This assured, throughout the control period, a positive volume change and stock accumulation of stands. The total ingrowth intensity (3.1 pcs./ha/year; 0.04 m^3/ha/year; 0.01%/year) was lower than the intensity of losses (4.1 pcs./ha/year; 0.99 m^3/ha/year and 0.25%/year).

In the examined beech forests, the maximum number of trees fell on the first diameter subclass (7-11 cm) whose overall frequency in 2003 amounted to 194 pcs./ha (Fig. 5), while volume peak was determined in the interval of diameter breast heights between 47.1 and 51 cm and corresponded to the value of 36.14 m^3/ha. In comparison with the data from 1993, this indicated its shift towards a lower diameter subclass (at the beginning of the control period, the maximum fell on 63.1-67 cm diameter group). It is evident from the performed analysis of volume distribution in the diameter subclasses of

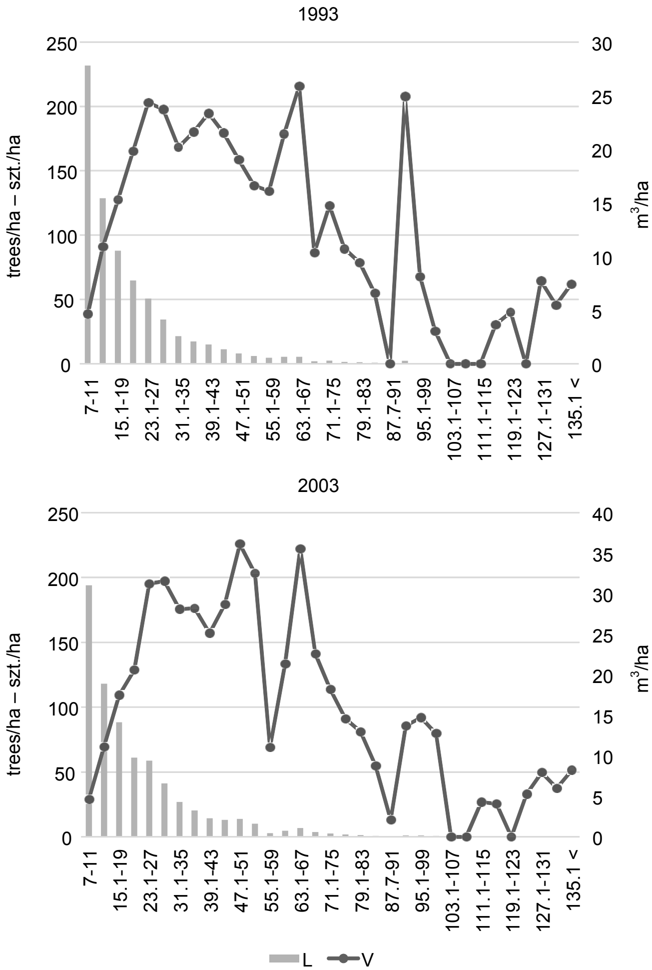


Fig. 5. Trees number (*L*) and volume (*V*) distribution in 4 cm diameter subclasses in 1993-2003

Rys. 5. Rozkład liczby (*L*) i miąższości (*V*) drzew w 4-centymetrowych stopniach grubości w latach 1993-2003

individual development phases that they have more consistent course in younger stands (Fig. 6). In the course of the development cycle, peaks of these distributions moved upwards by one or several thickness intervals. On the other hand, in the older terminal phase (T_2), the peak volume shifted from 91.1-95 cm diameter subclass in 1993 to 51.1--55 cm in 2003 prompting a change in the overall inventory from 63.1-67 cm to 47.1--51 cm. In addition, it should be stressed that, due to greater ingrowth intensity in both terminal phases, stands in this stage of development were characterised by a higher, in comparison with optimal phases, proportion of the thinnest trees (more than 30%).

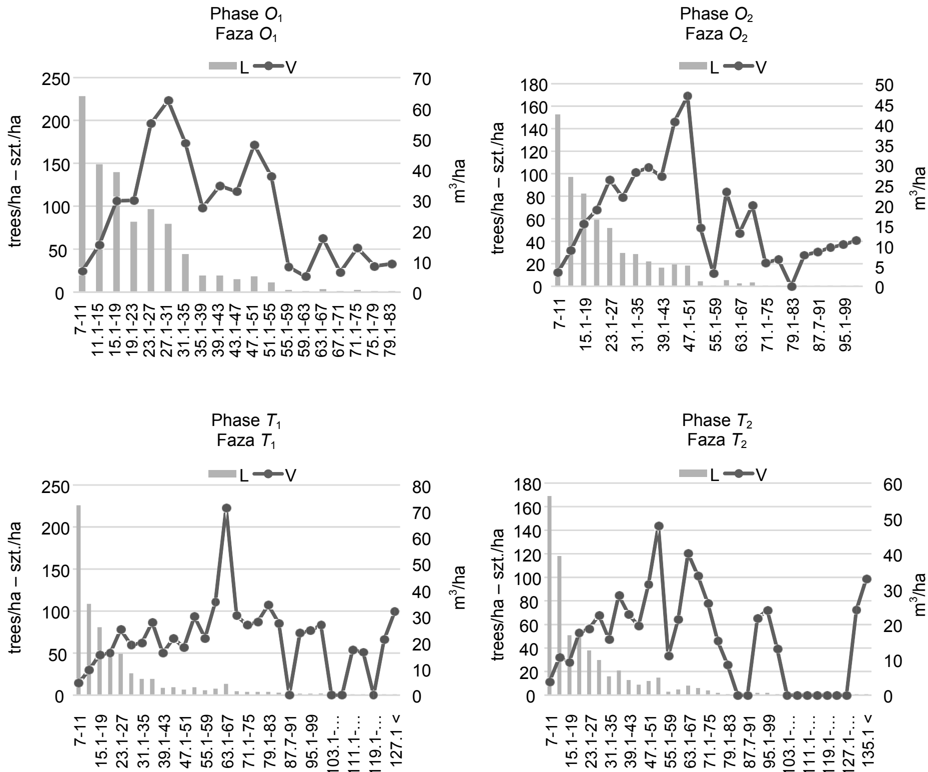


Fig. 6. Trees number (*L*) and volume (*V*) distribution in 4 cm diameter subclasses in development phases in 2003

Rys. 6. Rozkład liczby (*L*) i miąższości (*V*) drzew w 4-centymetrowych stopniach grubości w poszczególnych fazach rozwojowych w 2003 roku

The amount of dry-wood increased slightly in the course of the control period – from 26 to 37 pcs./ha (Fig. 7) which, with reference to the total number of trees in the examined beech forests, signified increase in the proportion of this group of trees from 3.8% to 5.1%. This resulted, primarily, from the intensity of the competition process for life space occurring among trees, especially in stands of the optimal maturing phase (O_1) where tree density was the greatest (over 900 pcs./ha). Conversion of the dry-wood into large timber volume yielded the value of 25.16 m^3/ha at the end of the control period (Fig. 8) which constituted 4.8% of the total volume of the examined forests. This value was more than twice greater in comparison with 1993 and, as evident from Figure 8, it was influenced, primarily, by old trees dying off in stands of terminal phases (values of the order of 35 m^3/ha).

As to the number of dry trees recorded in the year of measurement, beech was found dominant (share – 64.9%; Fig. 9), while with regard to volume – fir was dominant (share – 68.1%; Fig. 10).

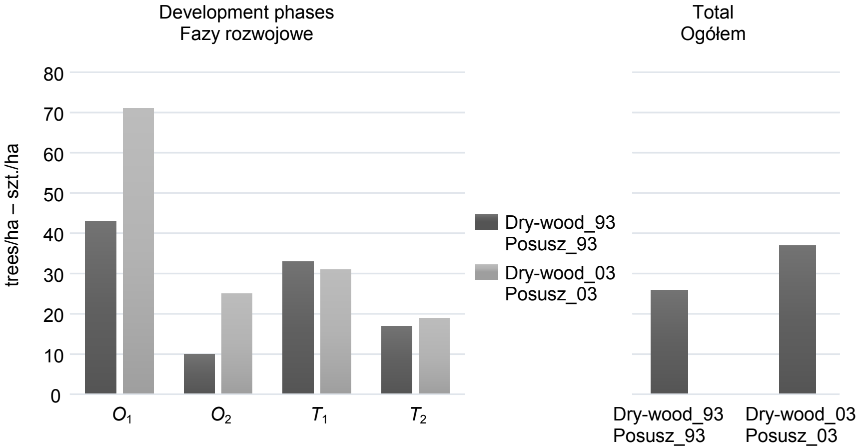


Fig. 7. Number of dead standing wood in Carpathian beech stands and its revision in the control period (1993-2003) in development phases separately and in all
Rys. 7. Liczba posuszu stojącego w drzewostanach buczyny karpackiej oraz jej zmiana w okresie kontrolnym (1993-2003) w fazach rozwojowych i ogółem

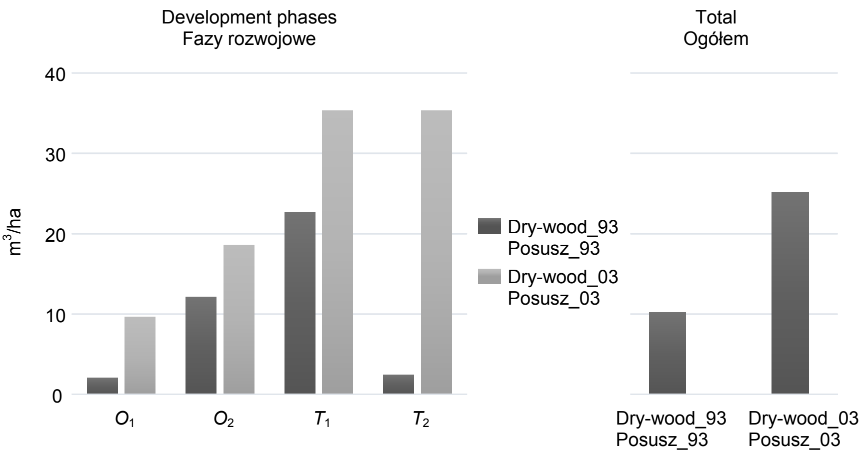


Fig. 8. Volume of dead standing wood in Carpathian beech stands and its revision in the control period (1993-2003) in development phases separately and in all
Rys. 8. Miąższość posuszu stojącego buczyny karpackiej oraz jej zmiana w okresie kontrolnym (1993-2003) w fazach rozwojowych i ogółem

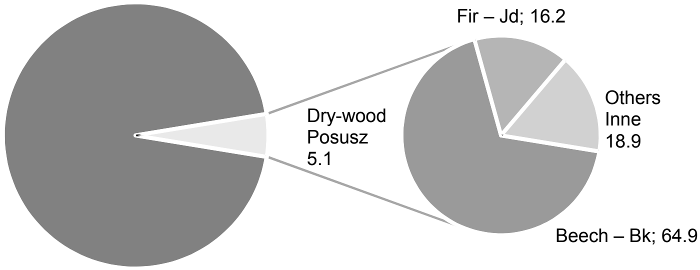
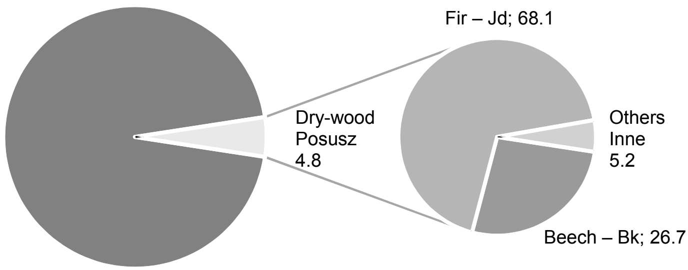


Fig. 9. Share of trees species in total number of dead standing wood in 2003, %
Rys. 9. Udział gatunków drzew w ogólnej liczbie posuszu stojącego w 2003 roku, %



Rys. 10. Share of trees species in total volume of dead standing wood in 2003, %
Rys. 10. Udział gatunków drzew w ogólnej miąższości posuszu stojącego w 2003 roku, %

DISCUSSION

The overall numerical structure of the examined beech forests did not change significantly in the discussed control period. The preponderance of the dying off process of trees in stands over the phenomenon of young individuals reaching the 7 cm threshold of diameter breast height measurement became apparent only during two developmental phases and can be attributed to two causes. Firstly – to a greater tree density in younger forest segments (phase O_1) – over 900 pcs./ha) and, secondly – to natural demise and death of individuals from the oldest age classes (phase T_2). During intermediate phases (O_2 and T_1), the situation was completely different, hence, in the final count, there was no significant change in the number of old forest trees between the beginning and end of the control period. Therefore, reasons for the spatial variability in numbers determined at the level of 50% should be sought in the characteristic, for the Carpathian beech forests, group type of horizontal distribution of trees in stands which begins to take its shape already at the level of natural regeneration [Mazur 1984, Jaworski and Kopeć 1988, Jaworski 1990, 1997, 2000, Szwagrzyk 1990, Leemans 1991, Holeksa 1998, Szmyt and Sugiero 2006]. It is true that on the majority of the experimental plots (88%), a random type of tree distribution in the old forest layer was observed but with a distinct bias towards the group form, usually in the entire range of distance [Szmyt and Sugiero 2006]. Irregular, group stand structure in beech stands was allowed to develop freely under the influence of natural forces such as: rapid changes of soil conditions on a small area, uneven natural regeneration from several seed years or group occurrence of a disease (mucorrhoea) as well as a result of genetic properties of parent trees [Korpel 1991]. Such structure in beech production stands can be obtained applying shelterwood fellings with a long period of regeneration, among others, as a result of damages caused by timber extraction [Fabijanowski and Jaworski 1996]. A model to be followed can be a bio-group distribution of spruce growing in natural conditions in montane regions [Otto 1994, Zajączkowski 1994]. Fabijanowski and Jaworski [1996] maintain that distribution of phenotypically differing trees in group management of forests exerts an exceptionally favourable impact both on possibilities of their good quality as well as genetic diversity.

Timber volume of the examined beech forests exceeding 500 m^3/ha is a quantity similar to the growing stock produced by multigeneration, lower subalpine Carpathian forests of primary nature [Korpel 1989, Jaworski and Karczmarski 1990a, Jaworski et al. 1991, 1995, 2000]. It should, however, be stressed that, in general, stands in the Western Carpathian Mts. are characterised by higher volume in comparison with those growing in the Bieszczady Mountains [Jaworski et al. 1992]. Nevertheless, while in Babiagóra National Park the estimated sizes of the growing stocks of large timber were comparable [Jaworski and Karczmarski 1990a], stands growing in the Łopuszna reserve in Gorce reached volumes of over 600, 700 m^3/ha [Jaworski and Skrzyszewski 1995]. Similar values on the Slovakian side were also observed by Korpel [1989] who reported volumes of the order of 709 m^3/ha on one of the research plots established in the Stužica reserve. Jaworski and co-workers [1992] link it, among others, with the absence of sporadic occurrence of fir and spruce in East Carpathian forests as these tree species are characterised by high productivity and strongly contribute to the overall stand volume as shown in the examined beech forests. Fir and spruce exhibited a greater proportion in the volume than in the number of trees.

The obtained results also showed that alongside fir and spruce, also sycamore can be an important, high-production tree species in Carpathian beech woods. It is also corroborated by studies of Jaworski et al. [1995] conducted in the Mocharne complex in Bieszczady National Park, where the share of sycamore in timber volume fluctuated from 66-72% and was higher in comparison with that of beech. According to the abovementioned authors, these results justify the increase in the share of sycamore in the Carpathian Mountains within the framework of a partial beech stand reconstruction in accordance with the postulated direction of forest management and restoration of the production type of sycamore-beech stands.

Current annual timber volume increment is an indicator not only of stand productivity but also of their development dynamics. The examined beech forests were characterised by increments exceeding 10 m^3/ha/year at each stage of development. A similar dynamics were observed for several decades in beech stands in the area of Central Europe. In 1970s and 1980s, their volume was increased by 10-20% and exceeded tabular data of the current annual timber volume increment by 10-40% which is estimated, at the present time, at 12-14.5 m^3/ha/year [Pretzsch 1996, Skovsgaard and Henriksen 1996, Untheim 1996]. In addition, numerous publications of the European Forest Institute (EFI) regarding growth analysis also of pine, spruce, fir and oak stands confirmed that, as a result of changes in forest site productivity in last several decades, contemporary European forests grow faster than in the past [Spiecker 1996, Spiecker et al. 1994, 1996].

In Poland, this hypothesis is corroborated by long-term investigations conducted by Miś [1995, 1999, 2008]. However, in the case of montane regions, values recorded so far could not be considered as ones significantly exceeding table data. Carpathian beech forests of primeval character, in general, are characterised by average volume increments ranging from 3.5-8.8 m^3/ha/year (in the Bieszczady Mts. and on Babia Góra – Jaworski and Kołodziej 2002, Jaworski and Paluch 2002). However, increments exceeding 10 m^3/ha/year were already observed, among others, in the Łabowiec reserve in the Sądecki Beskid Mts. – 11.1-13.61 m^3/ha/year [Jaworski et al. 1994]. Also on the Slovakian side of the Carpathian Mts. natural stands made up of beech and fir can be found characterised by such high productivity, although usually they are found to have fairly varying current timber volume increments: 4.7-8.6 m^3/ha/year in the Dobroč reserve, 3--12 m^3/ha/year – in the Kyjov reserve (Wyhorlat range) or 7.1-12.1 m^3/ha/year in Badín [Korpel 1995]. Wide intervals of these increments should be attributed to differences in developmental phases of the examined forests. On the other hand, in the case of production, multispecies experimental forests of the Department of Forest Management of Kraków Agricultural University in Krynica (Forest Experimental Station), current volume increments exceeding 10 m^3/ha/year are normal [Poznański and Banaś 2001].

In the examined beech forests, the observed high current volume increment in the control period ensured a positive change of volume and accumulation of stand growing stock despite the predominance of the process of tree decrement from stands over the transfer of new individuals from the undergrowth layer to the old forest layer. However, in the development of forests of varying structure, it is a fairly common phenomenon. Long-term investigations conducted in different-age and multispecies montane stands in the Forest Experimental Station in Krynica showed that, in general, it was just current increment which was characterised by the highest intensity, whereas the process of natural dying off of trees from stands was less intense and the phenomenon of trees reaching the threshold of diameter breast height measurement was the least intensive [Poznański and Banaś 2001]. This is also corroborated by experiments carried out in primeval forests [Jaworski and Kołodziej 2002] as well as in reserve stands [Dziewolski and Rutkowski 1987, 1991]. Moreover, it was found that, in general, volume increment dynamics is higher during optimal phases, while that of ingrowth and loss – in terminal phases. Similar observations were made in the examined lower subalpine beech forests of Bieszczady National Park.

In forests of a complex form in the structure of tree number and timber volume, a wide spread of two culminations of their distribution in diameter subclasses is characteristic: the number of trees in the lowest or one of the lowest of diameter subclasses and of volume – in one of the higher diameter groups [Poznański 2000]. The described phenomenon was clearly apparent in the examined beech forests. The first peak is influenced, first and foremost, by the intensity of growth of trees from the undergrowth layer to the assumed threshold of the diameter breast height measurement, while the second one – by the intensity of stand increment. On the other hand, the level of loss affects, to a considerable extent, the diameter subclass in a given object on which the peak stand volume falls. Finally, the process of dying off of trees in a stand is preceded by a phenomenon of demise of single trees which also exerts a significant influence on the forest health condition.

In the course of the last several decades, we could observe, both in European as well as in Polish forests, massive dying off, primarily, of coniferous species such as fir and spruce, frequently covering large areas. In the case of Carpathian forests of primeval nature, the volume proportion of dead fir trees is equally high [Jaworski and Skrzyszewski 1995, Jaworski et al. 1991, 1995] and in stands with a slightly higher number of trees of this species (Babia Góra and Pieniny National Parks), it exceeds even 90% [Jaworski and Karczmarski 1990b, 1991]. The total bulk of dead standing wood in these forests fluctuates between 5 and 150 m^3/ha which corresponds to 2-28% share of their overall volume and, according to Jaworski [1997], it should not constitute a threat to the stand. The discussed beech forests of the lower subalpine zone in Bieszczady National Park in which, at a significant proportion of fir dry-wood the total volume of dead standing wood does not exceed 5% of their total volume, also fit well into the above-presented scenario.

CONCLUSIONS

High degree of variations in numbers of trees in beech forests of the lower subalpine zone in Bieszczady National Park results from the group form of tree distribution characteristic for Carpathian beech forests.

With respect to their volume, the examined beech forests exhibit similarity with multigenerational forests of primeval character, although due to a relatively low proportion of coniferous species, they reveal smaller production possibilities in comparison with stands of lower subalpine zones of Western Carpathians.

The sustainability of the Bieszczady Mts. lower subalpine beech forests is ensured by a positive relationship between two opposing forest-forming processes – the process of tree survival (volume increment and ingrowth) and the decrement process. This relationship is characteristic for forests of complex form and manifests itself by a high intensity of volume increments, a slight intensity of losses and the smallest intensity of ingrowth.

In the case of the examined beech forests, the advantage of the dying off process of trees from stands over the phenomenon of young trees reaching the 7 cm threshold of diameter breast height measurement is determined by two factors: high tree concentration in younger forest fragments (phase O_1) and the natural dying off process of trees from the oldest age classes (phase T_2).

The external expression of the impact of increment, ingrowth and loss processes on tree distribution in diameter subclasses can be found in the wide peak distance of two traits characteristic for forests of complex form: the number of trees in the lowest diameter subclass and the volume in the diameter subclass several intervals higher.

Good health condition of the Bieszczady Mts. beech forests is confirmed by a relatively small number of dry standing trees which constituted a low percentage share in total tree numbers and timber volume of the examined stands. Such amount is comparable with natural size of dry-wood occurring in primeval forests and should not constitute a threat to their sustained existence.

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DYNAMIKA PROCESU WZROSTU I ROZWOJU DOLNOREGLOWYCH DRZEWOSTANÓW BUCZYNY KARPACKIEJ BIESZCZADZKIEGO PARKU NARODOWEGO

Streszczenie. Praca prezentuje wyniki analizy dynamiki wzrostu i rozwoju drzewostanów bukowych strefy regla dolnego Bieszczadzkiego Parku Narodowego pod kątem relacji liczebnościowo-miąższościowych trzech podstawowych procesów lasotwórczych: przyrastania na grubość, ubywania drzew z drzewostanu i dorastania młodych osobników do warstwy drzewostanu dojrzałego. Otrzymane wyniki dowodzą podobieństwa badanych buczyn do wielogeneracyjnych, złożonych lasów o charakterze pierwotnym. Przemawia za tym m.in. wysoka zasobność, dobry stan zdrowotny oraz dodatnia relacja pomiędzy procesem przeżywania drzew (przyrost miąższości i dorost) a procesem ich ubywania. Charakterystyczny jest też szeroki rozstaw kulminacji dwóch cech: liczby drzew w najniższym stopniu grubości oraz miąższości w stopniu o kilka przedziałów wyższym.

Słowa kluczowe: buczyna karpacka, Bieszczadzki Park Narodowy, ubytek, dorost, przyrost, posusz

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